

RESEARCH REPORT 1998 — 1999

MAX-PLANCK-INSTITUT FÜR WISSENSCHAFTSGESCHICHTE

Max Planck Institute for the History of Science

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Structure and Organization of the Institute

Scientific Advisory Board

Prof. Dr. Roger Chartier, Centre de Recherches Historiques, CNRS, École des Hautes Études en Sciences Sociales, Paris, France

Prof. Dr. Rivka Feldhay, The Cohn Institute for the History and Philosophy of Science and Ideas, Faculty of Humanities, Tel Aviv University, Israel

Prof. Dr. Peter Galison, Department of the History of Science, Harvard University, Cambridge, USA

Prof. Dr. Paolo Galluzzi, Istituto e Museo di Storia della Scienza and Università degli Studi di Firenze, Italy

Prof. Dr. Jean Gayon, Centre de recherches historiques et épistémologiques sur les sciences exactes et les institutions scientifiques, Université Paris 7-Denis Diderot, Paris, France

Prof. Dr. Jürgen Mittelstraß, Philosophische Fakultät, Fachgruppe Philosophie, Universität Konstanz, Germany

Prof. Dr. Rüdiger Wehner, Philosophische Fakultät-II, Zoologisches Institut, Universität Zürich, Switzerland

Departments and Research Groups

Department I

Director: *Prof. Dr. Jürgen Renn*

Research Scholars: *Dr. Peter Beurton*, *Dipl. Phys. Jochen Büttner*, *Giuseppe Castagnetti*, *PD Dr. Peter Damerow*, *Prof. Dr. Gerd Graßhoff (until March 31, 1999)*, *PD Dr. Dieter Hoffmann*, *Dr. Horst Kant*, *Prof. Dr. Wolfgang Lefèvre*, *Simone Rieger*, *Dipl. Phys. Matthias Schemmel*, *Dr. Volkmar Schüller*, *Prof. Dr. Renate Wahsner*, *Dr. Paul Weinig*, *Falk Wunderlich (until December 31, 1998, now predoctoral research fellow)*

Department II

Director: *Prof. Dr. Lorraine Daston*

Research Scholars: *PD Dr. Sonja Brentjes (until July 1999)*, *Prof. Dr. Joan Cadden (until July 1998)*, *Dr. William Clark (until September 1998)*, *PD Dr. Matthias Dörries*, *Dr. Anke te Heesen*, *Prof. Dr. Doris Kaufmann (until March 1998)*, *Prof. Dr. Wolfgang Küttler*, *Dr. Antoinette Roesler-Friedenthal*, *Dr. Sophie Roux (until August 1998)*, *Dr. H. Otto Sibum (until September 1998, now director of the independent research group II)*, *Dr. Friedrich Steinle (until March 1998 and since August 1999)*, *Prof. Dr. Irmline Veit-Brause (October 1998 to July 1999)*, *Dr. Annette Vogt*, *Dr. Michael Wintroub (September 1998 to August 1999)*

Department III

Director: *Prof. Dr. Hans-Jörg Rheinberger*

Research Scholars: *Dr. Sven Dierig*, *PD Dr. Michael Hagner*, *Dr. Sarah Jansen*, *Dr. Andrew Mendelsohn*, *Dr. Thomas Potthast*, *Dr. Denis Thieffry (until December 1998)*

Independent Research Group I

Established January 1999 for five years.

Director: *PD Dr. Ursula Klein*

Research Scholar: *Dr. Peter Ramberg*

Independent Research Group II

Established April 1999 for five years.

Director: *Dr. H. Otto Sibum*

Research Scholar: *Annik Pietsch*

Max Planck Society Research Fellowship
for Outstanding Woman Scholars

Established July 1998 for five years.

Dr. Emma Spary

Service units

Administration headed by *Claudia Paaß*

Library headed by *Urs Schoepflin*

Computing Service Unit headed by *Jörg Kantel*

Research Coordination: *Jochen Schneider*

The Institute's Research Scholars

Beurton, Peter J. (Dipl. 1968 [biology], Dr. rer. nat. 1973 [biology], Dipl. 1977 [philosophy] Humboldt-Universität zu Berlin, habil. phil. 1987 [philosophy] Universität Potsdam); research scholar Akademie der Wissenschaften der DDR (1972–1991); research scholar Forschungsschwerpunkt Wissenschaftsgeschichte und Wissenschaftstheorie, Berlin (1991–1994); research strategies in biological evolutionary theory; modern Darwinism and the philosophy of science (E. Mayr, K. Popper, T. S. Kuhn); genetics, population genetics, the biological species, and reductionism. Held lectures at universities and other academic institutions in Bornheim, Blacksburg, Cambridge (USA), Chicago, Göttingen, Jerusalem, Knoxville, New Haven, and Tel Aviv. At the Institute since September 1994.

Brentjes, Sonja (Dipl. 1973 [mathematics], Technische Universität Dresden, Dr. rer. nat. 1977, Technische Universität Dresden, Dipl. Arabic/Middle Eastern Studies, Martin-Luther-Universität Halle-Wittenberg, Dr. sc. nat. 1989, Dr. habil. rer. nat. 1991, Karl-Marx-Universität Leipzig); assistant professor, Karl Sudhoff Institute for the History of Medicine and Science, Karl-Marx-Universität Leipzig (1976–1990); fellowship CNRS, Université VIII, Paris, Saint-Denis (1991); Rockefeller Fellowship, University of Oklahoma, Norman (1991–1992); assistant professor, Karl Sudhoff Institute (1992–1993); “integration” fellowship, Humboldt Foundation, Institute for History of Science, Ludwig-Maximilians-Universität München (1993); Feodor Lynen Fellowship, Humboldt Foundation, member of the Institute for Advanced Study, Princeton (1994–1995); PD, Karl Sudhoff Institute (1995–1996); visiting professor, Institute for History of Science, Georg-August-Universität Göttingen (1995–1996); European travelers to the Middle East (16th–17th centuries) and the sciences in Muslim societies.

Held lectures at the *International Congress on Learning and Education in the Ottoman World* in Istanbul, and at the University of Essen. At the Institute from December 1996 to July 1999.

Büttner, Jochen (Dipl. 1997 [physics] Freie Universität Berlin): history of early modern mechanics. At the Institute since January 1998.

Cadden, Joan (B.A. 1965 Vassar College, M.A. 1967 Columbia University, Ph.D. 1971 [history and philosophy of science] Indiana University); assistant professor Harvard University (1971–1976); assistant professor, associate professor, professor Kenyon College (1978–1996); professor University of California at Davis (1996–present): history of medieval scientific and medical ideas on sexuality; medieval scientific arguments in disciplinary, social and political contexts. At the Institute from July 1997 to July 1998.

Castagnetti, Giuseppe ([philosophy and history] University of Milano); research scholar Max Planck Institute for Human Development and Education, working group Albert Einstein (1990–1995); research scholar Einstein Papers project, The Collected Papers of Albert Einstein, Boston (1989–1996): history of institutions of physics in the 20th century; political and social context of Albert Einstein's activities in Berlin. At the Institute since October 1997.

Clark, William (Ph.D. [history of science] University of California at Los Angeles, 1986); lecturer, history, University of California at Los Angeles (1987–1988); lecturer & Mellon Fellow, Bryn Mawr College (1988–89); lecturer & Kenan Fellow, Columbia University (1989–1991); Akademischer Rat a. Z., Institut für Wissenschaftsgeschichte, Göttingen (1991–1997); lecturer, University of Cambridge (1998–present): early modern German science and academic institutions. At the Institute from October 1997 to September 1998.

Damerow, Peter (Dr. 1977 [mathematics] Universität Bielefeld, habil. 1994 [philosophy] Universität Konstanz); Max Planck Institute for Human Development and Education: history of science and education, genesis of writing and arithmetic, individual and historical development of cognition, mathematical modeling in the sciences.

Held lectures at the ITEM-CNRS conference *Genèse* in Paris, at the *Hauptversammlung der Max-Planck-Gesellschaft* in Weimar (together with *Jürgen Renn*), at the Institute's public lecture series

Media of thinking, and further lectures at universities and other academic institutions in Cambridge (USA), Florence, Paderborn, and Philadelphia. At the Institute since January 1997.

Daston, Lorraine (A.B. 1973 Harvard University, Dipl. 1974 University of Cambridge, Ph.D. 1979 [history of science] Harvard University); assistant professor Harvard University (1980–1983) and Princeton University (1983–1986); Dibner Associate Professor Brandeis University (1986–1989); professor Georg-August-Universität Göttingen (1990–1992); professor University of Chicago (1992–1995): history of probability and statistics (16th–19th centuries); history of forms of scientific evidence and objectivity (16th–20th centuries).

Held plenary lecture at the annual meeting of the *History of Science Society* in San Diego and further lectures at universities and other academic institutions in Berlin, Braunschweig, Cambridge (UK), Cambridge (USA), Chicago, Heidelberg, London, Los Angeles, Lyon, New York, Potsdam, Princeton, Providence, San Diego, and Vienna. At the Institute since July 1995.

Dierig, Sven (Dipl. 1990 [biology], Dr. rer. nat 1995 [neurobiology] Universität Konstanz); post-doctoral fellow Universität Konstanz (1995–1997): history of laboratory physiology in connection with history of technology and urban history; virtual reconstruction of laboratory equipment and historical experiments.

Held a lecture at the Institute's workshop *Physiological and Psychological Practices in the 19th Century* and further lectures (partly with *Jörg Kantel* and *Henning Schmidgen*) at universities and other academic institutions in Berlin, Düsseldorf, Göttingen, Jena, and Lüneburg. At the Institute since July 1997.

Dörries, Matthias (Dr. rer. nat. 1989 (Freie Universität Berlin); habil. 1998 [history of science] Ludwigs-Maximilians-Universität, München); research scholar, Office for the History of Science and Technology, University of California at Berkeley (1989–1990); research scholar, Centre de recherche en histoire des sciences et des techniques, Paris (1991–1993); research scholar, Forschungsinstitut für Technik- und Wissenschaftsgeschichte, München (1993–1998); associate professor, Université Louis Pasteur (Strasbourg I) (1999–): history of the physical sciences (18th to 20th centuries); history of science in France (18th to 20th centuries).

Held a lecture at the *Deutscher Historikertag* in Frankfurt/M, and further lectures at universities and other academic institutions in Chicago, Montpellier, München, Regensburg Strasbourg, and Tarragona. At the Institute since January 1999.

Grabhoff, Gerd (M.A. 1983, Dr. rer. nat. 1986 [history of science], habil. 1995 [philosophy] Universität Hamburg); Oxford University (1980–1981); member of the Institute for Advanced Study Princeton (1987–1988); Minerva Associate at Tel Aviv University (1990–1991), Hochschulassistent Universität Hamburg (1988–1995); guest professor for philosophy Universität Hamburg (1994–1995); chair for the history of science at Georg-August-Universität Göttingen (1997–1998): modeling of scientific discovery processes; history of astronomy; methodology of sciences; natural philosophy late 19th and early 20th century. Held lectures at universities and other academic institutions in Bern, Bielefeld, Duisburg, Göttingen, Hamburg, and Köln. At the Institute from April 1995 to March 1999.

Hagner, Michael (Staatsexamen 1986 [medicine], Dr. med. 1987 Freie Universität Berlin, habil. 1994 [history of medicine] Georg-August-Universität Göttingen); research scholar and postdoctoral fellow Freie Universität Berlin (1986–1989); research scholar Medizinische Universität Lübeck (1989–1991) and Georg-August-Universität Göttingen (1991–1995); Heisenberg Fellow (1995–1996); visiting professor University of Salzburg (1998); Simon Silverman Visiting Professor Tel Aviv University (1999): history of epistemic objects in the neurosciences and in teratology (18th–20th centuries); history of experimental cultures (18th–20th centuries).

Held lectures at the conferences *Aufmerksamkeit* in Wien, and *Das Gesicht der Weimarer Republik* in Potsdam, the *Liechtensteiner Exkurse* in Schaan, at the Institute's public lecture series *The Sciences of the Body*, at the Institute's conference *The organisation of visibility*, and further lectures at universities and other academic institutions in Basel, Berlin, Beer-Sheva, Bielefeld, Cottbus,

Düsseldorf, Florenz, Heidelberg, Jena, Los Angeles, Lübeck, Münster, Tel Aviv and Zürich. At the Institute since January 1997.

Heesen, Anke te (Dipl. 1990 [cult. pedagogy], Universität Hildesheim; Dr. phil. 1995 (aesthetics und communication) Universität Oldenburg; Walther Rathenau Fellowship for the History of Science (1994–1995); research scholar at the Forschungszentrum Europäische Aufklärung (1996–1997); research scholar at the Deutsche Hygiene-Museum Dresden (1998–1999): history of visualization and education (18th century); material representation of knowledge (18th–19th centuries). At the Institute since October 1999.

Hoffmann, Dieter (Dipl. 1972 [physics], Dr. phil. 1976 Humboldt-Universität zu Berlin, Dr. habil. 1989 [history of science] Humboldt-Universität zu Berlin); research scholar Akademie der Wissenschaften der DDR (1976–1991); research scholar Physikalisch-Technische Bundesanstalt (1991–1992); research scholar Forschungsschwerpunkt Wissenschaftsgeschichte und Wissenschaftstheorie, Berlin (1992–1995); Guest Professor Humboldt-Universität zu Berlin (WS 1996/97), since 1997 there Privatdozent. History of physics in the 19th and 20th centuries, esp. institutional and experimental history of quantum theory and modern metrology; history of science in the GDR.

Held lectures at the conferences *Wissenschaft und Kalter Krieg* in Halle and *Die Deutsche Akademie der Wissenschaften 1914–1945* in Berlin, the *XVII. International Scientific Instrument Symposium* in Soro, the *VIII. Physikhistorische Tagung der Deutschen Physikalischen Gesellschaft* in Heidelberg, the fourth *Symposium zur Geschichte der Kaiser-Wilhelm-/Max-Planck-Gesellschaft* in Bad Homburg, and further lectures at universities and other academic institutions in Berkeley, Berlin, Boston, Halle, Lübeck, and Stuttgart. At the Institute since December 1995.

Jansen, Sarah (B.Sc. 1981 [biology] McGill University, Dr. phil. 1997 [history] Technische Universität Braunschweig); researcher Deutscher Bundestag (1983–1985); free-lance writer and independent scholar (1986–1991); instructor at the Universities of Giessen, Kassel, Braunschweig and Paderborn (1990–1997); visiting scholar Harvard University (1995); postdoctoral fellow Max-Planck-Institute for the History of Science 1997–1998; history of biology, biomedicine and the environmental sciences; history of population sciences; gender studies; history of scientific objects in science and politics since 1800.

Held lectures at the meeting of the *International Society of History, Philosophy, and Social Studies of Biology in Oaxaca*, the *Jahrestagung der Deutschen Gesellschaft für Geschichte und Theorie der Biologie* in Rostock, the *Liechtensteiner Exkurse* in Schaan, the workshop *Räume und Weisen der Normalisierung um 1900* in Braunschweig, the annual meeting of the *History of Science Society in Kansas City*, and further lectures at universities in Berlin, Braunschweig, and Cambridge (USA). At the Institute since January 1999.

Kant, Horst (Dipl. 1969 [physics], Dr. rer. pol. 1973 [history & philosophy of science] Humboldt-Universität zu Berlin); research scholar Humboldt-Universität zu Berlin (1973–1978); research scholar Akademie der Wissenschaften der DDR (1978–1991); research scholar Forschungsschwerpunkt Wissenschaftsgeschichte und Wissenschaftstheorie, Berlin (1992–1995): history of physics in the 19th and 20th centuries, esp. institutional and social aspects; history of radioactivity and nuclear physics; development of physics in Berlin.

Held a lecture at the *International Conference HISAP 1999* in Wien and further lectures at universities and other academic institutions in Berlin. At the Institute since October 1995.

Kaufmann, Doris (Dr. phil. 1983, habil. 1993 [history] Technische Universität Berlin); visiting professor Freie Universität Berlin (1994); visiting professor Universität Tübingen (1994–1995); visiting professor Universität Jena (1995); visiting professor Universität Bern (1995–1996): modern social and cultural history, history of psychiatry and of cultural anthropology, religious and gender studies; since April 1998 research director of the project of the Max Planck Society: “History of the Kaiser-Wilhelm-Gesellschaft during the National Socialist period (1933–1945)”. At the Institute from October 1995 to March 1998.

Klein, Ursula (Dr. phil. 1993, habil. 2000 [philosophy] Universität Konstanz). Postdoctoral fellow Forschungsschwerpunkt Wissenschaftsgeschichte und Wissenschaftstheorie Berlin (1993–95); research scholar Max Planck Institute for the History of Science (1995–97); visiting scholar Harvard University (1996–98); visiting scholar Dibner Institute (1997–98). Philosophy of science; history of laboratory sciences; the history of chemistry.

Held lectures at the annual meetings of the *American Chemical Society* in Dallas and the *History of Science Society* in Pittsburgh and further lectures at universities and other academic institutions in Cambridge (USA), Columbia, New York, and Princeton. At the Institute as director of an independent research group since July 1998.

Küttler, Wolfgang (Dipl. 1958 [history] Friedrich-Schiller-Universität Jena, Dr. phil. 1966 Universität Leipzig, Dr. sc. 1976, Professor 1978 [history] Akademie der Wissenschaften der DDR); research scholar (1958–1967) Friedrich-Schiller-Universität Jena and Universität Leipzig; research scholar (1967–1974); head of department (1974–1990), director (1990–1991) Zentralinstitut für Geschichte der Akademie der Wissenschaften der DDR; visiting professor Humboldt-Universität zu Berlin (1981–1990); research scholar Forschungsschwerpunkt für Wissenschaftsgeschichte und Wissenschaftstheorie, Berlin (1992–1995); theory, methodology and history of historical science, Marxist theory of history, Max Weber research.

Held lectures at universities and other academic institutions in Berlin, Bochum, Dresden, and Leipzig. At the Institute since October 1995.

Lefèvre, Wolfgang (Dr. phil. 1971 [philosophy], habil. 1977 [philosophy in connection with history of science] Freie Universität Berlin, apl. Professor Freie Universität Berlin [philosophy]): 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).

Held lectures at the Institute's workshops *Space-Time, Quantum Entanglement and Critical Epistemology* and *Between Leibniz, Newton, and Kant* and further lectures at universities and other academic institutions in Blacksburg, Braunschweig, and Cambridge (USA). At the Institute since July 1994.

Mendelsohn, John Andrew (A.B. 1989 [history & science] Harvard University, M.A. 1991 Princeton University, Ph.D. 1996 [history] Princeton University); Mellon Fellow in the Humanities (1989–1994); assistant in instruction Princeton University (1991–1992); international doctoral research fellow Social Science Research Council (1992–1993); postdoctoral research fellow Max Planck Institute for the History of Science Berlin (1995–1996); Simon Silverman Visiting Professor Tel Aviv University (1998); life and medical sciences in social context since 1800.

Held lectures at the annual meeting of the *History of Science Society* in Pittsburgh, at the annual conference of the *Society for the Social History of Medicine* in Glasgow, at the Institute's conferences and workshops *The Brain and its Sciences in the Twentieth Century*, *Scientific Personae*, and *Gehirn und Kultur*, and further lectures at the Universities of Heidelberg and Tel Aviv. At the Institute as research scholar since January 1997.

Pietsch, Annik (Diplom [biochemistry] Freie Universität Berlin, 1988; B.A. [history of art] Technische Universität Berlin, 1990); collaborator CNRS, Centre de Recherches sur la Conservation des Documents Graphiques (1990), collaborator Louvre, Laboratoire de Recherche des Musées de France (1990–91); Leader of the conservation analytical laboratory in the central restoration workshops of the Westfälisches Museumsamt (1992–99); Ph. D. student [art history], Freie Universität Berlin: Binding Media. Painting Techniques in Art, Science, and Industry in 18th and 19th Century Germany.

Held lectures at the Fachhochschule Hildesheim/ Holzminden and Fachhochschule Erfurt. At the Institute since July 1999.

Potthast, Thomas (Dipl. 1993 [biology] Universität Freiburg, Dr. rer. nat. 1998 [biology] Universität Tübingen); postgraduate fellow and research scholar Zentrum für Ethik in den Wissenschaften der Universität Tübingen 1994–1998; history, epistemology, and ethics of evolutionary biology, ecology, and nature conservation.

Held lectures at the *Jahrestagung der Gesellschaft für Ökologie* in Ulm (together with *Uta Eser*), the conference *Konfliktpartnerschaft: Gentechnologie als Herausforderung zu einer neuen Diskussionskultur?* in Mannheim, the annual meeting of the *Deutsche Gesellschaft für Geschichte und Theorie der Biologie* in Rostock, the annual meeting of the *History of Science Society* in Pittsburgh, the workshop *Rassenforschung im Nationalsozialismus. Konzepte und wissenschaftliche Praxis unter dem Dach der Kaiser-Wilhelm-Gesellschaft* in Berlin and further lectures at universities and other academic institutions in Berlin, Blaubeuren, Cambridge (USA), Cottbus, Greifswald, and Tübingen. At the Institute since September 1998.

Ramberg, Peter J. (B. Chem., 1984, University of Minnesota, M.S. [organic chemistry], M.A. [history and philosophy of science], PhD., 1993 [history of science], Indiana University). Visiting Professor (1993–95) and Senior Lecturer (chemistry, 1997–99), Johns Hopkins University; visiting professor (chemistry), Ohio University (1996–97); visiting professor (chemistry), North Dakota State University (1995–96). 19th century organic chemistry and stereochemistry; history and philosophy of chemistry. At the Institute since September 1999.

Renn, Jürgen (Dipl. 1983 [physics] Freie Universität Berlin, Dr. rer. nat. 1987 [mathematics] Technische Universität Berlin); collaborator and co-editor of *Collected Papers of Albert Einstein* (1986–1992); assistant, since 1993, associate professor Boston University (1989–1993) [philosophy and history of science, physics]; Simon Silverman Visiting Professor Tel Aviv University (1993) [history of science]; visiting professor ETH Zürich (1993–1994) [philosophy]; adjunct professor Boston University (since 1994); honorary professor Humboldt-Universität zu Berlin (since 1995) [history of science]; history of early modern mechanics, history of relativity theory; interaction between cognitive and contextual factors in the history of science.

Held lectures at the conferences *Volta and the History of Electricity* and *Science as a Culture* in Como-Pavia, at the *Fifth International Conference on the History and Foundations of General Relativity* in Notre Dame (USA), at the conference *The Transformation of Science – Research between Printed Information and the Challenges of Electronic Networks* in Elmau, at the colloquium *Adolf von Harnack (1851–1930)* in Ringberg, at the *Hauptversammlung der Max-Planck-Gesellschaft* in Weimar (together with Peter Damerow), and further lectures at universities and other academic institutions in Berlin, Dortmund, Florence, Göttingen, Köln, München, Potsdam, Stuttgart and Tübingen. At the Institute since March 1994.

Rheinberger, Hans-Jörg (M.A. 1973 [philosophy], Dipl. 1979 [biology], Dr. rer. nat. 1982, habil. 1987 [molecular biology] Freie Universität Berlin); research scholar Max Planck Institute for Molecular Genetics Berlin (1982–1990); honorary professor (history of biology) University of Salzburg (1989); lecturer (history of science and medicine) University of Lübeck (1990–1994); visiting professor Georg-August-Universität Göttingen (1992–1993); Ao. Univ. Prof. (molecular biology and history of science) University of Salzburg (1994–1996); honorary professor for history of science and technology at the Technische Universität Berlin (since 1998): history and epistemology of experimentation, history of the life sciences.

Held lectures at the workshop *Ein Moment und seine epistemische Dauer* in Frankfurt/Oder, at the Institute's conference *Reworking the Bench - Research Notebooks in the History of Science*, the workshop *Geschichte der Kaiser-Wilhelm-Gesellschaft im Nationalsozialismus – Bestandsaufnahme und Perspektiven der Forschung* in Berlin, the commission meeting of the *IUHPS/DDHS* in München, the meeting of the *International Society of History, Philosophy, and Social Studies of Biology in Oaxaca*, the workshop *American Foundations and the Development of Modern Biomedicine in Europe* in Pocantino Hills, the *Liechtensteiner Exkurse* in Schaan, the annual meeting of the *History of Science Society* in Pittsburgh, and further lectures at universities and other academic institutions in Athens, Austin, Berlin, Bielefeld, Blacksburg, Buffalo, Gamprin, Hamburg, Lexington, Leipzig, München, Roskilde, Stanford, Wien, and Zürich. At the Institute since January 1997.

Rieger, Simone (M.A. 1998 [linguistics and philosophy] Technische Universität Berlin): research project about optical chinese character recognition (Technische Universität Berlin), research project about technical terminology and its pragmatics in engineering sciences (Technische Uni-

versität Berlin); history of early modern mechanics, linguistics and semiotics; genesis of technical terminology. At the Institute since February 1999.

Roesler-Friedenthal, Antoinette, (M.A. 1994 Freie Universität Berlin, Dr. phil. 1999 Freie Universität Berlin [Art History]); research assistant British Museum London 1990–1991; research fellow Bibliotheca Hertziana (Max Planck Institute) Rome 1994–1999; research fellow Max Planck Institute for the History of Science, 1999–2001: Self-portraits and Images of the Artist in the Italian Renaissance; interactions between the art market and academic art history; time-related questions in the perception of works of art.

Held a lecture at the *30th International Congress of the History of Art* in Sussex and at the Freie Universität Berlin. At the Institute since March 1999.

Roux, Sophie (Agrég. 1987 [philosophy], Ph.D. 1996 [history of science] EHESS); fellow École Normale Supérieure (1984–1989); assistant in instruction Université de Paris I (1989–1992); fellow Fondation Thiers (1993–1995); postdoctoral fellow (1996–1997) and research fellow (1997–1998) at the Max Planck Institute for the History of Science Berlin; Centre A. Koyré Paris (1998–present): early modern physics and its epistemology. At the Institute from October 1997 to August 1998.

Schemmel, Matthias (Dipl. 1997 [physics] Universität Hamburg): history of general relativity, history of early modern mechanics. At the Institute since January 1998.

Schoepflin, Urs (Dipl. 1975 [sociology], Freie Universität Berlin); director of library: scientific information systems, scientific communication, sociology and history of science, scientometrics. Held lectures at the 21st and 22nd *Fortbildungstagung für Bibliotheksleiter/innen der Max-Planck-Institute und Arbeitsgruppen*, at the workshop *Das digitale Archiv Duderstadt im Kontext der Diskussion um die Digitalisierung* in Göttingen, at the *Seventh International Conference of the International Society for Scientometrics and Informetrics* in Colima, Mexico (together with *Wolfgang Glänzel*), and at the workshop *Dokumentenmanagement* in Nijmegen, Netherlands. At the Institute since September 1994.

Schüller, Volkmarr (Dr. rer. nat. 1972 [physics] Universität Greifswald); research assistant Universität Greifswald (1972–1976); research scholar Akademie der Wissenschaften der DDR (1979–1991); research scholar Forschungsschwerpunkt für Wissenschaftsgeschichte und Wissenschaftstheorie, Berlin (1992–1994): history of mathematics and physics (16th and 17th centuries).

Held a lecture at the *International Symposium on the History of Mathematics* in Göttingen. At the Institute since September 1994.

Sibum, H. Otto (Dr. rer. nat. 1989 [physics] Carl von Ossietzky Universität Oldenburg); research scientist Department of Physics, Universität Oldenburg (1989–1990); research associate (1991–1993); senior research associate (1994–1995) and affiliated research scholar (since 1996) University of Cambridge; research scholar (1995–1998) and director of an independent research unit (since October 1998) at the Max Planck Institute for the History of Science Berlin: history of physical sciences (17th – 20th centuries), history of experimentation and non-literal knowledge traditions.

Held lectures at the workshop *Historische Anthropologie der Wissenschaft* in Potsdam, at the Institute's workshops *Instruments, Travel and Science* and *Reworking the Bench*, at the conference *History of Precision Measurement* in Utrecht, at the Nobel Symposium *Museums of Modern Science*, at the Institut's conference *Scientific Personae*, and further lectures at universities and other academic institutions in Antwerpen, Braunschweig, Cambridge (USA), Princeton, and Oldenburg.

Spary, Emma (B.A. 1988 [natural sciences] University of Cambridge, Ph. D. 1993 University of Cambridge); Research Fellow, Girton College, Cambridge (1992–1995); Warwick Research Fellow, University of Warwick (1995–1998): history of natural history (late 17th – early 19th centuries); history of agriculture (18th century); history of the sciences of food (18th – early 19th centuries).

Held a lecture at the conference *Science and Medicine in the Enlightenment* in Edinburgh, at the workshop *Exercising Taste: Luxury and the Education of the Senses* in Coventry, and further lectures

at universities and other academic institutions in Amsterdam, Cambridge (UK), and Paris. At the Institute since July 1998.

Steinle, Friedrich (Dipl. 1982 [physics], Dr. rer. nat. 1990 [history of science], Universität Tübingen); research scholar Georg-August Universität Göttingen (1990–1995), research fellow Maison des Sciences, Paris (1994–95), research grant Deutsche Forschungsgemeinschaft (1996–1997), research fellow Dibner Institute for History of Science and Technology (MIT), Cambridge, USA (1998–1999): Early modern natural philosophy, history of physics (17th–19th centuries), philosophy of science, history and philosophy of experimentation.

Held lectures at the *Jahrestagung der Deutschen Gesellschaft für Geschichte der Medizin, Naturwissenschaft und Technik* in Leipzig, the *Seven Pines Symposium* in Lewis, the Conference “*Volta and the History of Electricity*” of the European Physical Society in Como, and further lectures at universities and other academic institutions in Bielefeld, Cambridge (USA), and Kassel. At the Institute from October 1997 to March 1998 and since August 1999.

Thieffry, Denis (Dipl. 1988 [molecular biology and philosophy of science] and Ph.D. 1993 [theoretical biology] Université Libre de Bruxelles); postdoctoral fellow Université Libre de Bruxelles (1993–1995); assistant professor Universidad Nacional Autónoma de México (1995–1997); research fellow at the Max Planck Institute for the History of Science Berlin (1997–1998); (since 1999–) Laboratory of Genetics, Department of Molecular Biology, Université Libre de Bruxelles: history of genetics, embryology and molecular biology (20th century).

Held lectures at the *Pacific Symposium on Biocomputing 1998* in Maui, at the Institute's conference *Postgenomics? Historical, Techno-Epistemic and Cultural Aspects of Genome Projects*, at the *Fifth International Conference on Mathematical Population Dynamics* in Zakopane (together with Lucas Sánchez), the *First International Conference on Bioinformatics of Genome Regulation and Structure* in Novosibirsk (together with *Luis Mendoza* and *Elena R. Alvarez-Buylla*) and at the University of Copenhagen. At the Institute from July 1997 to December 1998.

Veit-Brause, Irmline (Ph.D. 1967 [history] University of Cologne); tutor (history) Monash University (1968–1973); research associate, University of Cologne, (1973–1974); senior tutor, Monash University (1973–1977); lecturer (1977–1984); senior lecturer (1984–1988) and associate professor (since 1989); Deakin University (Philosophical Studies); visiting professor, Freie Universität Berlin (1991–1992): modes of rationality in the human sciences (19th century).

Held a lecture at the *Swedish Colloquium for the Advanced Study of Social Science* in Uppsala, and further lectures at universities and other academic institutions in Berlin and Göttingen. At the Institute from October 1998 to August 1999.

Vogt, Annette (Dipl. 1975, Dr. rer. nat. 1986 [mathematics] Karl-Marx-Universität Leipzig); research scholar Akademie der Wissenschaften der DDR (1975–1991); research scholar and coordinator Forschungsschwerpunkt Wissenschaftsgeschichte und Wissenschaftstheorie, Berlin (1992–1994): history of mathematics; history of mathematics in Germany in the 19th and 20th centuries; history of the relationships between Russia/Soviet Union and Germany in the 19th and 20th centuries in mathematics; history of Jewish scientists in Germany; history of female scientists in the 19th and 20th centuries.

Held lectures at the third and fourth *Symposium zur Geschichte der Kaiser-Wilhelm-/Max-Planck-Gesellschaft* in Bad Homburg, the *ICM '98* workshop on history of mathematics in Göttingen, the *Königsberger Symposium der Österreichischen Gesellschaft für Wissenschaftsgeschichte*, the workshop *Frauen(t)raum Technik - Ingenieurinnen zwischen Geschichte und Zukunftsberuf* in Berlin, the workshop of the DHS/IUHS *Women in Science* in Cambridge (UK) and further lectures at universities and other academic institutions in Berlin Bremen, Marseille, and Lindau. At the Institute since September 1994.

Wahsner, Renate (Dipl. 1961, Dr. phil. 1966 [philosophy] Humboldt-Universität zu Berlin, Dr. sc. 1978 [philosophy] Akademie der Wissenschaften der DDR, professor [history of science] Akademie der Wissenschaften der DDR (1987); research scholar Humboldt-Universität zu Berlin (1963–1970); research scholar Akademie der Wissenschaften der DDR (1974–1991); research scholar

Forschungsschwerpunkt Wissenschaftsgeschichte und Wissenschaftstheorie, Berlin (1992–1995); professor Universität Potsdam (1995): history of philosophy in connection with history of science; systematical relations between philosophy and natural science; epistemological fundamentals and problems of physics; German idealism; classical natural philosophy.

Held lectures (partly together with *H.-H. v. Borzeszkowski*) at the *Gesamttagung der Internationalen Gesellschaft "System der Philosophie"* in Wien, the *XXII. Internationaler Hegel-Congress* in Utrecht, the conferences *Physical Interpretation of Relativity Theory* in London, *Classical and Quantum Nonlocality* in Erice, *Experiment und Technik bei Hegel* in Kaiserslautern, the *Internationale wissenschaftliche Tagung aus Anlaß des 300. Geburtstages von Pierre Louis Moreau de Maupertuis* in Berlin, and further lectures at universities and other academic institutions in Berlin and Bern. At the Institute since October 1995.

Weinig, Paul (Dr. phil. 1994 [German philology] Johann Wolfgang Goethe-Universität Frankfurt/M.); teacher at the Goethe-Institut Frankfurt/M. (1991–1995): history of medieval mechanics in Arabic and Latin sciences; history of humanism in Germany (1400 to 1600); science and history of medieval manuscript-writing; history and methodology of language teaching (DaF). At the Institute since November 1995.

Wintroub, Michael (A.B. 1981 University of California at Berkeley, M.Sc. 1984 London School of Economics, M.A. 1990 University of California at Los Angeles, Ph.D. 1995 [European History] University of California at Los Angeles); research associate University of Cambridge (1994–1996); assistant professor University of Michigan, Ann Arbor (1996–present): ritual, identity formation, alterity and the history of objectivity in early modern Europe. At the Institute from September 1998 to August 1999.

Wunderlich, Falk (M.A. 1995 [philosophy] Freie Universität Berlin): Kant's natural philosophy. Held lectures at the Institute's workshop *Between Leibniz, Newton, and Kant* and at the Virginia Tech. University, Blacksburg. At the Institute as research scholar from September 1995 to December 1998.

The Research Program of the Institute, its Departments and Research Groups

Introduction

The Max Planck Institute for the History of Science was founded in 1994, and since then has grown from one scholar balancing a telephone on his lap to circa seventy-five scholars (including visitors), a support staff of 45, and a library of some 35,000 volumes. The numerous research projects described in this report are divided among three permanent departments (directed by *Jürgen Renn*, *Lorraine Daston*, and *Hans-Jörg Rheinberger*) and two five-year independent research groups (led by *Ursula Klein* and *H. Otto Sibum*). The range of these projects is extremely broad, spanning ancient Babylonian mathematics to contemporary debates over the human genome, and the diversity of themes correspondingly great, addressing topics in the history of almost every scientific discipline. These projects are documented in their considerable variety in these pages. All of the projects aim, however, to contribute to a theoretically informed understanding of the historical development of scientific knowledge: a “historical epistemology” that investigates the conceptual and material structures – patterns of argument, architectural spaces, regimens of experience, techniques of visualization, mental models – that have made the sciences in their present and past forms possible. Taken together, the research projects conducted at the Institute share three premises: first, that even the most deeply entrenched aspects of scientific thought and practice have a history; second, that comparative investigations are essential to understanding major changes in the history of science; and third, that the sources for a historical epistemology of science should be expanded to include images, objects, spaces, and gestures as well as texts. A few words about each of these premises, with illustrative reference to one or two research projects that attempt to apply them, will serve as a brief introduction to this report and to the common mission of the Institute.

History: Historical epistemology assumes that the most fundamental categories of contemporary scientific experience and reasoning have a history. Objectivity and experiment have been two longterm foci of historical research at the Institute. In both cases, core ideals and practices of science originate in specific intellectual and cultural contexts, and then gradually spread by means of new techniques and institutions. In the case of objectivity, new techniques of image-making (e.g. photography) and data analysis (e.g. inference statistics) were the concrete expression of scientific worries, new to the nineteenth century, about the distorting effects of the self on the investigation of nature (see p. 43). Experiment as a form of scientific experience emerged in the seventeenth century, and its history is still ongoing. Several research projects study how practical knowledge from industry and crafts was slowly integrated into the corpus of science in the late eighteenth and nineteenth centuries, how the “tacit” knowledge of the workshop was given a voice in the laboratory (see p. 78). Another cluster of projects addresses the diversification of “experimental systems”, with special attention to modes of representation as diverse as electroencephalography or chronoscopy (see p. 51).

Comparison: Most recent research in the history of science has taken the form of detailed studies of specific episodes situated within a restricted disciplinary and chronological context. While recognizing the necessity of such contextual studies as the basis for reliable historical work, the Institute encourages research projects that examine problems comparatively, across historical, cultural, and disciplinary contexts – hence the prominence of collaborative work at the Institute. Research projects on “Mental Models in the History of Mechanics” (see p. 18). “Demonstration-Test-Proof” (see p. 30), and “History and Epistemology of Experimentation” (see p. 48) chart developments over several centuries, in different cultures and disciplines. The goal of such comparisons is in the first instance taxonomic: to identify and classify variations. The utility of comparisons does not, however, end there: although extremely fruitful, the last decade of fine-grained contextual studies in the history of science has left open the question of how certain forms of knowledge overcome their local origins to become global. Comparisons should also lead to an

understanding of long-term developments in science in dependence on varying cultural conditions such as e.g. those of the Latin and Arabic traditions in mechanics.

Beyond Texts: Although the close study of scientific texts remains essential to almost all branches of the history of science, a leitmotif of research projects at the Institute has been the use of further kinds of historical documents, including images, instruments, buildings, and other material artefacts. The layout of botanical gardens, the idiosyncrasies of early thermometers, and the molecular models of chemists have their own hermeneutics that historians are learning to read as they have long read texts (see pp. 72, 78). These new sources have stimulated several research groups to develop innovative ways of documenting and analyzing everything from ancient balances to physiological laboratories, drawing heavily on the possibilities of computer technology (see pp. 26, 55).

The following chapters describe the projects currently pursued at the Institute in more detail. In addition to this Research Report, specific and up-to-date information about the Institute and its activities is available at <http://www.mpiwg-berlin.mpg.de>.

Department I (Director: Jürgen Renn)

The work of the research group headed by *Jürgen Renn* is mainly dedicated to the understanding of 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 two central projects: (1) the relation of practical experience and conceptual structures in the emergence of science, and (2) studies in the integration and disintegration of knowledge in modern science. 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 transformation processes of knowledge organization, in particular in developed sciences, and the role of fundamental concepts (both of the first and second order) in such processes. A further area of work is dedicated to developing advanced tools for an historical epistemology. In this area, new electronic media are used for exploring new ways of creating access to the empirical basis of the history of science.

A detailed account of the design and methodology of the major projects of the department has been given in the Institute's Research Report 1996–1997. The present report concentrates on the state of the work and on recent activities not covered by the previous report.

Meanwhile, one of the central research projects of the department, as well as some other undertakings, had to be suspended. The project "Dynamic Models of Scientific Discoveries" had to be given up because one of the senior scientists of the department (*Gerd Grabhoff*) accepted the call to the chair of history and philosophy of science at the University of Bern. As a consequence, several associated research activities at the Institute were also terminated and some of his closer collaborators left the Institute. The departure of the group affected the Institute all the more as its technical competence in the field of UNIX technology compensated for deficits due to the understaffed computer department of the Institute. For similar reasons, the research on the crisis of classical physics leading to the relativity and quantum revolutions had to be refocused, suspending research activities depending on the special qualifications of temporary collaborators who left the Institute for more permanent positions (*Edward Jurkowitz, Tilman Sauer, Britta Scheideler, Arne Schirrmacher*).

Some other reorientations with regard to the direction of research pursued in the department are the result of decisions that have become possible because individual activities, partly begun before the Institute was founded, have meanwhile been completed. Compared with the situation previously reported, the research could hence to a greater extent be focused on the main goals of the major projects. The advancement of these projects makes it possible to identify perspectives of future research based on their results. In particular, it is intended to more intensively study the rise of the analytical method as a result of early modern mechanics which revolutionized physics and became the most important prerequisite of the disintegration of classical science which has been one of the foci of research so far. This will be a first step towards bridging the historical interval between the emergence of classical physics and its decline and hence to learn more

about another kind of epistemological shift, the functioning of the mental models responsible for the rise and decline of the mechanical world view.

Another upcoming project draws on the extensive studies of the relativity revolution, as well as on the studies of the reorganization of research strategies in response to the quantum crisis investigated in recent years. Just as the emergence of General Relativity has been analyzed as a consequence of the reorganization of the classical knowledge on gravitation, it is planned to pursue a detailed analysis of the birth of quantum theory as a result of the reorganization of the classical knowledge on matter and radiation.

In addition to these plans, which to a certain extent emerge from the work done during the first five years of the Institute, partnerships with other institutions have made it now possible to tackle issues requiring an even more extensive interdisciplinary cooperation. In particular, a cooperation with the Max Planck Institute for Psycholinguistics in Nijmegen will make it possible to explore the roots of scientific theories of space and time in cognitive and linguistic preconditions of spatial orientation, and of the temporal structure of human activities. A recently launched joint research project with the Bibliotheca Hertziana (Max Planck Institute) in Rome is dedicated to an epistemological history of architecture. It aims at documenting and analyzing the long-term history of the unwritten knowledge that has made the great architectural achievements of mankind possible. This knowledge emerged long before the advent of science and was repeatedly subjected to transformations which explain the fascinating interplay of utility, rationality, and art that is the hallmark of architecture.

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 with an extraordinary significance to the development of science in general. In particular, more 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 time period from antiquity to the emergence of classical mechanics in early modern times. It is, however, intended to follow up the research questions of the project until 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 every-day experience or even based on *a priori* structures of thinking. These and other speculations involve a very restrictive notion of experience, however. They exclude the by no means universal experience that human beings acquire in a historically specific material environment when dealing, for instance, with the technology of their times. Therefore, the project is particularly focused 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 that they were used for.

Completed research activities

Translation of Newton's Principia:

A new edition in German translation of the principal source of classical mechanics has been completed and published (*Volkmar Schüller*). This edition contains a translation of the variants of the

three editions of the *Principia* edited by Newton in the years 1687, 1713 and 1726 and of Newton's manuscript for the edition in 1687. Moreover, translations of all contemporary reviews of the *Principia* are included.

Current research activities

Intuitive Mechanics:

Mechanical knowledge predates considerably 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. A dissertation project (*Katja Bödeker*) provides a survey of relevant research in psychology, linguistics, and cognitive science and evaluates methods and results with the aim to integrate them into an analysis of mechanical thinking from the viewpoint of historical epistemology.

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 oral explanation that accompanies their application.

Research on professional knowledge related to mechanics including extensive field work aiming at documentation of still-existing traditional technologies is being performed predominantly in two areas: artisanal knowledge related to the law of the lever going back to antiquity and engineering knowledge inherent in the invention and use of machines with particular emphasis on the early modern period. The relation between practical knowledge and the origin of mechanics as a science, which was for a long time based mainly on the law of the lever, is studied by reconstructing the knowledge needed for the invention, production, and usage of balances with unequal arms (*Peter Damerow, Jürgen Renn, Simone Rieger, Matthias Schemmel, Paul Weinig*). In the course of this study, the mechanical knowledge of ancient cultures (Greek, Roman, Chinese, Inca) is being investigated, based on the analysis of archeological finds and surviving traditional practices. The tradition of engineering knowledge since antiquity is studied with particular attention to forms of representation that are not predominantly shaped by the theoretical tradition such as drawings and models (*Wolfgang Lefèvre, David McGee, Marcus Popplow*). In the early modern period, these representations formed the core of a specific "reflecting practical mechanics," dealing with highly complex technical problems (rigidity of bodies, friction, etc.) which could not be addressed successfully with the theoretical mechanics then available. In particular, the body of mechanical knowledge was then confronted 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, eventually leading to classical mechanics. A dissertation project on Galileo as an engineer (*Matteo Valleriani*) investigates conditions of this change (see also expansion of theoretical mechanics in the early modern period, p.20).

Preliminary results of these studies on the professional knowledge of practitioners have been presented at an international conference on ancient science and technology and are being prepared for publication. The video documentation of the field work on traditional practices in Italy

and China will be made accessible both in the form of a research database and a documentary film (*Jürgen Renn, Richard Röseler, Matthias Schemmel, Zhang Baichun*).

Origins of theoretical mechanics:

Ancient Greek and Latin texts on mechanics are analyzed in order to reconstruct the emergence and developments of the first scientific representations of mechanical knowledge and the relation to mechanical knowledge in general available at that time (*Peter Damerow, Jürgen Renn, Paul Weinig*). First, it is determined what contents of mechanics are represented and how these contents are conceptualized by technical terms. These contents are compared with the technological knowledge of the time. Second, the formal structures of the representations are analyzed and cognitive operations are identified which structure the mechanical knowledge. In addition to the Greek and Latin sources, this investigation includes Arabic sources as well. During a workshop at Konstanz University the technical terminology used in these sources has been examined across the various languages with the help of a computer-assisted analysis. The language-technology developed by the Perseus Project, and in particular automated morphological analysis, is being implemented to support this study (see development, p. 26) which presently focuses on what probably represents the first text of theoretical mechanics, the “Mechanical Problems” of Pseudo-Aristotle (*Markus Asper, Istvan Bodnar, Peter Damerow, Brian Fuchs, Elke Kazemi, Peter McLaughlin, Jürgen Renn, Paul Weinig*).

Expansion of theoretical mechanics in the early modern period:

The new objects that raised the interest of “engineer-scientists” in the early modern period challenged the methods of preclassical mechanics. These challenging objects are studied in order to find out how they were assimilated into the existing body of mechanical knowledge and how the contents and structure of this knowledge was changed by this assimilation. An exemplary study showing how Galileo’s discoveries were triggered by such objects and constrained by the limits of preclassical mechanics (*Peter Damerow, Jürgen Renn, Simone Rieger*) is being published in a volume dedicated to the context of these discoveries, together with other studies also pursued in part at the Institute, in particular on the historiography of Galileo’s discoveries (*Giuseppe Castagnetti*) and on their roots in practical knowledge (*Wolfgang Lefèvre*).

Present work focuses on the branching of theoretical alternatives made possible by the enrichment of theoretical mechanics in the early modern period. This potential becomes visible, in particular, in sources which did not enter the heroic narratives of the birth of classical mechanics. Among these are unpublished materials (research notebooks, correspondence, unpublished manuscripts) and the works of scientists who are less well known because they did not, from the anachronistic perspective of classical physics, contribute to its emergence. In the sequel of the extensive work invested into making Galileo’s manuscripts accessible (see development, completed work, p. 27) his notes on mechanics have now become the subject of a dissertation project (*Jochen Büttner*). Another dissertation project is dedicated to similar research notes by Thomas Harriot, one of the most important contemporaries of Galileo who worked with different methods on the same subjects with similar results (*Matthias Schemmel*). A third dissertation project explores long-range effects of the objects challenging preclassical mechanics, which result from the fact that many of them could not be adequately handled with the simple theoretical means of classical mechanics developed in the period of its foundation; this dissertation deals with the roots of Euler’s reformulation of basic concepts of mechanics in such long-range effects (*Dirk Wintergrün*).

Edition and translation into English of sources related to the tradition of mechanics.

Work on the contents and contexts of sources on mechanical thinking is accompanied by the development of electronic tools for their computer-assisted analysis (see below) and the preparation of editions and translations. In view of the importance of the “Mechanical Questions” of Pseudo-Aristotle, a new translation with consistent rendering of technical terms is being prepared (*Elke Kazemi*), serving at the same time as a test bed for the prototype of a working environment for computer-assisted translation. The main treatises on the balance from the Arabic tradition and of its continuation in the medieval Latin tradition are prepared for critical editions or reeditions with consistent English translations, commentaries, and glossaries of technical terms (*Mohamed Abattouy, Thomas Berchtold, Paul Weinig*). Two further projects have been pursued in the framework of the Programme International de Coopération Scientifique (PICS): A new consistent translation into English and French of Galileo’s first treatise on motion “De Motu Antiquiora” has been all but completed (*Raymond Fredette, Mark Schiefsky*). The translation of Galileo’s correspondence dealing with mechanics and engineering problems is being continued (*Matteo Valleriani*).

Associated research activities

Commentary on Newton’s Principia:

Following up the publication of a new German translation of Newton’s “Principia,” the work on a commentary is being continued (*Volkmar Schüller*). A commentary on Newton’s theory of tides has been completed and is now being complemented by a commentary on Newton’s solution of the problem to relate gravitational forces to the orbits they generate. The commentary will also include a documentation of the contemporary reception of Newton’s “Principia,” in particular taking into account the “Notae in Newtoni Principia Mathematica Philosophia Naturalis” by David Gregory.

Various activities on the early development of mathematical thinking:

The emergence of mathematical thinking in the third millennium B.C., conceived as a reflection of the professional knowledge of Babylonian administrators, is the subject of an edited volume which is presently being prepared for publication (*Peter Damerow, Jens Høyrup*). A documentation of the quipus preserved from the Inca culture in various European and American museums is being pursued in cooperation with the Berlin Museum of Ethnology; in addition ancient Spanish sources are being studied which provide information about the function of the quipus in the accounting system both under the Inca administration and after their adoption by the Spanish colonial administration (*Carmen Loza*). Algorithmic operations in Babylonian and Egyptian mathematical problem texts have been compared with divinatory and juridical texts from a structural point of view (*James Ritter*). Further research activities have been pursued on deductive structures in the works of Apollonius (*Sabetai Unguru*) and, by the Lorenz-Krüger fellow of the Institute, on the relation of the medieval composition of music and the ancient theory of proportions (*Oscar Joao Abdounur*).

Various other activities related to the goals of the project:

In the context of work on basic structures of scientific thinking, an authorized edition of the collected works of the psychologist Howard Gruber is being prepared (*Katja Bödeker*). An analysis of the historical genesis and scientific function of astronomical diagrams illustrating the text of Martianus Capella has been completed and is being prepared for publication (*Christoph Lies*). This study was part of a systematic survey of diagrams in medieval planetary astronomy pursued in the context of the former project on “Dynamic Models of Scientific Discoveries” (*Bruce Eastwood, Michael May, Gerd Graßhoff*) which is no longer continued at the Institute due to the call of the responsible senior scientist to the University of Bern. Arabic mechanics and technology in cultural contexts has been studied (*Abdelhamid I. Sabra*). The history of the relation between mechanisms, organisms, and society and the socio-biological implications of this relation have been the theoretical focus of studies dedicated to the fourteenth century Islamic scholar Ibn Khaldun and to the

German chemist Georg Ernst Stahl (*Alfred Gierer*). Furthermore, the establishment of networks of communication by Henry Oldenburg has been investigated (*Mara Beller*), and extensive studies on a controversy between Leibniz and Papin, and also on the philosophical foundation of Newton's physics by Salomon Maimon have been pursued (*Gideon Freudenthal*). Finally, intersections between epistemology, philosophy of mind, and the history of science were in the focus of various research activities whose results have been prepared for publication (*Bernhard Thöle, Gabriel Motzkin*).

Project 2: Studies in the Integration and Disintegration of Knowledge in Modern Science

General goals of the project

The goal of the project is the study of the emergence and dissolution of core groups of concepts structuring vast arrays of scientific knowledge 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 of as a restructuring of the cognitive organization of previously-acquired knowledge. Core concepts of scientific disciplines such as space, time, force, motion, and matter in the case of mechanics or species, gene, selection, variation, and adaptation in the case of evolutionary biology usually 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, most scientific disciplines have also witnessed fundamental changes of precisely such core groups of foundational concepts in the past century. 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 the project in close connection 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.

Completed research activities

The Philosophical Integration of Classical Science:

From the perspective of historical epistemology it has been studied how first-order concepts of the classical scientific theories of the seventeenth and eighteenth centuries interacted with second-order concepts of global theories such as Kepler's Weltharmonik, Kant's dynamism, or Le Sage's atomistic theory (*Wolfgang Lefèvre, Falk Wunderlich*). This interaction has been investigated through the example of Kant's natural philosophy of his pre-critical period (1747–1780). A database rendering of Kant's concepts and their interrelations, based on an electronic version of the entire body of writing involved, was finished and published as a CD ROM.

Newton's Synthesis of τέχνη and φύσις and its Reception in the Hegelian System:

This work has been completed and has resulted in approximately 20 papers (*Renate Wahsner*). The undertaking centered around two main topics: (1) the synthesis of τέχνη and φύσις that was achieved through the foundation of Newtonian mechanics, and (2) Hegel's investigation of differential calculus which he conducted in terms of the conceptual-logical interdependence of quality and quantity.

The concept of the gene in development and evolution:

In modern biology, there are no longer unequivocal definitions of "adaptation," "gene," "species," or, in fact, "Darwinism" (*Peter Beurton, Raphael Falk, Hans-Jörg Rheinberger*). For this reason, a research initiative was launched shortly after the foundation of the Institute, bringing together

historians and philosophers of biology as well as active research biologists, in order to study and discuss what amounts to a protracted, still open-ended period of scientific turmoil. They have met at workshops held at the Institute and during working stays of guest scientists and have continuously exchanged their views and results in the past years. As an outcome of this intense interaction, a joint book project has been completed.

The Contexts of the Establishment of General Relativity:

As mentioned above, several research activities pertaining to this theme had to be discontinued since the responsible scholars left the Institute for more permanent positions at other institutions. In the case of the work on Einstein's political biography results of this work could nevertheless be completed and have been published (*Britta Scheideler*); the political context of Planck's work has been a subject of further study, resulting in several publications (*Giuseppe Castagnetti, Peter Damerow, Dieter Hoffmann, Jürgen Renn, Simone Rieger*).

The Quantum Crisis and the Reorganization of Research Strategies in Classical Physics – the Cases of Einstein and Bohr:

The study's central interest was the question to what extent the reorganization of physical research early in the twentieth century, reacting to the emergence of "quantum problems," took place as a result of explicit reflections on the disintegration of classical physics. Two major studies, one on Einstein's role at the Kaiser-Wilhelm-Institut für Physik in Berlin (*Giuseppe Castagnetti, Hubert Goenner*), the other on Niels Bohr and his institute in Copenhagen (*Alexei Kojevnikov*) have been completed and are being prepared for publication.

Current research activities

The reorganization of classical knowledge on gravitation:

The emergence of the General Theory of Relativity is studied, focussing, first, on the work of Albert Einstein and, second, on the largely unexplored history of alternative approaches to the problem of gravitation in late classical physics (*Julian Barbour, Dieter Brill, Giuseppe Castagnetti, Leo Corry, Hubert Goenner, Stefan Hajduk, Michel Janssen, Christopher Martin, John Norton, Jürgen Renn, Tilman Sauer, Matthias Schemmel, Scott Walter, Christopher Smeenk, John Stachel*). The aim is to reach a systematic account of the structure of the knowledge basis in classical physics which made a reconstruction of its core concepts unavoidable. A further aim is to understand the nature of the developmental process by which Einstein and his contemporaries overcame the obstacles impeding the development of new conceptual foundations, obstacles which prevented Einstein even from realizing that he had already found the correct field equations three years before he finally recognized them as such. The starting point of the investigation was a meticulous reconstruction of the interplay of physical and mathematical knowledge which constituted the successful heuristics of Einstein's discovery process in the period between 1907 and 1915 (*Michel Janssen, John Norton, Jürgen Renn, Tilman Sauer, John Stachel*). The scientific context of Einstein's search for a new theory of gravitation has been systematically studied by analyzing a broad range of sources related to the work on alternative approaches, including also the work of less well-known authors, in order to identify knowledge traditions that contributed to the emergence of General Relativity (*Julian Barbour, Dieter Brill, Giuseppe Castagnetti, Leo Corry, Hubert Goenner, Stefan Hajduk, Christopher Martin, John Norton, Jürgen Renn, James Ritter, Matthias Schemmel, Scott Walter, Christopher Smeenk, John Stachel, Yoonsuhn Chung*). The comprehensive results of the reconstruction of the genesis of General Relativity in its context are documented in the form of detailed commentaries on the historical sources and in the form of a new interpretation of the transition from the core concepts of classical physics to those of modern relativistic physics. A series of volumes is presently being prepared, including an edition of key sources pertaining to both the creation of the theory and to less successful approaches.

A failed attempt to unify electrodynamics and gravitation:

The difficulties which forced scientists at the beginning of the twentieth century to fundamentally change the conceptual basis of physics resulted from incompatibilities between its three main sub-disciplines, mechanics, thermodynamics and electromagnetism, when applied to “borderline problems” such as the explanation of the photoelectric effect, the electrodynamics of moving bodies, or the thermal equilibrium of electromagnetic radiation. Analyzed within the epistemic framework of the crisis which emerged from these incompatibilities, the widely accepted historiographic interpretation of the competing approaches of Hilbert and Einstein, allegedly ending in a race with Hilbert as the winner, had to be given up. A more thorough analysis of this competition in a broader context turned out to be necessary when archival research produced the puzzling result that Hilbert did not find the field equations of General Relativity independently, but took them from Einstein’s publication and inserted them afterwards into the proofs of his own publication (*Leo Corry, Jürgen Renn, John Stachel*). As a result of this analysis, Einstein’s and Hilbert’s struggles with a new theory of gravitation have been interpreted, in an extensive study, as alternative attempts to integrate the knowledge of the diverging subdisciplines of modern physics into one coherent framework, exploiting different resources which account for the different fates of the two approaches in the further restructuring of the whole body of physical knowledge (*Jürgen Renn, John Stachel*). In fact, Einstein’s approach, striving to encompass the knowledge of mechanics as well as that of electrodynamics, became the basis of modern cosmology while Hilbert’s approach, essentially founded in Mie’s attempt to reduce mechanics to an electrodynamic conception of matter, became the first of a series of still more or less unsuccessful attempts to find a common mathematical framework of the two classical field theories, electromagnetism and gravitation theory.

The crisis of specialization in astronomy:

Due to the high degree of specialization of the sciences in the early twentieth century, only with delay did the consequences of the conceptual restructuring of physical knowledge enter the intellectual horizon of experts dealing with subjects for which, in fact, the new theory was relevant, in particular, the attention of astronomers. Several meetings and preliminary investigations have been devoted to the study of the emergence of modern cosmology in cooperations with an international group of scholars (*Giuseppe Castagnetti, Jean Eisenstaedt, Hubert Goenner, Jürgen Renn*). Moreover, the conditions of the hesitant integration of the theory of General Relativity into astronomy are studied using the exceptional example of the work of Schwarzschild (*Matthias Schemmel*). As one of the founders of astrophysics, Schwarzschild had already in the nineteenth century realized the artificial character of the constraints imposed by specialization. He tackled some of the fundamental questions at the borderlines between theoretical physics and astronomical observation which were eventually answered within the framework of General Relativity. Schwarzschild was hence prepared to immediately recognize that astronomy and its extension to scientific cosmology would become the touchstone of the new theory and contribute to overcoming the disciplinary separation between physics and astronomy.

The emergence of contradictions between thermodynamics and radiation theory:

A further borderline problem produced by a progressive integration of knowledge which is intensively studied in the framework of the project is the problem of heat radiation. It requires the application of both the laws of radiation – covered by those of electrodynamics – and those of thermodynamics. Since such problems fall under the range of application of two partially different theoretical foundations, they represented not only a potential locus of conflict between different conceptual frameworks, but also points of departure for their integration into more developed theoretical frameworks. This in turn required a revision of fundamental concepts underlying all of classical physics, and hence a disintegration of traditional knowledge structures. For example, the electrodynamics of moving bodies became the core of the later special theory of relativity, with its new concepts of space and time to which the rest of physical knowledge had to be adapted.

The earlier research on conceptual transformations in the emergence of relativity theory has recently been extended to include the origins of quantum theory, integrating earlier attempts to

study the institutional conditions of the quantum revolution (*Jochen Büttner, Dieter Hoffmann, Michel Janssen, Jürgen Renn, Matthias Schemmel*). Planck's law of heat radiation of 1900 was later seen as the first decisive contribution to quantum theory, with its new concepts of matter and radiation which also required a reconceptualization of traditional physical knowledge. Another step is undoubtedly Einstein's proposal of the light quantum hypothesis in his 1905 paper. This step was taken on the basis of the development of statistical mechanics, which allowed conclusions to be drawn about the microscopical constitution of physical properties from their macroscopical properties; this background was the subject of a specific investigation (*Olivier Darrigol, Jürgen Renn*). An analysis of the interaction between Planck and Einstein and the comparison of their different approaches on the basis of the new evidence provided by Einstein's early letters has made it clear that, contrary to what is commonly believed, the origins of quantum mechanics can be adequately understood only in the framework of the integration problems raised by Einstein's models built from radiation, resonators, gas molecules, solid bodies, mirrors, and heat absorbers – components which represent knowledge areas incompatible at that time. Within this framework, Kuhn's controversial claim that the quantum discontinuity was established only after 1900 and by Einstein rather than by Planck thus turned out to be a fruitful starting point for the investigations now being pursued. Their goal is the reconstruction of the history of the interaction of the emerging quantum theory with the developing techniques of precision measurements in state institutions such as the Physikalisch-Technische Reichsanstalt from the viewpoint of historical epistemology.

The disintegration of evolutionary biology:

In the framework of the present project, processes of integration and disintegration are not exclusively studied in the field of physics but also for the protracted conceptual transformation affecting biology to this day (*Peter Beurton*). Evolutionary biology can no longer be viewed as a unified field of knowledge. Its foundational concepts, such as the concept of the gene, nevertheless still play a role for knowledge integration in biology, relating insights in molecular biology to knowledge in population genetics. From the point of view of the present project, applied to a subject quite different from physics, the concept of the gene can be more adequately understood as resulting from and developing in consequence of an ongoing knowledge integration which will eventually make genes understandable as products of the evolutionary process rather than as fundamental particles. In the sequel of publishing a volume of essays on the issue of the gene as an outcome of the project (see completed research activities, p. 22), work within the project has recently been concentrated on the impact of the historical analysis on questions of modern biology, because this approach to the gene also opens new opportunities of interpretation of the history and structure of the Synthetic Theory of biological evolution.

Associated research activities

Mechanism and organism:

Building on the completed research activities on Newton's Synthesis of *τέχνη* and *φύσις* and its reception in the Hegelian system (see above, completed research activities), the role played by the conflict between mechanism and organism in the epistemological foundation and reflection of modern natural science is being investigated (*Renate Wahsner*). A beginning has been made with the conception of organism as introduced by Kant as a thought principle and with his attempt to understand this principle in terms of a completion, not replacement, of mechanism.

Deduction of universal categories: A dissertation project is dealing with the historical background of Kant's transcendental deduction of the categories in his "Critique of Pure Reason" (*Falk Wunderlich*). Kant's argument is reconstructed within the context of contemporary questions, debates and terminology, in particular with regard to the concept of mind in eighteenth century metaphysics.

Studies on the history of atomic and nuclear research – from radioactivity to nuclear fission:

Preliminary research has been completed with the aim to give a comprehensive survey of the research activities of the Hahn/Meitner-group up to 1932, as well as on the international connections of this group (*Horst Kant*).

Various other activities related to the goals of the project:

Preconditions of the reassessment of the Darwinian gradualist and selectionist theory of evolution have been investigated, which was suggested by population genetics on the base of a theory of change in gene frequencies within populations (*Staffan Müller-Wille*). As part of a study on the history of the Max Planck Institute for Extraterrestrial Physics, the foundation of this institute in the context of space research after the launch of the Sputnik has been investigated by the Reimar Lüst fellow of the Institute (*Ulf von Rauchhaupt*). Another, still ongoing study concerns the transformation of the concept of vacuum from classical physics to modern quantum physics (*Yoonsuh Chung*), and preparatory work has been done in order to investigate the interrelations of mathematics and physics in the period of the creation of relativity and quantum theory (*Erhard Scholz*).

Development: 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 the retrieval 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 make it possible to integrate 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 Internet to cut across the traditional distinctions of research institutions, universities and libraries.

The process of restructuring scientific work in the history of science is part of a larger process of restructuring scientific research and dissemination presently discussed in the Max Planck Society. Although the preparation of electronic editions of historical sources and the development of new working environments is not at the center of activities at the Institute and cannot be adequately pursued with its resources, they are unavoidable as long as the time-lag in exploiting the potential of the new information technologies in the humanities has not been overcome. The

activities reported here follow proposals for the development of information management techniques which were envisioned at a conference at Elmau Castle, coorganized by *Jürgen Renn* on behalf of the "Beratende Ausschluß für EDV-Anlagen" (BAR) about future perspectives of information management in the Max Planck Society. At this conference it became clear that the consequences of the information revolution for research institutes make it necessary to provide the institutes with coordinated support for their information management. In particular, the time-lag of the humanities with regard to the ongoing information revolution will not be overcome as long as digital library projects such as those reported here do not receive the kind of support which is expected from the planned Center for Information Management (CIM) of the Max Planck Society proposed at the Elmau conference.

Completed work

Model working environment for manuscripts:

An electronic representation of Galileo's notes on motion and mechanics, kept as Ms. Gal. 72 in the Galilean collection of the Biblioteca Nazionale Centrale in Florence, has been prepared. It provides a working environment for scholarly work which is extensively used through the intranet of the Institute and has moreover been made freely available through the Internet (http://www.mpiwg-berlin.mpg.de/Galileo_Prototype/MAIN.HTM). The electronic representation is a joint pilot project of the Biblioteca Nazionale Centrale in Florence (*Isabella Truci*), the Institute and Museum for the History of Science in Florence (*Paolo Galluzzi*), and the Max Planck Institute for the History of Science in Berlin (*Peter Damerow, Jürgen Renn*). It was realized at the Institute by a team of scholars and staff (*Jochen Büttner, Michele Camerota, Giuseppe Castagnetti, Peter Damerow, Jörg Kantel, Jürgen Renn, Simone Rieger, Martin Warnke, Carmen Wedemeyer, Berndt Wischniewski*). The electronic representation has received the Pirelli INTERNETional Award 1998.

Medieval Manuscripts:

An "International Computer Catalog of Medieval Scientific Manuscripts" (ICCMSM) compiled over a number of years at the University of Munich (*Gerhard Brey, Menso Folkerts*) has been restructured and upgraded to modern database technology (*Gerhard Brey, Jochen Büttner, Peter Damerow, Paul Weinig*). It has been made accessible through the intranet of the Institute and is presently being prepared to be made freely available through the Internet (<http://archimedes.mpiwg-berlin.mpg.de/cgi-bin/iccmsm.pl>)

Cuneiform texts of the third millennium B.C.:

In a joint project of the Institute (*Peter Damerow*) together with the Seminar of Near Eastern Archaeology of the Freie Universität Berlin (*Hans Nissen*), with the Department of Near Eastern Languages and Cultures of the University of California at Los Angeles (*Robert K. Englund*), and with the Computer Center of the Universität Lüneburg (*Martin Schreiber, Martin Warnke*), an electronic representation of the proto-cuneiform tablets of ancient Mesopotamia (3200–3000 B.C.) has been prepared, based on the sources collected, edited and deciphered by the Uruk Project. This pioneering endeavor to introduce advanced techniques of electronic information management into scholarly work on archaic writing was subsequently extended to the development of techniques to virtually rejoin and analyze cuneiform archives now scattered in numerous museum collections. A first major activity in this direction, performed together with the Vorderasiatisches Museum der Staatlichen Museen zu Berlin (*Joachim Marzahn, Beate Salje*), concerns the cuneiform texts from the 3rd millennium B.C. kept in this museum; they have been scanned and made electronically accessible together with results of scholarly work on them (*Peter Damerow, Robert K. Englund, Michael Schüring*). The outcomes of both undertakings are presently being prepared to be made available through the Internet (<http://cdli.ucla.edu> or <http://cdli.mpiwg-berlin.mpg.de>). They have served as pilot projects for a larger venture, the Cuneiform Digital Library Initiative (CDLI) in which the Institute takes part (see below).

Current work

An open digital research library for the history of mechanics (Archimedes Project):

This project is a proof-of-concept project for an open digital research library for the history of science which integrates research and dissemination in a new way. It is a joint endeavor of the Max Planck Institute for the History of Science (*Jürgen Renn*), the Classics Department at Harvard University (*Mark Schiefsky*), and the Perseus Project at Tufts University (*Gregory Crane*), the English Department at the University of Missouri at Kansas City (*Jeffrey Rydberg-Cox*), realized within a wider network of scholarly cooperation supported in particular by "Project International de Coopération Scientifique" (PICS) (*Pierre Souffrin*). The Archimedes Project has designed a three-phase "production line" for digitizing printed texts and other source materials and structuring the outcome according to scholarly analysis of their content. So far in the first phase of text acquisition, primary data of the majority of text sources have been entered (approximately 10,000 pages of source texts). As for the next phase, the implementation of dedicated language technology, two seventeenth-century dictionaries have been made electronically available and the basic programming of the morphological analysis of Italian has been completed. Regarding the computer-assisted interpretation of the sources, working environments for metadata production have been developed and implemented. In particular, a working environment for the conformal translation of Greek and Latin sources using morphological analysis and automatic linking to dictionaries and prior translations of terms has been created to support the current research. The cooperation between the American and German partners engaged in the Archimedes Project includes the qualification and technical training of junior scholars, in particular in the context of a specially created Archimedes fellowship program.

The Administrative Archives of the Cathedral of Florence:

In cooperation with a research group of the Opera del Duomo (*Margret Haines*), i.e. the board of works of the Cathedral of Florence, an electronic representation of the administrative documents from the time when the cupola of the Cathedral was built is being developed (*Jochen Büttner, Peter Damerow, Jürgen Renn, Berndt Wischniewski*). The data to be represented and the results of their analysis will provide unique information about the structures of planning and the organization of knowledge at the most prominent construction site of the early Renaissance period. It is the major aim of work being pursued by the group of the Institute to secure the longevity of this unique set of data and to make it freely accessible through the internet.

The Cuneiform Digital Library Initiative (CDLI):

Based on the experience gained in Berlin from the digitization of the archive of the Uruk project and of cuneiform tablets in the collection of the Vorderasiatisches Museum (see above, completed works), an international initiative has been inaugurated aimed at integrating major collections of cuneiform texts from the third millennium B.C. and making these collections, together with the results of scholarly work on them, freely accessible through the internet (*Peter Damerow, Robert K. Englund, Hans Nissen*). Beginning in July 2000, the initiative will be supported by the NSF. At present, five museums (Vorderasiatisches Museum, Berlin; British Museum, London; Louvre, Paris; Hermitage, St. Petersburg) and scholars from several countries have joined the initiative. The work on the collection in the Vorderasiatisches Museum has been completed (*Peter Damerow, Robert K. Englund, Joachim Marzahn, Michael Schüring, Berndt Wischniewski*), and scanning of the cuneiform collection in the Hermitage is in progress and will be finished in the first half of the year 2000 (*Markus Schnöpf*). A preliminary SGML format for cuneiform texts has been developed as a tool for integrating transcriptions provided by different scholars and for transliterating texts from scanned images (*Mark Schiefsky*). As a test bed for the unification of transcriptions and the application of electronic tools, a group of 12,000 transcriptions of texts from the Ur-III period has been reformatted; an electronic representation including automatically generated word lists is being prepared to make them accessible through the internet (*Peter Damerow, Berndt Wischniewski*). As a test bed for transliterating cuneiform texts in a validating SGML working environment, the texts

from the Fara period kept in the Vorderasiatisches Museum are being transliterated (*Blahoslav Hruška*).

Department II (Director: Lorraine Daston)

Since its inception in 1995, the work of Department II has been principally organized around thematic research groups: “The Emergence of Scientific Objects” (1995–96), “Varieties of Scientific Experience” (1996–97), “Demonstration-Test-Proof” (1997–98), “The Scientific Persona” (1998–99), and “The Moral Authority of Nature” (1999–2001), as well as an ongoing project on “The History of Scientific Objectivity”. These themes are chosen to open up fundamental categories of scientific thought and practice to detailed historical investigation: how do some domains of phenomena (microbes, centers of gravity, monsters) become objects of scientific inquiry? how do new forms of scientific experience such as the experiment or the clinical trial establish themselves? under what circumstances do novel patterns of argument, e.g. mathematical demonstration or computer simulation, emerge? when and why does the intellectual and cultural identity of the scientist diverge from that of the sage or scholar? why is the conflation of the normative and the natural apparently so irresistible? The aim of questions like these is to create a historical epistemology, which examines the emergence and development of the categories – object, experience, proof – that have come to undergird rational inquiry, both theoretical and empirical. Historical epistemology attempts to root the abstract and immutable concepts of epistemology in the concrete, changing contexts of history. It addresses the specificities of scientific practices as well as the generalities of concepts and ideals: for example, the techniques of photography and statistical inference are as constitutive of scientific objectivity as the philosophical reflections of Kant or Helmholtz.

Each research group consists of a mix of junior and senior scholars, most of whom spend at least an academic year at the Institute working on individual topics within the framework of that year’s research theme. In addition to Institute funding, individual scholars have also been supported by fellowships from the Alexander von Humboldt Foundation, the USA Fulbright Commission, the French CNRS, the German Academic Exchange Service, the Swiss National Fund, and their home institutions. Because of the importance of comparative studies for historical epistemology, groups are composed with an eye toward diversity of disciplinary (history of natural history, mathematics, anthropology, chemistry, etc.), period (ancient to contemporary), and methodological (history, history of science, history of art, philosophy, sociology, anthropology) perspectives. Members of the group present works-in-progress to one another at biweekly departmental colloquia; moreover, each research project has included at least one international conference devoted to that year’s theme. (Publications relating to projects are listed under the author’s name in the Bibliography.)

Demonstration-Test-Proof (1997–98)

Christophe Bonneuil, Sonja Brentjes, Joan Cadden, Jordi Cat, Giovanna Cifoletti, William Clark, Lorraine Daston, Catherine Goldstein, Alain Herreman, Sally Humphreys, Evelyn Fox Keller, Morgane Labbé, Carmen Loza, Javier Moscoso, Marc Ratcliff, Joan Richards, Sophie Roux, Friedrich Steinle. Short-term Visiting Scholars: *Daniel Garber, Niccolò Guicciardini, Deepak Kumar*

Demonstrations, proofs, and tests seek not only to increase knowledge, but to make knowledge secure. Although the words “demonstration”, “proof”, and “test” in their narrow senses refer to very different aims and procedures – contrast, for example, the demonstration, which seeks to circumvent an induction over cases, with the eminently inductive test of a hypothesis or machine – their histories and current usages are nonetheless closely intertwined in the major European languages. The research group addressed the question of how knowledge, both scientific and technological, becomes trustworthy: what are the forms of argument, the techniques, the procedures that guarantee various kinds of knowledge; under what circumstances did they emerge historically; how did they become authoritative? Mathematical and scientific knowledge served as the departure point for the project, but comparisons were drawn from cases in the history of medicine, law,

and theology as well. Of particular interest were examples of (1) prototypical forms of argument that become models for all other forms of secure knowledge (e.g. the demonstrations of Euclidean geometry or scholastic proofs for the existence of God); (2) procedures and standards that migrate from one disciplinary context to another (e.g. the application of legal standards of evidence and proof to early modern civil and natural history); (3) the introduction of novel methods to prove and test (e.g. double-blind randomized trials in clinical research); and (4) the convergence and conflict of different ways of securing knowledge about the same objects (e.g. computer simulations versus laboratory experiments in recent physics).

In the Greek, Arabic, Latin, and later vernacular scientific traditions the significance of logical syllogisms and mathematical demonstrations as models for all conclusive argumentation, be it in theology, natural philosophy, or ethics, has been immense. Hence the history of the emergence, transmission, and evolution of logical and mathematical demonstrations is central to any history of proof. *Sonja Brentjes* continued earlier work on the transmission of Euclidean geometry in the medieval and early modern Islamic world, with particular emphasis on sixteenth- and seventeenth-century scientific exchanges between European, Safavid, and Ottoman scholars. She discovered several Arabic and Persian translations of European mathematical, geographical, astronomical, and medical works in India, and a unique Arabic version of Euclid's *Elements* in Bombay, which latter she is preparing as an edition. *Joan Cadden* explored criteria for legitimate forms of argument and objects of inquiry in late medieval Latin natural philosophy, especially the *Problemata* literature. The *Problemata* posed questions that often challenged the demonstrative methods of natural philosophy, or trespassed upon the territory of other disciplines, such as ethics and theology. These tensions between philosophical precept and practice can be studied to good advantage in the *Problemata* commentary (1310) of natural philosopher and physician Pietro d'Abano, whose explanations rely less on deductions from first principles or analysis by standard analytical categories than on the deployment of analogies and references to authoritative texts. *Catherine Goldstein* also studied alternatives to paradigmatic models of demonstration, particularly Euclidean demonstration, in the context of early modern number theory. She discovered suggestive analogies between the work of Bernard Frenicle de Bessy's procedures in Diophantine analysis and Francis Bacon's proposals for a reformed natural philosophy. *Joan Richards* addressed the valuation of rigor in mathematical demonstrations, contrasting geometry texts of the eighteenth and nineteenth centuries. She also explored the relationships between logical and mathematical demonstrations in Victorian Britain. *Alain Herreman* conducted semiotic analyses of mathematical texts in twentieth-century algebraic topology and twelfth-century Latin algorithms.

The transfer of methods of proof between cultures and disciplines provide historians with the clearest examples of how local knowledge succeeds or fails to become global. Since many if not most forms of conclusive argument in the sciences, mathematics, and technology lay claim to universal status, these transfers are often regarded as the ultimate test of validity: will the same methods work in Berlin, Boston, Bombay? *Carmen Loza* investigated how sixteenth-century Spanish colonial courts came to accept calculations performed by the traditional methods of the *quipu*, a set of knotted cords that served as an instrument of calculation and *aide mémoire*, as valid legal evidence for the payment of taxes and duties by indigenous peoples – a case of successful transfer made all the more striking by the fact of the imbalance of power between the Spanish authorities and the masters of the *quipu* calculations, and the competing interests of the parties in matters of tax collection. In another case of cultural transfer in a colonial situation, *Christophe Bonneuil* studied attempts in British, French, and Belgian African colonies to import scientific farming, and to compile unified botanical classifications on the basis of specimens and descriptions furnished by botanists, travelers, traders, and indigenous peoples. In both instances, bureaucrats and researchers found they had to modify ways of village life in order to produce the forms of knowledge they wished to collect and monitor: intellectual transfer required cultural transformation. *Giovanna Cifoletti* examined a case of disciplinary transfer, between rhetoric and algebra in early modern Italy and France. Noting the prominence of jurists among the early algebraicists, she points to the

influence of the French court, the Collège Royal, and the Parliament of Paris in the creation and reception of the work of Viète and Descartes. *Jordi Cat's* study of the electromagnetic theories of James Clerk Maxwell revealed the transfer of analogies and explanations drawn from industrial machines, physiological research on muscles, and artisanal and athletic practice into the Maxwellian physics of potential functions.

Lorraine Daston, Sophie Roux, and Friedrich Steinle formed a study group to examine another case of disciplinary transfer in early modern Europe: the adoption of the metaphor of “natural law” by both jurists and natural philosophers in the seventeenth century to describe the fundamental regularities of nature and society. *Steinle* surveyed the terminology of natural regularities (not only “law” but also alternatives, such as “rule”) in the context of seventeenth-century English natural philosophy, noting extension of the term “natural law” after the 1660s to empirical regularities as well as to a priori principles. *Roux* examined the theological and philosophical foundations of early modern natural law doctrines in both natural philosophy and jurisprudence with attention to three issues: ontology (how God created and then governed the world); epistemology (how humans come to know natural laws); and architectonics (how the laws of nature are integrated into systems of propositions). *Daston* sought parallels between standards for the evaluation of evidence among jurists and natural philosophers, especially in cases of apparent exceptions to natural laws. (This work was part of a collaboration with the Max Planck Institute for European Legal History in Frankfurt am Main, and was presented at a conference on “Natur-Gesetz-Naturgesetz” held under the auspices of the Deutsche Forschungsgemeinschaft: see “The Moral Authority of Nature”, p. 39.)

The sciences have been fertile in creating new forms of demonstration, test, and proof. Some of these are forms of argument in the purest sense (e.g. mathematical induction); others depend on protocols, instruments, techniques, and methods. Some, but not all, of these innovations become part of the permanent equipage of proof. The conditions of their acceptance or rejection are hence as important as those of their emergence for a history of modes of validity. Continuing her earlier research on the relation between the rational and irrational both in ancient Greece and in the history of classical studies, *Sally Humphreys* explored how cultic innovations could be made objectively “right” through a coincidence of pattern, e.g. a ritual that can be interpreted as marking a point of transition in astronomical, agricultural, and social time, and as re-enacting a significant event from the mythical past. *Javier Moscoso* studied how the anatomical study of monsters acquired special epistemological status in the eighteenth century: these were nature’s own experiments, proving or disproving hypotheses about normal embryological development. The special status of monsters as rare anomalies also raised problems of evidence, including the evaluation of witness testimony and the epistemological relationship between texts and illustrations. *Marc Ratcliff* began research on the epistemology of the microscope 1740–1830, which will form the basis for a Ph.D. dissertation in the history of medicine at University College London. *William Clark* analyzed the arguments of German archaeologists (1762–1862) on how to date cultural objects, in relationship to debates about how to reconstruct excavated sites and objects: should reconstructions sacrifice authenticity to the closest possible resemblance to the original, or should only materials excavated at the proper site and dating from the proper period be used?

Modes of demonstration, test, and proof must often be used in tandem with one another, raising vexed issues of convergence and relative degrees of validity. For example, all of the historical sciences are familiar with conflicts between various dating techniques: carbon 14, stratigraphic position, phylogenetic lineage, stylistic criteria for artefacts, and site context are all tried and true methods by which to prove the age of an object, but their results do not always agree. *Morgane Labbé* studied the conflicts among nineteenth-century statisticians, ethnographers, and geographers on how to capture the essence of nationality: was it a territorial distribution? a population that grew like an organism as a function of time? a homogeneous language group? Each of these definitions was linked to distinctive methods of representation, inquiry, and proof: the map, the census, the field study. *Evelyn Fox Keller's* research concentrated on the controversial uses of math-

ematical and computational models in developmental biology, from D'Arcy Thompson's *On Growth and Form* (1917) to the recent debates about the possibility of "computing the embryo".

In the research undertaken by the project group as well as in the papers presented at the two international conferences held in conjunction with the project, the relationship between the precepts and practices of proof was central. Studied up close, the practices of even the most formalized proof procedures (e.g. automated proof procedures to check computer programs that control nuclear missile systems) reveal an irreducible element of judgment and pragmatism. There is apparently no clear-cut relationship between the degree to which proof procedures are formalized and the solidity of the knowledge based upon them. Indeed, there may even be an inverse relationship: at least, physicists rarely resort to inference statistics to evaluate the robustness of their results, while psychologists use such techniques routinely. Practices of "making certain" loom large in mathematics as well as in the empirical sciences. Chinese traditions of algorithmic mathematics evolved sophisticated methods of checking results, but not an apparatus of demonstration. Even within mathematics in the Greek tradition of demonstration, the practice of constructing solutions (as opposed to proving them) remained significant through the early eighteenth century. Demonstrations, even the most formalized and automated, should be regarded as systems that integrate deductive procedures with elaborate, if implicit codes of practice. The opposition between rigorous demonstration and other more informal and pragmatic ways of making knowledge secure gives way to a continuum.

Related Conferences and Workshops:

"QED: Demonstration in Historical and Cross-Cultural Context"
(Max Planck Institute for the History of Science, 28–30 May 1998).

Organizer: *Lorraine Daston* (Max Planck Institute for the History of Science)

Speakers:

Kirsti Andersen (University of Aarhus, Netherlands): The Trust in an Analysis

Henk Bos (University of Utrecht, Netherlands): QEF – The Primacy of Construction over Proof in Early Modern Mathematics

Karine Chemla (CNRS-Université de Paris, France): The Ideals and Practice of Demonstration in Liu Hui's Commentary (263 AD) on *The Nine Chapters on Mathematical Procedures*

Giovanna Cifoletti (EHESS, Paris, France): Dialectical and Algebraic Arguments in the Sixteenth-Century

Peter Engelfriet (Rijksuniversiteit Leiden, Netherlands): Chinese Reception of Euclidian Mathematics

Catherine Goldstein (CNRS-Université de Paris, France): Infinite Descent: a Proof and its Histories

Niccolò Guicciardini (Università degli Studi di Bologna, Italy): The Debate on Newton's Mathematical Methods for Natural Philosophy

Ralf Haubrich (Universität Göttingen, Germany): Argumentation in Geometry: What is the Context of a Continuous Line?

Eberhard Knobloch (Technische Universität Berlin, Germany): Archimedes and his Adherents: Kepler, Guldin, and Leibniz

Herbert Mehrtens (Technische Universität Braunschweig, Germany): Proof and Representation in Modern Formalist Mathematics: The Debate between Pasch and Study

Reviel Netz (University of Cambridge, UK): Mathematical Fetishism: Practice and Ideology

Joan L. Richards (Brown University, Providence, USA): Proof and Persuasion: The Place of Logic in Victorian England

"Demonstration-Test-Proof" (Max Planck Institute for the History of Science, 25–28 June 1998)

Organizers: *Lorraine Daston* (Max Planck Institute for the History of Science) and *Arnold Davidson* (University of Chicago)

Speakers:

Ken Alder (Northwestern University, Evanston, USA): Proving a Lie: The Polygraph Technique and the Validation of Scientific Evidence in America

Francesca Bordogna (Northwestern University, Evanston, USA): A Geography of Evidence: Psychical Research, 1870–1910

Joan Cadden (University of California at Davis, USA/Max Planck Institute for the History of Science): Just Like a Woman: Authority and Comparison in the Anatomy of an Argument

John Carson (Cornell University, Ithaca, USA): Why Is "Intelligence" What Intelligence Tests Test?

Simona Cerutti (EHESS-CNRS Paris, France): Vicissitudes of the Judicial Proof: The Civil Procedure in Turin in the XVIIIth Century – Vicissitudes de la preuve judiciaire: la procédure sommaire à Turin au XVIIIe siècle

Brigid Doherty (Johns Hopkins University, Baltimore, USA): Modernism and the Medium of the Test: A Preliminary Study in Two Parts

Barbara Duden (Universität Hannover, Germany): The History of "Security" in the Knowledge of Pregnancy

Peter Galison (Harvard University, Cambridge, USA): An Accident of History

Ian Hacking (University of Toronto, Canada): Dreams in Place

Donald MacKenzie (Harvard University, Cambridge, USA): *Trusting the Computer: Technology, Risk, and Proof*

Ian W. F. Maclean (University of Oxford, Great Britain): *Signs, Observations, and the Principle of Charity in late Renaissance Law and Medicine*

Harry M. Marks (Johns Hopkins University, Baltimore, USA): *Trust in the Marketplace: Statistics and Clinical Research, 1940–1960*

Glenn Most (Ruprecht-Karls-Universität Heidelberg, Germany): *Persuading Thomas*

Krzysztof Pomian (EHESS-CNRS, Paris, France): *Proof in History*

Emmanuela Scribano (University of Siena, Italy): *Demonstrating the Existence of God. History and Problems*

Commentators:

Roger Chartier (EHESS Paris, France)

Lorraine Daston (Max Planck Institute for the History of Science)

Arnold Davidson (University of Chicago, USA)

Rivka Feldhay (Tel Aviv University, Israel)

Carlo Ginzburg (University of California at Los Angeles, USA)

David E. Wellbery (Johns Hopkins University, Baltimore, USA)

The Scientific Persona (1998–99)

Gadi Algazi, Francesca Bordogna, Sonja Brentjes, Kevin Chang, Lorraine Daston, Patricia Fara, André Laks, Hélène Mialet, Tara Nummedal, Kathryn M. Olesko, Andreas Renner, H. Otto Sibum, Charles Thorpe, Irmline Veit-Brause, Michael Wintroub. Short-term Visiting Scholars: *Elisabeth Crawford, Anne Secord, Steven Shapin, Thomas Söderqvist, Andrew Warwick*

Intermediate between the individual biography and the social institution lies the persona: a cultural identity that simultaneously shapes the individual in body and mind and forges a collective with a shared and recognizable physiognomy. The bases for personae are diverse: a social role (e.g. the mother), a profession (the physician), an anti-profession (the flâneur), a calling (the prophet). There is no one-to-one correspondence between any given social category and the existence of a persona: many venerable professions do not crystallize into a persona (e.g. the cook), while other activities that are established neither by institution nor remuneration nor specialized education nonetheless do cohere into one (e.g. the social critic). Personae are creatures of historical circumstance; they emerge and disappear within specific contexts. A nascent persona indicates the creation of a new kind of individual, whose distinctive traits mark a recognized social species. The members of the research group on “The Scientific Persona” traced the emergence of various scientific personae, where “scientific” is understood broadly enough to embrace the instrument-maker, the scholar, the technocrat, and the professor, as well as the experimenter and the naturalist. Although the chronological center-of-gravity was the nineteenth century, the period during which new words like “scientist”, *der Naturwissenschaftler*, *le scientifique* were coined for a group that laid claim to ever greater cultural recognition, the topics pursued by members of the research group spanned the Pre-Socratics through the twentieth-century physicist. In the same comparative spirit, cases in Britain, France, Italy, Germany, and the United States, as well as disciplines ranging from physics to botany to astronomy to philology were studied. The aim was to investigate the personal element in science not as biographers but more as botanists, piecing together a type specimen that represents a class rather than any individual in particular. The aim of the project is to introduce the concept of persona to the history of science, by showing how it can be fruitfully deployed in diverse periods, locales, and disciplines.

“Persona” was a concept originally developed by the French anthropologist Marcel Mauss in the context of cultures as various as the indigenous peoples of the Pacific Northwest and the ancient Romans to the history of modern science. Like Mauss, the members of the research group were concerned with the emergence and implications of categories of people – of collective ways

of thinking, feeling, judging, perceiving, working – rather than with individual biographies in all their idiosyncratic particularity. If personae are not individuals, nor are they stereotypes or social roles. The Latin word *persona* originally meant “mask”, but we must be careful not to project our modern understanding of the mask onto antique usage. For us, masks are easily donned and doffed, just as for us actors (both on stage and in society) step easily in and out of roles, without thereby transforming their core identities as individuals. As a metaphor, the mask in modern parlance is a topos of insincerity: to wear a mask is to disguise one’s authentic self, to succumb to social constraint and convention. The modern opposition of mask to true self mirrors that between the artifice of society versus the genuine nature of the individual, both the legacy of Rousseau’s moral and political theory of inauthenticity. In contrast, the ancient meaning of *persona* invoked by the research project recalls the dramaturgy of masks as makers, not destroyers of true identities. To put on a mask in ancient Greek and Roman theatre (and in the rites of passage analyzed by Mauss) was transformative, to attain rather than to suppress genuine selfhood. To understand personae in this sense is to reject a social ontology that treats only flesh-and-blood individuals as real, and dismisses all collective entities as mere aggregates, parasitic upon individuals. Personae are as real or more real than biological individuals, in that they create the possibilities of being in the human world, schooling the mind, body, and soul in distinctive and indelible ways.

Perhaps the most striking feature of the personae is that there are so few of them in comparison to individuals. In some cultures – Mauss provided several examples in his seminal essay – a small set of social identities, derived from ancestors or totem animals or gods, is endlessly repeated, generation after generation. Often the assumption of a *persona* is combined with a coming-of-age ritual, and the assumption of a new-old name, as in the case of confirmation, induction into certain religious or fraternal orders, or assuming the office of pope. Even in secularized cultures like our own, the stock of names is paltry compared to the number of individuals who bear them, and the choice of a name for a baby almost always locates the newborn within a tradition – be it of saints, forbearers, or heroes. The individual is subsumed within a collective identity, symbolized by names handed down for generations. In many cultures, personae are the literal incarnation of tradition, projecting a past (legendary or historical) onto the present and into the future. Personae negate the facts of human mortality and individuality. In every generation there will be bearers of the ancient names and identities; in every generation the social order crystallized by personae will be renewed.

Such customs may seem quaint in connection with modern science, with its bold individualism (think of the eponymy of laws, theorems, and units of measurement, and of the historiography of great names), and its prestissimo pace of change. Since at least the seventeenth century, the natural sciences seem to have resolutely erased, not relived their past. They are amnesiac disciplines, and insofar as they have a history of their own making, it is an epic history of titanic (and quirky) individuals. Hence the modern sciences seem to be poor candidates for the anthropological category of the *persona*. But before leaping to the all-too-familiar opposition between traditional and modern cultures, we might reflect on the stubborn collectivity of words like *der Wissenschaftler*, *le scientifique*, the scientist: although we have a plethora of names for scientific specialists (crystallographers, zoologists, mycologists, chemists, ornithologists, etc.), and although specialist journals and societies have notoriously fragmented the unity of science as both a corpus of knowledge and a social institution, both practitioners and laymen nonetheless cling to the collective denomination “scientist” and its various cognates in other languages. The very superfluity of umbrella organizations like the British Association for the Advancement of Science or the *Versammlung deutscher Naturforscher und Ärzte* should give us pause: they were established just at the time (early nineteenth century) that scientific specialization, as documented by the hyperbolic increase in specialist journals, societies, and university chairs, took off. The modern word “scientist” (coined ca. 1835) bears witness to a *persona* that resists the multiplication of identities even at the disciplinary level, not to speak of the level of the individual.

However recent the current names applied to students of nature may be, the history of this persona has a long prehistory. *André Laks* explored the problem of “intellectual differentiation” in Greek philosophy, with particular attention to the Pre-Socratics. His research focused on the re-evaluation of the relationship between eschatology and natural philosophy in light of recently discovered papyrus fragments containing new material from Empedocles. A cluster of studies on the figures of the scholar, the magus, and the alchemist in the late medieval and early modern period shed light on possible models and components of the scientific persona as it later emerged. *Gadi Algazi* examined how western European scholars (especially German humanists between 1470 and 1550) transformed their received persona and habitus once they no longer lived in monasteries and colleges and began to found family households in urban communities, in particular how the engrained dispositions of scholars (such as concentration and “learned forgetfulness”) shaped modern ways of life that could be cultivated by other social groups and professions. Using three seventeenth-century French scholars (Nicolas Fabri de Peiresc, Balthazar de Monconys, and Joseph Pitton de Tournefort) with direct contacts in the Middle East as case studies, *Sonja Brentjes* studied the impact of European interests in and perceptions of their Middle Eastern counterparts for the formation of a self-consciously European scholarly persona. *Tara Nummedal* addressed the persona of the alchemist in the Holy Roman Empire (1550–1620) through transcripts of criminal trials that prosecuted alchemists on charges of fraud. In contrast to extant studies on learned alchemists, her work reconstructs the figure of the working alchemist. At the other end of the social spectrum, *Michael Wintroub* analyzed the royal entries in early modern France as a key to the construction of elite identities, and continued earlier research on the practices and persona of the early modern collector. *Kevin Chang’s* study of the German chemist and physician Georg Ernst Stahl (1659–1734) situated the persona of the early modern empiricist within the context of the spiritual, intellectual, cultural, and institutional context of the University of Halle and its Pietist milieu. *Andreas Renner* investigated how the seventeenth-century reforms of Tsar Peter I created a new and self-conscious elite of learned men and specialists who challenged the traditional Russian social structure of estates.

The monumental figure of Sir Isaac Newton marks a watershed in the history of the scientific persona, as well as in the history of science *tout court*. *Patricia Fara* explored how Newton’s reputation crystallized the figure of the natural philosopher over the last three centuries, drawing on a wide range of sources (including literary media and material culture) to show how Newton’s conversion into a cultural figurehead depended on broader social shifts in attitudes towards science and genius. The late eighteenth and early nineteenth centuries were the critical period for the emergence of distinct (the scientist versus the philosopher) and increasingly differentiated (the theorist versus the experimentalist) identities among naturalists. Although novel, these identities were not created *ex nihilo*. Rather, they incorporated aspects of older personae (the sage, the saint, the scholar) and drew upon the habits and skills already cultivated in non-scientific contexts. Focusing on the production of scientific practitioners in the mathematico-physical seminar of the University of Königsberg, *Kathryn M. Olesko* investigated how ordinary life (including family) served as a cultural reservoir for the production of *der Wissenschaftler* in Biedermeier Germany, i.e. in the transitional era between the idiosyncratic Romantic genius to the mid-century outwardly objective, communitarian, discipline-based, and formally-educated scientific practitioner. *H. Otto Sibum* studied how “the art of experiment”, traditionally the province of artisans rather than scholars, became the core of a new scientific identity, the experimentalist, in the exact sciences during the late eighteenth and early nineteenth centuries. Here again the scientific persona assimilated abilities (e.g. manual techniques) and dispositions from other social categories. The process of differentiation within the scientific persona had driven a wedge between the humanist scholar and the natural scientist by the late nineteenth century. *Irmeline Veit-Brause* traced the origins of the schism between C.P. Snow’s “Two Cultures” to the institutional struggles over resources between the *Natur-* and *Kulturwissenschaften*, relying primarily on the career and correspondence of the German physiologist Emil du Bois-Reymond.

Once firmly established as a culturally recognized type, the scientific persona could be enlisted as a model for aspiring scientific disciplines. *Francesca Bordogna* contrasted images of the “ideal” scientist among American psychologists in the early twentieth century, interpreting these as attempts to reorder the rapidly changing field of psychology, in terms of both epistemological and political orientation. Closely intertwined with the scientific persona, especially after World War II, was the “scientific expert”. *Charles Thorpe* charted the emergence of the scientific expert, focusing on the career of the American physicist J. Robert Oppenheimer and the American atomic bomb project and its aftermath, and linking the emergence of experts to the institutional setting of large-scale bureaucracies. The study suggests that scientists have gained, in the post-war period, unprecedented power in the modern state. But, arguably, their role as experts has involved a dangerous narrowing of interest and authority. *Hélène Mialet’s* study of the knowing subject “in the making” inquired into the contemporary category of the scientific genius, comparing the “organizationally bound genius” at an applied research laboratory with the “heroic genius” represented by the physicist Stephen Hawking. She sought to rehabilitate the role of the individual actor in the increasingly complex and collective process of scientific creativity.

In its year-long discussions and at the conference held on the topic (see below: Related Conference), the research group addressed fundamental issues concerning scientific personae: how do they emerge and develop in historical context, in what ways are they consolidated and transmitted, how do they shape the individuals who exemplify them, what purposes do they serve, and what is the relationship between knowledge and the persona of the knower? This last question was a central preoccupation. Although members of the research group necessarily drew upon representations of scientists (as characters in literature and film, subjects of portraiture, icons of popular culture), the presumption was that a scientific persona is more than a perception of who scientists are and what they do. It is also a reality that molds selves from within: sharpening the senses, training the hand, channeling attention, expanding or contracting the credible, fixing patterns of inference and argument, instilling an ethos. Personae create new ways of being in the world, modifying perception (the chemist’s refined sense of smell), character (the patience and perseverance demanded by precision measurement), forms of inference and problem solving (the technocrat’s pinpoint focus), and bodily demeanor (the dexterity of the experimenter). Hence the interaction between habitus (dispositions instilled by long practice, usually beginning with childhood instruction) and persona was a recurring theme in group discussions.

The research group’s inquiry into the formation and function of scientific personae challenged the traditional epistemological separation between knowledge and the knower. Instead of assuming that the knower is a Cartesian ego, stripped of personality and body, the results of the research group pointed towards forms of knowledge that depended crucially on the cultivation of specific personal traits – the prodigious memory of the comparative linguist, the skilled hand of the experimentalist, the eye for the essentials of a mathematical modeler. These traits may be present to a greater or lesser degree in individuals, but it is the work of a persona to bind them together, to instill them by rigorous discipline, and to make them into the identifying marks of a collective. No specific individual ever fully incorporates the scientific persona, just as no individual biological organism ever fully incorporates the species or genus, but in the case of personae, individuals can be shaped by upbringing and training.

Related Conference

“Scientific Personae” (Max Planck Institute for the History of Science,
4–6 June 1999)

Organizers: *Lorraine Daston* and *H. Otto Sibum* (Max Planck Institute for the History of Science)
Speakers:

Gadi Algazi (University of Tel Aviv, Israel/Max Planck Institute for the History of Science): Scholars in Households: Refiguring the Learned Habitus, 1400–1600

James Bennett (Museum of the History of Science, Oxford, UK): Personae of Instrument Makers in the Eighteenth Century, and their Contradictions

Janet Browne (Wellcome Institute for the History of Medicine, London, UK): Darwin as Celebrity

Cathryn Carson (University of California at Berkeley, USA): What is a Scientist? Answers from Heisenberg's Audiences

William Clark (Cambridge University, UK): On the Apollonian Decadence of the Professorial Voice

Paula Findlen (Stanford University, USA): Becoming a Scientist: Gender and Knowledge in the Eighteenth Century

Nick Hopwood (Cambridge University, UK): Comrade Professor? Scientists and the Left

Myles W. Jackson (Willamette University, Salem, USA): The Savant versus the Handwerker in Nineteenth-Century Germany

Andrew Mendelsohn (Max Planck Institute for the History of Science.): The Scientist as Technocrat

Kathryn M. Olesko (Georgetown University, Washington D. C., USA): Assimilating the Everyday: Ordinary Life and the Production of Scientific Personae

Dominique Pestre (EHESS/CNRS, Paris, France): The French Savant (late XIXth Century-early XXth Century)

Silvan Schweber (Brandeis University, Waltham, USA): Homo Scientificus Americanus: Shaping New Roles and New Niches Under the Shadow of the Bomb

Anne Secord (Cambridge University, UK): “Be what you would seem to be”: Samuel Smiles, Thomas Edward and the Making of a Working-Class Scientific Hero

Steven Shapin (University of California at San Diego, USA): Who is a Scientist? Notes Towards a Cultural History of the Scientist's Role

H. Otto Sibum (Max Planck Institute for the History of Science): Experimentalists in the Republic of Letters

Commentators:

Valentin Groebner (Universität Basel, Switzerland),

Karin Knorr-Cetina (Universität Bielefeld, Germany)

Thomas Söderqvist (Roskilde University, Denmark)

The Moral Authority of Nature (1999–2001)

Book Project: *Danielle Allen, Marie-Noëlle Bourguet, Joan Cadden, Arnold Davidson, Lorraine Daston, Fa-ti Fan, Eckhardt Fuchs, Valentin Groebner, Abigail Lustig, Gregg Mitman, Michelle Murphy, Katharine Park, Matthew Price, Robert Proctor, Helmut Puff, Robert Richards, Londa Schiebinger, Laura Slatkin, Julia Thomas, Fernando Vidal*. Affiliated: *Carrie Asman, René Sigrist, Emma Spary, Anke te Heesen, Till Wahnbaeck*.

The conflation of the natural with the normative has counted as a philosophical fallacy for centuries, if not for millennia: the oppositions of *nomos versus physis*, *is versus ought*, and *nature versus culture* all aim to drive a wedge between the inexorable facts of nature and the human values of ethics and art. This division is a principal feature of our metaphysical terrain. Yet the very frequency with which these oppositions must be invoked and insisted upon suggests that the naturalistic fallacy of inferring from “what is the case” to “what ought to be the case” is still a deeply rooted habit of thought and feeling. At least within the western tradition, it has proved robustly resistant to philosophical harangues, and to a metaphysics of airtight categories that would prevent any mingling of the natural and the normative. The moral authority of nature surfaces in the most diverse contexts, some ancient, some modern, and others almost futuristic: the reproach “unnatural mother” is as old as the legend of Medea, but the notion of “natural human rights” is the invention of the Enlightenment, and the “unnaturalness” of human clones is a moral spectre

conjured up in tomorrow's newspaper. Appeals to the moral authority of nature are not restricted to popular culture: debates about nature as a standard for the good and the beautiful are also waged in science (e.g. in evolutionary theory) and law (e.g. in environmental regulations). If the naturalistic fallacy is indeed a fallacy, it is a remarkably widespread and persistent one, the resilience of which cries out for historical explanation.

In order to address this highly complex and still controversial topic within a comparative framework, both historical and cross-cultural, a working group of twenty scholars of diverse disciplines and nationalities was constituted in fall 1999. Their research topics embrace a broad range of historical cases, ranging chronologically from Antiquity to the twentieth century, and thematically from political theory to evolutionary biology to waste disposal. The group aims to produce a unified volume of essays on the topic, individually authored but conceptualized and revised in light of group discussions (editors: *Lorraine Daston* and *Fernando Vidal*). To this end three intensive meetings to discuss and revise drafts have been planned, the first of which took place at the Institute 13–25 September 1999; the two remaining meetings are scheduled for 19–30 June and 21–25 August 2000. Authors and topics are as follows:

Danielle Allen (University of Chicago, USA): Mandeville's Fable of the Bees: Nature Metaphors and the Philosophy of Natural Laws and Natural Rights

Marie-Noëlle Bourguet (Université de Paris VII, France): The New Nature of the Scientific Voyages of Discovery (1700–1830)

Joan Cadden (University of California at Davis, USA): The Natural Philosophy and Ethics of Sexuality in Medieval Aristotelian Thought

**Lorraine Daston* (Max Planck Institute for the History of Science): Normative Habits of Observation and Explanation in Enlightenment Natural History

Arnold Davidson (University of Chicago, USA): Philosophical Reflections on the Natural and the Unnatural

**Fa-ti Fan* (Ph.D. University of Wisconsin at Madison, USA/Max Planck Institute for the History of Science): Nature and National Identity in China: Archaeology, Paleoanthropology, and Biogeography in the Early Twentieth Century

**Eckhardt Fuchs* (Ph.D. Universität Leipzig/Max Planck Institute for the History of Science): The Nature of Internationalism and the Internationalism of Nature: Science as Universal Norm and Social Institution (1800–1920)

Valentin Groebner (Universität Basel, Switzerland): Deciphering the Body, Reading the Face: Arts of Identification (1450–1700)

**Abigail Lustig* (Ph.D. University of California at Berkeley/Max Planck Institute for the History of Science): Altruism, Biology, and Society

**Gregg Mitman* (University of Oklahoma at Norman, USA): Breathing Space: A History of Asthma and the Environment

**Michelle Murphy* (Ph.D. Harvard University, USA/ Max Planck Institute for the History of Science): Producing "Nature" and Seizing Reproduction in the Women's Health Movement (1970–89)

Katharine Park (Harvard University, USA): Nature's Secrets: Personifications of the Natural Order (1150–1620)

**Matthew Price* (Ph.D. Stanford University, USA/Max Planck Institute for the History of Science): Other People's Garbage: Nature and Culture in the Category of Trash

**Robert Proctor* (Pennsylvania State University, USA): The Political History of Agates

**Helmut Puff* (University of Michigan at Ann Arbor, USA): Sodomy and the Law Courts in Late Medieval Northern Europe

**Robert Richards* (University of Chicago, USA): Romanticism and Nineteenth-Century Biology

**Londa Schiebinger* (Pennsylvania State University, USA): Gender in the Voyages of Scientific Discovery

Laura Slatkin (University of Chicago, USA): Nature and Justice in Hesiod

Julia Thomas (University of Wisconsin at Madison, USA) *Ideals of Nature in Japanese Nationalism*
**Fernando Vidal* (Harvard University, USA): *The Naturalized Sciences of Man in the Eighteenth Century*

A two-year program of colloquia and related conferences accompanies the book project, involving some members of the working group (designated by *) resident for longer periods at the Institute and affiliated scholars, as well as the other Research Scholars and Visiting Scholars in Department II.

Concomitant with the project on “The Moral Authority of Nature”, *Lorraine Daston*, *Sophie Roux*, and *Friedrich Steinle* have continued and enlarged their working group on “Natural Law in Early Modern Europe” (see “Demonstration-Test-Proof”, see p. 32). The remarkable spread of natural law terminology to describe both regularities in the natural realm (e.g. the laws of collision in mechanics) and rights and duties in the legal realm (e.g. the natural law of human equality) is one of the most striking parallels between conceptual developments in the moral and natural sciences. The temporal coincidence of this parallel with the expansion of the moral authority of nature – in every sphere from pedagogy to weights and measurements –, an authority often grounded on appeals to natural law, is highly suggestive. However, historians of science and historians of law have yet to investigate this coincidence, its causes and consequences, closely. Following up on the conference “Natur-Gesetz-Naturgesetz” (see below: Related Conferences), a group of historians of early modern science and law met at the Max Planck Institute for the History of Science to plan a further collaboration, with the ultimate goal of a publication.

The discussions of the group to date have revolved around three major themes: the type of order defined by natural laws, and its alternatives; the role of the natural laws in the legitimation of divine and worldly authority; and the epistemology of natural laws.

What kinds of order? The concepts and vocabulary of order during the 16th–18th centuries were both diversified and differentiated: jurists, physicians, natural philosophers, mixed mathematicians (including astronomers), and theologians had all developed elaborate ways of understanding and talking about the divine, human, and natural orders, and exceptions thereto. These orders sometimes overlapped (e.g. theology and natural philosophy), but they also specialized and diverged (e.g. with respect to how they classified and dealt with anomalies). Moreover, the kind of order – its origins, jurisdiction, authority, intelligibility, and structure – invoked by the learned disciplines in theory and practice varied considerably: in natural philosophy, for example, the order of nature’s habits differed significantly from that of nature’s laws. There exists no synthetic treatment of these kinds of orders in the historical literature, no doubt because of the quantity and variety of the sources involved. But even within specific disciplines (e.g. history of early modern natural philosophy and mixed mathematics) there is very little literature on the subject. Some such synthetic overview would be a precondition for answering further questions concerning interactions among disciplines such as law, medicine, and natural philosophy, as well as for understanding what is distinctive about an order of laws (both in the natural in human realms) in particular. Although there seems to be an inflationary tendency (at least in English natural philosophy) in the late 17th c. to apply the vocabulary of “natural laws” to almost any natural regularity, its uses in the early 17th c. appear to have been restricted in both jurisprudence and natural philosophy to fundamental principles, from which the whole system could be derived – presumably mimicking the activity of the Divine Legislator. This legislative model raises obvious questions about parallels with models for ideal legislation among early modern political theorists, as well as actual practices of centralizing governments that sought to “rationalize” customary law.

What role do natural laws play in legitimation? In recent historiography of both early modern science and law the rise of natural law systems is often associated with a “crisis of legitimation” in a period of religious and civil strife. Appeals to natural law (so runs the story) replace appeals to tradition as the bedrock of justification for religion (natural theology), the state, and of course natural philosophy. Even if this story turns out to be true in its broad outlines, it begs an important question: how did nature become the kind of entity that could wield such authority? Nature’s

authority in medieval texts is circumscribed, centering on matters of the family, reproduction, and sexuality, with occasional extensions to heresy (as *contra naturam*, like sodomy). Moreover, the nature of the 16th and 17th centuries (and even 18th, if one thinks of Montesquieu) was often conceived as Hippocratic, i.e. as consisting of a patchwork of local climates and topographies that produced equally distinctive customs, complexions, and polities. Universal nature existed as a precept only in specific scientific contexts (e.g. rational mechanics); universal human nature was also debatable. Hence to claim that nature could serve as a legitimating force because it was universal begs two further questions: (1) how did nature come to be conceived of as universal, despite manifest evidence of variability? and (2) why should the universal carry authority? Beyond these specific questions is the more general (and as yet vaguely formulated) question about the practices of legitimation: how in fact were conflicts between authorities and insurgents resolved within a framework of natural law? There is for example considerable evidence that Newton, Richard Bentley, John Wilkins, and other Latitudinarians within the early Royal Society actively sought to make the new natural philosophy a cornerstone of a certain kind of religion and polity, but how (aside from the Boyle Lectures) did they put precept into practice?

How do we come to know natural laws, and how certain is that knowledge? Two epistemological models appear to have governed knowledge of natural law in early modern natural philosophy. On the one hand, the theology of divine voluntarism stressed God's inscrutable fiat: since divine will is absolutely free, the only way to discover natural laws is through empirical inquiry (the position of Robert Boyle and Samuel Clarke). On the other hand, rationalist appeals to the "light of nature" claimed to discover natural laws in the same way as mathematical truths, by the inspection of self-evident intuitions (the position of Descartes and Leibniz). Corresponding positions can be found among natural law jurists (e.g. Grotius), who contrasted what might be called empiricist (on the basis of anthropological universals) and rationalist (on the basis of irrefragable intuitions) methods of discovering natural laws. Epistemological positions on how natural laws come to be known implied differing stances on the certainty of that knowledge, rationalists arguing for certitude and empiricists for probabilism.

Meetings of the group to exchange and discuss first and second drafts of essays are planned for February 2001 (Berlin) and September 2001 (Oxford). Members of the Natural Law Group are as follows:

Jean-Robert Armogathe (EHESS, Paris, France)
Michel Blay (École Normale Supérieure, Lyon, France)
Lorraine Daston (Max Planck Institute for the History of Science)
Gerd Graßhoff (Universität Bern, Switzerland)
Sachiko Kusukawa (University of Cambridge, UK)
Catherine Larrère (Université de Bordeaux, France)
Ian W. F. Maclean (University of Oxford, UK)
Sophie Roux (Centre Alexandre Koyré, Paris, France)
Jan Schröder (Universität Tübingen, Germany)
Friedrich Steinle (Max Planck Institute for the History of Science)
Michael Stolleis (Max Planck Institute for European Legal History, Frankfurt/Main, Germany)
Hubert Treiber (Universität Hannover, Germany)
Catherine Wilson (University of British Columbia at Vancouver, Canada)

Related workshops and conferences:

"Natur-Gesetz-Naturgesetz" (Bad Homburg, 20–23 October 1999)

Organizers: *Lorraine Daston* (Max Planck Institute for the History of Science), *Helge Ritter* (Universität Bielefeld), *Michael Stolleis* (Max Planck Institute for European Legal History, Frankfurt/Main)

Speakers for “Naturgesetz” Session:

Lorraine Daston (Max Planck Institute for the History of Science): Credibility and the Marvelous in Early Modern Natural Philosophy

Gerd Graßhoff (Universität Bern, Switzerland): Natural Law, Divine Creation and Regularities in Heaven: Natural Laws in the Copernican Revolution

Catherine Larrère (Université de Bordeaux, France): Loi commandement et loi rapport: le problème de la loi naturelle chez Montesquieu et ses antécédents dans la philosophie morale et la philosophie naturelle

Ian W. F. Maclean (University of Oxford, UK): Evidence, Logic, the Rule and the Exception in Renaissance Law and Medicine

Sophie Roux (Centre Alexandre Koyré, Paris, France): Les lois de la nature au XVIIe siècle: idée, concept, métaphore, polémique

Friedrich Steinle (Max Planck Institute for the History of Science): From a-priori Insights to Empirical Regularities: The Concept of Laws of Nature and its Alternatives in the Early Royal Society

Commentators for “Naturgesetz” Session:

Michel Blay (Ecole Normale Supérieure, Lyon, France)

Catherine Wilson (University of British Columbia at Vancouver, Canada)

“Historical Perspectives on Anthropomorphism in the Sciences”

(Max Planck Institute for the History of Science, 11–12 May 2001)

Organizers: *Lorraine Daston* (Max Planck Institute for the History of Science) and *Gregg Mitman* (University of Oklahoma at Norman, USA)

Since the emergence of modern science in the seventeenth century, anthropomorphism has been a methodological tabu. Nowhere has this tabu been more hotly debated than in the sciences of animal behavior. This workshop seeks to illuminate contemporary controversies on the scientific, political, and artistic (e.g. nature films) uses of anthropomorphism by situating them within a broader historical and philosophical context.

“Moralizing Nature, 1600–1750” (Max Planck Institute for the History of Science,

1–2 June 2001)

Organizers: *Lorraine Daston* (Max Planck Institute for the History of Science) and *Peter Reill* (University of California at Los Angeles, USA)

Early modern Europe witnessed a vast expansion of the authority of nature, especially in the domains of jurisprudence, theology, and political theory, but also within the arts. Appeals to “nature” became the bedrock of justification for religion (e.g. physico-theology), governments (e.g. social contracts deriving from a state of nature), and legislation (e.g. the natural rights of man). This conference explores the causes and dimensions of nature’s new authority in the seventeenth and early eighteenth centuries, in conjunction with the rising prestige of natural philosophy and natural history. A follow-up conference on the period 1750–1830 is planned for December 2001, to be held at the Clark Library in Los Angeles.

History of Scientific Objectivity (1995–)

Lorraine Daston, Wolfgang Küttler, Annette Vogt

This ongoing project seeks to reconstruct the ideals and practices of scientific objectivity in historical context. The premise of the project is that scientific objectivity has a history, and a relatively short one, emerging in the middle decades of the nineteenth century. The history of the word “objectivity” is suggestive in this context. Its cognates in European languages derive from the Latin

adverbial or adjectival form *objectivus/objective*, introduced by fourteenth-century scholastic philosophers such as Duns Scotus and William of Occam. (The substantive form does not emerge until much later, around the turn of the nineteenth century.) From the very beginning, it was always paired with *subjectivus/subjective*, but the terms originally meant almost precisely the opposite of what they mean now. “Objective” referred to things as they are presented to consciousness, whereas “subjective” referred to things in themselves. The words “objective” and “subjective” fell into disuse during the seventeenth and eighteenth centuries, invoked only occasionally as technical terms by metaphysicians and logicians. It was Kant who dusted off the musty scholastic terminology of “objective” and “subjective”, and breathed new life and new meanings into them. Only in the 1820s and 1830s did dictionary entries first in German, then in French, and later in English begin to define the words “objectivity” and “subjectivity” in something like the (to us) familiar sense, often with a nod in the direction of Kantian philosophy.

Current usage in several European languages packs a crowd of meanings – moral meanings, methodological meanings, metaphysical meanings – into the word “objectivity” and its various cognates. Viewed in its specific contexts of usage, objectivity is a complex and not wholly coherent concept. However, viewed from a level of high generality, these multiple meanings of objectivity do converge in a common sense: all forms of objectivity seek to combat some aspect of the self, as not only subjective but as dangerously subjective. This is why objectivity and subjectivity are, since Kant, an inseparable pair, like concave and convex, each defining the other. Epistemology – the philosophical diagnosis of possible obstacles to knowledge – is older and broader than objectivity. Objectivity arises from the fear that certain facets of the self pose the greatest threat to knowledge. But in the long philosophical tradition of epistemology, this is only one of many fears about how we can fail to achieve knowledge. Scientific objectivity occupies such a central and commanding place in our modern catechism of epistemological virtues that it threatens to swallow up all other aims that might guide scientific inquiry. But the quest for scientific objectivity is not necessarily or even historically identical to the quest for truth or certainty or explanatory breadth or mathematical deep structures in the understanding of nature. Sometimes scientific objectivity coincides with these other epistemological virtues, but sometimes it conflicts with them: that is, it is possible to imagine (and to instantiate historically) concrete cases in which scientists may be forced to choose between, for example, a commitment to truth and a commitment to objectivity.

These conflicts among epistemological virtues – truth, certainty, objectivity, precision – can be seen most clearly in the specifics of quotidian scientific practice. *Lorraine Daston* investigated how the values of truth, beauty, and objectivity guided scientific image-making in the eighteenth and nineteenth centuries, particularly in botany and anatomy – sciences which owed great advances to illustration in the early modern period, and whose subject matter had long been objects of aesthetic contemplation in the fine and decorative arts. Among eighteenth-century scientific illustrators, four factors converged to harmonize the values of truth and beauty with one another: first, the pedagogy of drawing; second, the ornamental and artistic deployment of certain images, especially those of flowers and the human body; third, the characteristics and conventions of the various media (watercolor, gouache, pastels, etc.) and reproductive techniques (engraving, etching, lithography, etc.); and fourth, the imperative to represent types rather than individual natural objects. The image “drawn from nature” bore the imprint of draughtsmanship drills, aesthetic values, and the characteristic optic of its reproduction technique. Until the mid-nineteenth century, it also quite proudly and explicitly represented the naturalist’s conception of the object. For the naturalist, this conception was as distinct from the phantoms of the imagination as it was from the bald appearance of the individual object at hand. The trained eye winnowed the essential from the accidental, the normal from the pathological, the typical from the anomalous, the variable from the constant. Eighteenth- and early nineteenth-century naturalists sought to condense and integrate a legion of individual impressions into a “true” representation, in both words and images, of the natural kind in question.

The advent of photography did not immediately challenge the alliance of truth and beauty that merged scientific illustration with the certain artistic genres, such as the still life. Scientists in the 1820s and 1830s were quick to remark upon the potential of the new invention for scientific illustration – but they often underscored its importance for art as well. The initial grounds for enthusiasm over photography as both a scientific and an artistic medium were similar, namely the possibility of capturing each and every minute detail almost effortlessly. Only in the 1840s–50s another discourse concerning the advantages of photography for scientific illustration emerged alongside the argument from minute detail: the argument from objectivity. The argument from detail had extended the accomplishments of the human artist to superhuman levels; in contrast, the argument from objectivity broke entirely with aesthetics and artistry. The new regime of objectivity drove a wedge between truth and beauty in scientific illustration, and between the personae of the scientist and the artist. These new oppositions pivoted around the fulcrum of the will. Subjective art invited, even demanded the externalized exercise of the will, actively molding matter and form to conform to the artist’s conception. For scientists, in contrast, the objective was all that resisted the external exercise of will; conversely, many of their worries about the possible interventions of subjectivity centered upon the intrusions of the “arbitrary” or the “willful” into observation and representation.

The problem of variability in images haunted naturalists who pursued truth and beauty as much as it did their successors dedicated to objectivity. But different epistemic ideals made for different diagnoses of the sources of variability. Naturalists of the earlier period located variability in the objects themselves – in the accidental, the singular, the monstrous. Later naturalists shifted the source of variability inward, to the multiple subjective viewpoints that shattered a single object into a kaleidoscope of images. Hence the deliberate and open exercise of will on the part of the earlier naturalists, who selected and shaped both their objects and their illustrators, in contrast to the clenched self-restraint of the later naturalists, who turned the will inwards and who vainly hoped that through photographs, nature would illustrate itself.

The element of the personal in science may also be expressed in terms of the personal characteristics of scientists. “Impersonality”, or blindness to individual traits such as nationality, religion, race, or sex is a scientific ideal closely allied to that of objectivity. *Annette Vogt’s* comprehensive survey of women scientists at the Berlin University and the institutes of the Kaiser-Wilhelm-Gesellschaft (1898–1945) sought to answer the question of how the ideals and practices of early twentieth-century scientific research, particularly those of objectivity, promoted the recruitment and participation of women in surprisingly large numbers, as she was able to establish through archival research in the records of the Berlin University, the Max-Planck-Gesellschaft (successor to the Kaiser-Wilhelm-Gesellschaft), and the Academic Assistance Council (Oxford). She also studied how many women were expelled from laboratories after 1933, and their subsequent careers both in Germany and in exile.

She was able to locate at least 239 women scientists employed by the Kaiser-Wilhelm-Gesellschaft, and to establish that women headed at least twelve departments in the institutes of the KWG. She is currently engaged in a reconstruction of the scientific careers of these dozen department heads, as well as those of women visiting scientists to the institutes. Documentation of women completing doctorates and habilitations at the Berlin University continued, and was partially incorporated into an exhibition at the Humboldt Universität Berlin on “Von der Ausnahme zur Alltäglichkeit. Frauen an der Universität Unter den Linden” (1 December 1999 – 13 January 2000). Further research will attempt to expand the study from biographies of individual women scientists to a prosopography revealing their intellectual and social backgrounds, and to investigate the culture of gender relations at Berlin’s foremost scientific institutions during the first half of the twentieth century.

Objectivity’s flight from the personal is often expressed as an escape from perspective, as a “view from nowhere”. This description has created special methodological tensions within the human sciences, insofar as they are simultaneously committed to objectivity and perspectivity.

Wolfgang Küttler's monograph on the relation between perspectivity, objectivity, and historicity in the work of Max Weber explores this tension in three contexts: first, practical life in relation to the sciences; second, the subject matter of the historical sciences of culture and society; and third, the functions of science in modern society.

Weber's own methodology, as well as keen appreciation of the historical impact of modern science, prompted his investigations of the historical development and current state of science. Famously, he held science to be a historical and cultural activity centrally implicated in the processes of rationalization and disenchantment that formed the modern world. The implications of Weber's historical and philosophical inquiries into the nature of modern science were wide-ranging, including the recovery of the unity of scientific and cultural knowledge, the problem of the relationship between history and scientific progress, the interaction of science and value-formation in a "disenchanted" world, and the chances for objectivity in a value-dominated society.

Other research activities of the department's research scholars

Matthias Dörries: Book on "The Future of Science in Nineteenth-century France (1830–1871)": This book reconstructs the conflicting visions of what the future of science would look like at a time when for the first time science and technology were transforming French society to such an extent that change was no longer located in a distant future, but actually experienced within a single generation. "Speaking in tongues: Studies in science and language" is an edition of several articles – linking human and natural sciences – that explore how natural philosophers and scientists have found analogies to language and the development of languages fruitful in their scientific work (see p. 116).

Anke te Heesen: Research on the history of natural history cabinets in the eighteenth century, including an edited volume on the relationship between the history of collecting and the history of science (see pp. 39, 47).

Antoinette Roesler-Friedenthal: Project on the relations between art history and art commerce in its widest sense. The study examines the development of the academic discipline of art history and its distinctive methods in interaction with socio-economic factors, including the art market, connoisseurship, and the literary genre of the collection catalogue (see pp. 116, 47).

Sophie Roux: Project on Descartes and Cartesianism in the seventeenth century, with special attention to the contexts of the science of mechanics, corpuscularian theories of matter, and different conceptions of physics in the early modern period (see pp. 30, 42).

Friedrich Steinle: Habilitation on "Der Einstieg in ein neues Feld: Forschungspraxis im frühen Elektromagnetismus bei Ampère und Faraday" (Technische Universität, Berlin) a study of early nineteenth-century electromagnetism, focusing on the early researches of André-Marie Ampère and of Michael Faraday with the aim of enriching the philosophy of experiment with detailed historical materials (see pp. 30, 42).

Planned Project

The Common Languages of Art and Science (2001–03)

Organizers: *Lorraine Daston* (Max Planck Institute for the History of Science) and *M. Norton Wise* (Princeton University, USA)

Preparation: *Antoinette Roesler-Friedenthal, Anke te Heesen*

Related Workshop:

“What’s in a Line: Drawing as Intelligence and Intelligibility”

(Max Planck Institute for the History of Science, 18–19 December 2000)

Organizers: *Lorraine Daston* (Max Planck Institute for the History of Science), *H. Otto Sibum* (Max Planck Institute for the History of Science), *M. Norton Wise* (Princeton University, USA).

Drawing in science is at once ubiquitous and invisible. Scientific manuscripts and texts abound with sketches, diagrams, engravings, lithographs, and other products of the draughtsman’s pen. Yet the process and purposes of drawing in science have only sporadically attracted the attention of historians. Historians of art have occasionally studied scientific illustrations, particularly in works of natural history, but have rarely shown interest in the significance of drawing *per se* for the working scientist. Historians of architecture and engineering treat drawings that depict buildings, bridges, machines, and other constructions as an important source, but until recently, these sorts of drawings were segregated from both scientific and artistic drawings under the rubric “technical”. The aim of this workshop is to examine the phenomenon of drawing in science within a broader context that embraces artistic and technical drawing as well, focusing on the period ca. 1750–1850, and addressing two themes: the intelligibility of drawings and the form of intelligence drawing presupposes and cultivates.

Department III (Director: Hans-Jörg Rheinberger)

History of the material culture and practical dynamics of science lies at the center of the work of *Hans-Jörg Rheinberger's* research group. Our focus is on three aspects of that culture and dynamics: (1) the history and epistemology of experimentation; (2) the history of objects and spaces of knowledge and of mental equipment; (3) the uses of theory in the life sciences. Many of the individual projects, a selection of which is presented here, cover more than one of these aspects, and most of them concern the biological and medical sciences from the eighteenth to the twentieth century. The overarching interest is in the historical and epistemological conditions of scientific innovation.

History and Epistemology of Experimentation

Since Francis Bacon, experiment has been seen as the signature of modern science. Detailed analysis of forms of experimentation is, however, of relatively recent origin. Our aim is an encompassing historical as well as epistemological analysis of experiment. Our premise is that there are types of experimentation and that these have emerged and developed over time, acquiring different forms in different disciplines; and, second, that this variety is not peripheral but integral to the epistemology of the sciences.

Successive scientific accounts of living beings have moved, since the seventeenth century, from a classificatory *historia naturalis* through an anatomy of visible structures and a physiology of obvious body functions to the multidisciplinary investigative enterprise of late nineteenth- and twentieth-century life science. Its subject matter reaches in scale from biodiversity through the social behavior of organisms down to macromolecules. To each of these levels of organization and investigation there corresponds a phenomenology, a set of analytical approaches and experimental procedures by which its objects are shaped. To understand the epistemic activity of science at these levels, we ask how research fields and ultimately disciplines aggregate around ensembles of practices and technologies, including methods, concepts, and theoretical conjectures. Such aggregations appear to be underdetermined if viewed from a social or conceptual perspective alone. While, on the one hand, they lead to relatively stable configurations of epistemic power and explanatory relevance, these configurations, on the other hand, are usually historically transient and prone to disaggregation over time.

This view of scientific development may be called *pragmatogenic*. It requires that historical assessment begin with a reconstruction of the practical contexts in which particular concepts and associated theories gained momentum and eventually came to dominance. Central to this reconstruction is to show in detail that experimentation itself is a historically variable scientific form of life that has undergone decisive shifts of structure and content from the early modern period to the present. These shifts are best revealed through broad comparisons. The demonstrative experiment of the seventeenth century, for instance, contrasts greatly with the experiment as a more or less systematic extension of observation in the eighteenth century. Conversely, in the nineteenth century in many areas of science, observation becomes itself dependent on experimental exploration. Of particular importance in understanding the life sciences of the nineteenth and the twentieth centuries is a close inspection of what we call "experimental systems" as the smallest integral working units of research in laboratories and other places of knowledge production.

Beyond these macrohistorical changes, the practice of experiment at any given epoch has taken more than one form and, over the centuries, has become vastly diversified. This variety needs to be assessed. To take an example from the work of the Department in 1998–99 and continuing into 2000–01, special attention has been paid to the role in experiment of techniques and instruments of representation, such as electroencephalography (*Borck*), photography (*Geimer*), chronoscopy (*Schmidgen*), microcinematography (*Landecker*), and other methods of visualizing small-scale objects (*Métraux et al.*). All this work, and the comparisons it enables, has begun to

bear out our premise that studying the forms of experiment is integral to a comprehensive historical epistemology of the sciences.

The case studies and comparisons that are needed to realize this aim require new methodologies. These include careful comparative analyses of various genres of scientific writing such as research notes, lectures, published texts of various formats such as handbooks, textbooks, and research articles. They also require a semiotic approach to visualizations: from unpublished sketches to engravings, photographs, recordings of traces, and other inscriptions. Finally, these methodologies include study of historical laboratory structures, their architecture, the technological functioning of laboratories, the role of laboratory objects, their structuring impact on behavior, the trajectory of instruments, and not least the virtual reconstruction of historical experiments.

History of Objects and Spaces of Knowledge and of Mental Equipment

This area of investigation concerns two main aspects of the material culture of science: first, choice of objects and model organisms; second, the spaces and places in which these objects or organisms function as carriers of epistemic interest. Some of the projects also illustrate what may be called the mental equipment of the scientists who work in these spaces and investigate these objects. Just as the term “material culture” has been useful in characterizing work on the historicity of objects and knowledge spaces, so too the term “mental equipment” – originally developed by *Annales* historians – is meant to designate the historicity of thought habits of scientists and scientific communities.

Scientific Objects. Historical work on the laboratory is not confined to the form of the micro-study. It opens the perspective to long-range macrostudies of the material culture of science. It is evident that a decisive aspect of scientific innovation lies in choosing, shaping, reshaping, and sometimes also in abandoning scientific objects. Studying the history of these entities presupposes that they take on various forms in the different research contexts in which they acquire their epistemic virtues and powers. Embryos, brains, or macromolecules are not epistemic objects by themselves; they are things which become epistemically laden insofar as they locate monsters, memory, or messengers respectively in an assembly of practical and theoretical relations. Complementary to the analysis of concepts, we pursue the analysis of these impure epistemic entities in their impure settings, half-way between crude pieces of matter and rarefied ideal types – material enough to exert the characteristic resistance and resilience met with in the exercise of science and symbolic enough to serve the interests of a quest for knowledge.

In the life sciences, the choice of organism has always played and continues to play a decisive role. Since the end of the eighteenth century, the meaning of key biological concepts has been shaped by the availability of particular model organisms. Late eighteenth-century vitalism, for example, was by no means a purely speculative endeavor; it is unthinkable without the frog as a model and emblem of bioelectricity. The same animal, however, became crucial in other historical contexts in a quite different manner. It was instrumental to the establishment of physiology as a discipline in Germany around 1830; two decades later, it became the material carrier for the success of the Berlin organic physicists; around 1900, it helped to establish “Entwicklungsmechanik”; and in the second half of the twentieth century, it became one of the first higher organisms around which molecular biology developed. The history of genetics, to take another example, could be written almost in its entirety as a succession of model organisms: from humans to plants such as peas and tobacco, to the fruitfly, to molds and bacteria and back to higher organisms. The uses and scientific “careers” of certain organisms are bounded by a complex set of conditions. These include technicalities such as utility, disposability, aptness for laboratory work, and ease of manipulation; forms of everyday life; theoretical presuppositions; and, not least, contingency. In experimental medicine in particular – with its problem of identifying proper animal models for the

study of human diseases and for testing pharmacological substances – these conditions extend also to ethical and economical considerations.

Spaces of Knowledge. A natural object can become interesting for many reasons, but it only becomes epistemically relevant if it fits into historically specified real and symbolic spaces. Such spaces of knowledge production include naturalists' cabinets, botanical gardens, agricultural experiment stations, laboratories, the "field" of the anthropologist or the naturalist, the archive, which in its modern form is an invention of the nineteenth century, and, more recently, electronic environments with their potentials for modeling and simulation. A history of such spaces and places ought to reveal the strategies of inclusion and exclusion associated with them. Spaces of knowledge production mark the boundaries of epistemic objects and connect them to larger cultural settings, forms of art and architecture, and especially forms of scientific communication. In turn, these spaces receive their particular shapes from the chosen objects of study. Such mutual fitting of objects and spaces is not only characteristic of the microworld of experimental systems, but also of the macroworld of natural histories, anthropological and clinical classifications, and multidimensional scientific accounts of mass phenomena such as epidemics. That macroworld has been the subject of special interest in the Department in 1998–99 and continuing in 2000–01, through projects on such mass objects and spaces as population and environment (*Höhler, Jansen, Lachmund, Mendelsohn*).

Mental Equipment. Finally, to a material culture there corresponds the mental equipment of the scientist. In recent years, historically specifiable configurations of explicit and tacit knowledge, of skills, of bodily and mental discipline, and of gestural repertoires became of interest to historians of science as they recognized that the mastering of instruments and the training of the senses were integral to knowledge production. The concept of mental equipment encompasses these various aspects of the knowing subject and relates them to virtues, passions, mentalities, idiosyncrasies. The aim is thus to combine culturally shaped (self-)images and values of scientists with their concrete scientific practices. The scope reaches from the importance of sensibility in late-eighteenth-century life sciences and the role of heroism in romantic self-experimentation to attempts to include or exclude the participating observer in twentieth-century anthropology. In 1998–99 and in projects continuing in 2000–01, interest in the Department has been especially focused on the senses and the observer, as both subject and object of science in the nineteenth century (*Hagner, C. Hoffmann, Hyder, Métraux, Schickore* et al.).

Overall, the methodological concepts of epistemic object, space of knowledge, and mental equipment are aimed at overcoming such traditional dichotomies as internal and external factors of scientific development, experiment and observation, basic and applied research, scientific method and bricolage.

The Uses of Theory in the Life Sciences

These studies aim to assess the specificity and role of the "theoretical" in the investigation of living things. In part, it is the practical turn in the history of science itself that makes the question of the theoretical once again interesting and investigable from a new perspective. Concept formation and the function of generalizations in biology are analyzed from a number of different perspectives: the relation between physical and life sciences; the organizing function of concepts in both experiment and representation, especially over longer periods of time; the problem of the heterogeneity of biological discourses; and the historicization of analytical categories such as reductionism, vitalism, holism, and mechanism. Special emphasis is on the pragmatic aspect of how concepts and generalizations do work as tools in various historical contexts and on how they become embodied in practical configurations. Examples are the concept of information in molecular biology (*Brandt*); the concept of regulation in embryology (*Thieffry*); the concept of the cell (*Parnes*); the concept of the gene (*Rheinberger*, see project description of *Beurton*, p. 22). Such concepts appear

to fulfill their function without being firmly embedded in an axiomatic theoretical framework. Their fruitfulness even appears often to be bound to a certain lack of strict definition.

Each epoch came to draw the boundary between the realm of the living and that of the non-living differently and as the result of a negotiation that is in itself a first order problem for the history of science. Natural history and physiology in the eighteenth century drew this boundary in a distinctly different manner from how it was drawn by romantic biology around 1800, or by the biological and medical disciplines of the nineteenth century such as cytology, sensory physiology, and evolutionary biology. Today, the realm of the organic is conceived of as being the unique product of an evolutionary process and therefore irrevocably shaped by history. This may be one of the deeper reasons for the fact that in the history of the biosciences since the late nineteenth century "theoretical biology" or "theoretical medicine" has played a role different from that played by theoretical physics in the history of physics (*Laubichler*).

Another perspective on the problem of the theoretical derives from the complexity of the living as it has emerged fitfully and differently in various fields since the development of biology in the nineteenth century. As a consequence of this complexity, conceptualization of the living takes place on many different levels of organization. Access to and therefore definition of such levels has been largely dependent on technologies whose development has usually not been intrinsic to the development of the biological sciences themselves. The question as to how these levels of epistemic activity are connected thus becomes a pressing one. We suspect that the connections are largely ad hoc, due to historical contingencies. Heterogeneity of discourses results. Instead of joining the perennial quarrel over reducibility – of biology to physics at large, and of one level of analysis to another – we propose to investigate the historical dynamics of such heterogeneity in its own right (*Potthast*).

A further concern of studies in this section is historicization of categories that have often been used to characterize global attitudes toward the study of living beings. Among them are categories such as reductionism, holism, mechanism, and vitalism. Of special interest will be to analyze how these categories have been used in different historical periods by scientists themselves to demarcate their own approaches in an attempt to establish new research strategies and to gain the power of definition over certain domains of research. One of the most intriguing features of these categories is their pertinacity and their longevity under so many different guises (*Potthast, Mocek*).

Research Projects on the "History and Epistemology of Experimentation"

Strategies of Experimentation and Experimental Systems in Genetic Research in Germany, 1900–1950

Hans-Jörg Rheinberger

Following his detailed investigation of the history of protein biosynthesis research between 1945 and 1965 (*Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube*, 1997), *Rheinberger* has concentrated his research on a number of case studies designed to map the development of experimental genetics from the end of the nineteenth century to World War II. The general aim of the project is to have a close 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 genetics in Germany.

The first study deals with the corn and pea hybridizations which led Carl Correns to reformulate Mendel's laws around 1900. This study is based on Correns' research protocols and sheds new light on one of the founders of classical genetics. The work of Correns is then followed through the next two decades, 1900–1920. It will be shown that it was the strict pursuit of Mendelian genetics that eventually led Correns to the investigation of extrachromosomal phenomena. Correns' strategies of experimentation are revealed to be closely related to the material character-

istics of the breeding systems he used. A second case study investigates the establishment of an experimental system that allowed convergence of transmission genetics and developmental physiology. It looks at how Alfred Kühn and his coworkers came to analyze and conceptualize gene-action chains involved in pigment formation in the flour moth *Ephesia kühniella* between 1925 and 1945, thus laying the foundations of physiological genetics. The third case study is devoted to the establishment of tobacco mosaic virus as a model of combined physical, chemical, and biological investigation of genetic material at the Kaiser Wilhelm Institutes for Biology and Biochemistry around 1940. Further studies will include the experimental work of Max Hartmann on protozoa and of Fritz von Wettstein on the genetic basis of plant physiology.

Chronos and Psyche: The History of Psychological Time Measuring Experiments, 1850–1914

Henning Schmidgen

This project in the history of experimental psychology investigates the discursive and non-discursive practices connecting psychology to technology and architecture in the nineteenth and twentieth centuries. The focus is on competing forms of psychological time measurement in the second half of the nineteenth century. The goal is to elucidate the various material cultures of psychological chronometry and its epistemological preconditions – notably concerning the relation of subjectivity and time.

With the example of the chronoscope, *Schmidgen* traces the lineages of a psychological instrument and unveils surprising connections between psychology and disciplines such as physics and chemistry. Before entering psychological laboratories, the chronoscope was used in the teaching of physics to demonstrate the law of gravity. Moreover, the performative culture of experimental chemistry provided a model for psychological experimentation. Like the technology of experimental psychology, its architecture too played an important role in the development of research. Through the disposition of separate rooms for specific research topics, the laboratory expressed and reinforced a new organization of psychological research work. These dispositions corresponded in part with the arrangement of topics in psychological textbooks. In the quest for disciplinary independence, psychological laboratories were defined against such spaces as the ward and the morgue and were made part of the discourse on the unity of the discipline.

Finally, *Schmidgen* argues that a key epistemological precondition for measuring psychological time was to conceive of subjectivity as something essentially fluid or streaming. Here, the project explores relations between experimental psychology and philosophy. Following Kant's transcendental aesthetics, Johann Friedrich Herbart thematized "the oscillations and the flow of psychological facts". Wilhelm Wundt deviated from Herbart's attempts to mathematize the course of mental representations and turned to the experimental time study of psychological states. This shift decisively demarcates experimental psychology both from the cerebral localization practices of phrenology in the early nineteenth century and from neuropsychology in the twentieth.

Noise or Nature? Photography of the Invisible around 1900

Peter Geimer

This project looked at photography as a means of scientific representation and focused especially on what towards the end of the nineteenth century was treated as photography of the invisible. In various cases, photographs functioned as experimental proof of the existence of otherwise inaccessible phenomena like rays, waves, fluids, and souls. The study aimed at a description and analysis of this ambiguous function of photography above and beyond its value as a medium for representing the visible world. Thus it posed epistemological as well as aesthetic and art historical questions. Special interest derived from cases in which it was doubtful what exactly had inscribed itself on the photographic plate. Around 1900, chemists, biologists, physicists, and spiritualists

debated whether the photographic medium recorded molecular processes in the developing bath or heat or human emanations, whether plates produced traces of external referents or presented traces of the photographic medium itself. Thus the project dealt with an experimental sphere of knowledge in which one and the same visual document oscillated between noise and nature, between accidental waste product and intended epistemological object.

This specific balancing between fact and artifact led *Geimer* to pay particular attention to those photochemical and optical effects that photographers as well as historians of photography had always neglected as waste, failure and accident (blurs, spots, halos, veils). These traces normally remain excluded from historical narratives, be they technical, iconographic, or aesthetic. And yet from the beginning, photographic accidents have been neither defects nor exceptional cases; on the contrary, they were constitutive manifestations of photography. The sensitivity of photographic plates gave birth to a double effect: it caused both production and destruction, appearance and disappearance of scientific representations. Moreover, what first appeared as disturbing accident could later serve as scientific explanation for otherwise inexplicable phenomena. The project took initial steps toward a history of photography as an archeology of photographic (arti)facts.

The Emergence of the Electric Brain: Experimental Epistemologies of Electrophysiological Investigations of the Human Brain, 1920–1950

Cornelius Borck

The shaping of the life sciences through the development of ever more sophisticated measurement and visualization techniques has become a main area of research in the history of science. Case studies have reconstructed distinct socio-cultural conditions under which specific experimental procedures emerged and created particular cultures of representation. *Borck's* research project investigates the nexus of psycho-physiological theorizing and electro-technical experimentation from the interwar period to the aftermath of World War II as the site for the emergence of the "electric brain", the conceptualization of the human mind as an electrical machine. The development of brain wave recording serves as a basis for reconstructing the heterogeneous cultural contexts of visualization in this field of electrical investigations into human psycho-physiology. The versatility of brain-wave recording, which combined techno-scientific ideals with ideas from occultist circles, formed new visions of human nature and of the human mind.

In the 1920s, the human brain became literally the power source of an experimental electrical circuit, and its output was registered via graphical recordings. By comparing the recordings with clinical symptoms, organic lesions, mental states, psychic functions, personality types, intelligence, or forms of behavior, the practices of brain-wave recording constructed a new, electric brain. The graph of the brain's electrical activity, the electroencephalogram (EEG), opened up a new two-dimensional space for the neuroscientific inscription of psychological functions, for representing human individuality and identity, and for situating and understanding the human mind in electro-technical terms.

Starting with an elucidation of the context of electrophysiology in Germany – from the commodification of electricity in Weimar culture to electrotherapeutic practices in general – *Borck* deals with the research of the first two German EEG groups and their different trajectories: Hans Berger in Jena and his holistic framework; and the neurophysiology group at the Kaiser Wilhelm Institute for Brain Research at Berlin-Buch, where electrophysiology had to fit into the localization paradigm of the institute's director Oskar Vogt. The project then traces the spread of the technique in Europe and North America and the eventual domination of the field by researchers in the United States. Finally, *Borck* studies the effects of World War II on the cultural embedding of this branch of the neurosciences and the role of neurophysiology in the international postwar cybernetics movement.

Cellular Features: Tissue Culture and Time Lapse Cinematography

Hannah Landecker

The development of the technology with which to grow living cells excised from complex organisms outside of the body for extended periods of time – a technique known as tissue culture – coincided with the visualization of cellular life through the young medium of microcinematography. Populations of cultured cells were filmed with time lapse technique beginning in 1913; images were taken at regularly spaced intervals, and when the resulting film was projected, the movements and actions of living cells were seen at a greatly accelerated rate. This research project is designed to detail the history of biological microcinematography in France, Germany, England, and the United States between 1909 and 1935. Microcinematography and tissue culture in combination created an important epistemological shift in the understanding of the cell as a fundamentally dynamic element of bodily processes rather than a static element of bodily structure. By studying the specific case of biological microcinematography, this project also addresses larger themes, of the status of the cell as an object of twentieth-century experimental practice, and the understanding of the phenomena of life, senescence, reproduction, cancer, bacterial infection, and death as fundamental cellular processes.

Robert Musil's "Essayism" and the Epistemology of Experimental Procedures

Birgit Griesecke

In his critical examination of Ernst Mach's writings, Robert Musil developed his methodological concept of *Essayismus*. The concept does not refer primarily to the literary genre of the essay. It centers on the open structure of experience and its correlation with innovative scientific leaps. Its tendency to transcend the boundaries of heterogeneous discourses is reflected in the methodology of *Griesecke's* project. It aims to investigate current epistemological problems such as the dichotomy between "scientific" and "literary" cultures and the exclusiveness of the Occidental notion of science and the epistemic dominance of the West. These dichotomies are analyzed, in relation to essayism, on the basis of two historical case studies of Western and Japanese traditions. One concerns the introduction of surgical anesthesia (Crawford W. Long/Hanaoka Seishû), the other deals with texts of geographical and ethnographical exploration (Georg Forster/Arai Hakuseki). *Griesecke* argues that the characteristics of Musilian essayism – attentiveness to the "lifeworld" as an indispensable resource of scientific questions, metaphoric and metonymic dynamics, interaction between precision and vagueness, between "Wirklichkeitssinn" and "Möglichkeitssinn" – can be traced in different research processes which led to remarkable medical achievements as well as in descriptions of foreign terrains and cultures which were even able to transform that culture's own familiar, stable categories.

**Experimental Systems in Nineteenth-Century Life Sciences:
The Virtual Laboratory for Physiology (VLP)**

Sven Dierig, Jörg Kantel, Henning Schmidgen

General Goals

The Virtual Laboratory for Physiology (VLP) is an internet project aimed at offering a comprehensive documentation of the life sciences in the nineteenth century, with a special focus on the material culture of physiological and psychological research. The VLP is an electronic research tool enabling historians of science, technology and culture, museologists and collectors, and students actively to explore the history of the experimental life sciences. As a digital archive, the VLP gives access to a rich collection of hyperlinked texts and illustrations concerning the experimentalization of life between 1830 and 1930. It includes scans of journal articles, handbooks, monographs, catalogues of scientific instruments, and other historical records. In addition, the VLP is a platform for electronic publishing, on which results of ongoing historical research can be presented. Finally, the VLP is meant to encourage collective exploration of new ways of writing history. Taking seriously the potential of web technologies, the VLP establishes a multi-media way of reconstructing the past, a way in which images, sounds, and eventually moving pictures are fully integrated.

The holdings of the VLP are organized according to the following sections: experiments, technology, objects, sites, exposition, people, library, concepts. The archive will be complemented by a history forum (PANEL), in which people working with or within the VLP can prepare and present their studies, which may range from illustrated articles to stories crystallizing around virtual reconstructions of experiments. A prototype is planned to be placed on the World Wide Web in 2000. The prototype will demonstrate what a virtual laboratory can accomplish for research and teaching in the history of science.

Selected Hyperlinked Contents:

Experiments. This section of the archive presents typical experiments carried out in the life sciences in the nineteenth century. The focus is on visual representations of experiments. Under such headings as “Heart & Circulation”, “Brain & Nervous System”, and “Experience & Behavior”, a reader can access representations of classical experiments in physiology and psychology. In addition to the image of the experiment, the source of that image, and a short description of the experiment will be given. Other information includes instruments displayed in the image as well as circumstances described in the corresponding source text. A user also receives the complete bibliographical reference of the image. A short comment draws attention to the significance and the consequences of the experiment and to further historical questions to be explored. One of our aims in the section “Experiments” is to collect multiple historical images of one type of experiment and to present them in chronological series. Ideally, we anticipate being able to reconstruct the evolution of an experimental system over a time-span of 20, 30 or in some cases 50 years. Users will thereby be able to observe the various uses of the experiment and changes in its setup – additions, variations, shifting contexts.

Technology. This section mainly concerns instruments. It provides images of instruments used in physiological and psychological research yet also includes power sources as well as fittings and accessories. The material presented here is mainly taken from handbooks, but also from instrument-makers’ catalogues. Wherever possible, these images are arranged in chronological series. We also include recent photographs of extant historical instruments and information on the holder of those instruments, and the location of collections. Further information includes bibliographic references concerning the instrument, a description of the instrument and its experimental uses, the name of the instrument-maker, and historical problems worthy of further investigation.

Objects. Like the instruments, the objects of nineteenth-century physiology and psychology – frogs, rabbits, dogs, human beings – were integral to experiment. Disciplines and institutions in the life sciences crystallized around “model organisms”. Frogs, rabbits, and other animals were collected on the outskirts of cities, sometimes within them. Some were bred and housed in scientific institutes. Antivivisectionist movements in many countries condemned the use or misuse of animals in research and at times forced researchers to find other methods – for example, to miniaturize their objects or to move outside the cities. This rich history is documented here.

Sites. This section concerns sites of knowledge production. Here, users will find the places in which research was carried out: laboratories and institutes, but also field stations, museums, and hospitals. We provide a list of these sites and display building plans, charts, and architectural views. When possible, we also display the current state of the building or site. We understand sites of knowledge production in a broad sense and include sites dedicated less to research than to education, training, everyday work, or entertainment and leisure, such as the lecture hall, gymnasium, factory, theater, and railway station.

Further Projects Related to History and Epistemology of Experimentation

Using laboratory notebooks, *Andrea Loettgers* has undertaken a case study of the development of an astrophysical instrument of the late nineteenth century, Samuel Langley’s bolometer. The emphasis of this study has been on the relation between the development of the instrument and the experimental practices into which it was inserted. *Jérôme Ségal* is working on a project concerning the history of simulation in molecular biology. Taking protein folding as his case study, he focuses on the new experimental practices introduced by the use of computers, that is, on experimentation *in silico*.

Research Projects on "History of Objects and Spaces of Knowledge and of Mental Equipment"

The Ingenious Brain: On the History of Elite Brain Research in the Nineteenth and Twentieth Centuries

Michael Hagner

This project considers how and why the brain became both a scientific object and a cultural organ loaded with values and symbols. Whereas in *Homo cerebrialis. Der Wandel vom Seelenorgan zum Gehirn* (1997), *Hagner* analysed the coming into being of the brain as the organ in which various mental qualities were localized, he is now concentrating on the history of the investigation of brains of extraordinary individuals: geniuses in the arts and sciences, individuals of special talent, and criminals. The history of these skulls and brains is twofold: it comprises the establishment of a new epistemic object – the ingenious brain – as well as idealized types that became crucial for the modern understanding of the scientist. Scientists, though usually employed by the state as professors, academicians and teachers, nevertheless remained extraordinary figures with specific characteristics. Their genius was supposed to be visible in their work and – post mortem – in their brains.

The interest in ingenious brains reaches back to the late eighteenth century, when physiognomicists and physical anthropologists established cerebral parameters for explaining intellectual differences among human beings. Reports about extraordinary brains were part of biographical sketches, often delivered in celebratory obituaries. The utilization of brains and skulls for cultural portraits of scientists was in accordance with the then available methods and parameters for investigating brains. These skills presaged the beginnings of modern elite brain research in the 1850s. In this decade, the older interest in the brains and skulls of geniuses was transformed into a systematic and comparative exploration of the brains of extraordinary persons. The first systematic investigations of ingenious brains were quite disappointing, but the years between the 1860s and the 1920s witnessed a remarkable number of dissections of this kind. Although these investigations explicitly distanced themselves from older "mythological" enterprises, scientific curiosity was shaped by the cultural (self-)understanding of leading figures in society, including scientists – and not only in the famous cases of Lenin and Einstein. The study will show that extraordinary brains were central to twentieth-century scientific culture.

Ecce cortex: Contributions to the History of the Modern Brain

Michael Hagner in collaboration with *Cornelius Borck, Cristina Chimisso, Sven Dierig, Doris Kaufmann, Andreas Mayer, Andrew Mendelsohn, Alexandre Métraux, Helmut Müller-Sievers, Simon Schaffer and Henning Schmidgen*

The aim of this collaborative book project was to bring together various ongoing research projects within the Institute and to launch a discussion on the question of a cultural history of the modern brain. What seemed at first to be scattered individual interests turned into a common and overarching interest in the historicity of an object that is at once one of the most fascinating research areas in the sciences and among the most culturally vested organs in the history of modern man. This interwovenness invited us to rethink strict distinctions between scientific disenchantment and cultural reenchantment. Participants examined the extent to which the brain carried metaphors and values, symbols and meanings, and the extent to which it was bound to specific cultural, social, and political claims. Assuming multiple relations between these cultural dynamics and scientific practice in anatomy, psychiatry, anthropology, cognitive science, philosophy, and literature, the group tried to avoid traditional historiographical concepts such as "influence" and "reception". Instead, participants examined the historical spaces and conditions that made possible new questions, theories, and practices. Ongoing discussions among participants both preceded

and followed a workshop held August 30 – September 1, 1998. The book *Ecce cortex* appeared in the fall of 1999.

The Laboratory in the City: Urbanization, Industrialization, and the Place of Experiment in Nineteenth-Century Physiology

Sven Dierig

Laboratories are not isolated from the world; they have always existed in relation to the space around them. Like universities, museums, hospitals, botanical gardens, and other institutions of scientific research and education, laboratories have been and still are typically located in cities. And both laboratories and cities are subject to change. Using the example of Berlin and the institutionalization of experimental physiology by Emil du Bois-Reymond, this project places the laboratory revolution in physiology in the context of the transformation of urban space in the industrial revolution. This “urban history of physiology” seeks to understand how cities and laboratories “cooperate” in the production of scientific novelty. Emphasis is on the ways in which ongoing changes in urban life and society, industry, economy, and technology permeated the “walls” of physiological workplaces and yielded scientific knowledge. The study is organized topically rather than chronologically. Investigation of three topics – organisms, instruments, and laboratories – illustrates 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.

Organisms: Research fields, experimental setups and instruments in nineteenth-century physiology accreted around model organisms such as frogs, cats, rabbits, and dogs. Assuming that the scientific career of an organism as an experimental tool depends not only on various features of the organism or the techniques employed, the project studies the role of Berlin’s weekly markets, zoos, aquariums, urban biotopes, and other urban places in providing physiological research with supplies of experimental organisms.

Instruments: This topic concerns the role of technology in the making of scientific novelty at the time when Berlin became a technological metropolis. Focusing on electrophysiology and the so-called graphical method, the aim is to ask how local conditions lead to substitution of one instrument or experimental setup for another and to unravel the interrelationships between the use of instruments, changes in instruments, and the evolution of urban technology systems: systems of power (water, gas, electricity), systems of transport (horse-drawn carriages, urban railways, electric street cars), and systems of communication (telegraph, telephone).

Laboratories: This focus of the project was inspired by work in the sociology of scientific knowledge showing the laboratory as a specific workplace, designed for the factorylike production of new experimental phenomena. The argument is that laboratories produce knowledge for a scientific market just as factories and their machines produce goods for a consumer market. Stages in the laboratory revolution in physiology in Berlin are analyzed in terms of the evolution from manual work to mass production in the industrializing city.

Some aspects of the project have been presented on the workshop “Physiological and Psychological Practices in the Nineteenth Century: their Relationships to Literature, Art, and Technology” organized by *Sven Dierig* and *Henning Schmidgen*, July 3 – 4, 1999. The workshop is documented in the Institute’s Preprint No. 120.

Science and the City

Sven Dierig, Jens Lachmund, Andrew Mendelsohn

This project is dedicated to bringing together what have been all too separate fields of research: the history of science and the history of the city. The project takes the form of collaboration within the Institute, an international workshop, and a collective publication. The workshop will be held in

December 2000. The results of the project will be published in 2003 as volume 18 of the History of Science Society journal *Osiris*. Through this group effort, we aim to show various ways in which practices and objects of science, on the one hand, and material and social forms of the city, on the other, were co-produced. The sciences to be represented in the project can be sorted onto a spectrum ranging from those which have the city as their main object of study (urban sociology, urban planning) to those only partly concerned with the city as such (public health, demography, epidemiology, urban ecology) to those which do not at all take the city as their subject (experimental physiology, zoology, clinical medicine). At one end of this spectrum, the workshop aims to examine the various forms of representation (maps, survey forms, statistics, narratives) through which knowledge of the city was encoded and how these functioned in the production and reproduction of the urban as a scientifically ordered phenomenon. At the other end of the spectrum, the workshop aims to include in an urban history of science those fields which are not directly concerned with the city, by exploring the ways in which the "walls" of the laboratory, the museum, and the clinic were highly permeable and even difficult to manage. These places of knowledge were embedded not only in society and culture, as historians have amply demonstrated, but also specifically in the city.

Science en Masse

Andrew Mendelsohn

This project aims to develop a theoretical and historiographical framework for understanding science in the mass dimension, that is, empirical inquiry into the nature and behavior of large-scale phenomena composed of many parts or individuals, be these phenomena organic, social, or physical. Thus the focus is less "big science" than the sciences of "big" objects. Through what practices, whether expert or everyday, do these come into being and hold together? The survey, the questionnaire, the map, the table and other instruments of data-gathering and representation have evolved in ways that deserve to be explored and compared. So too have the techniques, both qualitative and quantitative, used to model big objects. Framed deliberately wider than the capacities of a single historian, the project will take the form of a workshop and collective publication.

The project grew out of a case study of a massive bacteriological and epidemiological experimental campaign in Imperial Germany, which was sustained for a decade over a human population of several million and perceived by contemporaries as a vast "machinery" of scientific research and state administration. It is described in *Mendelsohn's* dissertation and in his forthcoming book on the bacteriological revolution. Within the wider framework of "science en masse", his research has shifted to focus on the role of earlier epidemiological practice and thought – as much by social reformers, chemists, psychiatrists, and public administrators as by physicians – in shaping models less of disease than of society, environment, population, and mass phenomena since the eighteenth century. Whereas historians have traditionally asked how politics and culture shaped methods of investigating epidemics and theories of their causation, here the question is how the development of those very techniques of inquiry into mass phenomena of health, disease, and death helped give such categories as the "social" and the "environmental" their modern form.

The Technical Fix and the Technocratic Life

Andrew Mendelsohn

This project began with the observation that over the course of the nineteenth century, in several areas in which knowers were enlisted by the state or industry to research and solve human problems, a new method arose. Whereas around 1850, to take the example of hygiene, disease appeared to be a broad human and social problem requiring a broad social solution, by 1900 it appeared to be a narrow medical problem requiring a focused solution. The new method was often called "technical". It was typically identified by its critics as "narrow" or "one-sided", a vocabulary that

overlapped with contemporary discourse on perceived problems in the development of science, government, and modern social life. In the twentieth century, it earned the label “technocratic”, which accentuated the ambiguity of positive and negative connotations and came to stand for much of what was thought to be characteristic of modernity.

The first thesis of the project is that this process was not one of reduction, of pruning away human and social dimensions from a preexisting technical hard core. The technical solution, or “fix”, was not a default setting to which human action reverted when it somehow ceased to be social and political. Thus the project asks: What is a technical solution to a human problem? Addressing this question has required a taxonomy of the various forms taken by the relation between knowledge and power, *Wissenschaft* and *Herrschaft*.

The second thesis is that the coming into being of the technocratic derived less from change in science or polity than from the emergence of a new kind of person. The expert as civic leader or statesman gave way to the expert as intervener from outside society and politics. One important result of research thus far was that social processes associated with modernity, such as specialization, professionalization, bureaucratization, and rationalization, fail empirically to describe this difference in kind of expert and of expertise. Far more revealing are the concrete life patterns – and particularly the physical and cultural mobility – of prototypical figures involved in problem-solving for the state, such as the engineer, the social or physical surveyor, the district medical official, the navy or army doctor.

Constitution of Objects: Pest, Population, Race, Mass

Sarah Jansen

Sarah Jansen's work focuses on developing a methodology to investigate the “constitution” of scientific objects that have been “successful” in shaping both scientific and non-scientific realities. Instead of treating entities such as “pests” and “populations” as natural categories studied by scientists, *Jansen* investigates how these objects take shape and how they become part of scientific, cultural, social and political realities. Her approach involves detailed analyses of the processes by which these objects emerge, become stabilized and perceived as existing independent of human agency.

Jansen's book “*Schädlinge*”. *Geschichte eines wissenschaftlichen und politischen Konstrukts, 1840–1920* (in press) analyzes three interwoven processes: the emergence of the “pest” as a process of constituting a scientific-technological and political object, the formation of the discipline of economic entomology, and the self-shaping of the human actors as economic entomologists. The perspective is on the “pest” as an effect of pest control and not as its pre-discursive cause: “insects”, “parasites” and “pests” circulate as collective symbols between scientific and political discourses, practices and institutions, absorbing and giving off elements of knowledge in the process. The book contributes to the field of historical and epistemological studies of science and technology as well as, by analyzing both practices and semantics of “pest” control as one of the conditions of possibility of later NS man murder undertaken with the insecticide Zyklon B to, the discussions about science, national socialism, and modernity.

In her ongoing project on population, race, and mass as objects of ecology, anthropology and demography, *Jansen* analyzes the constitution of “population” and related objects from 1870 to 1950. The project traces how people, but also groups of free-ranging animals were conceptualized as “populations” to be regulated and managed. By investigating the traffic between human population sciences, including eugenics, racial anthropology and demography, and nascent ecology, the project enables a perspective on modes of regulation of both human and animal populations that takes into account their mutual impact veiled by today's disciplinary divide.

In a recent case study, *Jansen* has come to extend her methodology to include the role of “epistemic tensions” between related objects such as “race”, “mass” and “population” and the different forms of power inscribed in these objects. For a population to emerge, the individual mem-

bers need to be identified in order to count as members of a collective to be regulated and to establish the boundaries of the collective. Typological species classifications were unsuited for establishing differences, in the given case, between different migrating herring schools. Around 1900, criminalistic and anthropometric concepts and practices were imported to fisheries biology, a field constitutive of population ecology. With the transfer of these concepts and practices, the object "race" with its hegemonic inscriptions, as well as identifications of the normal and the deviant, became an integral part of nascent ecology. Drawing on the literature on laboratory experiments, another focus of the work is the epistemological analysis of field experiments, their contribution to shaping the "population" objects, and their relationship to the laboratory.

Mapping Urban Nature: Ecological Expertise and Urban Planning in Germany since 1975

Jens Lachmund

This project is a historical-sociological case study of the rise of urban ecology in Germany. In the past three decades issues such as the protection of species, habitats, soils, water, and more generally of "sustainable development", have created new roles for ecological experts as advisors in urban planning affairs. At the same time, the ecology of the city has evolved as a distinct interdisciplinary research field closely related to environmental planning. Drawing upon a notion of the city as a "space of knowledge", the project examines the various ways in which the epistemic practices of this discipline have been mutually connected to the material and cultural history of the urban environment.

With Berlin (West) as its focus, the project examines the historical career of these urban ecological surveys. Although there is a long tradition of ecological surveys outside the cities, systematic urban ecological surveys of cities did not emerge before the late 1970s. Particularly, from the mid-1970s onwards in most cities of the FRG, and after unification also in the former GDR, so-called "biotope-mapping" was conducted for local municipalities. These were comprehensive surveys of plants, animals and their habitat structures, which were considered a basis for nature promotion measures and more ecological town planning.

The project seeks to shed light on the social and material practice of ecological expertise in its urban context. It examines how biotope mapping came into being as a nexus of heterogeneous activities moving across various institutional domains and implying specific modes of epistemic and political ordering. By tracing the historical development of urban biotope mapping, it addresses the various processes that have shaped the construction and "stabilization" of biotope mapping as a field of ecological expertise. Instead of the diffusion of an existing body of scientific expertise into the contexts of its application this was far more a process of mutual adaption or "co-construction" in which new modes of producing knowledge about urban spaces and new modes of political regulation were inextricably interwoven.

Accordingly, biotope maps are not treated as merely neutral means of representing pre-existing features of the environment. Rather, the project seeks to show how biotope maps were actively involved in the construction of "urban nature". It is a mosaic of various "biotopes", some of them considered to be relatively "natural", others to be highly "artificial". By delineating these regions and by making visible the relations between them, biotope mapping called them into existence as new objects of knowledge. Urban woods and parks as well as wastelands, residential areas, and industrial sites were classified and mapped according to ecological criteria. This has had far-reaching implications for the definition of the nature-culture divide: whereas nature had long been the "other" of the city, biotope mapping inscribed "naturalness" into the urban environment itself.

Great Expectations: Oceanographical and Meteorological Research as Spatial Frontiers after 1900

Sabine Höhler

This project deals with the conceptualization and colonization of space in twentieth-century oceanographical and meteorological research. The general aim is to understand spatial imaginations and processes by which these scientific fields render “space” an object and an effect of knowledge. The focus is on the construction of space as a resource in Weimar Germany and ways in which scientifically motivated oceanic and aerial survey expeditions after World War I were connected to the politics and especially the popular geographic image of “Lebensraum”. Postulating that space gains depth through production of spatial knowledge and effective spatial control, *Höhler* examines how oceanic and atmospheric spaces were made available through techniques of surveying, data collecting, and mapping, in which sounding techniques were central. The concept of frontier will be used to analyze the aspects of migration and colonization involved in such research endeavors.

Apparatuses of the Senses: Measuring the Senses as Part of Experimental Settings in the Early Nineteenth Century

Christoph Hoffmann

Christoph Hoffmann's project explores an epistemological rupture in the knowledge of the human senses in the early nineteenth century. Although the optics of the eye and the limitations of human vision were well known in the eighteenth century, the function of the senses was understood as reliable and controllable by the mind. Around 1800, the organs of vision and of hearing became opaque objects which themselves seemed to intervene in perception. The organs thus achieved the status of an investigable “epistemic thing”. This rupture can be located in physiological research on subjective visual phenomena, at least in the German context, but also in the measurement and observational practices of the physically oriented sciences. They became the subject of a separate line of research. The project focuses on three “Entstehungsherde” (Foucault with Nietzsche) of this shift:

(a) In 1823 the astronomer Friedrich Wilhelm Bessel found individual differences between astronomers who observed the transit of a star over the meridian. In the following years, these observations were corroborated. Registering individual differences became a regular practice at observatories and displayed the senses of the observers as objects of ongoing measurement and experimentation. (b) Ernst Heinrich Weber's study “*De subtilitate tactus*” (1834) reported differences in tactile sensitivity in different areas possessing this sense. In serial tests Weber measured the smallest perceivable differences in spatial distance at several places on the skin. Today these experiments are recognized as the basis of the so-called Weber-Fechner law. Yet in the 1830s Weber also linked his experiments with a theory of the organization of sensory organs and of the nervous transmission of sensation. Thus he inscribed the epistemological framework of his research on the senses as sensible instruments of measurement into anatomical and physiological structures of the body. (c) In the summer of 1835 Weber visited his brother Wilhelm in Göttingen. In the experiments of the brothers Weber, an electric circuit was used as a telegraph: signals were sent by the induction of currents and received by the skin. The instrument-maker Carl August von Steinheil later provided a bell-ear module as signal-receiver. Understanding the senses as parts of a technological “setup” was nothing new to Steinheil. Trained by Bessel in the early 1820s, he had worked on an automatic time-registering device for astronomical transit observations, a device meant to substitute for the ear of the observer. Thus, in workshop practices around 1830 such as these, the senses had become interchangeable parts of experimental instruments.

These three “Entstehungsherde” provide a detailed picture of epistemological and practical changes in knowledge of the senses after 1800. Whereas anatomical and physiological research

tended to sharpen the "subjectivity" of sensations, the approach to the senses in the physical sciences focused on their "instrumentality" and "functionality". When after 1850 the notion of "sensory apparatus" was commonly and self-evidently used by physiologists in modeling the senses experimentally as technological apparatuses, it was after all the performance of the preceding epoch of research and practical measurement that had turned the senses and technological apparatuses into *one* scientific object.

The Microscopic Anatomy of the Retina and the History of Vision Studies

Jutta Schickore

This project in the history of the study of vision focuses on microscopic investigations of the finer structure of the eye carried out in the first half of the nineteenth century. To analyze nineteenth-century studies of sense perception and vision, historians have directed their attention mainly to Johann Evangelista Purkyne and Johannes Müller's subjective sensory physiology, or else to the experimental physiology of the mid-nineteenth-century "organic physicists". By contrast, the general aim of *Schickore's* project is to assess the significance of micro-anatomical studies of the sensory organs in this context.

The first part of the study concerns attempts in the 1830s – especially by Gottfried Reinhold Treviranus – to determine the microscopic structure of the retina and to locate its light-sensitive elements. It turned out that newly discovered facts of retinal structure could not be interpreted in terms of a theory of vision and remained a constant challenge for physiologists who sought to elucidate the function of the retina. The second part of the study examines how two microscopists, Ernst Brücke in Berlin and Heinrich Müller in Würzburg, made fresh starts on these questions in the late 1840s. Their respective styles of microscopical research reveal that both were representative of the drive toward experiment in the life sciences. A third study examines how in the second third of the nineteenth century, microscopists developed methods of preparation which were based on new ideas about how a proper microscopic object should look like. The example of the introduction of chromic acid reflects a dramatic transformation of microscopy from a practice of preserving to an experimental enterprise.

These case studies indicate that microscopic anatomy escapes the common historiographical distinction between emergent experimental physiology, on the one hand, and observational and morphological approaches in microscopy, on the other. Consequently, *Schickore* is now shifting the emphasis of her work to methodology in nineteenth-century microscopy. She is concentrating on manuals of microscopy as the outcome of the microscopists' immediate concern with the possibilities and limitations of microscopic analysis and investigating connections between the microscopists' methodological writings and practices and the contemporaneous discussions on the productive and erroneous observer.

Phenomenological Space and Measurement

David Hyder

While writing his thesis on Wittgenstein's *Tractatus* and its nineteenth-century scientific background, *David Hyder* took interest in the analogy between Wittgenstein's notion of a "logical space" and the view, prevalent among many workers in sense-physiology, that all sensibilia were organized in spatial structures – the color-space, sound-space, tactile continua, and so on. The young Wittgenstein had made use of *his* notion to explain how linguistic expressions could have determinate meanings even when the referents of these expressions did not exist: he argued that propositions were like "addresses" of locations in a space, which might or might not be filled. Helmholtz, who had done the basic physiological research leading to the manifold theory of perception, had himself used this theory in an analogous way in his writings on non-Euclidean geometry. He too had had to explain the sense in which non-Euclidean geometries were conceivable,

even if they were not, as he conceded, realized in fact. For both Helmholtz and Wittgenstein, positing a deep spatial structure of experience made it possible to preserve intensional meaning in the absence of concrete referents. This conception of sensation – in some sense an extension of Kant’s spatio-temporal manifold to cover the whole field of human experience – is to be found in the philosophical writings of scientists such as Mach, Poincaré, Boltzmann, and Weyl, as well as in Wittgenstein and Carnap. For all these authors, the ultimate meaning of linguistic expressions – both those of everyday language and those of the various sciences – was to be found in their reference to the elements of such a primitive data-space. The history of this conception sheds light not only on the epistemology of the Vienna Circle, the first “philosophers of science,” but also on strong phenomenological tendencies in the German-speaking scientific community at the turn of the century.

Invisible Architectures: On Small-Scale Entities in the Life Sciences

Alexandre Métraux in collaboration with Christoph Gradmann, Sarah Jansen, Ohad Parnes, Marc Ratcliff, Hans-Jörg Rheinberger, Jutta Schickore and Judy Schloegel

This collaborative project brought together researchers at the Institute working on various aspects of visualizing small-scale entities – single cells, germs, parts of tissues, microscopically minute animals – in the life sciences since the eighteenth century. The group sought to demonstrate the ways in which biological seeing did not catch the “naturally given” morphological properties of living matter, but rather presupposed the management of bodies by various techniques such as slicing, applying dyestuffs, filtering light rays, and so on. In such management, scientists continually faced problems. Could one be sure of having achieved the selective visibility of relevant or potentially relevant features under such constraints? How could one exclude or reduce the likelihood that the manipulations had created artefacts? Gathering visual data in contexts both of selective visibility and manipulative uncertainty had furthermore to be coupled with the conceptualization of life processes. Hence the target objects were assessed both in terms of theoretical plausibility and in terms of a secondary, technically produced visibility masking their pristine, hidden “naturalness”. A third aspect, beyond technical questions of representation and theoretical considerations, concerned the education of the eyes. To include the mindful eye of the observer – and hence the culturally determined scopic regimes under which life scientists have been and are still working – turned out to be a challenging topic of historical reconstruction. A workshop took place October 13–15, 1998. The contributions are being published as a special issue of *Science in Context* in 2000.

Conventional Experiment in Unconventional Spaces

Nani Clow

This project studies the ways in which the practices, methods, and instruments of experimental physics were employed in the investigation of a wide variety of psychic phenomena – thought transference, spirit manifestations, cross correspondence, telekinesis – from the late 1880s to the 1920s. Methods of scientific conduct and observation were imported into seances in order to establish control over events, to designate criteria for evidence, and to standardize modes of behavior and witnessing. Experimental methods and instruments were used to control the medium (in order to prevent fraud) as well as to measure, record, and document phenomena. The project aims at a comparative study of telepathy in Britain, France, and Germany. Such comparison ought to enable deeper insight into the ways in which epistemological worldviews drove experimental practices in different local cultures and in turn shaped and transformed the understanding of psychic phenomena.

Further Projects Related to the History of Objects and Spaces of Knowledge

Jonathan Simon studied the isolation and naming of a poisonous plant extract, strychnine, by two French pharmacists, Pierre-Joseph Pelletier and Joseph-Bienaimé Caventou, in 1818. The general aim was to use a historical case of scientific research to address a well-established philosophical problem: the relationship between words and things in identification procedures. *Judy Johns Schloegel* worked on the history of protozoan genetics and more generally on protozoology and microscopy in the late nineteenth and twentieth centuries. She was concerned primarily with the history of genetic determinism in relation to choice of organisms, and with the epistemological consequences of affective relationships between biologists and their research organisms. *Bruno J. Strasser's* project dealt with the transition from molecular biology to biotechnology. Taking the history of restriction enzymes as his case study, he aimed at showing how things (enzymes) first taken as *objects* of an experimental investigation can later become *tools* used in another experimental setup.

Research Projects on "The Uses of Theory in the Life Sciences"

Agents of Life and Disease

Ohad Parnes

Ohad Parnes's dissertation aims to trace the origins of the fundamental concepts of microscopical biology in the period 1830–1870. At the core of the project stands the redefinition of physiology and pathology in terms of causal relations between specific material agencies and corresponding specific effects.

The project consists of two main parts. In the first part, the work of Theodor Schwann, leading to his formulation of the cell theory in 1838, is analysed. In contrast to previous historiography, *Parnes* locates Schwann's cell theory in the context of his earlier research on muscle contraction (1835), stomach digestion (including the discovery of pepsin in 1836), and fermentation (1837). All these investigations were driven by an attempt to explain the dynamics of life in terms of causal agents, without recourse to vital forces. Schwann believed that if one could construct the right experimental setting, it should be possible to discern specific material agents for each physiological process. This part of the work is largely based on the analysis of Schwann's unpublished research notes, hitherto hardly consulted by historians.

The second part of the project deals with the aftermath of Schwann's work, specifically with the way this new experimental and conceptual regime took over in the period 1840–1870. In this part, *Parnes* retraces the interconnections between developments in physiology and those which

took place in the pathological realm. In this period, not only did cell theory take over the microscopical-anatomical imagination, but the conception of the cell itself as an agent of life and disease underwent major changes. In medicine, a growing emphasis was observed on the specific etiology of diseases. *Parnes* argues that this etiological point of view by and large preceded the bacteriological revolution and was not, as is often argued, its result. This part of the project includes an analysis of the work of the physiologists Emil du Bois-Reymond and Carl Ludwig and of the pathologists Jacob Henle and Ludwig Traube.

Toward a History of the Notion of Genetic Regulation and its Bearing on Embryology

Denis Thieffry

This project traced the main conceptual shifts that occurred as experimental embryology yielded to developmental biology over the course of the twentieth century. The concepts of “regulation” and “regulatory network” were central to these shifts. Since the notion of “regulation” is important in contemporary biology, previous authors have investigated its history, especially with respect to the emergence of the concept of a “regulatory gene” in molecular genetics at mid-century. Yet the notion of “regulation” is far older, and its history involves a variety of disciplines, from chemistry to physiology to embryology.

The project followed versions of the notion of regulation as implied in embryological concepts such as “induction”, “field”, “epigenesis”, and “canalization”, up to recent interpretations of embryonic development in terms of a spatio-temporal control of gene expression. Under the new molecular biology, most of these embryological concepts went through an eclipse in the 1960s-70s. But some of them, notably “gradient”, continued to inspire the research of theoretically inclined biologists as well as that of some experimentalists working on regeneration and insect development. More recently, several of these concepts (“gradient”, “epigenesis”) were redefined in molecular terms and were used in the description of cell differentiation and embryonic development, whereas others (“canalization”) have remained marginal. Aiming to understand how the uses and successes of these concepts related to specific experimental settings, model organisms, disciplines, and local cultures, this analysis emphasizes polysemy and shifts of meaning.

The work of the Belgian embryologist Albert Dalcq, who attempted to give a general “causal” account of early animal embryogenesis in the late 1930s received special attention. Subsequent emphasis was on the development of the notion of the “regulatory gene” and that of the “operon” by Francois Jacob and Jacques Monod. Finally, the historical reconstruction highlighted the ways in which the study of embryogenesis was remodeled so as to be integrated into the new molecular framework. This research forms the basis of a book on the respective contributions of geneticists, molecular biologists, and embryologists to our present understanding of embryonic development.

Metaphors and the Dynamics of Science: Research on the Tobacco Mosaic Virus in Germany, 1940–1960

Christina Brandt

As a project situated between the history of biology and literary studies, *Brandt's* dissertation integrates textual analysis and historical reconstruction. The focus is on the role of metaphors in the dynamics of knowledge production. *Brandt* explicates how the language of molecular information transfer, which entered the life sciences in the 1950s and fundamentally shaped the discursive structure of molecular biology, was inscribed in a local experimental and institutional setting: tobacco mosaic virus (TMV) research at the Max Planck Institutes in Tübingen between the late 1940s and early 1960s.

Whereas philosophers of science have often discussed the constructive role of metaphors in science with regard to similarities between metaphors and models, analogies or pre-theoretical

frameworks, the literary approach behind this study opens a different perspective on the problem. Arguing that the fruitfulness of the information concept was not due to the transfer of an information theoretical framework, *Brandt* stresses instead the changing and flexible meanings of information metaphors. Emphasis is thus on the heterogeneous ways in which these metaphors were embedded in different sites of knowledge production. Close attention is paid to the linguistic arrangement of knowledge in various genres of scientific texts and to the relations between these texts and experimental practices. The first part of the dissertation describes the beginnings of TMV research at the Kaiser Wilhelm Institutes for Biochemistry and for Biology. The second part focuses on theoretical work on the "genetic code", while the third part explores the popular and semi-popular uses of the information concept. The fourth part analyzes the key experimental events and their dynamics: the sequence analysis of the viral coat protein and the shift of interest to the viral RNA and its mutagenesis. The following two parts compare the representation of this work in different genres of scientific texts and the subsequent conflation between these levels of representation. Only around 1960 did the language of information and code enter the realm of experimentation as TMV became a tool for deciphering the genetic code. Finally, in the 1960s, the information concept became a kind of philosophical core of the new biology, around which long-standing questions concerning the essence of life were reevaluated.

Between Philosophy and Experiment: A History of Theoretical Biology, 1900 to World War II

Manfred D. Laubichler

Theoretical biology became an established field only in the mid-1930s. Since the late nineteenth century, however, experimental biologists and philosophers had participated in ongoing discussions on the topic. The discourse of theoretical biology was centered primarily on the question of the conceptual, epistemological, and methodological foundations of biology. Other themes included the relation of biology to physics and metaphysics, the specificity of biological processes, and the representation of biological knowledge. The emergence of theoretical physics served as a model for similar developments in biology. However, an inclusive theoretical biology could only emerge at the beginning of the twentieth century after certain crucial events had fundamentally transformed biology. Among these were the Darwinian theory of natural selection, cell theory, the causal-mechanical theory of development, and the rediscovery of Mendel in addition to developments in physics such as the theory of thermodynamics and the theory of electromagnetism.

Analyzing the discourse on theoretical biology in these decades helps provide a historical understanding of the epistemology of biological theory and practice. Theoretical biology appears to be especially suited because it was *not* an established discipline with its own specific set of questions. It served rather as a forum for reflection among biologists from different disciplines, such as genetics, cell biology, physiology, comparative anatomy, and "Entwicklungsmechanik". In these discussions, three aspects may be distinguished: the interpretation of experimental results, the development and analysis of a system of fundamental biological processes, and methodological problems of biology. Conceptually, theoretical biology was simultaneously a part of biological research of the time and a critical (or meta-theoretical) analysis of biology as such.

Theory Formation in Developmental Physiology in Germany in the 1930s-40s

Reinhard Mocek

"Entwicklungsmechanik" as an approach to the analysis of animal organisms was introduced by Wilhelm Roux in the 1880s. Originating in the fields of embryology and morphology, it proposed to elucidate laws of animal morphology in ontogenesis. From its inception, "causal morphology," as "Entwicklungsmechanik" was also called, combined an experimental approach to the problem of morphogenesis with a strong element of conceptualization. The experimental results of Roux

and Driesch led to two different theories of development. They in turn gave rise to a new form of the old controversy between mechanism and vitalism. The first decades of the twentieth century saw the successive development of gradient theory, field theory and organizer theory. These theories constituted key features of an organismic biology which claimed to do justice to the uniqueness of life, all while remaining faithful to the methods of physical and chemical analysis. This enterprise was severely challenged in the 1930s when developmental physiology was confronted with successful approaches involving genetics and biochemistry. *Mocek's* project aimed at a detailed historical analysis of this process, thus expanding his earlier book-length study: *Die werdende Form: Eine Geschichte der kausalen Morphologie* (1998).

Ecology, Evolution, and the Ethics of Nature

Thomas Potthast

This project concerns the specific historical junctures of biology and ethics that preceded and eventually contributed to the founding of the discipline of bioethics around 1970. The focus is on the two major environmental fields of biology – ecology and evolutionary biology – and on their relation to an ethics of nature, as it was articulated in the later twentieth century. Attention is paid to normative agendas of scientists, institutions, and disciplines as well as to theory formation and research practice. The goal is to understand the hybrid connection between moral and epistemological elements in the constitution of biological disciplines and of bioethics. Though the project mainly concerns biology and ethics in Germany, comparison with Britain and North America promises to reveal more general patterns by which ecology and evolutionary biology did or did not mingle with an ethics of nature in the period 1930–1970, that is, before the zenith of environmentalism. To what extent has the development of these biological disciplines and of bioethics differed in each of these countries? Is there a German “Sonderweg” in the environmental and organismic disciplines of biology with respect to the ethics of nature?

At the core of the project is a close study of networks around two influential mid-twentieth-century German ecologists: the freshwater biologist August Thienemann and the zoologist and entomologist Karl Friederichs. These ecologists' national-conservative conceptions of nature and society as organic wholes contrasted with dynamic and evolutionary views of nature and society as dominated by the individual struggle for existence, views which were held especially by experimental physiologists and geneticists. Within German ecology, tensions appeared as well. On the one hand, ecological research was oriented toward practical application to fisheries, forestry, and water hygiene. On the other hand, ecology was presented as a unifying enterprise and even as a metascience unifying natural science, the humanities, and ethics in a synthetic, holistic account of nature. Experimentalization and quantification were regarded as inadequate to the task of gaining knowledge about nature, thus leading to severe conflicts with powerful experimental biologists in Germany, who went so far as to question whether ecology should be included in biology at all. In these debates, the overall cultural and moral significance of biology was contested and redefined. Opponents regarded each others' epistemologies as morally wrong ways of doing science and being a scientist. These conflicts stretched from the Weimar period through the Third Reich to the Federal Republic.

Further Projects Related to “The Uses of Theory in the Life Sciences”

Berna Kılıç Eden studied Gottlob Frege's anti-psychologism. *Eden's* research project aimed at an exploration of the scientific and cultural context for the rise of anti-psychologism within the framework of late-nineteenth-century theories of “man.” *Abigail Lustig* explored issues in protozoology and its systematics in the late nineteenth and twentieth centuries. The focus of her project was on a conflict between the German evolutionary theorist August Weismann and the French-Algerian protozoologist Emile Maupas over the interpretation of the meaning of sex and death

among the ciliates, a debate that reflected profound differences over the methodology of evolutionary theory. *Maria Yamalidou's* project investigates the emergence of a "molecular" discourse in physiology in the mid nineteenth century as a case of interaction between the physical and the life sciences. She focuses on debates surrounding the "molecular physiology" of John Hughes Bennett at Edinburgh.

Other Projects

Neurosciences in Germany, 1930–1950

Michael Hagner and Cornelius Borck

This project asks how dramatic changes in a national political framework affected the scientific work of a group regarding itself as part of an international community and a scientific elite. Physicians' role in the murderous activities of the National Socialist regime has been known since the Nuremberg trials, and scholars have often avoided a discussion of scientific research practice in biomedicine under the Third Reich. Ironically, historical scholarship has thus implicitly followed the argument of the defendants at Nuremberg, by separating properly "scientific" research of international standard from the misled and "unscientific" activities of certain individuals. Overcoming this dichotomy requires a more complex reconstruction of science under National Socialism using the methods of cultural history. The main task is to draw a network of experimental practices, scientific conceptions, political activities, and historical contingencies. For the field of neurosciences, we aim to reconstruct (a) the main strands of and thematic changes in neuroscientific research and neuropsychiatric practice during the period; (b) the ways in which leading neuroscientists situated brain research in the public domain; (c) the course of international cooperation over the entire period; (d) the involvement of neuroscientists in the war through war-related research projects and such other roles as psychiatric advisors; and (e) continuities of research lines after 1945 and postwar reorganization of brain research both within and outside the Kaiser Wilhelm/Max Planck Society. The project is connected to the Max Planck Society's ongoing research on its forerunner, the Kaiser Wilhelm Society, under National Socialism.

In her project on "Surrationalism and its Obstacles," *Cristina Chimisso* investigated the relation between science and morality in the philosophy of Gaston Bachelard. *Antonio García Belmar* analyzed the development of a genre of scientific writing, the chemistry textbook, in France in the first half of the nineteenth century. *Janina Wellmann* has begun a project on the *Encyclopédie* and its plates, focusing on the constitution and transmission of knowledge incorporated in and moving between text and image.

Conferences

Postgenomics? Historical, Techno-Epistemic, and Cultural Aspects of Genome Projects (July 8–11, 1998)

The conference was organized by *Hans-Jörg Rheinberger* in cooperation with *Lily Kay* (Harvard University), sponsored by the German Human Genome Project, and attended by about 80 participants, including molecular biologists, historians of science, cultural historians, and science studies scholars from the United States, France, Great Britain, and Germany. The aim of the conference was to explore the epistemic, technical, and cultural challenges of genome research – especially human genome research – and to set them in historical context. Genome sequencing, as it has been practiced during the past decade, is increasingly seen – by participants as well as critics – as a transient episode on the way to a postgenomic biology that is still largely conjectural. Developmental biology, evolutionary biotechnology, and rational drug design are elements of this distant vision.

The historical frame of the conference was large enough to allow attention to genetic discourse throughout the twentieth century as well as to recent debates. Of special current interest was the revelation of a troubling discrepancy between growing expert appreciation of organismic complexity and ever more sophisticated scientific gene discourse, on the one hand, and a trend toward naive genetic determinism in the public and economic spheres, on the other. The conference went on to pose the question: "Whose Genome?" Since its inception, and to some extent contrary to its original impetus, genome research has become a variegated enterprise including, besides the human genome in its diversity, a whole array of other organisms. Finally, participants made an effort to contemplate and rethink the techno-epistemic and cultural dimensions of these developments, which have led to remarkable new constellations of basic and applied biological research. The results of the conference are summarized in the Institute Preprint No. 110.

Reworking the Bench: Research Notebooks in the History of Science
(November 11–14, 1998)

The general aim of this workshop, organized by *Jürgen Renn*, *Hans-Jörg Rheinberger*, and *Frederic L. Holmes* (Yale University), was to investigate research notebooks as a form of documentary evidence of processes of discovery. Another aim was to explore broader historiographic issues concerning research notes as sources for narratives of the history of science. First, notebooks were compared to other non-printed sources, to printed documents, and to contextual information not contained in print or writing. Second, the diverse structure of research notes was analyzed. Third, it was asked whether notebooks could usefully be considered as a distinct genre of scientific writing and as a tool for rather than a trace of research. A further point of concern was how to integrate the micro-information on investigative pathways provided by notebooks into broader narratives of the experimental and cultural practices of science. Finally, it was asked whether research notebooks could be used to reveal general patterns – not to say a "logic" – of the "context of discovery." The conference was organized so as to maximize context and comparison: between historical periods, from early-modern to twentieth-century science; among the many major fields of scientific investigation in which research notes played a role; and, finally, between the sciences and other areas such as technology, design, and architecture. In a joint effort following the conference, the organizers are working on a comprehensive volume on the uses of research notes in the history of science.

The Organization of Visibility: Photography in Science, Technology and Art
(January 14–16, 1999)

For several decades, historians of science have stressed the fact that visualization plays an important role in the production and distribution of knowledge. This workshop, organized by *Peter Geymer*, focused on the nineteenth and early twentieth centuries and on one specific technical medium – photography – and thus allowed both for detailed case studies and for comparative understanding of photographic visualization in science, art, and technology. Contributors agreed that the referential function of photography is not fixed and ahistorical, but was constantly produced and reproduced, defined, interpreted, and explained. Moreover, organizing visibility included the possibility that such organization could fail. Photographic information had to be defended against competing means of representation.

A subtheme of this discussion on visibility was invisibility. From its beginnings, the camera was perceived as an instrument able to see more than human eyes could see. Increasingly, photography assumed the function of recording the invisible. In all cases, the photographic plate recorded that which had no appearance beyond the plate itself. Photographic devices thus furnished images without perceptible models. In some cases, these images were the only available proof of the existence of the recorded phenomena. The information given by these recordings was

difficult to control, since no referents were available for comparison. In short, the workshop studied “visibility” and “invisibility” as variables that emerged, coincided, and shifted only in concrete experimental systems and in aesthetic discourses rather than forming fixed identities. Some of the contributions will be published in a volume on the role of photography in science, technology, and art.

The Brain and its Sciences in the Twentieth Century (November 25–27, 1999)

Organized by *Michael Hagner* and *Cornelius Borck*, this conference took the end of the “decade of the brain” as an occasion to review trajectories of neuroscientific research in the last century by convening historians of science, social scientists, philosophers, linguists, and neuroscientists. Aiming to historicize current neuroscientific developments, the conference identified continuities and traditions and discussed them according to apparently contrasting themes: mind/brain (psychosomatic links and connections versus cognitive sciences and artificial minds); the human condition (emotions versus language); and the role of technology (representation and intervention versus consumption and control). A second aim was to understand the historical dynamics of these dichotomies. The neurosciences have been full of promises throughout the past century: from psychosurgery to psychoactive drugs, from cybernetics to artificial minds, from holistic and integrative medicine to psycho-neuro-immunology. An important result of the conference was the realization that the proleptic anthropological and philosophical claims of the neurosciences had remained stable for at least a century: the recent advent of new visualization techniques showed that the “big questions” are not yet answered but open new horizons of expectation and new promises of imminent breakthroughs. Revised versions of several papers will be published as a separate issue of *Science in Context* in 2002.

Independent Research Group I (Director: Ursula Klein)

Project 1: Representing Invisible Objects in the Laboratory Sciences

Ursula Klein (responsible) in cooperation with *Eric Francoeur*, *Peter Ramberg* and *Sara Vollmer*
General Goals of the Project

This project, which began in January 1999, studies the tools and modes of representing invisible objects of research (such as electromagnetic waves, energy, molecular structures, chemical processes) in nineteenth- and twentieth-century laboratory sciences. We are interested in “external” representations as a collective scientific work of constructing signs on paper (or any other medium) standing for the objects under investigation. In the foreground is not the traditional epistemological question of correspondence and truth, but representation as an everyday activity situated in the laboratory or closely related to it. We take it for granted that laboratory scientists want to represent their invisible objects under investigation and do not ask whether this claim is justified. Rather we ask how scientists performed this kind of work; what kind of collectively available “tools of representation” (sign systems) they applied; how the semiotic dimensions of these tools enabled and constrained scientists in the construction of representations; how scientists created “robust fits” (Hacking) between various modes of representation; how they matched representations with experimental marks and data; what kind of broader cultural values specific modes of representation took on; and, above all, how the tools of representation shaped the goals of research, propelled the coming into being of new research objects and contributed to conceptual development. To answer these questions we apply conceptual resources taken from semiotics, epistemology, art history, historiography of science, and sociology of science. Our overall approach assumes that representations and conceptual development in laboratory sciences can be studied with the same analytic resources as earlier have been applied to laboratory instruments and experimental interventions. The specific focus of the project are representations in the history of nineteenth- and twentieth-century chemistry and biochemistry. Chemistry is a core laboratory science, in fact the oldest laboratory science; and more than any other laboratory scientists, chemists and biochemists have used a broad variety of different modes of representation. Therefore, chemistry and biochemistry are a fertile ground for studying the above mentioned questions. Until recently, historians and philosophers of science took it for granted that verbal language and mathematics were the principle modes of representing the invisible objects of experimental research. This view has been challenged by studies on diagrammatic representations (“pictorial turn”). The history of nineteenth- and twentieth-century chemistry and biochemistry sheds some new light on this problem. In chemistry and biochemistry a broad variety of modes of representation have been in use: verbal language, mathematical formulas, tables (e.g., affinity tables, taxonomic tables, the periodic table), diagrams (e.g., structural formulas, molecular orbital diagrams, molecular orbital energy diagrams), photographs, three-dimensional physical models (ball-and-stick models, space-filling models); and especially the unique symbol system invented by chemists – the various kinds of chemical formulas – that became as emblematic for their science as flasks, beakers and distillation columns. Moreover, in the last twenty years, chemists were pioneers in the development of computer based modeling and digital image processing, such as scanning tunneling microscopy.

The special research topics of all four participants of the project make it possible to cover the entire range of tools and modes of representation in the history of nineteenth- and twentieth century chemistry. Other colleagues, in particular from the US, have been involved as visiting scholars and/or as participants of the conference “Types of Paper Tools and Traditions of Representation in the History of Chemistry” (organized by *Ursula Klein*), which was held at the Institute from December 2–4, 1999. The fifteen speakers – most of them were historians of science, philosophers, or chemists – discussed topics which included the various productive functions of chemical formulas in nineteenth-century chemistry and chemical industry (*Klein, Ritter, Travis, Ramberg*), the

epistemological role and cultural value of three dimensional molecular models (*Francoeur, Meinel*), the visual representation of Mendeleev's Periodic System (*Bensaude-Vincent, Scerri*), and the interrelation of mathematical, diagrammatic and linguistic representations in quantum chemistry (*Nye, Park*), etc. More than twenty additional guests, among them many chemists, participated in the conference; they came from various countries, such as Denmark, Germany, Japan, Poland, Portugal, Switzerland, and the USA. An edited volume containing the conference papers is planned for spring 2001.

Research activities related to project 1:

Physical and Computer Modeling of Chemical Structures (Twentieth Century)

Eric Francoeur

The development of structural theories in nineteenth-century chemistry was concomitant with the development and adoption of techniques for textually describing and graphically portraying molecular structures. Another related representational practice whose development has been historically parallel to that of graphical techniques has been the use of physical structures to represent the structure of molecules, a practice commonly referred to as physical, or mechanical, molecular modeling. The recent decades have also seen the development of computer generated interactive molecular graphics as yet another representational practice. The historical development of these two practices is the focus of this project.

The first part is the continuation of research performed for his doctoral dissertation. It aims at exploring the role of physical models in twentieth century chemical research through a study of their use in specific areas of research, notably stereochemistry, conformational analysis and protein structure. The cases documented so far show clearly how such models have been central for the process of defining, exploring and intervening in the domain of molecular structures by providing mechanical embodiments of these structures, simulation devices on which "experimental" inquiries could be performed. A further step at this stage will be to explore the epistemic significance of these modeling practices and how they could shed a new light on notions of representation, simulation, and experimentation. In parallel, further studies on the development of specific modeling tools, notably space-filling models, are also being performed.

The second part of this project is still in its early stages and is being conducted in collaboration with *Jérôme Ségal* of Department III. It is a study of the origin and development of interactive molecular graphics, a practice which has recently become central and ubiquitous in the study of molecular and macromolecular structures. The current focus is on the early period of this practice (1965–1970), with a special emphasis on the work of Cyrus Levinthal and his collaborators at MIT in the mid 1960s. The first results of this work will be submitted for publication shortly, and it is hoped to expand this study to the investigation of later developments in this field, as well as its integration in areas of research such as x-ray crystallography of macromolecular structures, protein conformation studies and rational drug design. Wider issues to be considered include the role of visual representation in computer modeling and simulation.

The Various Functions of Chemical Formulas as Paper Tools in Early Nineteenth-Century Chemistry

Ursula Klein

From the late 1820s onward, chemical formulas (such as H₂O for water), introduced by Jacob Berzelius in 1813 as a shorthand for representing the composition of chemical compounds according to the theory of proportions, became enormously productive paper tools for representing chemical reactions in organic chemistry, for modeling the constitution of organic substances, and for creating a new taxonomic order based on such models. Moreover, the chemists' work on paper

with Berzelian chemical formulas generated new chemical concepts and new domains of research under the headings of substitution, valence, chemical structure, and so on.

The first part of the project, which reconstructs the semiotic and epistemological dimensions of Berzelian formulas, their application by European chemists from the late 1820s until 1840, and their impact on the transformation of the natural historical culture of vegetable and animal chemistry into an experimental culture, was completed in spring 1999. It resulted in a “Habilitationsschrift” and contained the following five parts:

1. Two Cultures of Organic Chemistry in the Nineteenth Century
2. Experiments on the Periphery of Vegetable Chemistry
3. Formula Models and Model Objects
4. The Disintegration of the Natural-Historical Culture of Organic Chemistry and the Formation of a New Experimental Culture
5. The Semiotic Aspects and Practical Applications of Berzelian Formulas in the 1830s and 1840s.

The second part of the project will explore the stabilization and expansion of the new experimental culture of “substitutions” in European organic chemistry after 1840, which included the further application and modification of chemical formulas as tools to model the reaction and constitution of chemical substances. This experimental culture created a new world of artificial substances not existing in nature outside the laboratory, and an associated world on paper embracing algebraic formulas and various types of diagrammatic symbols. It had a strong impact on the chemical industry and went hand in hand with a new cultural image of synthetic chemistry as the most progressive science for changing the architecture of the modern world.

The Meaning and Purpose of Chemical Formulas in Stereochemistry (1874–1913)

Peter J. Ramberg

This project concerns the fundamental change in the meaning of chemical symbol systems from structural to stereochemical formulas during the last quarter of the nineteenth century. The major part of this project is the completion of a book-length manuscript on the incorporation of spatial principles into chemical theory between 1874 and 1914. The book will first outline the theoretical and cultural context of the near simultaneous proposal of the tetrahedral carbon atom by J. H. van't Hoff and J. A. Le Bel in 1874, and follow the research traditions created by their discovery in the chemistry of Johannes Wislicenus, Arthur Hantzsch, Victor Meyer, Carl Bischoff, Emil Fischer, and Alfred Werner. It will show the emergence of stereochemical ideas as a natural continuation of established research traditions in chemistry, while also illustrating the novel characteristics of stereochemical formulas and ideas, especially the unprecedented use of mechanistic and dynamic principles in chemical explanation.

Part of this project is the completion of two essays on broader issues in the philosophy of chemistry. The first essay on the prediction of non-existent compounds by chemical theory was initially presented 1999 at the Institute's workshop on Paper Tools and Traditions of Representation in the History of Chemistry, and will be rewritten for the published workshop proceedings. It explores how chemists decide to isolate a previously non-existent compound predicted by the structure theory. The second essay will address the curious historical fact of how nineteenth-century chemical theory became increasingly sophisticated theoretically without a concurrent introduction of new instrumentation by forming an epistemology of chemical experimentation in which the chemicals of the laboratory are considered as instruments or exemplary models, much as organisms such as fruit flies or rats have been considered as instruments in biology. A third essay will trace the early history of the Walden Inversion, that is, Paul Walden's discovery during the 1890s that the optical rotation of a compound could be inverted by a sequence of substitution reactions, and the early unsuccessful attempts to explain it by such chemists as Emil Fischer and Alfred Werner.

Scanning Tunneling Microscopy and the Meaning of Observation

Sara Vollmer

This project is concerned with a new observational technique developed in the early 1980s, the technique of scanning tunneling microscopy (STM). Like x-ray crystallography and electron microscopy, STM permits the creation of images of the shapes of molecules. However, the way in which it produces these images is radically different from any previous method used to image molecules. In STM, a tiny probe explores the surface of an object. When the probe is within a certain minimal distance of the object, electrical conductivity rapidly increases. The increase indicates the location of the “surface” of the object, and a computer interfaced with the probe records coordinates at which the electrical conductivity increases. The computer then creates an image (or images) that represent the object. This technique permitted the creation, for the first time, of images of individual atoms – as opposed to, in the case of x-ray diffraction, images of lattices of atoms. These new images were not unlike photographs of atoms showing, among other things, the surfaces of atoms as portions of spheres. In materials such as graphite and gold, these spheres could be seen to be arranged symmetrically, each sphere packed neatly amongst others.

This development in observational methods raises epistemological questions. When we create images of molecules by scanning probe microscopy, it would seem that we observe the molecules that are imaged. Yet, observation is clearly not unmediated; there are a wide range of instrumental effects that come into play in scanning tunneling (and other scanning probe) microscopy. Theoretical interpretations are also critical in the transition from a series of coordinates at which conductivity increases, to the formation of an image of the object.

The project analyzes the different epistemological elements involved in scanning tunneling microscopy and how they interact to form an image. One of the goals of the project is to develop an account of observation at a level of generalization that can be meaningfully applied to observation that relies on a wide range of different physical principles, including observation when no image is observed, observation by electron microscopy, by x-ray microscopy, and by scanning tunneling microscopy. The project’s aim also includes a study of the history of the invention of scanning tunnel microscopy, and an investigation of the importance of this invention in a technological and institutional context, as well as a consideration of its broader social ramifications.

Project 2: Cultures of Chemistry in the 18th Century

John Dettloff and Sarah Lowengard

General goals of the project

This project studies the interrelations between science and workshops in eighteenth-century Europe. It asks how the technical equipment and other materials for performing scientific experiments and for producing economic goods, respectively, were exchanged; how various types of knowledge – ranging from technological know-how and skill to theoretical assumptions – were flowing from workshops to scientific practices and vice versa; what kinds of intermediate practices or subcultures were established; what role the state played in these practices, etc. Again, the focus on chemistry is especially appropriate for studying these questions. Several eighteenth-century chemical practices were situated in areas where scientific practices and economic production overlapped, thus displaying intermediate features of both scientific cultures and workshops; some of these practices, such as color making, drug manufacturing, and saltpeter production, exhibit a peculiar internal structure and dynamic – social, political, material, and epistemic – and were stabilized to such a degree that we can conceptualize them as specific cultures or subcultures.

Research activities related to project 2:

Chemistry in the Garden, the Arsenal, and the Academy

John Dettloff

The project engages in a comparative investigation of the scientific and social patterns of chemical practice that formed in and around academic laboratories, mines and metallurgical ateliers, arsenals, and gardens. By using places as the focus of historical analysis this study scrutinizes the ways in which the materials and structures, institutional designs, and social roles available to chemical practitioners at various sites provided chemists with different sets of incentives, resources, and constraints as they fashioned the objects and purposes of their research, the tools and techniques of their inquiries, the social and political alliances that supported their activities, their conceptual frameworks, and their claims of cultural authority. In this way focus is shifted away from individual biography and intellectual chronology toward study of the pressures and dynamic interactions of different forms of chemical practice as they evolved in specific local cultures.

One phase of the project examines the chemistry developed in pharmaceutical and natural-history gardens, like the Parisian *Jardin royal des plantes médicinales* and the *Jardin des apothecaries*. In botanical gardens apothecaries gathered, studied, and prepared herbal and chemical medications; chemists practiced and taught analysis and synthesis of mineral, plant, and animal substances; physicians learned the *materia medica* of their profession and the effects of medicines on the body; natural historians collected, described, organized, and investigated specimens from the three kingdoms of nature. The admixture of personnel and pursuits in gardens created fertile ground to nurture theories relating to the chemistry of life and the historical transformation of nature. Chemistry became rooted in a site devoted to understanding vitality, natural order, and the interchanges among natural species over time. This project describes the techniques chemical practitioners devised to explore these subjects, the obstacles they encountered, as well as the novel concepts of chemical classification, structure, and action they articulated in the course of their research.

A second phase of the project investigates one of the major insurgent movements of eighteenth-century French chemistry – the effort of savants and administrators to harness chemical knowledge to the industrial, fiscal, and military aspirations of the French state. The project tracks these dynamics by following the practices and theories developed around arsenals and mines as chemists intervened in the production of commodities like saltpeter, iron, and steel. In particular, it focuses on the ways in which the military and industrial imperatives of the French state made some research questions particularly pressing in the chemical community and the wider culture. Moreover, it follows the efforts of chemists to establish decisive criteria to determine investments, settle labor and mercantile payments, and reform industrial operations. It thus explicates the relationship between precision instrumental measurement and theory in the chemical laboratory and the procedures used to gauge work and commodities in the arena of economic production. In this way it reveals the domestic and geopolitical pressures that impelled collaborations among chemists, financiers, and royal administrators and fostered a culture in which particular quantitative chemical practices and theories attained cultural authority.

Color in the Workshop – Color in the Laboratory

Sarah Lowengard

The focus of this project is eighteenth-century understanding of color: what it was; how it was made; who had “the best” (and why); how to improve the color making process and how to interpret its physical phenomena. As a topic of considerable interest and conjecture then (as now) for specialists and non-specialists alike, it proves to be uniquely suited to examination of the relationship between workshop or production-oriented goals and those of the academies. Eighteenth-century rhetoric stressed the combination of intellectual and economic value that might result from the application of philosophical ideas to practical endeavors. A body of knowledge about color, established by natural philosophers or physicists, supported investigations of new techniques as well as new theories. Scientific investigations of the arts and trades would provide groundwork for the improvement of established branches of industry and lead to the creation of new ones.

Throughout the eighteenth century, experiments with pigments, glazes and dyestuffs, and efforts to deepen understanding of these materials, offered obvious links between investigations into the natural world and improvements in the man-made one. A related question concerns eighteenth-century efforts to systematize color, and the role played by color making practice on theoretically derived color lines, wheels, triangles, spheres and pyramids.

The thrust of the research has been to refine and expand the previous results of a doctoral thesis, which considered these connections in Britain and France, adding to it information from academic societies and commercial concerns in Germany. To this end, the research included: the development of a deeper fluency with eighteenth-century technical writing about color and color production, particularly that coming from or intended for Germany-based or German-speaking communities; the formulation of a clearer picture of the eighteenth-century intellectual and commercial communities in Germany; and the location of relevant archival sources to provide a clearer insight into personal and public beliefs and practices that may not have been appropriate to formal publication media.

Independent Research Group II (Director: H. Otto Sibum)

Experimental History of Science

In 1998–1999 *H. Otto Sibum* continued his research project on the history of experiment and its significance for the production and communication of knowledge. He also collaborated with *Lorraine Daston* on the “Scientific Persona” project (see p. 35). In his book-length manuscript he focuses on the genesis and development of a scientific fact, the mechanical equivalent of heat, which became the building block of nineteenth century thermodynamics and energy physics. One of the central issues is that of opening up the material culture of science to scrutiny. Instruments, machines, space (physical and symbolic) and even the actors’ economy of the senses have all become objects of historical investigation. The approach is based on the assumption that it is the use of technologies that gives them their historical meaning. Among historians the different means of investigating the actual uses of instruments within different cultural traditions have recently become a major concern. *Sibum’s* studies make a distinctive contribution to this research. In addition to undertaking close analysis of literary and graphical resources, *Sibum* has developed a performative historiography which reworks experiments by performing them with replicas of historical apparatus. Complementing the traditional means of scholarship, this method enables a considerable enrichment of our knowledge of the language of laboratory events. The reworking of James Joule’s paddle wheel experiment to determine the mechanical equivalent of heat (1850) has shown, for example, that the experimental techniques of heat measurement on which Joule’s trials depended were neither recorded in Joule’s publications nor in his own notebooks. Nevertheless they could be reconstructed through research on the interfaces between the experiment, its literary representations, and the different cultural traditions in which Joule worked. This is because the performance of historical experiments through reworking enables us to uncover experimental techniques and forms of knowledge which are often essential to an experiment, but which have become blind spots in laboratory reports – because they have been taken for granted through constant repetition and familiarity. It therefore demonstrates very clearly the importance of non-literary forms of communication that are simply beyond the scope of conventional studies of the laboratory.

Among other things, the approach focuses on the connections between sensual experience and the conceptual development of science, a problem that Michael Polanyi first highlighted in his concept of “tacit knowledge”. Yet in Polanyi’s work, just as in a more recent historical study which explicitly points to the key importance of sensual experience, this knowledge remains hidden from us. Performative historiography allows the researcher to comprehend the experiment as a spatio-temporal event and thereby brings the character of knowledge production as a process into the center of consideration. The working knowledge of the experimenter is embodied in the actor’s performance. In the process of experimentation the action functions as a medium of cultural memory, comparable with ritual or the transfer of craft skills from master to apprentice. *Sibum* has described this performative knowledge, bound to the concrete craft actions of an individual or group of people, as gestural knowledge. The unusual combination of concepts in gestural knowledge seeks to break away from the traditional, static conception of scientific knowledge based on a bodiless spirit, in favor of a conception that finds knowledge in the process of genesis and development, as something dynamic and continuously in interchange with respective forms of action and communication. “Skills” or manual capabilities are to be regarded as a constitutive part of the knowledge of the experimenter. What we encounter in written reports of the experiment is then only one, symbolic part of an essentially more complex gestural knowledge, which the historical experiment is able to bring to execution. What Michael Polanyi designated as “tacit” or “personal” knowledge now proves itself to be a form of expression for a historical, gestural knowledge which either resides in the actors’ performances themselves or is expressed to some degree in the form of an artefact, but is nevertheless historically reconstructable.

In further historical explorations the research could show that James Joule had no possibility of acquiring the techniques necessary for his temperature measurements in the elite scientific culture of his time – since they did not exist there. *Sibum* was able to locate the source of Joule's unique skills in the long overlooked connection between such apparently autonomous practices as the experimental sciences and the local craft skills of the brewing industry, then undergoing radical changes; and in which Joule had worked actively for twenty years. The experiences of this performative historiography clearly show that laboratory events – the actors' use of practical and theoretical technologies of knowledge production – can be described as a historical cross-section of actions and structures in the field of cultural production. Further research on the process of publishing Joule's results has shown that the manuscript underwent important changes up until it was printed. In the published text the experiment was described as giving empirical evidence of the existence of a constant relationship between mechanical work and heat. But Joule saw deeper implications in his study, which were edited out by his referees. Further studies enabled *Sibum* to identify a research collective which had developed forms of gestural knowledge that led Joule to propose a dynamic theory of heat as a result of his experiments. This research methodology, however, also makes it possible for us to grasp the process of the communication of experimental knowledge in an improved way. The critical reappraisal of the way in which Joule's experiment was replicated in selected centres of science makes explicit a continuing process of struggle – of forty years duration – over the practices involved in determining this scientific fact and its conceptual meanings. The results of these micro studies of exchange processes amongst the emerging subcultures of the nineteenth century exact sciences will make an important contribution to the current discourse on the suitability of different models of knowledge transmission.

In October 1998 *H. Otto Sibum* was invited to plan and set up an independent research group which began its work in April 1999. Current members mainly focus on the investigation of research practices and their meaning for the development of the physical sciences from the 17th until the twentieth century. The expression "Experimental History of Science" refers in part to the historiographic approach developed in previous years by the Director. In particular, the recent research on experiment as a non-literary knowledge tradition in science with specific means of acquiring and communicating knowledge has important historiographical consequences. Firstly, we have to rethink the often exclusive use of texts and images as sole historical sources and pay much more attention to the material objects – silent representatives of the past – and appropriate modes of investigation. This involves revising our understanding of knowledge as merely textual. Instruments, three-dimensional models, architectural spaces have all to become objects of historical investigation in order to account for other forms of knowing. Secondly, when studying scientists' practices performed in the laboratory or in the study we have to investigate the productive role of the human body, i.e. to integrate sensuous experience as a cultural sensorium in its historical development. Thirdly, studying scientists at work requires bridging the gap between epistemology and practice. Experimental history of science aims to show how this divide could historically have emerged in the various endeavours to make sense of practitioners' knowledge. By carving out the specific relations between forms of knowledge and their social bearers we can identify the canonical limits of an emerging field of knowledge.

In the first year, project members have begun to investigate the tensions between knowledge derived from literary sources and knowledge embodied in practical engagement in experiment in, for example, the arts, crafts and engineering. Concern with this tension itself has a long and multifaceted history, which the project wants to trace and relate to the emergence of science. The changing meaning and relation between knowledge and skill is of particular importance here. *William T. Lynch* from Wayne State University has finished a book manuscript which examines the significance that shared Baconian methods had for the emergence of the early Royal Society and its earliest published books, and has also begun an investigation of the epistemological status of craft knowledge as displayed in surveying as opposed to natural philosophical knowledge. Contrary to the Royal Society opinion, which differentiated between knowledge and skill and conceded to the

craftsmen and artisan only a rather passive role in knowledge production, i.e. as providing merely the fertile soil for science, *Lynch* aims at reconstructing the material practices of surveyors in order to judge their epistemological value. He concentrates on the Irish land survey project of William Petty, later a member of the Royal Society of London. *Lynch* has begun a material reconstruction of surveying both to test ideas derived from the historical record about the form the survey took and to explore in an ethnographic fashion the kinds of skills or tacit knowledge necessary to carry out similar techniques with historically accurate tools today. This part of his study is particularly important because Petty sought to circumvent the biggest obstacle to his plan – the craft nature of surveying – through the division of labor. Secondly, the study wants to answer questions such as what kinds of information did the surveys provide to what kinds of actors? How were legal judgments and practical possession of the land affected? This project of carving out the tension between knowledge, material practices and skill will certainly contribute to a better understanding of the establishment of seventeenth century experimental natural philosophy.

Several members of the research group focus on a second major period of historical transformation – the turn of the eighteenth to the nineteenth century – in which the tension between knowledge and skill became an integral part of the formation of experimental science. Eighteenth century French experimental philosophers, for example, commented on the consequences of limiting oneself to deriving knowledge from literary sources alone, and juxtaposed this knowledge of the savants with knowledge derived from the manipulation of instruments. Seeking to precisely convey the working knowledge of the experimentalist, German experimental philosophers established the power of using demonstration devices in experimental lectures in this same period. But this tension between manual and mental work in research did not only remain an academic affair; it reflected a much broader cultural problem of the time. This year, project members concentrated on experimental work and their findings indicate already that research practices did not follow strict disciplinary boundaries. Experimental knowledge was generated mainly outside Universities in the mechanical arts, crafts, engineering and industry. Its integration into the academic landscape was a process of long duration, in which the emerging divide between practice and epistemology or knowledge and skill was one important issue.

Annik Pietsch, a Ph.D. student of art history, contributes to this investigation by work describing the change of painting techniques from the eighteenth to the nineteenth century as a history of changing binding media. Her exploration of practices of art production in Berlin promises to provide insights into the development of the arts and sciences from an unusual perspective. Her close studies of materials and techniques in preparing and using colors allow the reconstruction of the practitioners' knowledge and displays the interdependence of arts, craft and industry and science.

The art historian *Kilian Heck* began his investigation of the connection between visual perception and scientific development by studying an extremely limited context: the city of Berlin after 1815. Berlin came to be part of the broader project of remodelling Prussia from an absolutist state to a nation that was conceived to be represented by the *Bildungsbürgertum*. *Heck* explores mutual connections between educational programs of academic institutions and museums (particularly drawing and perspective), the architecture and decoration of spaces of learning, and the broader intellectual discourse.

The perspective of the art historian complements a research project undertaken by *M. Norton Wise* (a short term visiting fellow) on the emergence of laboratory science and the role of graphical representations in the physical sciences in modernizing Prussia. Overlapping interests in artistic and scientific drawing sparked the plan for a workshop to be held in December 2000 on "What's in a line: Drawing as Intelligence" convened by *L. Daston*, *H. Otto Sibum* and *M. Norton Wise*. The aim of the workshop is to examine the phenomenon of drawing in science within a broader context that embraces artistic and technical drawing, addressing two themes: the intelligibility of drawings and the form of intelligence that drawing presupposes and cultivates.

Gerhard Wiesenfeldt, another member of the research group, began his exploration of this period of transformation from natural philosophy to physics and the related tension between knowledge and skill by studying the change of visual representations of experimental practices in electrical research. He analyzes differences in the manner of illustrating natural philosophy and physics as expressions of a changing conception of experimental science. The project is based on the thesis that both the experimental practices and the visual representations have been constitutive for natural philosophy and physics. In this respect, attempts to demarcate contents and disciplines, which can be found in the field of galvanism or in the controversy between German *Naturphilosophen* and academic scientists, are being analyzed.

H. Otto Sibum studied how “the art of experiment”, traditionally the province of artisans rather than scholars, became the core of a new scientific identity, the experimentalist, in the exact sciences during the late eighteenth and early nineteenth century. Since the early modern period scholarly opinions range from denying that experiment has any epistemological value to the (nineteenth century) conviction that this form of inquiry is the only way to make sense of natural causes. One of the underlying issues in these controversies about the meaning of experiment was that the physical manipulation of objects, “the art of experiment”, was not seen to belong to the scholarly tradition in which a clear distinction between doing and knowing still predominated. Even enlightened philosophers like Diderot, who described the arts as a form of knowing, conceded that this knowledge operates outside the enlightened discourse. His encyclopaedic project was one answer to the dilemma of how to give the practitioners’ knowledge a language, which could be understood by anyone. But his approach (as well as many other literary approaches of the rising bourgeois culture) reduced these complex forms of knowing to visual representations or descriptions of manual techniques, thereby creating myths about practice that maintained the boundary between epistemology and practice. Therefore the eighteenth century engineer, with his training in manual operations and technical drawing, was seen for a short time as the ideal candidate, the “third man”, in bridging theory and practice. However, with the rise of laboratory space and the development of precision instrumentation around 1800, experimentalists whose cultural origins often go back to the artisanal and engineering world faced similar problems in communicating their special knowledge. In order to understand the process of gaining authority and credibility through experimental work we have to study the mediation between experimentalists and scholars in this period of major cultural transformation. By the late nineteenth century the process of differentiation within the sciences had driven a wedge between the humanist scholar and the natural scientist.

Finally we follow the relation between skill and knowledge to the period around 1900, the birth of modern physics with its clear distinctions between experimental and theoretical sciences. Two historians of physics cover this field through their work on early relativity theory and quantum physics. Both fields are usually regarded as products of the newly emerging sub-discipline of theoretical physics and therefore treated as exemplary academic philosophical knowledge. However, experimental history of science aims at investigating the laboratory of theory, i.e. the research practices and material culture of these endeavours.

Richard Staley investigates the interplay between instruments, experiment and theory in the physics community. The main focus of his present research has been a close study of the genesis of Albert Michelson’s interferometer, describing the relations between experimental work on the velocity of light, ether-drift, spectroscopy and metrology in the development of a new class of instruments. During his stay to date he has completed a chapter on this topic, “Travelling Light”. For his book project “Physics circa 1900” he is investigating experimental work on electron theory and the co-creation of “classical” and modern physics in the early development of relativity. The reconstruction of hitherto neglected experimental and instrumental trajectories offers a new footing for an examination of the emergence of relativity (together with specific accounts of its history) out of a complex disciplinary theater.

Karl Hall's project stems from his Ph.D. thesis on the history of Soviet theoretical physics during the interwar period. He explores the changing practices of theoretical physics in Soviet culture. *Hall* traces the theorists' development of programs of research in local cultural disputation, but also their roles as spokesmen for basic science and reluctant interpreters of the philosophy of modern physics. His main project of the past year concentrates on Michael Polanyi's laboratory collaborations with the Soviet physicist Abram Joffe in the late 1920s. Their work on dielectric breakdown dealt with a hideously complicated bulk phenomenon far removed from the quantum mechanics of single particles, but after the initial successes of the quantum mechanical electron theory of metals there was considerable hope that it might yet be incorporated into a larger synthesis of solid state theory. Breakdown became an unexpected laboratory site for contesting a complex set of experimental, theoretical, industrial, economic, ideological, and cultural concerns. The aim of *Hall's* project is to explain the historical constitution of Polanyi's influential postwar ideas about tacit knowledge, which he developed in response to the challenge of adequately representing in semantic terms how knowledge is produced in the experimental workplace.

Instruments, Travel and Science: Itineraries of Precision in the Natural Sciences, 18th–20th Century

Marie-Noëlle Bourguet, Christian Licoppe, H. Otto Sibum

A second related project concerns the emergence in Europe of a new instrumental and measurement culture with its changing cognitive practices between the mid-eighteenth and the twentieth century. In collaboration with *Marie-Noëlle Bourguet* (Paris) and *Christian Licoppe* (Paris), workshops were organized with the aim of publishing a book titled "Instruments, Travel and Science: Itineraries of Precision in the Natural Sciences, 18th – 20th Century". The diversity of local knowledge traditions in this period raises the question of how these "local" world-views were progressively replaced by a new "global" and universalist approach based on different cognitive practices. In this process, the increasing use of quantifying practices, the displacement and voyages of instruments across the globe, and the circulation and appropriation of skills played an essential role. Reconstituting their history, from the standpoint of investigating material practices, would thus throw new light on an essential question of the history and philosophy of science relating to the emergence of a universalist conception of nature and of a science which describes it. The scope of the project involves both a long-term approach and a resolutely comparative perspective. The authors will discuss French, German and British initiatives, as well as the relationship between these initiatives and the knowledge and techniques of travellers in other cultural spaces (India, Africa, Southeast Asia and North America). As for periodization, the specificity of the subject calls for a transgression of the usual historical division between early modern and the modern period. Authors and topics are as follows:

Simon Schaffer (University of Cambridge, UK): Golden Means: Assay Instruments and the Geography of Precision in the Guinea Trade

Christian Licoppe (Centre National d'Études de Télécommunications, Paris): The Project for a Map of Languedoc in Eighteenth Century France at the Contested Intersection between Astronomy and Geography

James Bennett (Museum of the History of Science, Oxford): The Travels and Trials of Mr. Harrison's Timekeeper

Marie-Noëlle Bourguet (Université de Paris VII): Why Should Naturalists Carry Instruments?

Giuliano Pancaldi (CIS, Università di Bologna): Appropriating Invention. The Reception of the Voltaic Battery in Europe

Christophe Bonneuil (Centre Koyré, CNRS, Paris): The Accurate Species

Kapil Raj (CNRS, Paris): When Human Travellers become Instruments: The Indo-British Exploration of Central Asia in the 19th Century

H. Otto Sibum (Max Planck Institute for the History of Science): Fieldwork of a Modern Physicist

Richard Staley (Max Planck Institute for the History of Science): Travelling Light
David Turnbull (Deakin University, Australia): Travelling Knowledge: Narratives, Assemblages
and Encounters

Max Planck Society Research Fellowship for Outstanding Women Scholars

Emma Spary

The work carried out by *Emma Spary* since her appointment in July 1998 has concerned two distinct areas: European natural history in the eighteenth century and the history of food, eating and taste prior to the development of an institutionalized “nutrition science”. Each project is concerned with the problem of scientific authority and its negotiation in relation to political, social or material media of presentation of scientific knowledge, as a route into a better understanding of the processes of change, continuity and credibility which enable us to speak meaningfully of “scientific knowledge”. It is a general assumption of both projects that, because scientific facts are cultural objects, a thorough cultural history of the historical period concerned is a necessary preliminary to meaningful analysis of the formation of scientific authority.

Project 1: European Natural History in the Eighteenth Century

The history of eighteenth-century natural history remains an underexplored field, colored by the assertions of an earlier generation that the eighteenth century was a period of stagnation in scientific enterprise and by subsequent emphasis on the experimental sciences. Many major issues concerning the recruitment of scientific credibility by naturalists, the manipulation and creation of material settings and tools such as cabinets, specimens or books, or the manufacture of relations between the external world (natural and social) and the internal order of the collection are currently being investigated. Naturalists performed a complex epistemological switchback in constructing classificatory systems, the characteristic enterprise of natural history. They needed to convert the world into orders whilst retaining the legitimacy conferred upon the orderer by the appeal to nature. In part this was to be achieved through the meticulous policing of what counted as a faithful (re)presentation of nature, but it also involved attention to self-presentation and appeals to a literate public and improving rulers to invest resources – and engage – in natural historical practice.

Current research activities:

Parisian Natural History in the Revolutionary Years

During the spring and summer of 1999, final revisions were carried out on a book project entitled *Naturalising the Tree of Liberty: French Natural History from Old Regime to Revolution*. The primary concern of this work is to create a new basis for institutional history which presents the scientific institution as a contingent product of cumulative social negotiations among actors both within the field of natural history and outside. The specific example chosen is the Muséum d’Histoire Naturelle, founded in Paris by the staff of the former royal natural history garden as a response to the new political world created by the French Revolution. Its survival during the troubled years of the 1790s poses a problem for understanding the nature of political engagement by scientific practitioners, as well as challenging earlier interpretations of the political significance of natural history in eighteenth-century France. The book will be published by the University of Chicago Press in the summer of 2000.

Chapter headings:

Introduction

Chapter 1: The Place of “*Histoire Naturelle*” at the Jardin du Roi

Chapter 2: Acting at a Distance: André Thouin and the Function of Botanical Networks

Chapter 3: Revolutionary Culture: Generation, Degeneration and

Regeneration in the Jardin du Roi

Chapter 4: Patronage, Community and Power: Strategies of Self-Presentation in New Regimes

Chapter 5: The Spectacle of Nature: The Muséum d'Histoire Naturelle and the Jacobins

Conclusion: Possible Futures

A Semiotics of the Collection

Research also continued on a study of the relations between specimens, illustrations and descriptions in collections and books of natural history. Using as examples the Parisian ornithological collections maintained by René-Antoine Ferchault de Réaumur, a powerful figure in the early eighteenth-century Académie Royale des Sciences, and Georges-Louis Leclerc de Buffon, director of the Jardin du Roi, it is possible to demonstrate marked contrasts between modes of representing and creating such material, visual or textual objects of natural history. Different classificatory orders, correlated with different accounts of the social and natural worlds, could be sustained by different systems of rules for the depiction, description, observation and collection of natural objects which directed the viewer to specific sets of characteristics to be taken as “natural”. This study also suggested that the tacit existence of such rules may explain how scientific texts enforce particular interpretations upon readers, by tying appropriate and inappropriate modes of viewing illustrations to particular cultural assumptions about the nature and function of a given genre of publication or illustration. A model of semiotics derived from the work of Roland Barthes was useful to display the problems at stake in making and representing the collection, but was also open to challenge by the application of certain important criticisms of structuralism drawn from Derrida and gender analysis.

New Historiographical Models of Scientific Illustration

In the interpretation of scientific images, insights drawn from art history enable us to comprehend the style and genre of a particular illustration, as well as permitting the analysis of iconographic and gestural references. But a large proportion of scientific images do not contain such references; their depictions are not of persons or practices but of objects, in particular natural objects. For natural history this is a particular problem. Depictions of naturalia were supposedly self-sufficient, with the link between the image and “real nature” guaranteed by a battery of disciplines imposed by authors upon artists. Even so the “natural” quality of illustrations was hotly contested, and if illustrations were demonstrated to be inauthentic, the associated classificatory projects or claims concerning nature generated by the author could be undermined by critics. The rules of depicting naturalia were thus crucially important for defining nature and affirming the authoritative status of the investigator of nature. At the same time, they were rarely discussed in works of natural history, since to do so was to undermine the self-evidently natural quality of images.

A wide-ranging study of conchological and other natural historical works published from the late seventeenth to the nineteenth century was carried out, covering materials from France, the Dutch Republic, and different German and Italian states. This showed, first of all, that criteria for generating natural history illustrations were culturally local: the adoption of specific criteria could be traced via direct cultural contacts between groups of practitioners. Secondly, whilst such criteria were implemented slightly differently in different cultures of collecting, they preserved a demonstrable underlying unity even after the explicit theoretical grounds for subscribing to such design criteria had been abandoned. Efforts were made to analyze the justification for this persistence of particular rules of design by the study of changing accounts of taste, artistry and natural theology. This opens the way to a discussion of Latour’s model of scientific knowledge as “black-boxed”. It seems likely that many forms of scientific practice and representation are adopted from

generation to generation as part of a “style” of science which may be specific to one discipline or subdiscipline, which facilitates communication among practitioners, and which is taken for granted as the expected format for presenting and ordering new knowledge. The process of conversion of field or laboratory notes and other similar materials into these “appropriate” modes of presentation is another important example. The fact that such styles may never be explicitly discussed or related to the activities of particular practitioners or the concerns of particular works suggests a need for further research into tacit rules of communication of scientific knowledge, which may go unrecognized by the researcher except through such broader surveys of primary materials.

Project 2: The Sciences of Food in the Eighteenth Century

A genuine, institutionalized science of nutrition emerged only in the 1840s, and its authoritative status was swiftly adopted by European researchers, medical practitioners and the general public. Yet from the last decades of the seventeenth century to the early decades of the nineteenth, scientific practitioners from a variety of different disciplines – chemistry, pharmacy, medicine, surgery, natural history, agronomy, and political economy in particular – asserted their right to present themselves as expert commentators on the subject of food, taste and dietary choice, both before literate audiences from the polite elite, and as mediators between government and the illiterate poor in cities and countryside, where political self-expression was closely tied to the availability and quality of food. The activities of scientific practitioners in this sphere have not been investigated for any European country. This project takes France as a case study for exploring the problems associated with the assertion of scientific and medical authority in a domain lacking institutional or disciplinary identity and which was central to the everyday lives of all. By drawing together subjects usually considered separately, a history of food acts as a means of exploring hitherto ignored relations between medical and scientific disciplines. Many food reformers were active in several different areas, but by tracing their movements from one discipline to another by means of their comments on food, the continuity between personnel, practices and reforming agendas can be demonstrated. This highlights the importance of viewing eighteenth-century scientific practitioners as multi-disciplinary: the self-presentation of such individuals was, first and foremost, as members of polite society with all the improving political aims that such a role implied in this period and culture.

Current research activities:

Surgery and the “Extraordinary Eater”

In publications aimed at both scientific and general audiences in the second half of the eighteenth century, well-known surgeons described cases of the extraordinary consumption of food, either in terms of quantity or in terms of the nature of the substances consumed (chalk, leather, wood, etc.). Such interest can be related to a long tradition of study of marvels and the extraordinary, but for surgeons, the particular function of the study of extraordinary eaters was closely tied to their emerging scientific identity as a profession. The modes of description and re-description of the extraordinary eater’s body reveal that such individuals were categorized and anatomized precisely because they posed an epistemological problem for surgical self-presentation and the redefinition of the surgeon’s corporeal skills. At the same time, the fostering of Royal connections enabled the Paris surgical community to constitute itself as an elite with power over the practice of surgery throughout the country. As such, extraordinary eaters became the centre of a conflict between provincial surgeons, who supported curious modes of making knowledge, and central surgeons, who increasingly attempted to “normalize” extraordinary phenomena as merely rare natural events. Surgical writings, ironically, whilst writing extraordinary eaters out of the picture of corporeal

skills, also provide the only source of detailed knowledge of the lives of these marginal individuals, enabling a better understanding of the function of their corporeal skills at different social levels.

Taste and the Reform of Regimen

Research was commenced into perhaps the best-known aspect of scientific and medical accounts of food during the early modern period: the Hippocratic-Galenic regimen. Customarily presented as a theory which dominated medical accounts of the body until the end of the eighteenth century without change, classical regimen nonetheless had a history of transformation and adaptation during the eighteenth century which enabled physicians to assimilate contemporary developments in chemical and mechanical medicine. Boerhaave's iatromechanism entered France by way of the enormous success of Swiss medical writing and practice from the 1760s onwards, and generated a renewed interest in regimen. The Genevan Tronchin and the Lausanne practitioner Tissot were particularly renowned as the physicians to philosophes and salonnières. Both became involved in the Genevan and Parisian debate over the moral status of the writings of Jean-Jacques Rousseau. Decisions among the *philosophes* and *salonnières* concerning dietary choices confronted both the relation between eating and intellectual activity, discussed in Boerhaavian and neo-Hippocratic writings on health, and also the split among savants over the implications of Rousseau's writings for government of the self and of the nation. Further research into this subject will throw light upon the ways in which forms of knowledge become detached from their local social and political meanings in order to take on the status of universal natural truths, and on the strategies employed by outsiders in attempting to legitimate their activities within the conflicted and corporative medical world of eighteenth-century Paris, by means of an appeal to Nature.

Provision of Matériel, Equipment and Working Space

The Facility

At present, the Institute works in rented offices in the building of the Embassy of the Czech Republic and in some additional rooms in the neighborhood needed for the growing holdings of the library. Conference rooms can be used as far as they are not needed by the embassy itself. The Max Planck Society is planning a new building close to the Max Planck Archives and the campus of the *Freie Universität* in Berlin-Dahlem. Subject to approval by the governmental authorities the Institute hopes to move into its new building around 2003/04.

Library and Documentation Unit

Headed by *Urs Schoepflin*

The Library is the central information unit of the Max Planck Institute for the History of Science. Its task is to assist research by providing literature, reference and modern information services in any form. This includes the acquisition and delivery of traditional printed sources like books or journals, microfiche and microfilms, bibliographic reference files, and extends to electronic documentation and electronic archives. Along with electronic documentation, the Library supplies not only reference information and sources in history of science, but also the appropriate tools to search and handle the wealth of electronic information available in-house and worldwide. The collections of printed books and journals are presented for open access and arranged systematically according to the Dewey Decimal Classification to meet user requirements for browsing. The Library offers a reading area with Intranet and Internet connections as well as a casual reading corner for newspapers. These areas can be configured for discussion groups and receptions. Local and Internet electronic resources are made available through the Library's homepage. The Library is permanently accessible for members of the Institute, including evening hours and weekends.

Library Developments.

The development of the collections was continued and concentrated on reference works, major source works, and critical standard editions along with a selection of secondary literature. The Library benefited from the partial acquisition of the private library of Ernst Florey, from donations of the private library of Ernst W. Böhm and from older holdings of the Max Planck Institute for Biology. Due to the limited space available to the Library in the main building, additional quarters had to be found in a near-by office building to house part of the holdings. The collection of printed books – current holdings of over 35,000 volumes – is arranged in the following divisions:

- Reference collection
- Lorenz Krüger collection
- Source works
- Secondary literature
- Rare books

As a further information resource, 130 current journals belonging to the core literature in the research areas of the Institute are available. These include a selection of current newsletters of the major learned societies and institutions in history of science.

The Library's microform source collection (e.g., Landmarks of Science, Newton's Manuscripts and Papers and Einstein's Collected Works) was further expanded and now holds some 12,000 historical works, journals, and manuscripts. Microfilm readers, reader-printers and reader-scanners are provided to take full advantage of this strategic resource for research at the Institute (see Project "Computer-Aided Source Collection in History of Science" p. 89).

The Inter Library Loan (ILL), another service priority to support research at the Institute, has been expanded to serve the new research groups and has gained a high level of acceptance. It provides bibliographic reference and document delivery from the major research libraries in Berlin, Ger-

many and abroad. ILL also provides copies of journal articles as well as microfilms of books and other documents. Provisions are made for receiving remote documents in digitized form. Catalogs of the lending libraries can be consulted on microfiche, electronic files, and through the Internet as a part of the Library's reference service.

Electronic resources

The Library's electronic resources were considerably expanded and now include over 1,600 scholarly electronic journals, bibliographic reference and full-text databases, encyclopedias, and electronic library catalogs. Catalog information on all the Library's collections and holdings is provided via an internal Online Public Access Catalog (OPAC) available through the Intranet. Databases on CD-ROM can be searched on individual workstations.

A selection of remote bibliographic databases are available for direct searches. These include table of contents files (Current Contents, Online Contents) as well as subject databases (History of Science and Technology, Web of Science, Philosopher's Index, Historical Abstracts, Dissertation Abstracts, Biosis, Medline, etc.). For mediated searches in a wide range of other databases the Library has access to the networks of the Dialog host services.

All local and remote electronic services are integrated in the Library's World Wide Web homepage providing a unified access to the various electronic resources. This page lists links to the Institute's library resources (catalog of holdings, new acquisitions lists, current journals), as well as to major library catalogs in Germany and abroad, to bibliographic information, to text archives, or to relevant sites in the history of science field.

Besides continuous support in library, archive, and bibliography matters, the Library periodically offers structured introductions to the collections and services. Special courses are taught in the use of remote bibliographic databases, library catalogs on the Internet, and in the use of personal bibliography makers (EndNote). Support is also provided for problems with reformatting various bibliographic software.

Staff development was accompanied by training schedules covering systems administration, search techniques in bibliographic databases, Internet training, and language courses. Staff members were also delegates at conferences and exhibitions relevant to the information field.

Project "Computer-Aided Source Collection in History of Science"

Since the institute is not endowed with an old library of gradually expanded holdings, many of the historical sources have had to be acquired in the form of microfilm. To date, these microfilm archives store over 12,000 works and manuscripts. To offer state-of-the-art access to this resource, a digital library was conceived. This digital library includes tools for the management and access of electronic facsimile documents, as well as a digitization unit with paper and large-scale microfilm scanners. The Computer-Aided Source Collection in History of Science is a joint project of members of the research groups, the Computing service unit, and of the Library.

The document server so far holds over 300 source documents. Care was taken to use widely available standard software for access and browsing (Web browser), both to immunize against dedicated and platform-dependent software solutions and to guarantee flexibility for future developments.

The digitization unit consists of a heavy-duty paper scanner for documents on paper and a SunRise microfilm scanner. We plan to scan the core documents of the microfilm archive to make them available on the Intranet. The films will be digitized to gray-scale images in order to give the most detailed reproduction of the original possible. Production will be supported by temporary assistants.

In parallel, the Library has begun to acquire relevant source works in high quality image scans to overcome traditional restrictions in the availability of rare books and archival material.

Integration into professional networks.

Particular attention was paid to the further integration of the Library's concepts and developments into professional networks. Besides participating in national and international conferences, the head of the Library regularly attended the librarians' meetings of the Max Planck Society to discuss policy and technical issues.

Other foci were new concepts of information provision and service development. Urs Schoepflin was a member of the task force preparing a proposal for a Center for Information Management for the Max Planck Society (CIM). He also investigated advanced concepts of information provision of source works in digitized form with other libraries such as the Herzog August Bibliothek (Wolfenbüttel), the State Libraries in Göttingen and Munich, the British Library, and the University of Pennsylvania Library (Philadelphia).

Finally, the Library is involved with the Institute of Library Science at Humboldt University, Berlin, where concepts, services, and the organization of the Library are regularly presented at seminars.

Scholarly activities at the library

In addition to his duties as head of the Library, Urs Schoepflin has also carried out scientometric research in the areas of scientific communication structures and reception processes of scientific literature.

In an ongoing study (in cooperation with Wolfgang Glänzel, Information Science and Informatics Research Unit at the Library of the Hungarian Academy of Sciences, Budapest) the differences in reception between fields of science were further investigated. Previous studies of the project focused on the differences in the aging of journal literature in science and the social sciences. Recently a serious shortcoming of bibliometric studies based on the Social Sciences Citation Index (SSCI) was studied: the lack of a universally applicable subject classification scheme for individual papers, because their assignment to broader subject categories, e.g. of a journal, are misleading. A special method for an item-by-item subject classification was developed. The empirical results of this approach proved reliable to overcome the shortcomings in the SSCI database. Applications will be further extended to fields in the humanities where citation based studies (e.g. evaluation of research performance) have up to now encountered even more difficulties. It is expected that the method will shed a new light on reception processes in scientific communication and also on special limitations of the established bibliometric methods in the fields where the Institute is particularly active.

Computing Service Unit

headed by *Jörg Kantel*

Computing activities are essential to fulfilling the Institute's research mission. Besides standard computer applications, more sophisticated functions are being increasingly used. These tasks include:

- acquisition of historical sources by scanning and, occasionally, by optical character recognition,
- computer-assisted analysis of texts and images,
- publication of documents (texts, images, structured data, computer animations, digital movies etc.) on the World Wide Web.

Although computer-based research activities play an ever-growing role in the Institute's work, the above activities can only be supported to the extent that the computer department (2 people plus 3 part-time students) can cope with the routine tasks required to keep up with the Institute's expanding IT infrastructure:

- planning and acquiring the computing equipment necessary for the Institute's research projects, administration unit, and the library
- periodically upgrading and supporting the Institute's internet connection
- supporting and expanding the Institute's Local Area Network (LAN)
- providing routine IT support to the research projects
- providing IT training to collaborators and guests
- providing support by designing the computing facilities of the Library and Documentation Unit of the Institute, as well as supporting the computing facilities of the Administration Unit (SAP)
- designing future computing facilities for the Institute

Hardware

As mentioned in the last Research Report the standard environment for the Institute's staff and visitors consists of Apple Macintosh computers. However, due to the growing needs of specialized soft- and hardware it has been necessary to also install other kinds of machines and operating sys-

tems. Now a growing number of workplaces work with Windows (95/NT) machines as well as with Linux boxes installed at the Institute. In addition, the need for specialized server machines is growing. High-end servers for internet purposes as well as for various cpu time-consuming tasks are still available (Windows NT, Linux, Solaris, Irix, and high-end Macintosh computers).

The number of central servers has also increased during the last two years. Backup-, database-, calendar-servers, servers for providing information through the http-protocol (WWW) for intranet as well as for internet have been installed. Most of these are Apple Macintosh computers but a growing number are Linux boxes, especially the http-, mail- and dns-servers. The external WWW-server for the Institute can be visited at <http://www.mpiwg-berlin.mpg.de/>.

In order to obtain better support for the Linux boxes, we have arranged for a support agreement with the Gesellschaft für Wissenschaftliche Datenverarbeitung, Göttingen (GWDG).

The administration unit's server has changed from a SINIX machine to a Windows NT Server, and the workstations for SAP applications have been upgraded by the Max Planck Society's central IT unit from Windows 3.1 to the Windows 95 operating system.

Network

Together with the growing number of workplaces the network has also been redesigned and expanded. The Local Area Network (LAN) now covers more than 200 workplaces. With the skillful help of the GWDG, the Institute's LAN was anchored in a 1 GBit FDDI backbone (instead of 100 MBit in the past). Six hub-systems have been installed to provide a star topology network with a 100-MBit Ethernet (previously 10-MBit) frontend connection from the nearest hub-system to every workplace. Also the newly occupied external rooms for the library in the Glinkastraße facility are connected transparently by a routing system to the Institute's LAN.

The Administration Unit's network was updated to 100 MBit from a separate hub-system. Due to security reasons it is still an isolated system without any connection to the research network.

The permanent connection to the Fritz Haber Institute in Berlin-Dahlem has been upgraded from a 64kBit ISDN-Link to a 2-MBit permanent line. From the FHI, the Institute is connected to a 155 MBit line direct to the internet via the German Research Net (Deutsches Forschungs Netz, DFN).

Project support and training

The Computing Unit has provided key support to the following research activities:

- the Virtual Laboratory for Physiology (see p. 55)
- an image and text database supporting the research on engineering and mechanical thinking (see p. 19)
- the Cuneiform Digital Library Initiative (see p. 28)
- the Computer-Aided Source Collection in History of Science (see p. 89)
- The computing service unit has also provided several training sessions for users, e.g.
- Internet for Beginners
- Scanning Images and Working with Optical Character Recognition
- Working with the eXtensible Markup Language (XML)
- HTML, Java, and CGI – The Languages of the Web.

Junior Scientists and Guest Scientists

The Institute's Visiting Scholars and Research Fellows

Considerable areas of the Institute's research program are covered by visiting scholars and research fellows funded by the Institute and by a growing number of other institutions. Their contributions encompass individual projects, contributions to workshops and conferences, and cooperation in context of the departments' long-term research activities. Most of these activities are described in the reports of the departments and research groups above and not in the following list. For specific information on the work of individual researchers, please use the name index.

Prof. Dr. Mohamed Abattouy (Visiting Scholar, Université M. Ben Abdellah, Fes, Morocco, April 14 – 30 and June 18 – December 17, 1998; April 5 – 23 and July 2 – December 26, 1999)

Dr. Oscar Joao Abdounur (Lorenz Krüger Postdoctoral Research Fellow, Universidad de Sao Paulo, Brasil, October 1, 1999 – September 30, 2000)

Dr. Gadi Algazi (Visiting Scholar, Alexander-von-Humboldt-Stiftung; Dept. of History, Tel Aviv University, Israel, July 21, 1998 – September 30, 1999)

Dr. Carrie Asman (Postdoctoral Research Fellow, Humboldt-Universität zu Berlin, October 1, 1999 – June 30, 2000): Habilitation on "Schmuck und Scham: Grenzen des Körperlichen 1500/1800": a history of pearls in cultural and scientific context. Pearl-like spherical shapes are ubiquitous in astronomical, chemical, and crystallographic models from at least the 17th century. The project explores visual components of cross-disciplinary patterns of influence based on models implementing one particular form borrowed from nature (see p. 39).

Prof. Dr. Mara Beller (Visiting Scholar, The Hebrew University of Jerusalem, Israel, September 1 – October 15, 1999)

Dr. Jutta Berger (Postdoctoral Research Fellow, Technische Universität Berlin, April 1 – June 30, 1999) reworked a chapter of her dissertations for publication: "Statistische Deutung Chemischer Reaktionen in der Chemie des 19. Jahrhunderts."

Charlotte Bigg (Predoctoral Research Fellow, Darwin Trust of Edinburgh; Cambridge University, UK, April 1 – May 15, 1999)

Katja Bödeker (Predoctoral Research Fellow, FU Berlin, November 1, 1999 – October 31, 2001)

Dr. Christophe Bonneuil (Postdoctoral Research Fellow, CNRS; Université Paris 7, France, March 1, 1997 – February 28, 1998)

Dr. Cornelius Borck (Karl Schädler Postdoctoral Research Fellow, Liechtenstein Fonds for the History of Science; Institut für Wissenschafts- und Technikforschung, Universität Bielefeld, April 1, 1998 – March 31, 2001). Project description see p. 53.

Dr. Francesca Bordogna (Postdoctoral Research Fellow, Department of History, Northwestern University, Evanston, USA, October 1, 1998 – June 30, 1999)

Prof. Dr. Robert Brain (Visiting Scholar, Department of the History of Science, Harvard University, Cambridge, USA, June 15 – July 25, 1998) Book on the graphic method in the natural sciences during the 19th century: why methods of self-recording instrumentation became a central feature of science, technology, and medicine, and ultimately one of the primary means of visualization in the sciences, across many disciplines. The study also contributes to the history of computing and calculation using analog (continuous) quantities rather than discrete or digital quantities.

Christina Brandt (Predoctoral Research Fellow, October 1, 1996 – March 31, 2000). Project description see p. 66.

Gerhard Brey (Visiting Scholar, November 30 – December 11, 1998 and April 14 – May 1, 1999)

Prof. Dr. Alberto Cambrosio (Visiting Scholar, McGill University, Montreal, Canada, October 1 – November 30, 1999) completed and presented a chapter on morphological and immunological approaches to the diagnosis of leukemia for a book he is writing with Peter Keating, tentatively

entitled *Biomedical Platforms: (Re)Producing the Normal and the Pathological in Late Twentieth Century Medicine*.

Jimena Canales (Predoctoral Research Fellow, Harvard University, Cambridge, USA, October 10 – November 10, 1998)

Dr. Jordi Cat (Postdoctoral Research Fellow, University of California at Davis, USA, October 1, 1997 – September 30, 1998)

Kevin Chang (Predoctoral Research Fellow, DAAD; University of Chicago, USA, October 1, 1998 – September 30, 1999)

Dr. Cristina Chimisso (Postdoctoral Research Fellow, Department of History and Philosophy of Science, University of Cambridge, UK, October 1, 1997 – October 31, 1998). Project description see p. 69.

Prof. Dr. Giovanna Cifoletti (Visiting Scholar, École des Hautes Etudes en Sciences Sociales, Paris, France, May 1 – June 30, 1998)

Dr. Nani N. Clow (Harvard University, Cambridge, USA, Predoctoral Research Fellow, March 1 – June 30, 1999, Postdoctoral Research Fellow September 1, 1999 – August 31, 2001). Project description see p. 65.

Dr. Elisabeth Crawford (Visiting Scholar, Université de Strasbourg, France, May 17 – 21, 1999)

Prof. Dr. Olivier Darrigol (Visiting Scholar, CNRS; Equipe REHSEIS (UPR 318), Paris, France, October 1, 1998 – March 31, 1999)

Prof. Dr. Claude Debru (Visiting Scholar, Université Louis Pasteur, Strasbourg, France, May 1 – July 15, 1999) worked on and presented papers on topics in the philosophy and history of biology. One topic concerned the category of the “possible” and its realization in biotechnology; the other, Helmholtz’s psychophysiology of time.

Dr. John J. Dettloff (Postdoctoral Research Fellow, Smithsonian National Museum of American History, Washington, USA, July 1, 1999 – June 30, 2001)

Prof. Dr. Bruce Eastwood (Visiting Scholar, University of Kentucky, Lexington, USA, July 19 – August 19, 1999)

Dr. Berna Kılıç Eden (Postdoctoral Research Fellow, University of Chicago, USA, September 1, 1997 – September 30, 1998). Project description see p. 68.

Prof. Dr. Robert Englund (Visiting Scholar, University of California at Los Angeles, USA, June 15 – July 31, 1999)

Prof. Dr. Raphael Falk (Visiting Scholar, The Hebrew University of Jerusalem, Israel, February 9 – March 14, 1999) worked with *Peter Beurton* and *Hans-Jörg Rheinberger* to complete the editing of a book on “*The gene concept in evolution and development*”. He also worked on and presented papers on the gene concept and on scientific racism.

Dr. Fa-ti Fan (Postdoctoral Research Fellow, University of Wisconsin-Madison, USA, September 1, 1999 – August 31, 2001)

Dr. Patricia Fara (Postdoctoral Research Fellow, Australian National University, Canberra, Australia, October 1, 1998 – September 30, 1999)

PD Dr. Johannes Fehr (Visiting Scholar, Collegium Helveticum, Zürich, Switzerland, September 16 – September 29, 1998) formulated a project on the history of experimental phonetics. The project aims to trace intellectual exchange between the academic field of linguistics and the practical and entrepreneurial world of communication technology – exchange which began in the 19th century and culminated in the reorientation of linguistics through the collaboration of electrical engineers, mathematicians, cryptologists, and linguists during World War II in developing information and intelligence technologies.

Dr. Eric Francoeur (Postdoctoral Research Fellow, Centre de Sociologie de l’Innovation, École Normale Supérieure des Mines, Paris, France, May 1, 1999 – April 30, 2001)

Raymond Fredette (Visiting Scholar, Centre interuniversitaire de recherches sur la science et la technologie, Montréal, Canada, March 27 – April 3, 1998 and March 9 – May 3, 1999)

Prof. Dr. Gideon Freudenthal (Visiting Scholar, Tel Aviv University, Israel, July 27 – September 4, 1998 and August 1 – 31, 1999)

Prof. Dr. Daniel Garber (Visiting Scholar, University of Chicago, USA, March 23 – March 30, 1998)

Dr. Antonio García Belmar (Postdoctoral Research Fellow, CSIC; Inst. de Estudios Documentales e Históricos sobre la Ciencia, Universitat de València, Spain, September 1, 1997 – August 31, 1998). Project description see p. 69.

Prof. Dr. Rodolphe Gasché (Visiting Scholar, State University of New York at Buffalo, USA, June 13 – July 15, 1999) pursued various topics in philosophy and hermeneutics, especially the work of Martin Heidegger, Jacques Derrida, and Jan Patočka on the philosophical notion of “Europe”, on which he presented a paper.

Dr. Peter Geimer (Postdoctoral Research Fellow, Philipps-Universität Marburg, June 1, 1997 – January 31, 1999). Project description see p. 52.

Prof. Dr. Alfred Gierer (Visiting Scholar, Max-Planck-Institut für Entwicklungsbiologie, Tübingen, November 1 – November 30, 1998)

Prof. Dr. Catherine Goldstein (Visiting Scholar, CNRS; Université de Paris Sud, France, April 1 – July 8, 1998)

Dr. Christoph Gradmann (Visiting Scholar, Universität Heidelberg, Institut für Geschichte der Medizin, February 22 – March 19, 1999) worked on medicine and microbiology in Germany, 1870-1910, focusing on Robert Koch.

Prof. Dr. Gerd Grabhoff (Visiting Scholar, Universität Bern, Switzerland, July 12 – August 20, 1999)

Birgit Griesecke (Postdoctoral Research Fellow, August 1, 1999 – July 31, 2001). Project description see p. 54.

Prof. Dr. James R. Griesemer (Visiting Scholar, Department of Philosophy, University of California at Davis, USA, May 4 – 31, 1998) worked on a book that will present a new concept of the units of evolution, unifying hereditary and developmental aspects of reproduction. He presented papers on his new theory of reproduction, on the history of Weismannism, and on the philosophical analysis of scientific diagrams.

Dr. Niccolò Guicciardini (Visiting Scholar, Dipartimento di Filosofia, Università degli Studi di Bologna, Italy, May 23 – 30, 1998)

Dr. Karl Hall (Postdoctoral Research Fellow, July 1, 1999 – June 30, 2000)

Dr. Michael Hau (Schloßmann Postdoctoral Research Fellow, University of Iowa, USA, February 1, 1999 – January 31, 2001) “The Humane Expert: Physicians, Empathy and the Crisis of Modern Medicine during the Weimar Republic” deals with the attempts of Weimar physicians to introduce a new form of expertise based on empathic healer personalities, as opposed to the modernist expertise based on the standardization of services, scientific knowledge, and technical skills. This movement arose in response to the challenge of alternative medical practitioners and to some extent appropriated the discourse of pre-war medical reform movements.

Dr. Kilian Heck (Universität Hamburg, Rathenau Postdoctoral Research Fellow, October 1, 1997 – December 31, 1998; Postdoctoral Research Fellow, June 1 – September 30, 1999)

Dr. Ton van Helvoort (Visiting Scholar, Dept. of History, Maastricht University, Netherlands, April 1 – 30, 1998 and March 1 – April 15, 1999) worked on topics in the history of cancer research in Germany, especially on the cancer institute at the Charité in Berlin.

Dr. Alain Herreman (Postdoctoral Research Fellow, Université de Paris VII, France, October 1, 1997 – September 30, 1998)

Dr. Elfrieda Hiebert (Visiting Scholar, September 15 – November 15, 1998) and *Prof. Dr. Erwin N. Hiebert* (Visiting Scholar, Harvard University, Cambridge, USA, September 15 – November 15, 1998): “Helmholtz on Music: The Role and Limits of Scientific Analysis” deals with the Berlin setting of Helmholtz’s studies, his experiments and publications in the physics and physiology of acoustics, leading to the publication of the *Tonempfindungen* (1863). The project also examines the responses to Helmholtz’s views on the science and aesthetics of music on the part of music his-

torians, musicologists, performers, scientists, mathematicians, instrument builders, and composers.

Sabine Höhler (Postdoctoral Research Fellow, July 1, 1999 – June 30, 2001)

Dr. Christoph Hoffmann (Karl Schädler Postdoctoral Research Fellow, Liechtenstein Fonds for the History of Science; Europa-Universität Viadrina Frankfurt/Oder, April 1, 1998 – March 31, 2001). Project description see p. 62.

Prof. Dr. Frederic L. Holmes (Visiting Scholar, Yale University, New Haven, USA) made several short visits to the Institute in 1998–99. Together with *Jürgen Renn* and *Hans-Jörg Rheinberger*, he organized a conference on “Reworking the Bench: Research Notebooks in the History of Science” see p. 70, and is now involved in preparing a volume on this topic.

Prof. Dr. Blahoslav Hruška (Visiting Scholar, Czech Academy of Science, Prague, August 1 – September 30, 1999)

Marion Hulverscheidt (Predoctoral Research Fellow, Heinrich-Böll-Stiftung; Georg-August-Universität Göttingen, May 1, 1998 – December 31, 1999) worked on her dissertation on clitoridectomy and its representation in 19th-century German medicine and anthropology.

Prof. Dr. Sarah C. Humphreys (Visiting Scholar, University of Michigan, Ann Arbor, USA, January 1 – April 30, 1998)

Dr. David Hyder (Lorenz Krüger Postdoctoral Research Fellow, September 1, 1997 – August 31, 1998; Postdoctoral Research Fellow, Research Council of Canada; September 1, 1998 – June 30, 2000). Project description see p. 63.

Prof. Dr. Myles W. Jackson (Visiting Scholar, Alexander-von-Humboldt-Stiftung; Department of History, University of Chicago, USA, December 1, 1999 – August 20, 2000)

Dr. Michel Janssen (Postdoctoral Research Fellow, Boston University, USA, July 1 – August 31, 1998 and July 19 – August 26, 1999)

Prof. Dr. Lily E. Kay (Visiting Scholar, Harvard University, Cambridge, USA, May 15 – August 15, 1998) co-organized with Hans-Jörg Rheinberger the conference “Postgenomics?” see p. 69. and worked on a new research project in history of neuroscience: Warren S. McCulloch’s calculus of mind, or the introduction of logical representations of brain activities as neural nets in the 1940s and 1950s.

Dr. Elke Kazemi (Lorenz Krüger Postdoctoral Research Fellow, Universität Konstanz, October 1, 1998 – March 31, 2000)

Prof. Dr. Evelyn Fox Keller (Visiting Scholar, MIT, Cambridge, USA, January 1 – June 30, 1998)

Prof. Dr. Elaheh Kheirandish (Visiting Scholar, Harvard University, Cambridge, USA, August 31 – September 4, 1998)

Jari Kirsilä (Predoctoral Research Fellow, Université Louis Pasteur de Strasbourg, France / University of Joensuu, Finland, October 1 – October 31, 1999) worked on the topic “Analysis versus Synthesis – Alternative Approaches in late 19th Century Organic Chemistry.”

Dr. Alexei Kojevnikov (Visiting Scholar, Institute for the History of Science, Moscow, Russia, June 26 – July 26, 1998)

Prof. Dr. Deepak Kumar (Visiting Scholar, Jawaharlal Nehru University, New Delhi, India, April 25 – May 9, 1999)

Dr. Morgane Labbé (Postdoctoral Research Fellow, CNRS; Laboratoire de Démographie Historique, EHESS, Paris, France, October 1, 1996 – September 30, 1998)

Dr. Jens Lachmund (Schloßmann Postdoctoral Research Fellow, October 1, 1998 – January 31, 2001). Project description see p. 61.

Prof. Dr. André Laks (Visiting Scholar, Université Charles de Gaulle, Lille, France, September 1, 1998 – January 15, 1999)

Dr. Hannah Landecker (Postdoctoral Research Fellow, October 1, 1999 – September 30, 2001). Project description see p. 54.

Prof. Dr. Pierre Laszlo (Visiting Scholar, Université de Liège, Belgium, October 1 – October 31, 1999) worked on various projects in the history of chemistry and biology, especially the relation of

Kenneth D. Roeder's studies of insect behavior to advances in electronic instrumentation, on which he presented a paper.

Dr. Manfred Laubichler (Postdoctoral Research Fellow, Princeton University, USA, June 1 – July 15, 1998 and August 1 – December 31, 1999). Project description see p. 67.

Dr. Andrea Loettgers (Postdoctoral Research Fellow, Deutsche Forschungsgemeinschaft; Universität Göttingen, March 15 – December 31, 1999). Project description see p. 56.

Dr. María Luz López Terrada (Visiting Scholar, CSIC; Instituto de Estudios Documentales e Históricos sobre la Ciencia, Universitat de València, Spain, June 1 – July 31, 1998) studied the relations between 16th-century Spanish and Central European naturalists, especially around the figure of Carolus Clusius. Her project focused on the key role of Renaissance Spain in the introduction of American nature into European science.

Dr. Sarah Lowengard (Postdoctoral Research Fellow, State University of New York, USA, April 15, 1999 – April 14, 2000)

Dr. Carmen Loza (Postdoctoral Research Fellow, Ecole des Hautes Etudes en Sciences Sociales, Paris, France, October 1, 1997 – March 31, 2000)

Dr. sc. Karlheinz Lüdtke (Visiting Scholar, Universität Jena, July 1, 1997 – December 31, 1998) worked on and presented a paper on the early history of virus research.

Dr. Abigail Lustig (Postdoctoral Research Fellow, University of California at Berkeley, USA, September 1, 1997 – October 31, 1998 and September 1, 1999 – August 31, 2001). Project description see p. 68.

Dr. William Lynch (Postdoctoral Research Fellow, Cornell University, Ithaca, USA, January 1 – August 21, 1999)

Christopher Martin (Predoctoral Research Fellow, University of Pittsburgh, USA, August 1 – August 31, 1998)

Dr. Michael May (Postdoctoral Research Fellow, April 1, 1997 – March 31, 1998)

Dr. David McGee (Postdoctoral Research Fellow, September 1, 1999 – August 31, 2001)

Dr. Peter McLaughlin (Visiting Scholar, Universität Konstanz, April 1 – May 31, 1999) worked with *Hans-Jörg Rheinberger* on 18th-century natural history and on early modern theories of heredity. Planning was begun for a long-term cooperative project on the cultural history of heredity. He also worked on and presented a paper on the concept of “design” in contemporary philosophy of biology.

Dr. Alexandre Métraux (Visiting Scholar, Otto-Selz-Institut, Universität Mannheim, September 1, 1997 – February 28, 1998) organized a group project in Department III on visualizing small-scale entities in the life sciences and participated in the project “Ecce cortex” see p. 57. He also carried out research on topics in the history of neurophysiology and psychology, including the history of color tops from Newton to Edward Titchener.

Dr. Hélène Mialet (Postdoctoral Research Fellow, University of Oxford, UK, September 1, 1998 – August 31, 1999)

David Millett (Predoctoral Research Fellow, University of Chicago, USA, July 1 – September 30, 1998): Dissertation (University of Chicago) on “Instrumentation and Representation in Brain Physiology: From the Excitable Cortex to the Electro-encephalogram”: how brain mapping and functional localization once again became important topics of scientific inquiry.

Prof. Dr. Gregg Mitman (Visiting Scholar, University of Oklahoma, USA, September 1, 1999 – June 30, 2000)

Prof. Dr. Reinhard Mocek (Visiting Scholar, October 1, 1998 – December 31, 1999). Project description see p. 67.

Dr. Javier Moscoso (Postdoctoral Research Fellow, University Autónoma, Madrid, Spain, June 15 – September 15, 1998)

Prof. Dr. Gabriel Motzkin (Visiting Scholar, Department of History, Hebrew University of Jerusalem, Israel, August 17 – September 13, 1998)

- Prof. Dr. Helmut Müller-Sievers* (Visiting Scholar, Northwestern University, Evanston, USA, August 1 – September 3, 1998) worked on his book on the role of anatomy in Georg Büchner's writings and participated in the group project of Department III "Ecce cortex" see p. 57.
- Dr. Staffan Müller-Wille* (Postdoctoral Research Fellow, December 1, 1997 – May 31, 1998)
- Dr. Michelle Murphy* (Postdoctoral Research Fellow, Cornell University, Ithaca, USA, September 1, 1999 – August 31, 2001)
- Tara Nummedal* (Predoctoral Research Fellow, DAAD; Stanford University, USA, October 1, 1998 – June 30, 1999)
- Prof. Dr. Mary Jo Nye* (Visiting Scholar, Oregon State University, Corvallis, USA, November 20 – December 18, 1999) presented a paper on "Michael Polanyi" at an informal colloquium of the Institute, was a speaker at the conference "Types of Paper Tools and Traditions of Representation in the History of Chemistry" (Dec. 2–4, 1999), and contributed to project 1 of the independent research group of *U. Klein* (see p. 72).
- Prof. Dr. Kathryn M. Olesko* (Visiting Scholar, Georgetown University, Washington D.C., USA, October 1 – December 31, 1998)
- Prof. Dr. Dorinda Outram* (Visiting Scholar, University of Rochester, USA, July 12 – August 13, 1999)
- Ohad Parnes* (Predoctoral Research Fellow, July 1, 1997 – June 30, 1998 and September 1 – December 31, 1999). Project description see p. 65.
- Dr. Hans Pols* (Rathenau Postdoctoral Research Fellow, Department of the History of Science, Harvard University, Cambridge, USA, October 1, 1998 – August 31, 1999 and June 1 – September 30, 2000): "Psychiatry, Technology, and the Law" charts the transformation of American psychiatry from a medical sub-specialty concerned with the institutionalization of the mentally ill to a much broader discipline concerned with mental health and adjustment of virtually everybody, touching upon a great many aspects of everyday life (see p. 107).
- Dr. Marcus Popplow* (Postdoctoral Research Fellow, October 1, 1997 – September 30, 2001)
- Prof. Dr. Theodore M. Porter* (Visiting Scholar, Department of History, University of California at Los Angeles, USA, June 15 – July 15, 1998)
- Dr. Matthew W. Price* (Postdoctoral Research Fellow, Cornell University, Ithaca, USA, September 1, 1999 – August 31, 2001)
- Prof. Dr. Robert Proctor* (Visiting Scholar, The Pennsylvania State University, USA, June 1 – December 31, 1999)
- Dr. Helmut Puff* (Visiting Scholar, University of Michigan, Ann Arbor, USA, September 1 – July 31, 2000)
- Dr. Marc J. Ratcliff* (Postdoctoral Research Fellow, Schweizerischer Nationalfonds, Université de Genève, Switzerland, October 1, 1997 – August 30, 1998): Book on the history of the language of the natural sciences, as well as publications in the history of psychology, 18th-20th centuries (see p. 30).
- Dr. Ulf von Rauchhaupt* (Reimar-Lüst-Postdoctoral Research Fellow, October 1, 1998 – September 30, 2000)
- Andreas Renner* (Postdoctoral Research Fellow, Universität Bielefeld, October 1, 1998 – September 30, 1999)
- Prof. Dr. Joan L. Richards* (Visiting Scholar, Brown University, Providence, USA, January 5 – 16, 1998, May 20 – June 30, 1998 and December 8 – 13, 1999)
- Prof. Dr. James Ritter* (Visiting Scholar, Université de Paris 8, France, April 1 – July 8, 1998)
- Prof. Dr. Alan Rocke* (Visiting Scholar, Case Western Reserve University, Cleveland, USA, May 1 – May 30, 1999) presented a paper at the Institute's colloquium entitled "Giessen on the Seine: French Academic Chemical Laboratories, 1830–1870" (May 5, 1999); and he contributed to both projects of the independent research group of *U. Klein*.
- Prof. Dr. Abdelhamid Sabra* (Visiting Scholar, Harvard University, Cambridge, USA, August 29 – September 13, 1998)

Prof. Dr. Sahotra Sarkar (Visiting Scholar, University of Texas at Austin, USA, June 1 – August 31, 1998) worked, first, on a comparative history of biological conservation, emphasizing the variety of traditions of applied biology (resource ecology, forestry management) and the variety of cultural traditions and attitudes towards the natural world; and, second, on a history of evolutionary genetics, envisioning that field as a bridge between evolutionary theory (including formal population genetics) and biochemical genetics.

Dr. Britta Scheideler (Visiting Scholar, Johannes Gutenberg Universität, Mainz, September 14 – October 2, 1998)

Dr. Jutta Schickore (Postdoctoral Research Fellow, April 1, 1997 – August 31, 1999). Project description see p. 63.

Prof. Dr. Londa Schiebinger (Visiting Scholar, Alexander von Humboldt-Forschungspreis; The Pennsylvania State University, USA, June 1, 1999 – June 30, 2000)

Dr. Mark Schiefsky (Postdoctoral Research Fellow, Harvard University, Cambridge, USA, January 1 – December 31, 1999)

Dr. Judith J. Schloegel (Postdoctoral Research Fellow, Indiana University, Bloomington, USA, October 1, 1997 – October 31, 1998). Project description see p. 65.

Dr. Henning Schmidgen (Postdoctoral Research Fellow, March 1, 1997 August 31, 2000). Project description see p. 52.

Prof. Dr. Erhard Scholz (Visiting Scholar, Gesamthochschule Wuppertal, November 30 – December 31, 1998)

Prof. Silvan S. Schweber (Visiting Scholar, Brandeis University, Waltham, USA, March 13 – March 19, 1998)

Dr. Anne Secord (Visiting Scholar, Wellcome Unit for the History of Medicine, Cambridge University, UK, January 25 – January 31, 1999)

Dr. Jérôme Ségol (Postdoctoral Research Fellow, CNRS; Centre Marc Bloch, March 1, 1999 – June 30, 2000). Project description see p. 56.

Prof. Dr. Steven Shapin (Visiting Scholar, Department of Sociology, University of California at San Diego, USA, June 1 – June 30, 1999)

René Sigrist (Predoctoral Research Fellow, Université de Genève, Switzerland, October 1, 1999 – January 31, 2000): Dissertation on “La République des Lettres et l’essor des sciences expérimentales: exemples genevois, 1670–1820” (Université de Genève, Switzerland): Characteristic experimental methods developed by Genevan scientists, including laboratory practices, experimental strategies, and rhetorics of proof and persuasion (see p. 39).

Dr. Skúli Sigurdsson (Postdoctoral Research Fellow, Icelandic Research Council; Harvard University, Cambridge, USA, August 1, 1997 – December 31, 1998) continued his work on the history of the electrification of Iceland.

Dr. Jonathan Simon (Postdoctoral Research Fellow, University of Pittsburgh, USA, September 1, 1997 – August 31, 1998). Project description see p. 65.

Christopher Smeenk (Predoctoral Research Fellow, University of Pittsburgh, USA, August 1 – August 31, 1998)

Prof. Dr. Thomas Söderqvist (Visiting Scholar, Roskilde University, Danmark, May 17 – June 20, 1999)

Prof. Dr. John Stachel (Visiting Scholar, Boston University, USA, June 1 – July 15, 1998; December 15 – December 22, 1998; December 7 – December 16, 1999)

Dr. Richard Staley (Postdoctoral Research Fellow, June 1, 1999 – May 31, 2001)

Dr. Joan Steigerwald (Visiting Scholar, DAAD; Norman Bethune College, York University, UK, July 1 – August 31, 1999) examined material on physiology and Naturphilosophie around 1800, especially in contemporary journals such as the *Archiv für medizinische Erfahrung*, material which will be integrated into her larger project on Naturphilosophie, Kant, and Schelling, on which she presented a paper.

Claudia Stein (Predoctoral Research Fellow, Studienstiftung des Deutschen Volkes; Universität Stuttgart, October 1, 1997 – November 30, 1999) Dissertation on “Die Franzosenkrankheit im frühneuzeitlichen Deutschland 1495–1630” (Universität Stuttgart, Germany): traces the specifically early modern conception of the disease in the context of qualitative pathology and the cosmology of a divinely-created microcosm-macrocosm, using vernacular German tracts and archival material from hospitals in imperial Augsburg.

Bruno J. Strasser (Predoctoral Research Fellow, Schweizerischer Nationalfonds; Institute Louis-Jeantet for the History of Medicine, University of Geneva, Switzerland, October 1, 1998 – September 30, 1999). Project description see p. 65.

Dr. Bernhard Thöle (Postdoctoral Research Fellow, September 1, 1997 – October 31, 1998)

Charles R. Thorpe (Predoctoral Research Fellow, University of California at La Jolla, USA, January 1 – September 30, 1999)

Carsten Timmermann (Predoctoral Research Fellow, The Wellcome Trust; University of Manchester, UK, July 1 – September 20, 1998) carried out research for his dissertation on the controversy over a so-called “crisis of medicine” in Germany in the 1920s.

Prof. Dr. Sabetai Unguru (Visiting Scholar, Tel Aviv University, Israel, September 1, 1997 – February 28, 1998)

Matteo Valleriani (Postdoctoral Research Fellow, University of Padua, Italy, October 15, 1998 – December 31, 2000)

Dr. Fernando Vidal (Visiting Scholar, Schweizerischer Nationalfonds; University of Geneva, Switzerland, September 1, 1999 – August 31, 2000)

Dr. Sara H. Vollmer (Postdoctoral Research Fellow, Dept. of Philosophy, University of Maryland, USA, June 1, 1999 – December 31, 2000)

Till Wahnbaeck (Predoctoral Research Fellow, University of Oxford, UK, October 1, 1999 – March 31, 2000) Dissertation on “The Luxury Debate in the Italian Enlightenment: The Shaping of Political Economy in Eighteenth-Century Lombardy and Tuscany” (Balliol College, University of Oxford): explores the range of meanings of the term “luxury” as a major tool of intervention in economic, political, and social debates, defining political economy as an emergent science (see p. 39).

Dr. Scott Walter (Postdoctoral Research Fellow, CNRS; REHPSCI (CNRS UMR 7596), Paris, France, January 1, 1998 – January 31, 1999)

Dr. Andrew Warwick (Postdoctoral Research Fellow, Imperial College of Science, Technology and Medicine, London, UK, January 31 – February 7, 1999)

Prof. Dr. George Weisz (Visiting Scholar, McGill University, Montreal, Canada, November 8 – November 28, 1999) pursued research on and presented a paper on the history of medical specialization in Germany, as part of a comparative history of medical specialization in four countries. He also began research for and presented a paper on a new project on the science of mineral waters in nineteenth and 20th-century Europe.

Janina Wellmann (Predoctoral Research Fellow, Humboldt-Universität zu Berlin, July 1, 1999 – June 30, 2001). Project description see p. 69.

Gerhard Wiesenfeldt (Postdoctoral Research Fellow, Universität Hamburg, June 1, 1999 – May 31, 2001)

Prof. Dr. M. Norton Wise (Visiting Scholar, Department of History, Princeton University, USA, June 15 – July 15, 1998; December 7 – 15, 1998 and August 1 – 31, 1999): Project on “Muscles and Engines: Hermann Helmholtz and the Berlin Physical Society in the Industrializing Military State”: shows how Helmholtz’s muscle physiology and energy physics were tied together by the concept and practical measurement of “work”, as realized in the indicator diagrams employed by engineers to measure the work done by steam engines. Situated educationally, economically, militarily, and aesthetically in the culture of 1840s Berlin, Helmholtz’s researches in diverse fields take on a new, unified meaning.

Prof. Dr. Andrea Woody (Visiting Scholar, University of Washington, Seattle, USA, November 20 – December 18, 1999) participated in the conference “Types of Paper Tools and Traditions of Representation in the History of Chemistry” (Dec. 2–4, 1999), and contributed to project 1 of the independent research group of *U. Klein*.

Falk Wunderlich (Predoctoral Research Fellow, January 1, 1999 – December 31, 2000)

Dr. Maria Yamalidou (Postdoctoral Research Fellow, September 1, 1999 – August 31, 2000).

Project description see p. 68.

Rakefet Zalashik (Predoctoral Research Fellow, Tel Aviv University, Israel, September 13 – October 15, 1999) worked on her master's thesis on the psychiatry of Johann Christian Reill.

Prof. Dr. Baichun Zhang (Visiting Scholar, Institute for History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, November 1, 1999 – April 30, 2000)

Relations with German and Foreign Research Institutions

Memberships

The Institute is member of the *Verbund 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*, *Matthias Dörries* is visiting professor at the *Université Louis Pasteur Strasbourg I*, *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

Bibliotheca Hertziana – Max Planck Institute, Rome (Department I, Development, Project Epistemic History of Architecture)

Institute for the History of National Science, Chinese Academy of Sciences (Department I, Project 1, see p. 19)

Max Planck Institute for Human Development and Education, Max Planck Institute for Psychological Research, Max Planck Institute of Research into Economic Systems, and Max-Planck-Project Group “Common Goods: Law, Politics, and Economics” (Department II, Project Grenzen der Rationalität)

Max Planck Institute for European Legal History (Department II, Project on Natural Law, see p. 32)

Observatoire de la Côte d’Azur: PICS (Department I, Project 1, see pp. 21, 28)

Opera di S. Maria del Fiore (Department I, Development, see p. 28)

Tufts University, Medford (Department I, Archimedes Project, see p. 28)

Istituto e Museo di Storia della Scienza and Biblioteca Nazionale Centrale, Florence (Department I, Development, see p. 27)

Department of Near Eastern Languages and Cultures, University of California at Los Angeles,

Vorderasiatisches Museum Berlin, Institut für Vorderasiatische Altertumskunde of the Freie Universität Berlin, Hermitage Museum St. Petersburg (Department I, Development, CDLI, see p. 28)

Prof. Dr. Raphael Falk, Department of Genetics, Hebrew University of Jerusalem (book project on gene concept, see p. 22)

Prof. Dr. Menso Folkerts, Ludwig-Maximilians-Universität München (Department I, Development, ICCMSM, see p. 27)

Prof. Dr. Frederic L. Holmes, Section of the History of Medicine, School of Medicine, Yale University, New Haven (Department I and III, book project “Reworking the Bench”, see p. 70)

Prof. Dr. Timothy Lenoir, Program in History and Philosophy of Science, Stanford University (Department III, Virtual Laboratory, see p. 55)

Prof. Dr. Helmut Müller-Sievers, German Department, Northwestern University, Evanston USA (Department III, Book Project Ecce Cortex, see p. 57)

Editorships

Peter Damerow is Co-Editor of the series *Materialien zu den frühen Schriftzeugnissen des Vorderen Orients (MSVO)*.

Lorraine Daston is Advisory Editor to the *Ideas in Context* series of Cambridge University Press.

Michael Hagner is 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*.

Wolfgang Küttler is Member of the Editorial Boards of the *Sitzungsberichte der Leibniz-Sozietät Berlin*, of the journal *Comparativ* (Leipzig) and of the *Historisch-Kritisches Wörterbuch des Marxismus*.

Andrew Mendelsohn is Advisory Editor to *Isis*.

Peter Ramberg is Member of the Editorial Board of the *Bulletin for the History of Chemistry*.

Jürgen Renn is Member of the Editorial Boards of the *Boston Studies in the Philosophy of Science* and of *Science in Context*.

Hans-Jörg Rheinberger is Member of the Editorial Boards of the *Journal of the History of Biology*, of the *Sociology of the Sciences Yearbook*, and of *History and Philosophy of the Life Sciences*, furthermore he is Consulting Editor to the *Studies in History and Philosophy of the Biological and Biomedical Sciences*, and the *Jahrbuch für Geschichte und Theorie der Biologie*.

Teaching Activities

Winter 1997/98

Peter Damerow, Peter McLaughlin: Weltmodelle der frühen Neuzeit (Seminar, Universität Konstanz)

Christoph Hoffmann: Reizbarkeit - Die Entdeckung der Nerven in der Moderne 1870 – 1920 (Proseminar, Europa-Universität Viadrina Frankfurt/Oder)

Dieter Hoffmann: Max Planck – ein Gelehrter im wissenschafts- und zeithistorischen Spiegel (Seminar, Humboldt Universität zu Berlin)

Thomas Potthast: Naturschutzethik: naturwissenschaftliche und moralphilosophische Begründungen des Naturschutzes (Hauptseminar, Universität Tübingen)

Thomas Potthast: Naturschutz und Ethik (Blockseminar, Universität Freiburg)

Jürgen Renn: Galileis Discorsi (Hauptseminar, Humboldt Universität zu Berlin)

H. Otto Sibum: Changing Experimental Cultures in 18th and 19th Physical Sciences (3 Lectures during the Lent Term, University of Cambridge, UK)

Emma Spary et al.: Natural History from Linnaeus to Cuvier (final year undergraduate course, University of Cambridge, UK)

Annette Vogt: Geschichte des Frauenstudiums I (Übung, Humboldt Universität zu Berlin)

Summer 1998

Peter Damerow, Peter McLaughlin, Paul Weinig: Die Entwicklung der vorklassischen Mechanik im 16. Jahrhundert (Seminar, Universität Konstanz)

Michael Hagner: Einführung in die Geschichte der Lebenswissenschaften (Vorlesung, Universität Salzburg)

Michael Hagner: Ausgewählte Kapitel aus der Geschichte der Lebenswissenschaften (Seminar, Universität Salzburg)

Jens Lachmund: Sozialität des Raumes - Räumlichkeit des Sozialen (Seminar, Technische Universität Berlin)

Wolfgang Lefèvre: Philosophie – Gesellschaft – Wissenschaft: Bild und Text – zur Rolle nicht-sprachlicher Repräsentation in Philosophie und Wissenschaft I (Forschungskolloquium, Freie Universität Berlin)

Andrew Mendelsohn: The Health of Nations: Epidemiology, Sociology, Population (Seminar, Tel Aviv University)

Annette Vogt: Geschichte des Frauenstudiums II (Übung, Humboldt Universität zu Berlin)

Paul Weinig: Grammatik für den Bereich Deutsch als Fremdsprache (Seminar, Freie Universität Berlin)

Winter 1998/99

Cornelius Borck: Studientag Wissenschaftsgeschichte (Blockseminar, Verbund Wissenschaftsgeschichte)

Peter Damerow, Peter McLaughlin, Paul Weinig: Die Tradierung und Weiterentwicklung der antiken Mechanik im arabischen Mittelalter (Seminar, Universität Konstanz)

Michael Hagner et al.: Geschichte und Ethik in der Medizin (Vorlesung, Georg-August Universität Göttingen)

Lorraine Daston: The Moral Authority of Nature (Seminars and Lecture, University of Chicago)

Christoph Hoffmann: Episteme des Abfalls (Proseminar, Europa-Universität Viadrina Frankfurt/Oder)

Jens Lachmund: Zur Soziologie der Natur: Das Beispiel Stadtnatur (Seminar, Technische Universität Berlin)

Wolfgang Lefèvre: Philosophie – Gesellschaft – Wissenschaft: Bild und Text – zur Rolle nicht-sprachlicher Repräsentation in Philosophie und Wissenschaft II (Forschungskolloquium, Freie Universität Berlin)

Jürgen Renn: Alternativen in der Wissenschaftsgeschichte am Beispiel der Mechanik (Hauptseminar, Humboldt Universität zu Berlin)

Hans-Jörg Rheinberger: Modelle und Modellorganismen in der Geschichte der Biologie (Vorlesung, Technische Universität Berlin)

Henning Schmidgen: Psychologie und Technologie (Proseminar, Freie Universität Berlin)

H. Otto Sibum: Science and the Knowing Body since the Enlightenment (3 Lectures during the Lent Term, University of Cambridge, UK)

Annette Vogt: Wissenschaftlerinnen in Berlin – an der Akademie der Wissenschaften, an der Universität und in der Kaiser-Wilhelm-Gesellschaft (Übung, Humboldt Universität zu Berlin)

Summer 1999

Cornelius Borck: Studientag Wissenschaftsgeschichte (Blockseminar, Verbund Wissenschaftsgeschichte)

Peter Damerow, Peter McLaughlin: Wissenschaftsgeschichte und Kognitionswissenschaft (Seminar, Universität Konstanz)

Lorraine Daston: The Ideals and Practices of Scientific Objectivity (Isaiah Berlin Lectures, University of Oxford, UK)

Michael Hagner: The Cultural History of the Brain (Seminar, Tel Aviv University)

Christoph Hoffmann: "Was ist ein Dichter" (Pro-/ Hauptseminar, Europa-Universität Viadrina Frankfurt/Oder)

Dieter Hoffmann: Elektrizität und Magnetismus – zur Etablierung eines Wissenszweiges im 18. und 19. Jahrhundert (Seminar, Humboldt Universität zu Berlin)

David Hyder: Philosophie der Informatik (Seminar, Humboldt Universität zu Berlin)

Jens Lachmund: Karten, Pläne, Daten: Zur visuellen Repräsentation von Städten und Landschaften (Seminar, Technische Universität Berlin)

Wolfgang Lefèvre: Philosophie – Gesellschaft – Wissenschaft: Bild und Text – zur Rolle nicht-sprachlicher Repräsentation in Philosophie und Wissenschaft III (Forschungskolloquium, Freie Universität Berlin)

Andrew Mendelsohn: Organismus und Gesellschaft im 19. Jahrhundert (Seminar, Humboldt Universität zu Berlin)

Thomas Potthast: Ökologie, Naturschutz und Ethik: interdisziplinäre Verknüpfungsversuche in historischer und aktueller Perspektive (Seminar, Freie Universität Berlin)

Henning Schmidgen: Kritik und Klinik, 1920–1970 (Hauptseminar, Freie Universität Berlin)

Annette Vogt: Casablanca – Exil und Remigration von Wissenschaftler(innen) (Proseminar, Humboldt Universität zu Berlin)

Winter 1999/00

Cornelius Borck: Studientag Wissenschaftsgeschichte (Blockseminar, Verbund Wissenschaftsgeschichte)

Cornelius Borck: Medizinische Terminologie (Kurs, Freie Universität Berlin)

Cornelius Borck: Psychosomatik als Ausweg? Medizintheoretische Neuansätze nach dem 2. Weltkrieg (Seminar, Freie Universität Berlin)

Peter Damerow, Peter McLaughlin: Die Entwicklung der Kosmologie Descartes' (Seminar, Universität Konstanz)

Lorraine Daston: Geschichte der wissenschaftlichen Objektivität (Vorlesung und Seminar, Humboldt-Universität zu Berlin)

Matthias Dörries: Histoire sociale des sciences (Lecture, Université Louis Pasteur, Strasbourg I)

Matthias Dörries: Science, éthique et droit (Lecture, Université Louis Pasteur, Strasbourg I)

Christoph Hoffmann: Text und Experiment (Pro-/ Hauptseminar, Europa-Universität Viadrina Frankfurt/Oder)

Dieter Hoffmann: Wissenschaftler in Sozialismus- Karrieren von Naturwissenschaftlern und Technikern in der DDR (Seminar, Humboldt Universität zu Berlin)

Wolfgang Lefèvre: Philosophie – Gesellschaft – Wissenschaft: Bild und Text – zur Rolle nicht-sprachlicher Repräsentation in Philosophie und Wissenschaft IV (Forschungskolloquium, Freie Universität Berlin)

Jens Lachmund: Soziologische Theorien der Globalisierung und ihre Relevanz für die Stadtsoziologie (Seminar, Technische Universität Berlin)

Thomas Potthast: Naturschutz und Ethik (Blockseminar, Universität Freiburg)

Jürgen Renn: Einsteins Autobiographie – Die Entstehung von Relativitäts- und Quantentheorie in der rückblickenden Reflexion von Albert Einstein (Hauptseminar, Humboldt Universität zu Berlin)

Hans-Jörg Rheinberger: Ausgewählte Kapitel zur Geschichte der Biologie (Seminar, Technische Universität Berlin)

Henning Schmidgen: Medien des Imaginären (Hauptseminar, Bauhaus Universität Weimar)

Volkmar Schüller: Einführung in Newtons Principia (Vorlesung und Seminar, Humboldt Universität zu Berlin)

H. Otto Sibum: Instruments, Models and Working Experiments (4 Lectures during the Lent Term, University of Cambridge, UK)

Annette Vogt: Mäzenatentum in Wissenschaft und Kunst. Bedeutende Stifter(innen) in Berlin (Proseminar, Humboldt Universität zu Berlin)

Hosted Scholars

1998/1999 the Institute hosted 25 scholars funded externally by the following institutions:

- Alexander von Humboldt Stiftung
- Centre National de la Recherche Scientifique
- Consejo Superior de Investigaciones Científicas
- Darwin Trust of Edinburgh

- Deutscher Akademischer Auslandsdienst
- Deutsche Forschungsgemeinschaft
- Heinrich-Böll-Stiftung
- Icelandic Research Council
- Liechtenstein Fonds for the History of Science
- Research Council of Canada
- Schweizerischer Nationalfonds
- Studienstiftung des Deutschen Volkes
- The Wellcome Trust

Symposia, Conferences, Colloquia

International Summer Schools

Berlin Summer Academy 1999, "Science, Technology, and the Law",
August 23–27, 1999

Science, technology, and the law are among the most important institutions of the modern period. They have not only penetrated deeply into the fabric of political and social life; they also display a rich history of mutual interaction, including routine cooperation as well as conflict. On the one hand, law has become an arbiter of technological and scientific matters, for example, in patent disputes or, more recently, in litigation or legislation concerning biotechnological and other politically contested technological innovations. On the other hand, beginning with the routine use of expert witnesses in the courtroom, scientific and technological expertise has become widely used as a resource for legal decision-making. The recent extension of legal regulation to new fields of technological and scientific activities has dramatically expanded the quest for of scientific and technical advice in legal procedures. It was the aim of the ninth Berlin summer academy to shed light on the relationship between science, technology and the legal system. It explored the interaction of these fields at different times and at different places, following their epistemical and social practices through various transformations from the early modern period to the near present.

As in previous years the summer academy was a transdisciplinary enterprise bringing together scholars and advanced doctoral students from the history of science, social studies of science, philosophy, legal studies, and other fields of social and cultural history. Following the format of previous summer academies, it began with an intensive preparatory seminar for junior participants, led this year by *Robert Proctor* (Pennsylvania State University) and *Michael Hagner* (Max Planck Institute for the History of Science), assisted by *Hans Pols* and *Jens Lachmund* (both Max Planck Institute for the History of Science). Over the course of one week participants discussed key literature on the theme of the summer academy and prepared commentaries on the papers presented during the second week by senior scholars.

The second week focused on five main topics: (1) The Scientist as Expert Witness; (2) Thinking in Cases; (3) Who Owns Science? (4) Law and the Life Sciences; (5) Priority and Property, Discovery and Invention: What do Patents Patent and Where? In all of these fields, close relationships have evolved between scientific or technological expertise and legal forms of regulation. As most of the papers have shown, however, science and technology have not been simple tools which were applied to pre-given/*prescribed* judicial problems. Epistemically, these constellations often involved unease about matters of truth, proof, evidence, and trust. This implied conflicts between scientific and legal modes of reasoning as well as the migration of concepts and categories from one sphere to the other. In fact, the very boundary that sets apart science, technology, and the legal system proved to be rather permeable and historically negotiated. On a more institutional level, the interaction between science, technology and law has also created new social roles, forms of interaction, and (often fragile) power balances between different groups of experts as well as between experts and other participants of/*in* the legal system. In a time of widespread concern about the consequences of the mutual engagement of science, technology and the law, a historical perspective on these problems might be of direct importance for the understanding of contemporary public debate .

List of speakers:

Ken Alder (Northwestern University, Evanston): Reading Characters: French Handwriting Experts from the Counter-Reformation to the Dreyfus Affair

John Forrester (University of Cambridge, UK): Reasoning in Cases in Law and the Sciences.

Tal Golan (Dibner Institute): The History of Scientific Expert Testimony in the English Courtroom.

Sheila Jasanoff (Harvard University): Cases and Controversies: Epidemiology, Mass Torts, and the Expansion of Judicial Power

Dan Kevles (California Institute of Technology): Patenting Human Genes: The Advent of Ethics in the Political Economy of Patent Law

Marianne de Laet (Columbia University): Using Patents: Another Intellectual Property Mode.

Jens Lachmund (Max Planck Institute for the History of Science): Science, Law, and the Rise of Urban Nature Conservation. The Berlin Species Protection Survey, 1979–1984

Paul Lucier (Rensselaer Polytechnic Institute): The Kerosene Controversy: Chemistry, Industry, and the Law

Elizabeth Lunbeck (Princeton University): Narrating Nymphomania Between Science and the Law

Everett Mendelsohn (Harvard University): The Controversial Career of DNA in the Courtroom: Creating Identity.

Donald MacKenzie (University of Edinburgh): Physics and Finance: S-Terms and Modern Finance as a Topic for Science Studies.

Hans Pols (Max Planck Institute for the History of Science): Legal Anthropology and Colonial Administration in the Former Dutch East Indies.

Anthony Travis (Hebrew University Jerusalem): Patents for Synthetic Dyestuffs: The Interaction Between Science, Technology, and the Law

Martha A. Woodmansee (Case Western Reserve, Cleveland): Beyond Authorship: Imagining Rights in Traditional Culture and Bioknowledge

Second Meeting of the International Laboratory for the History of Science on "Material Calculation", June 19–26, 1999

The International Laboratory for the History of Science is a joint project of the Dibner Institute for the History of Science and Technology, Cambridge (USA), the Max Planck Institute for the History of Science, Berlin, the Cohn Center, Tel-Aviv University, the Istituto e Museo di Storia della Scienza, Florence, and the Center for the History of Science, University of Athens. It brings together junior and senior scholars for seven to ten days each year to confront a focused and novel research topic through hands-on contact with instruments and techniques, as well as the study of texts. Approximately a dozen fellows meet with five or six senior scholars, experts in the topic to be dealt with in the particular year, for an intensive seminar under the sponsorship of one of the five participating institutions. The unity of the International Laboratory is one of approach rather than of theme: a workbench-like emphasis on the concrete sources of past scientific experience, whether embedded in objects, mediated by techniques, or displayed in words and images.

The goals of the International Laboratory for the History of Science are: (1) to expand the preparation of younger scholars in the history of science and related fields by exposure to sources and methods not ordinarily included in graduate training; (2) to introduce techniques and perspectives from other disciplines (e.g. archaeology, cognitive science, art history) as they intersect with problems in the history of science; (3) to promote interactions of junior and senior scholars around a focused topic across national boundaries; and (4) to stimulate research on new areas in the history of science by concentrating scholarly attention on them by means of the seminars.

The second meeting of the International Laboratory examined the historical development of ethnomathematics and of abstract arithmetic from proto-arithmetical practices in rural communities to sophisticated arithmetical techniques used by ancient, medieval and early modern administrators and merchants. For each level of historical achievements the work was focused on the relation between material tools and operations by means of which calculations were actually performed, on the one hand, and the cognitive preconditions and outcomes of their application in the institutional contexts of economy and public administration, on the other hand.

The study of arithmetical techniques during the meeting was focused on the following themes:

- overview: calculation in different cultures,
- roots of calculation techniques in indigenous cultures,
- calculation techniques in Pre-Columbian cultures,
- calculation techniques in East, South and Middle Asia,
- calculation in Mesopotamia before and after the invention of the sexagesimal positional system,
- the material culture of calculation after the exchange with the European colonizers,
- outlook: historio-geography of calculation techniques and their interaction with the development of number concepts.

In some cases, the theoretical consequences of these technologies were far-reaching. Nevertheless, the manipulations and tricks of the trade which were once second nature to the communities of calculators have been largely submerged in the history of exact sciences. The very fact that such techniques were second nature to the experts who wielded them renders them effectively invisible, especially to historians who have grown up with different techniques for solving the same class of problems. There is a need for a hands-on excavation of these arithmetical techniques in close conjunction with careful examination of primary texts that document their former practice as well as of devices and techniques still used today by indigenous people in various cultures. At this meeting of the International Laboratory for the History of Science, the preconditions and implications of arithmetical techniques to be studied were explored by actually practicing them and comparing the outcomes.

List of senior scholars

Ubiratan D'Ambrosio (University of Campinas), *Michael Closs* (University of Ottawa), *Peter Damerow* (Max Planck Institute for the History of Science), *Robert K. Englund* (University of California at Los Angeles), *Menso Folkerts* (University of München), *Jöran Friberg* (University of Göteborg), *Geoffrey Saxe* (University of California at Berkeley). A special presentation of non-exhibited quipus of the Inca culture and other artifacts kept in the Museum für Völkerkunde was provided by *Manuela Fischer*, Curator of the American collections, and *Carmen Loza*, Max Planck Institute for the History of Science, who also provided an overview of types, production techniques, and functions of quipus in the Inca culture.

Other Conferences and Workshops

14 – 18 January 1998: Workshop of Archimedes Project (see p. 28)

3 – 5 February 1998: Greek Mathematics: Workshop organized by Sabetai Unguru in context of Project 1 of Department I

28 – 30 May 1998: QED: Demonstration in Historical and Cross-Cultural Context (see p. 34)

5 – 6 June 1998: Space-Time, Quantum Entanglement and Critical Epistemology (Department I, Project 2, see p. 23)

25 – 28 June 1998: Demonstration-Test-Proof (see p. 34)

8 – 11 July 1998: Postgenomics? Historical, Techno-Epistemic, and Cultural Aspects of Genome Projects (see p. 69)

24 – 28 August 1998, Berlin and 27 February – 9 March 1999, Konstanz: Die Tradierung und Weiterentwicklung der antiken Mechanik im arabischen Mittelalter (see p. 20)

30 August – 1 September 1998: Gehirn und Kultur (see p. 57)

2 – 6 September 1998, Berlin and 12 June, 1999, Paris: Instruments, Travel and Science: Itineraries of Precision in the Natural Sciences, 18th – 20th Century (see p. 82)

13 – 15 October, 1998: Invisible Architectures: On Small-Scale Entities in the Life Sciences (see p. 64)

11 – 14 November 1998: Reworking the Bench: Research Notebooks in the History of Science (see p. 70)

- 14 – 16 January 1999: The Organization of Visibility: Photography in Science, Technology and Art (see p. 70)
- 15 – 18 March 1999, Florence and 26 November 1999, Berlin: Structures of Planning and Organisation of Knowledge in the Construction of the Florentine Cupola, together with Opera del Duomo, Florence (see p. 28)
- 4 – 6 June 1999: Scientific Personae (see p. 38)
- 3 – 4 July 1999: Physiological and Psychological Practices in the 19th Century: their Relationships to Literature, Art, and Technology (see p. 58)
- 14 – 16 July 1999: Philosophy and Science between Leibniz, Newton and Kant (workshop in context of Project 2 of Department I)
- 20 – 23 October 1999: Natur-Gesetz-Naturgesetz (see p. 42)
- 25 – 27 November 1999: The Brain and its Sciences in the Twentieth Century (see p. 71)
- 2 – 4 December 1999: Types of Paper Tools and Traditions of Representation in the History of Chemistry (see p. 72)

Planned Conferences

- 22 – 23 June 2000: Reflection and Intervention (Department I)
- 13 – 15 July 2000: Pure Science and its Impurities (Department III, organized by *Christoph Hoffmann*)
- Fall 2000: Workshop on the Canon of Mechanical Treatises in the Early Modern Period (in the framework of PICS, (see p. 28)
- 16 – 18 November 2000: Science between Money and Mind (see p. 116)
- 1 – 12 December 2000: Science and the City (see p. 58)
- 14 – 16 December 2000: The Foundations of Quantum Physics before 1935 (Department I together with German Physical Society, IUHPS-DHS and European Physical Society)
- 18 – 19 December 2000: What's in a Line: Drawing as Intelligence and Intelligibility (see p. 47)
- Spring 2001: Workshop on spatial thinking (see p. 18)
- 1 – 4 March 2001: The Mapping Cultures of 20th Century Genetics (organized by *Hans-Jörg Rheinberger* and *Jean-Paul Gaudillière*, CERNES, Paris)
- 11 – 12 May 2001: Historical Perspectives on Anthropomorphism in the Sciences (see p. 43)
- 24 – 27 May 2001: A Cultural History of Heredity - 17th and 18th Centuries (organized by *Hans-Jörg Rheinberger* and *Peter McLaughlin*)
- 1 – 2 June 2001: Moralizing Nature, 1600–1750 (see p. 43)
- 1 –10 June 2001: Fourth International Laboratory for the History of Science: *Art, Science, and Techniques of Drafting in the Renaissance* (held by the Istituto e Museo di Storia della Scienza, organized by an international consortium, see p. 108) in Florence and Vinci
- 13 – 24 August 2001: Berlin Summer Academy 2001: Human Origins
- Summer 2001: Workshop on the Epistemic History of Architecture (Department I)
- October 2001: Bioethics and History (Department III, organized by *Thomas Potthast*)

The Institute's Colloquia

- 11 February 1998** *Bernadette Bensaude-Vincent*: Atomism and Positivism in the 19th Century France
- 25 February 1998** *Nicholas Jardine*: The Production of Meanings
- 18 March 1998** *Silvan S. Schweber*: The Moral Responsibility of the Scientist: Bethe and Oppenheimer
- 8 April 1998** *Rudolf Stichweh*: Globalisierung des Wissenschaftssystems: Historische und Systematische Aspekte

- 22 April 1998** *Jürgen Mittelstraß*: Das Undenkbare denken. Über den Umgang mit dem Undenkbaren und Unvorstellbaren in der Wissenschaft
- 29 April 1998** *Neel Smith*: Reading Ptolemy's Geography with a GIS: Observations on his Data Sources and Methods
- 20 May 1998** *Alan Gabbey*: The Mind and its Place in Newtonian Nature
- 3 June 1998** *Evelyn Fox Keller*: Form and Formalism: The Place of Mathematics in Studies of Biological Form: 1917 – 1997
- 17 June 1998** *Theodore Porter*: Positivist Science and the Enlightenment Tradition
- 8 July 1998** *Robert Brain, M. Norton Wise*: Muscles and Engines – Hermann von Helmholtz in the Industrializing Military State
- 9 September 1998** *Abdelhamid I. Sabra*: Problems in the Transmission of Greek Science to Islam
- 7 October 1998** *Salvo D'Agostino*: The Bild-Conception of Physics from Helmholtz to Schrödinger
- 21 October 1998** *John Pickstone*: Foucault, Kuhn, Gillispie and the Age of Analysis: towards a synoptic History of Science Technology and Medicine, 1780–1850
- 4 November 1998** *Nils Roll-Hansen*: Eugenics in Scandinavia after 1945: Change of Values and Growth in Knowledge
- 11 November 1998** *Joella Yoder*: The manuscripts of Christiaan Huygens: Their history as exemplified by the condition of de motu and de vi centrifuga
- 16 December 1998** *Margit Szöllösi-Janze*: Lebens-Geschichte – Wissenschafts-Geschichte. Vom Nutzen biographischer Forschung für Geschichtswissenschaft und Wissenschaftsgeschichte
- 3 February 1999** *Andrew Warwick*: Making sense of Maxwell in Victorian Cambridge
- 10 February 1999** *Raphael Falk*: Can the Norm of Reaction Save the Gene Concept?
- 24 March 1999** *Daniel Garber*: On the Frontlines of the Scientific Revolution: How Mersenne Learned to Love Galileo
- 7 April 1999** *Paul U. Unschuld*: Social Dynamics in Ancient China as Reflected in Ancient Chinese Medical Thought – Findings in the Mawangdui Manuscripts and the Huang Di Neijing Suwen of the 2nd Century B.C. to the 3rd Century A.D.
- 21 April 1999** *Michel Blay*: Force, Continuity, and the Mathematization of Motion at the End of the XVIIth Century (Newton, Leibniz, Varignon)
- 5 May 1999** *Alan Rocke*: Gießen on the Seine: French Academic Chemical Laboratories, 1830–1870
- 30 June 1999** *David Gugerli*: Sociotechnical Evidence. The “pictorial turn” as a challenge for historiography
- 15 July 1999** *Howard Gruber*: The Idea of Point of View
- 11 August 1999** *M. Norton Wise*: Drawing with Precision
- 20 October 1999** *Manfred Laubichler*: Allgemeine Biologie: Between Conceptual Unification and Popularization of the Life Sciences
- 17 November 1999** *George Weisz*: Rethinking Medical Specialization in Comparative Perspective
- 15 December 1999** *Robert Proctor*: A Historian of Science in Court: Three Trials to Compensate Forcible Sterilization, Radiation Experimentation, and Tobacco Industry Malfeasance

Academic Achievements, Scientific Awards and Memberships

Habilitation thesis

Ursula Klein completed her Habilitation thesis on “Experimente, Modelle, Paper-Tools – Kulturen der organischen Chemie im 19. Jahrhundert” and received the *venia legendi* in philosophy with a focus on the history of science by the University of Konstanz in January 2000.

PhD theses

Francesca Bordogna completed her thesis on “The Scientific Contexts of William James’s Pragmatist Epistemology” and was awarded her PhD by the University of Chicago in December 1998.

Nani Clow completed her thesis on “The Laboratory of Victorian Culture: Experimental Physics, Industry, and Pedagogy in the Liverpool Laboratory of Oliver Lodge, 1881–1900” and was awarded her PhD by Harvard University in August 1999.

Sarah Jansen completed her thesis on “‘Schädlinge’: Zur Selbstkonstruktion der angewandten Entomologie in Deutschland, 1840–1920” and was awarded her PhD by the Technical University of Braunschweig in July 1997.

Cheryce Kramer completed her thesis on “A Fool’s Paradise: The Psychiatry of Gemueth in a Biedermeier Asylum” and was awarded her PhD by the University of Chicago in June 1998.

Mark Schiefsky completed his thesis “Techne and Method in the Hippocratic Treatise ‘On Ancient Medicine’” and was awarded his PhD by Harvard University in June 1999.

Appointments

Christophe Bonneuil (Predoctoral/Postdoctoral Research Fellow August 1996 – February 1998) was appointed as Chercheur at Centre Koyré d’Histoire des Sciences et des Technique, Paris, France.

Francesca Bordogna (Predoctoral Research Fellow April – December 1996, Postdoctoral Research Fellow October 1998 – June 1999) was appointed as Assistant Professor at the University of Notre Dame, USA.

Jordi Cat (Postdoctoral Research Fellow October 1997 – September 1998) was appointed as Lecturer at the University of Chicago, USA.

Cristina Chimisso (Postdoctoral Research Fellow October 1997 – October 1998) was appointed as Lecturer at the University of Aberdeen, UK.

William Clark (Research Scholar October 1997 – September 1998) was appointed as Visiting Lecturer at Cambridge University, UK.

Berna Kılıç Eden (Predoctoral Research Fellow September 1995 – December 1996, Postdoctoral Research Fellow September 1997 – September 1998) was appointed as Assistant Professor at the Bogazici University, Istanbul, Turkey.

Fa-ti Fan (Postdoctoral Research Fellow September 1999 – August 2001) was appointed as Assistant Professor at the State University of New York at Binghamton, USA.

Patricia Fara (Postdoctoral Research Fellow October 1998 – September 1999) was appointed as Lecturer at Cambridge University, UK.

Antonio García Belmar (Postdoctoral Research Fellow September 1997 – August 1998) was appointed as investigador contratado at Consejo Superior de Investigaciones Científicas, Universitat de València, Spain.

Peter Geimer (Postdoctoral Research Fellow June 1997 – January 1999) was appointed as wissenschaftlicher Mitarbeiter at the Sonderforschungsbereich Anthropologie und Literatur at Universität Konstanz, Germany.

Gerd Graßhoff (Research Scholar April 1995 – March 1999) was appointed as Professor at the University of Berne, Switzerland.

Kilian Heck (Postdoctoral Research Fellow October 1997 – December 1999 and June 1999 – September 1999) was appointed as wissenschaftlicher Assistent at Universität Heidelberg, Germany.

Alain Herreman (Postdoctoral Research Fellow October 1997 – September 1998) was appointed as Chercheur Associé at CNRS, REHSEIS, Paris, France.

David Hyder (Postdoctoral Research Fellow September 1998 – August 2000) was appointed as wissenschaftlicher Assistent at Universität Konstanz, Germany.

Michel Janssen (Postdoctoral Research Fellow Summer 1998 and 1999) was appointed as Assistant Professor at Boston University, USA.

Doris Kaufmann (Research Scholar October 1995 – March 1998, Research Director of the project History of the Kaiser-Wilhelm-Gesellschaft during the National Socialist period April 1998 – February 2000) was appointed as Professor at Universität Bremen, Germany.

Alexei Kojevnikov (Postdoctoral Research Fellow October – December 1995, April – September 1996, Visiting Scholar June 1998 – July 1998) was appointed as Assistant Professor at the University of Georgia, Athens, USA.

Morgane Labbé (Postdoctoral Research Fellow October 1996 – September 1998) was appointed as Consultant at Centre de Civilisation Française, University of Warsaw, Poland.

William Lynch (Postdoctoral Research Fellow January 1999 – August 1999) was appointed as Assistant Professor at the Wayne State University, USA.

Michael May (Postdoctoral Research Fellow April 1997 – March 1998) was appointed as Teamleiter at GMD – Forschungszentrum Informationstechnik, Sankt Augustin, Germany.

Andrew Mendelsohn (Postdoctoral Research Fellow/Research Scholar October 1995 – August 2000) was appointed as Lecturer at the Centre for the History of Science, Technology and Medicine, Imperial College, University of London, UK.

Hélène Mialet (Postdoctoral Research Fellow September 1998 – August 1999) was appointed as Assistant Professor at Cornell University, Ithaca, USA.

Javier Moscoso (Postdoctoral Research Fellow June 1998 – September 1998) was appointed as Professor at Universidad de Murcia, Spain.

Staffan Müller-Wille (Predoctoral/Postdoctoral Research Fellow May 1996 – May 1998) was appointed as wissenschaftlicher Mitarbeiter at Deutsches Hygienemuseum, Dresden, Germany.

Marc J. Ratcliff (Postdoctoral Research Fellow October 1997 – August 1998) was appointed as Assistant (FNRS) at the University of Geneva, Switzerland.

Sophie Roux (Postdoctoral Research Fellow/Research Scholar October 1996 – August 1998) was appointed as Professeur agrégé at Centre Alexandre Koyré/École des Hautes Etudes en Sciences Sociales, Paris, France.

Britta Scheideler (Postdoctoral Research Fellow October 1995 – September 1997, Visiting Scholar September 1998 – October 1998) was appointed as wissenschaftliche Mitarbeiterin at Johannes Gutenberg-Universität, Mainz, Germany.

Mark Schiefsky (Postdoctoral Research Fellow January 1999 – December 1999) was appointed as Assistant Professor at Harvard University, Cambridge, USA.

Jérôme Ségal (Postdoctoral Research Fellow March 1999 – November 2000) was appointed as Maître de Conférence at Institut Universitaire de Formation des Maîtres, Paris.

Jonathan Simon (Postdoctoral Research Fellow September 1997 – August 1998) was appointed as Lecturer at the University of Sydney, Australia.

Denis Thieffry (Research Scholar July 1997 – December 1998) was appointed as Professor at Université d'Aix-Marseille II.

Scott Walter (Postdoctoral Research Fellow January 1998 – January 1999) was appointed as Assistant Professor and Director of the Philosophy Department the ACERHP, Université Nancy 2, France.

Michael Wintroub (Research Scholar September 1998 – August 1999) was appointed as Assistant Professor at the University of Michigan, USA.

Awards

The Book “Wonders and the Order of Nature” by *Lorraine Daston* and *Katharine Park* was awarded the Roland H. Bainton Book Prize 1999 and the Pfizer Price of the History of Science Society 1999. The electronic representation of Galileo’s manuscript Ms. Gal. 72 (see p. 27) was awarded the Pirelli INTERNETional Award 1998.

Tara Nummedal’s essay “Alchemical Reproduction and the Strange Career of Anna Maria Zieglerin” was awarded the Partington Prize by the Society for the History of Alchemy and Chemistry.

Outreach

Public Evening Lecture Series 1998: The Sciences of the Body

Barbara Duden (Universität Hannover): Entkörperung in der Moderne – Zur Geschichte des erlebten (Frauen-) Körpers zwischen 1950 und 1990

Michael Hagner (Max-Planck-Institut für Wissenschaftsgeschichte): In der Grenzregion von Körper und Seele. Zur Geschichte des Schwindels im 19. Jahrhundert

Emma Spary (University of Warwick): A Taste for Learning: Gastronomy and the Sciences in Post-Revolutionary France

Heinrich von Staden (Yale University): Reading the Agonal Body: The Language of Conflict and Competition in “Hippocrates”

Public Lecture 1998

Elfrieda und Erwin Hiebert (Harvard University): Naturwissenschaft und Musik – Das Erbe von Hermann von Helmholtz. Reflexionen über die musikalische Praxis mit Beispielen am Klavier

Public Evening Lecture Series 1999: Media of thinking

Michael S. Mahoney (Princeton University): Rechnen – Denken – rechnendes Denken

Christina von Braun, Institut für Kulturwissenschaft, Humboldt-Universität zu Berlin:
Der Körper des Alphabets

Peter Damerow (Max-Planck-Institut für Wissenschaftsgeschichte): Anatomie der ungeborenen Zahl – Entzifferung der numerischen Notierungen in proto-keilschriftlichen Verwaltungstexten Mesopotamiens (3.200 – 3.000 v. Chr.)

Jan Assmann (Ägyptologisches Institut, Ruprecht-Karls-Universität Heidelberg):
Die Inanghaltung der Welt – Riten als Medien des Denkens im alten Ägypten

Studenttag Wissenschaftsgeschichte

Since its inception in January 1999 this history of science workshop has convened around 30 pre- and postdoctoral scientists twice a year to discuss their work in progress. It is jointly organized by *Michael Becker*, Wissenschaftskolleg zu Berlin, and *Cornelius Borck*, Max Planck Institute for the History of Science.

Book Presentation

The Book *Ecce Cortex* (see p. 57) was presented to the public on 23 September, 1999.

Conference Project: Science between Money and Mind (Wissenschaft zwischen Geld und Geist) November 16-18, 2000

Lorraine Daston, Matthias Dörries, Michael Hagner

“First of all it’s about money.... No, first of all, I admit it, it’s about simplicity.... The most important criterion is a simple question with a simple system that nobody else works on, and to which I can give a simple answer, so that my research funding will be renewed.” This sober remark of a rising young biologist at the end of the twentieth century stands in sharp contrast to Max Planck’s propagation in 1946 of “absolute values in the sciences and ethics... to strive for which is the real task of an intellectually active human being.” By these absolute values Planck meant not only the determination of physical constants, as he had done for the quantum of action, but also the scientist’s “truthfulness... with himself.”

Pragmatism and idealism – or, reduced to essences, money and mind – seem irreconcilable; and there is little doubt that the (self-)image of the sciences has oscillated between the two poles. However, to find evidence that science had ever existed without money would be as difficult as to assert that the sciences at the end of the twentieth century could be reduced entirely to economic conditions. Today, on the threshold of the next millennium, discussions about science’s future and financing move between the economic – practical feasibility – and the cultural – intellectual self-understanding. This conference will illuminate science’s Janus faces from a range of perspectives, encompassing both the humanities (*Geisteswissenschaften*) and the natural sciences (*Naturwissenschaften*).

In the twentieth century, human curiosity and the desire for knowledge witnessed increasing coordination, concentration, industrialization and instrumentalization, driven by increasing resources. Does the actual intellectual achievement of this century lie in this organization of intellect? Take, as a consequence of this development, research proposals and their increasing influence on scientific competition. Research proposals are hybrids: on the one hand they emphasize utility and efficiency; on the other, they have little hope of success if they do not incorporate and perpetuate specific cultural and scientific values.

Similar tensions also inform the creation and uses of patents. On the one hand, there is the ideal of intellectual priority and scientific knowledge; on the other, there are solid financial interests, including the acquisition and rapid pace of information and technology turnover, mimicking commodities in the market of scientific production.

A scientific career also manifests tension between pragmatic aims and a “higher calling.” The scientist’s old ideal of individual autonomy is variously realized in the university, a research center or a biotech or computer firm. Nevertheless, despite increasing organization and bureaucratization, scientists still enjoy a degree of freedom to be found in few other professions.

“Wissenschaft zwischen Geld und Geist” will highlight the following themes:

- scientific careers: pragmatic aims and “higher calling”;
- the history of research proposals: competition and intellectual achievement;
- the history of patents: commercialization of knowledge and intellectual priority;

- funding of science: national-cultural values and objective knowledge (taking archaeology as an example);
- values of science: system constraints and autonomy.

The conference aims at both exploring possible margins in the amalgam of money and intellect and providing some initial answers to the questions raised. It aims to contribute to the historical and cultural self-understanding of our scientific world at the turn of the millennium.

Publications and Preprints

Publications

Abattouy, Mohamed. "Les mathématiques de l'isochronisme chez Galilée." In *Dirasat Falsafiyya wa susyulujiyya muhdat ila Jamal el-Dine Alaoui (Philosophical and sociological studies dedicated to Jamal el-Dine Alaoui)*, ed. Faculty of Letters Department of Philosophy, Fez University. 63-91. Fez: Faculty of Letters, Fez Univ., 1999.

Abattouy, Mohamed. "Al-Muzaffar al-Isfizari, 'alim mikaniki min al-qarnayn 5-6/ 11-12, mu'allif Irshad dhawi al-cirfan ila sina'at al-qaffan" [al-Muzaffar al-Isfizari a mechanician scholar of the Vth-VIth/XIth-XIIth centuries, author of Guiding the Learned Men in the Art of the Steelyard." In *Quatrième Colloque Marocain d'Histoire des Sciences (Murrakush, 12-15 février 1998) in Marrakesch, February 12-15 1998*, Rabat: Publications de la Faculté des Lettres Rabat-Agdal, in press.

Abattouy, Mohamed. "The Arabic tradition of mechanics : historical and textual characterisation." *Review of the Faculty of Letters Dhar el-Mehraz in Fez* (in press)

Abattouy, Mohamed. "The Aristotelian foundations of Arabic mechanics : IXth-XIIth centuries." In *The dynamics of natural philosophy in the Aristotelian tradition and beyond, organised by the Center for Medieval and Natural Philosophy, Nijmegen University, August 15-21, 1999*, ed. Christoph Luethy. Leiden: Brill, in press.

Abattouy, Mohamed. "'Mechané' vs. 'hiyal' : essai d'exploration sémantique et conceptuelle." In *Proceedings of the International Conference 'The problem of imagination and rationality in the history of scientific knowledge', Rabat 29.-30.10.1998*, Rabat: Faculty of Letters Rabat-Agdal Press, in press.

Abattouy, Mohamed. "'Nutaf min al-hiyal' : an Arabic short version of Pseudo-Aristotle's 'Problemata mechanica'." *Early science and medicine* (in press)

Abattouy, Mohamed. "Sur quelques démonstrations grecques et arabes de la loi du levier : transmission et transformation." In *Cinquième Colloque Marocain d'Histoire des Sciences (Murrakush, 11-14 février 1999)*, Rabat: Publications de la Faculté des Lettres Rabat-Agdal, in press.

Abattouy, Mohamed and Paul Weinig, eds. *Intercultural transformation of scientific knowledge in the Middle Ages*. Special issue of "Science in Context", in press.

Abdounur, Oscar Joao. *Matematica e musica : o pesnamento analogico na construação de significados*. Sao Paulo: Editora Escrituras, in press.

Algazi, Gadi. "Tradition als Gespräch der Ungleichen : Bauern und Herren in der spätmittelalterlichen Dorfversammlung." In *Eid und Wahrheitssuche*, eds. Stefan Esders and Thomas Scharff. 191-210. Frankfurt am Main: Lang, 1999.

Algazi, Gadi. "Bodily rites and social organization : Norbert Elias's process of civilization." *Zmanim – a historical quarterly* 70 (in press): 62-83.

Algazi, Gadi. "Pruning peasants : private war and maintaining the Lords' peace in late medieval Germany." In *Medieval transformations : texts, power and gifts in context*, eds. Esther Cohen and Mayke De Jong. 245-274. Leiden: Brill, in press.

Algazi, Gadi and Rina Drory. "Love : a code for social competence at the Abbasid court." *Annales histoire, sciences sociales* (in press)

Ash, Mitchell G. and Michael Hau. "Der normale Körper, seelisch erblickt." In *Gesichter der Weimarer Republik : eine physiognomische Kulturgeschichte*, eds. Claudia Schmolders and Sander L. Gilman. Köln: DuMont Verlag, in press.

Asman, Carrie Lee. "Die Alchemistenküche, ein Laboratorium der Kunst." *Internationales Atelierprogramm, Künstlerhaus Bethanien* (1999)

Asman, Carrie Lee. "Le tresor du Goethe : le collectionneur et ses dons." *Revue Germanique Internationale* 12 (1999): 153-161.

Asman, Carrie Lee. "Wunderkammer Europa, von Xanadu bis Weimar." *Kunstforum International* (in press)

Becker, Peter and William Clark. "Introduction." In *Little tools of knowledge : historical essays in academic and bureaucratic practices*, eds. Peter Becker and William Clark. Michigan: Univ. of Michigan Press, in press.

Becker, Peter and William Clark, eds. *Little tools of knowledge : historical essays in academic and bureaucratic practices*. Michigan: Univ. of Michigan Press, in press.

Berger, Jutta. "Review of: Kritsman, V. A.; Zaikov, G. E.; Emanuel, N. M.: Chemical kinetics and chain reactions : historical aspects. New York, NY, Nova Science Publ. 1995." *NTM (Neue Serie)* 6 (3 1998): 185-186.

Berger, Jutta. *Affinität und Reaktion : über die Entstehung der Reaktionskinetik*. Studien und Quellen zur Geschichte der Chemie ; 9, Berlin: Verl. für Wissenschafts- und Regionalgeschichte Engel, in press.

Beurton, Peter. "Darwins Notebooks und die Ausbildung der Selektionstheorie." *Jahrbuch für Geschichte und Theorie der Biologie* 5 (1998): 7-34.

Beurton, Peter. "Was sind Gene heute?" *Theory in biosciences* 117 (1998): 90-99.

Beurton, Peter. "Was ist die Synthetische Theorie?" In *Die Entstehung der Synthetischen Theorie: Beiträge zur Geschichte der Evolutionsbiologie in Deutschland 1930-1950*, eds. Thomas Junker and Eve-Marie Engels. 79-105. Berlin: Verlag Wissenschaft und Bildung, 1999.

Beurton, Peter. "Ernst Mayr through time on the biological species concept." *Theory in biosciences* (in press)

Beurton, Peter. "Gene - die Atome der Evolution?" *Jahrbuch für Geschichte und Theorie der Biologie* (in press)

Beurton, Peter. "Sewall Wright." In *Klassiker der Biologie*, ed. Ilse Jahn. München: Beck, in press.

Beurton, Peter. "Theodosius Dobzhansky." In *Klassiker der Biologie*, ed. Ilse Jahn. München: Beck, in press.

Beurton, Peter. "A unified view of the gene, or how to overcome reductionism." In *The concept of the gene in development and evolution*, eds. Peter Beurton, Raphael Falk, and Hans-Jörg Rheinberger. Cambridge: Cambridge Univ. Press, in press.

Beurton, Peter, Raphael Falk, and Hans-Jörg Rheinberger, eds. *The concept of the gene in development and evolution : historical and epistemological perspectives*. Cambridge: Cambridge Univ. Press, in press.

Blakemore, Colin, Alan Cuthbert, Sheila Jennett, Roy Porter, Londa Schiebinger, Tom Sears, and Tilli Tansey, eds. *Oxford companion to the body*. Oxford: Oxford Univ. Press, in press.

Bonneuil, Christophe. "'Penetrating the natives': peanut breeding, peasants and the colonial state in Senegal (1900-1950)." *Science, technology and society* 4 (2 1999): 273-302.

Bonneuil, Christophe. *Mettre en ordre et discipliner les tropiques : les sciences du végétal dans l'empire français, 1870-1940*. Paris: Ed. des Archives Contemporaines, in press.

Borck, Cornelius. "John C. Eccles (1903-1997) : neurophysiologist and neurophilosopher." *Journal of the history of the neurosciences* 7 (1 1998): 76-81.

Borck, Cornelius. "Tools in action : the auscultation of medical practices from past and present." *EASST review* 17 (2 1998): 3-7.

Borck, Cornelius. "Visualising nerve cells and psychological mechanisms : the rhetoric of Freud's illustrations." In *Freud and the neurosciences : from brain research to the unconscious*, eds. Gisela Guttman and Inge Scholz-Strasser. 75-86. Wien: Verlag der Österreichischen Akademie der Wissenschaften, 1998.

Borck, Cornelius. "Fühlfäden und Fangarme : Metaphern des Organischen als Dispositiv der Hirnforschung." In *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*, ed. Michael Hagner. 144-176. Göttingen: Wallstein-Verlag, 1999.

Borck, Cornelius. "Review of: Hagner, Michael: Homo cerebrialis. Der Wandel vom Seelenorgan zum Gehirn. Berlin, Berlin-Verl. 1997." *Bulletin of the history of medicine* 73 (1999): 710-711.

Borck, Cornelius. "Der Kopf im Stromkreis. Elektrodiagnose und Elektrotherapie der Psyche in der Weimarer Republik." In *Gehirn und Denken - Kosmos im Kopf*, ed. Deutsches Hygiene-Museum. 118-129. Ostfildern: Cantz, in press.

Borck, Cornelius. "Strom im Gehirn. Zur mehrfachen Erstbeschreibung elektrischer Hirnaktivität." In *Instrument - Experiment : historische Studien*, ed. Christoph Meinel. 118-127. Berlin: GNT-Verlag, in press.

Borck, Cornelius and John G. R. Jefferys. "Seizure-like events in disinhibited ventral slices of adult rat hippocampus." *Journal of neurophysiology* 82 (5 1999): 2130-2142.

Bordogna, Francesca. "Physiology and psychology of temperament in James's pragmatism." *Journal of the history of the behavioral sciences* (in press)

Borzeszkowski, Horst-Heino v. and Renate Wahsner. "Dualism of physical space-time and dynamics as a consequence of the possibility to measure and calculate motion." In *Proceedings of the conference "Physical interpretation of relativity theory", 11-14th September 1998, London*, ed. Michael C. Duffy. 56 - 62. London: British Society for the Philosophy of Science, 1998.

Borzeszkowski, Horst-Heino v. and Renate Wahsner. "Not even classical mechanics is mechanistic." In *Worldviews and the problems of synthesis : the yellow book of Einstein meets Magritte*, eds. Diederik Aerts, Hubert van Belle, and Jan van der Veken. 251-262. Dordrecht (u.a.): Kluwer Academic Publishers, 1999.

Borzeszkowski, Horst-Heino v. and Renate Wahsner. "Christian Wolff's mechanical philosophy : a comparison with Isaac Newton's mechanics." In *Between Leibniz, Newton, and Kant - philosophy and science in the 18th century*, ed. Wolfgang Lefèvre. Dordrecht: Kluwer, in press.

Borzeszkowski, Horst-Heino v. and Renate Wahsner. "Die Natur technisch denken? Zur Synthese von τέχνη und φύσις in der Newtonschen Mechanik oder das Verhältnis von praktischer und theoretischer Mechanik in Newtons Physik." In *Zur Kultur der Moral : praktische Philosophie in der posttraditionellen Gesellschaft*, ed. Michael Weingarten. Berlin: Philo-Verlag, in press.

Borzeszkowski, Horst-Heino v. and Renate Wahsner. "Non-locality versus locality: The epistemological background of the Einstein-Bohr debate." In *Proceedings of the Conference "Classical and Quantum Nonlocality", 27. 4.-4. 5. 1999, Erice*, Singapore: World Scientific, in press.

Borzeszkowski, Horst-Heino v. and Renate Wahsner. "Voltaire's Newtonianism as a bridge from English empiricism to Cartesian rationalism and its implications for the concept of mechanics in German idealism." In *Between Leibniz, Newton, and Kant - philosophy and science in the 18th century*, ed. Wolfgang Lefèvre. Dordrecht: Kluwer, in press.

Bourguet, Marie-Noëlle. "De la Méditerranée." In *L'invention scientifique de la Méditerranée. Egypte, Morée, Algérie*, eds. Marie-Noëlle Bourguet, Bernard Lepetit, Daniel Nordman, and Maroula Sinarellis. 7-30. Paris: Editions de L'École des hautes études en sciences sociales, 1998.

Bourguet, Marie-Noëlle, Daniel Nordman, Vassilis Panayatopoulos, and Maroula Sinarellis, eds. *Les enquêtes en Méditerranée : les expéditions françaises d'Égypte, de Morée et d'Algérie*. Athènes: Institut de Recherches Néohelléniques, 1999.

Bourguet, Marie-Noëlle and Bernard Lepetit, eds. *Remarques sur les images de la Méditerranée (1750-1850)*. Les enquêtes en Méditerranée : les expéditions françaises d'Égypte, de Morée et d'Algérie. Athènes: Institut de Recherches Néohelléniques, 1999.

Brain, Robert M. "The ontology of the questionnaire: Max Weber on measurement and mass investigation." *Perspectives on science* (in press)

Brain, Robert M. "Representation on the line: graphic recording and the instruments of scientific modernism." In *From energy to information : representation in art, science, and literature*, eds. Bruce Clarke and Linda Henderson. Stanford, Calif.: Stanford Univ. Press, in press.

Brain, Robert M. "Review of: Smith, Crosbie: "The science of energy". Chicago, Ill., Univ. of Chicago Press 1998." *Annals of science* (in press)

Brentjes, Sonja. "Additions to book I in the Arabic traditions of Euclid's elements." *Studies in history of medicine and science* 15 (1-2 1997-1998): 55-117.

Brentjes, Sonja. "La transmission arabe de l'introduction arithmétique dans des travaux non-mathématiques au cours du IX siècle." In *Histoire des Mathématiques Arabes. Actes du 3me Colloque Maghrébin sur l'Histoire des Mathématiques Arabes, Tipaza (Alger, Algérie), 1-3 Décembre 1 ; 1*, ed. Youcef Guergour. 23-29. Alger: Association Algérienne d'Histoire des Mathématiques, 1998.

Brentjes, Sonja. "On the Persian transmission of Euclid's elements." In *La science dans le monde iranien à l'époque islamique*, ed. Z. Vesel. 73-94. Téhéran: Institut Français de Recherche en Iran, 1998.

Brentjes, Sonja. "Crossing boundaries : new approaches to the history of "Pre-Modern" science and technology." *Science in context* 12 (3 1999): 381-384.

Brentjes, Sonja. "The interests of the republic of letters in the Middle East, 1550-1700." *Science in context* 12 (3 1999): 435-468.

Brentjes, Sonja. "Arithmetic." In *Encyclopedia of Arabic science*, ed. Roshdi Rashed. Rome: Enciclopedia Italiana, in press.

Brentjes, Sonja. "Historiography of mathematics, in Turkey, Iran, and the Arab Countries before 1970." In *Historiography of mathematics*, eds. Joseph W. Dauben and Christoph J. Scriba. San Diego: Academic Press, in press.

Brentjes, Sonja. "Observations on Hermann of Carinthia's version of the Elements and its relation to the Arabic transmission." *Science in context* (in press)

Brentjes, Sonja. "On the relation between al-Nyarizi's Arabic commentary on the Elements and the Latin version of a commentary ascribed to Anaritius." *Centaurus* (in press)

Brentjes, Sonja. "On the relation between the Ottoman Empire and the West European Republic of Letters (17th-18th centuries)." In *Proceedings of the International Congress on Learning & Education in the Ottoman World, April 12-15, 1999*, ed. Ekmeleddin Ihsanoglu. Istanbul: IRCICA, in press.

Carl, Wolfgang and Lorraine Daston, eds. *Wahrheit und Geschichte : ein Kolloquium zu Ehren des 60. Geburtstages von Lorenz Krüger. Abhandlungen der Akademie der Wissenschaften in Göttingen, Philologisch-Historische Klasse ; Folge 3 ; 231*. Göttingen: Vandenhoeck und Ruprecht, 1999.

Daston, Lorraine see also: Carl and Daston

Castagnetti, Giuseppe see: Renn, Castagnetti and Damerow

Cat, Jordi. "'The physicists' debate on unification at the end of the 20th century." *Historical studies in the physical and biological sciences* 28 (2 1998): 253-300.

Chimisso, Cristina. "Der Geist und die Fakultäten." In *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*, ed. Michael Hagner. 224-253. Göttingen: Wallstein-Verlag, 1999.

Christlieb, Norbert, Gerd Graßhoff, Andreas Nelke, Andreas Schlemminger, and Lutz Wisotzki. "Automatic spectral classification." In *Classification, data analysis, and data highways*, eds. I. Balderjahn, R. Mathar, and M. Schader. 16-23. Heidelberg: Springer, 1998.

Christlieb, Norbert, Gerd Graßhoff, Andreas Nelke, Andreas Schlemminger, and Lutz Wisotzki. "LINNÉ : a software system for automatic classification." In *Astronomical data analysis and software systems*, eds. Rudolf Albrecht, R. N. Hook, and H. A. Bushouse. 457-460. San Francisco, Calif.: Astronomical Society of the Pacific, 1998.

Clark, William see also: Becker and Clark

Clark, William. "Commentary to papers by Michael Dettelbach, Roger Hahn and Hans Peter Reill." In *Skepticism at the end of the 18th and beginning of the 19th century*, eds. Richard Popkin and Johann VanderZande. 213-218. Leiden: Brill, 1998.

Clark, William. "The death of metaphysics in enlightened Prussia." In *The sciences in enlightened Europe*, eds. William Clark, Jan Golinski, and Simon Schaffer. 423-473. Chicago, Ill.: Univ. of Chicago Press, 1999.

Clark, William. "Der Untergang der Astrologie in der deutschen Barockzeit." In *Im Zeichen der Krise : Religiosität im Europa des 17. Jahrhundert*, eds. Hartmut Lehmann and Anna-Charlotte Trepp. 433-72. Göttingen: Vandenhoeck & Ruprecht, 1999.

Clark, William. "On the table manners of academic examination." In *Wissenschaft als kulturelle Praxis : 1750-1900*, eds. Hans Erich Bödeker, Peter Hanns Reill, and Jürgen Schlumbohm. 33-67. Göttingen: Vandenhoeck & Ruprecht, 1999.

Clark, William. "On the ministerial registers of academic visitations." In *Little tools of knowledge : historical essays in academic and bureaucratic practices*, eds. Peter Becker and William Clark. Michigan: Univ. of Michigan Press, in press.

Clark, William. "On the romantic plots of the research library." In *History of the book : history of the sciences*, eds. Nicolas Jardine and Marina Frasca-Spada. 190-206. Cambridge: Cambridge Univ. Press, in press.

Clark, William. "The prosopography of enlightened science." In *The eighteenth century volume of the Cambridge history of science*, ed. Roy Porter. Cambridge: Cambridge Univ. Press, in press.

Clark, William, Jan Golinski, and Simon Schaffer. "Introduction." In *The sciences in enlightened Europe*, eds. William Clark, Jan Golinski, and Simon Schaffer. 3-31. Chicago, Ill.: Univ. of Chicago Press, 1999.

Clark, William, Jan Golinski, and Simon Schaffer, eds. *The sciences in enlightened Europe*. Chicago, Ill.: Univ. of Chicago Press, 1999.

Creager, Angela, Elizabeth Lunbeck, and Londa Schiebinger, eds. *Science, technology, and medicine in the twentieth century: What difference has feminism made?* Chicago, Ill.: Univ. of Chicago Press, in press.

Damerow, Peter see also: Renn, Castagnetti and Damerow

Damerow, Peter. "Prehistory and cognitive development." In *Piaget, evolution, and development*, eds. Jonas Langer and Melanie Killen. 247-269. Mahwah, NJ: Erlbaum, 1998.

Damerow, Peter. "Sprache und Schrift : Anmerkungen zu Niklas Luhmanns Theorie der Kommunikationsmedien." *Rechtshistorisches Journal* 17 (1998): 427-436.

Damerow, Peter. "Review of : Martin Kuckenbug: ... und sprachen das erste Wort. Die Entstehung von Sprache und Schrift. Düsseldorf: Econ, 1996." *Spektrum der Wissenschaft* (Januar 1999): 119-120.

Damerow, Peter see also: Høyrup and Damerow

Damerow, Peter. "How can discontinuities in evolution be conceptualized?" *Culture and psychology* 6 (2 in press): 155-160.

Damerow, Peter, Gideon Freudenthal, Peter McLaughlin, and Jürgen Renn. *Exploring the limits of preclassical mechanics*. 2nd ed., New York, NY: Springer, in press.

Damerow, Peter and Wolfgang Lefèvre. "Wissenssysteme im geschichtlichen Wandel." In *Enzyklopädie der Psychologie. Themenbereich C: Theorie und Forschung, Serie II: Kognition, Band 6: Wissen*, eds. Friedhart Klix and Hans Spada. 77-113. Göttingen: Hogrefe, 1998.

Damerow, Peter and Jürgen Renn. *Galileo Galilei's notes on motion : electronic representation of the manuscript Ms. Gal. 72*, <http://www.mpiwg-berlin.mpg.de/Galileo_Prototype/INDEX.HTM>. Members of the contributing institutions: Isabella Truci (Biblioteca Nazionale Centrale, Florence), Paolo Galluzzi (Istituto e Museo di Storia della Scienza, Florence), Jürgen Renn (Max Planck Institute for the History of Science, Berlin); realization: Jochen Büttner, Peter Damerow, Jürgen Renn and Simone Rieger; programming and electronic data processing: Berndt Wischnewski; transcriptions: Michele Camerota; JAVA programming: Jörg Kantel; design of the navigation system: Carmen Wedemeyer and Martin Warnke; translations: Fiorenza Z. Renn and June Inderthal, 1998.

Damerow, Peter and Jürgen Renn. "Galilei." In *Lexikon der Physik*, ed. Walter Greulich. 442-444. Band 2. Heidelberg: Spektrum-Verlag, 1999.

Damerow, Peter and Jürgen Renn. "Galileo at work : his complete notes on motion in an electronic representation." *Nuncius* 13 (1999): 781-789.

Darrigol, Olivier. "From organ pipes to atmospheric motions : Helmholtz on fluid mechanics." *Historical studies in the physical and biological sciences* 29 (1998): 1-51.

Darrigol, Olivier. "Baconian bees in the electromagnetic fields: experimenter-theorists in nineteenth-century electrodynamics." *Studies in the history and philosophy of modern physics* 30 (1999): 307-305.

Darrigol, Olivier and Jürgen Renn. "Statistical mechanics." In *History of science: the scientific revolution*, ed. Sandro Petruccioli. Rom: Istituto della Enciclopedia Italiana, in press.

Daston, Lorraine see also: Gigerenzer, Swijtink, Porter, Daston et al.

- Daston, Lorraine. "Die Kultur der wissenschaftlichen Objektivität." In *Naturwissenschaft, Geisteswissenschaft, Kulturwissenschaft: Einheit - Gegensatz - Komplementarität*, ed. Otto Gerhard Oexle. 9-39. Göttingen: Wallstein-Verlag, 1998.
- Daston, Lorraine. "Fear and loathing of the imagination in science." *Daedalus* (127 1998): 73-95.
- Daston, Lorraine. "L'invention de l'objectivité." *Les Cahiers de Science & Vie* (48 1998): 16-23.
- Daston, Lorraine. "The language of strange facts." In *Inscribing science - scientific texts and the materiality of communication*, eds. Timothy Lenoir and Ulrich Gumbrecht. 20-38. Stanford, Calif.: Stanford Univ. Press, 1998.
- Daston, Lorraine. "Nature by design." In *Picturing science, producing art*, eds. Caroline A. Jones and Peter Galison. 232-253. New York, NY: Routledge, 1998.
- Daston, Lorraine. "The nature of nature in early modern Europe." *Configurations* 6 (1998): 149-172.
- Daston, Lorraine. "Probability and evidence." In *Cambridge history of seventeenth-century philosophy*; 2, eds. Daniel Garber and Michael Ayers. 1108-1144. Cambridge: Cambridge Univ. Press, 1998.
- Daston, Lorraine. "Une histoire de l'objectivité scientifique." In *Des sciences et des techniques : un débat*, eds. Roger Guesnerie and François Hartog. 115-126. Paris: Éditions de l'École des Hautes Études en Sciences Sociales, 1998.
- Daston, Lorraine. "Wunder und Beweis im frühneuzeitlichen Europa." In *Die ungewisse Evidenz : für eine Kulturgeschichte des Beweises*, eds. Gary Smith and Matthias Kroß. 13-68. Berlin: Akademie-Verlag, 1998.
- Daston, Lorraine. "Academies and the unity of the sciences : disciplining the disciplines." *Differences : a journal of feminist cultural studies* 10 (2 1999): 67-86.
- Daston, Lorraine. "Afterword : the ethos of enlightenment." In *The sciences in enlightened Europe*, eds. William Clark, Jan Golinski, and Simon Schaffer. 495-504. Chicago, Ill.: Univ. of Chicago Press, 1999.
- Daston, Lorraine. "The anti-crisis." *Rechtshistorisches Journal* 18 (1999): 449-457.
- Daston, Lorraine. "As imagens da objectividade : a fotografia e o mapa." In *Coordinacao e apresentacao*, ed. Fernando Gil. 79-103. Lissabon: Edicoes Joao Sa da Costa, 1999.
- Daston, Lorraine. "Die Akademien und die Einheit der Wissenschaften : die Disziplinierung der Disziplinen." In *Die Königlich Preußische Akademie der Wissenschaften zu Berlin im Kaiserreich*, eds. Jürgen Kocka, Rainer Hohlfeld, and Peter Walther. 61-84. Berlin: Akademie-Verlag, 1999.
- Daston, Lorraine. "'How to make a Greek god smile' : essay review of Fisher, Philip: Wonder, the rainbow and the aesthetics of rare experiment. Cambridge: Harvard Univ. Press 1999." *London review of books* 21 (12 1999): 11-12.

Daston, Lorraine. "Kommentar zu Wendy Doniger." In *Der Mann, der mit seiner Frau Ehebruch beging*, ed. Wendy Doniger. 43-50. Frankfurt am Main: Suhrkamp, 1999.

Daston, Lorraine. "The moralized objectivities of nineteenth-century science." In *Wahrheit und Geschichte*, eds. Wolfgang Carl and Lorraine Daston. 78-100. Göttingen: Vandenhoeck und Ruprecht, 1999.

Daston, Lorraine. "Objectivity and the escape from perspective." In *The science studies reader*, ed. Mario Biagioli. 110-123. New York, NY: Routledge, 1999.

Daston, Lorraine. "Objectivity versus truth." In *Wissenschaft als kulturelle Praxis : 1750-1900*, eds. Hans Erich Bödeker, Peter Hanns Reill, and Jürgen Schlumbohm. 17-32. Göttingen: Vandenhoeck & Ruprecht, 1999.

Daston, Lorraine, ed. *Biographies of scientific objects*. Chicago, Ill.: Univ. of Chicago Press, in press.

Daston, Lorraine, ed. *Early modern science*. Cambridge: Cambridge Univ. Press, in press.

Daston, Lorraine. "Objectivity with and without words." In *Little tools of knowledge : historical essays in academic and bureaucratic practices*, eds. Peter Becker and William Clark. Michigan: Univ. of Michigan Press, in press.

Daston, Lorraine. "Preternatural Philosophy." In *Biographies of scientific objects*, ed. Lorraine Daston. Chicago, Ill.: Univ. of Chicago Press, in press.

Daston, Lorraine and Katharine Park. *Wonders and the order of nature : 1150 - 1750*. New York, NY: Zone Books, 1998.

Dierig, Sven see also: Kantel and Dierig

Dierig, Sven. "Hirngespinnste am Klavier - Über "chopinisierte" Nervensaiten im Berliner Fin de Siècle." In *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*, ed. Michael Hagner. 26-50. Göttingen: Wallstein-Verlag, 1999.

Dierig, Sven. "Urbanization, place of experiment and how the electric fish was caught by Emil du Bois-Reymond." *Journal of the history of neurosciences* (in press)

Dörries, Matthias. "Language as analogy in the natural sciences." *Berichte zur Wissenschaftsgeschichte* 22 (1 1999): 28-31.

Dörries, Matthias. "Review of: Daum, Andreas W.: Wissenschaftspopularisierung im 19. Jahrhundert : bürgerliche Kultur, naturwissenschaftliche Bildung und die deutsche Öffentlichkeit, 1848-1914. München: Oldenbourg, 1998." *Internationales Archiv für Sozialgeschichte der deutschen Literatur* (1999): <http://iasl.uni-muenchen.de/rezensio/liste/liste.htm>.

Dörries, Matthias. "The French laboratory in the nineteenth century." In *Storia della scienza. VII: La scienza dell'800, sez.D. Physica*, ed. Jed Z. Buchwald. Rom: Istituto della Enciclopedia Italiana, in press.

Dörries, Matthias. "Johann von Lamont." In *New dictionary of national biography*, ed. Henry C. G. Matthew. Oxford: Oxford Univ. Press, in press.

Dörries, Matthias. "The public face of science: François Arago." In *Actes de la V Trobadas d'història de la Ciència i de la Tècnica. Societat Catalana d'Història de la Ciència i de la Tècnica*, ed. Josep Batlló. 43-54. Barcelona: Institut d'Estudis Catalans, in press.

Dörries, Matthias. "Sciences historiques - sciences de la nature. Ernest Renan Verhältnis zu den Naturwissenschaften." In *Ernest Renan. Werk und Wirkung eines nationalen Kosmopoliten*, eds. Jochen Brüning and Friedrich Niewöhner. Berlin: Akademie-Verlag, in press.

Dürbeck, Gabriele, Jutta Schickore and Gerhard Wiesenfeldt, eds. *Wahrnehmung der Natur - Natur der Wahrnehmung : Studien zur Geschichte visueller Kultur um 1800*. Dresden: Verlag der Kunst, in press.

Eden, Berna Kılıç. "Robert Leslie Ellis and John Stuart Mill on the one and the many of frequentism." *British journal for the history of philosophy* (in press)

Eden, Berna Kılıç. "John Venn's evolutionary logic of chance." *Studies in history and philosophy of science* 30A (4 1999): 559-585.

Eden, Berna Kılıç. "Changing meanings of objective and subjective probabilities." In *Turkish studies in history and philosophy of science*, eds. Guven Guzeldere and Gurol Irzik. Dordrecht: Kluwer, in press.

Eichhorn, Wolfgang and Wolfgang Küttler. "Geschichte in möglichen Perspektiven denken : Formationsentwicklung im 19. und 20. Jahrhundert." *Sitzungsberichte der Leibniz-Sozietät* 34 (7 1999): 7-52.

Fan, Fa-ti. "Review of: James Pusey: Lu Xun and evolution. Albany, NY, State Univ. of New York Press 1998." *Journal of the history of biology* 32 (1999): 218-220.

Fan, Fa-ti. "Review of: Mark Elvin and Liu Ts'ui-jung: Sediments of time : environment and society in Chinese history. Cambridge, Cambridge Univ. Press 1998." *Endeavour* 23 (3 1999): 138.

Fan, Fa-ti. "Review of: Robert Marks: Tigers, rice, silk, and silt : environment and economy in late Imperial South China. Cambridge, Cambridge Univ. Press 1998." *Journal of interdisciplinary history* 30 (1999): 166-167.

Fan, Fa-ti. "China : general works." In *Reader's guide to the history of science*, ed. Arne Hessenbruch. London: Dearborn, in press.

Fan, Fa-ti. "China : natural history." In *Reader's guide to the history of science*, ed. Arne Hessenbruch. London: Dearborn, in press.

Fan, Fa-ti. "Hybrid discourse and textual practice: sinology and natural history in the nineteenth century." *History of science* (in press)

Fan, Fa-ti. "John Reeves." In *New dictionary of national biography*, ed. Henry C. G. Matthew. Oxford: Oxford Univ. Press, in press.

Fan, Fa-ti. "Orientalism." In *Reader's guide to the history of science*, ed. Arne Hessenbruch. London: Dearborn, in press.

Fan, Fa-ti. "Review of: Watanabe Masao: Science and cultural exchange in modern history : Japan and the West. Tokyo, Hokusen-Sha, 1997." *British journal for the history of science* (in press)

Fara, Patricia. "Review of: Morus, Iwan Rhys: Frankenstein's children : electricity, exhibition, and experiment in early-nineteenth-century London. Princeton, NJ., Princeton Univ. Press 1998." *Nature* 396 (6710 1998): 425-426.

Fara, Patricia. "Catch a falling apple : Isaac Newton and myths of genius." *Endeavour* 23 (4 1999): 167-170.

Fara, Patricia. "A magnetic entrepreneur : Gowin Knight and the promotion of science in the 18th century." *RSA Journal* (2/4 1999): 131-133.

Fara, Patricia. "Review of: Barnett, Jo Ellen: Time's pendulum : the quest to capture time, from sundials to atomic clocks. New York, NY, Plenum Trade 1998." *Isis* 90 (1999): 343-344.

Fara, Patricia. "Review of: Poole, Robert: Time's alteration : calendar reform in early modern England. London, UCL Press 1998." *The British journal of the history of science* 32 (3 1999): 363-365.

Fara, Patricia. "Review of: Winter, Alison: Mesmerized : powers of mind in Victorian Britain. Chicago, Ill., Univ. of Chicago Press 1998." *Endeavour* 23 (2 1999): 30-31.

Fara, Patricia. "Electricity and magnetism." In *Encyclopedia of the Enlightenment*, ed. Stephen Chasteen. New York, NY: Oxford Univ. Press, in press.

Fara, Patricia. "Faces of genius : images of Newton in eighteenth-century England." In *Exemplary lives*, ed. Geoffrey Cubitt. Manchester: Manchester Univ. Press, in press.

Fara, Patricia. *Posthumous lives : Isaac Newton, scientific genius and secular saint*. London: Picador Press, in press.

Ferreira, Fátima, Christof Ebner, Bettina Kramer, Georg Casari, Peter Briza, Andreas J. Kungl, Rudolf Grimm, Beatrice Jahn-Schmid, Heimo Breiteneder, Dietrich Kraft, Michael Breitenbach, Hans-Jörg Rheinberger, and Otto Scheiner. "Modulation of IgE reactivity of allergens by site-directed mutagenesis : potential use of hypoallergenic variants for immunotherapy." *FASEB Journal* 12 (1998): 231-242.

Fox Keller, Evelyn. "Structures of heredity." *Biology and philosophy* 13 (1998): 113-118.

Fox Keller, Evelyn. "Making sense of life : explanation in developmental biology." In *Biology and epistemology*, eds. Jane Maienschein and Richard Creath. 244-260. Cambridge: Cambridge Univ. Press, 1999.

Freudenthal, Gideon see: Damerow, Freudenthal, McLaughlin and Renn

García Belmar, Antonio and José Ramón Bertomeu Sánchez. *Nombrar la materia : una introducción histórica a la terminología química*. Barcelona: Serbal, 1999.

García Belmar, Antonio and José Ramón Bertomeu Sánchez. "Mateu Orfila's *Eléments de chimie médicale* and the debate about chemistry applied to medicine during the early XIXth century in France." *Ambix* 47 (in press)

García Belmar, Antonio and José Ramón Bertomeu Sánchez. "French chemistry textbooks (1802-1852) : new books for new publics and new educational institutions." In *Communicating chemistry : textbooks and their audiences, 1789-1939*, eds. Bernadette Bensaude-Vincent and Anders Lundgren. 57-89. Canton: Science History Publications, 1999.

Geimer, Peter. "Das Haus der Inkohärenz : Capriccio und Sammlung im 18. Jahrhundert." In *Kunstform Capriccio*, ed. Ekkehard Mai. 87-103. Köln: König, 1998.

Geimer, Peter. "Erwin Panofsky." In *Ästhetik und Kunstphilosophie von der Antike bis zur Gegenwart in Einzeldarstellungen*, ed. Monika Betzler. 610-614. Stuttgart: Kröner, 1998.

Geimer, Peter. "Johann Joachim Winckelmann." In *Ästhetik und Kunstphilosophie von der Antike bis zur Gegenwart in Einzeldarstellungen*, ed. Monika Betzler. 815-821. Stuttgart: Kröner, 1998.

Geimer, Peter. "Niklas Luhmann." In *Ästhetik und Kunstphilosophie von der Antike bis zur Gegenwart in Einzeldarstellungen*, ed. Monika Betzler. 514-517. Stuttgart: Kröner, 1998.

Geimer, Peter. "Die Zeiten der Ruine." In *Tomorrow forever : Architektur, Zeit, Photographie*, eds. Carl Aigner and Hubertus v. Amelunxen. 30-35. Köln: DuMont, 1999.

Geimer, Peter. "L'autorité de la photographie : révélations d'un suaire." *Etudes photographiques* 6 (1999): 67-99.

Gierer, Alfred. "Ibn Khaldun on solidarity ('Asabiyah') - modern science on cooperativeness and empathy : a comparison." *Philosophia naturalis* (in press)

Gierer, Alfred. "Stahls konstruktiver Antimechanismus." In *Georg Ernst Stahl in wissenschaftshistorischer Sicht*, eds. Dieter von Engelhardt and Alfred Gierer. 49-58. Barth: Heidelberg, in press.

Gigerenzer, Gerd, Zeno Swijtink, Theodore Porter, Lorraine Daston, John Beatty, and Lorenz Krüger, eds. *Das Reich des Zufalls : Wissen zwischen Wahrscheinlichkeiten, Häufigkeiten und Unschärfen*. Heidelberg: Spektrum-Verlag, 1999.

Glänzel, Wolfgang and Urs Schoepflin. "A bibliometric study of reference literature in the sciences and social sciences." *Information processing and management* 35 (1 1999): 31-44.

Glänzel, Wolfgang, Andrés Schubert, Urs Schoepflin, and Hans-Jürgen Czerwon. "An item-by-item subject classification of papers published in journals covered by the SSCI database using reference analysis." In *Proceedings of the seventh international conference of the International Society for Scientometrics and Informetrics*, ed. César A. Mácias-Chapula. 162-171. Colima: Univ. de Colima, 1999.

Glänzel, Wolfgang, Andrés Schubert, Urs Schoepflin, and Hans-Jürgen Czerwon. "An item-by-item subject classification of papers published in journals covered by the SSCI database using reference analysis." *Scientometrics* 46 (3 1999): 431-441.

Goenner, Hubert, Jürgen Renn, Jim Ritter, and Tilman Sauer, eds. *The expanding worlds of general relativity*. Einstein studies ; 7. Boston: Birkhäuser, 1999.

Gradmann, Christoph. "Hermann von Helmholtz als Physiologe und Mediziner." In *Hermann von Helmholtz : Klassiker an der Epochenwende*, eds. Helmut Klages and Heinz Lübbig. 127-151. Braunschweig: Physikalisch-Technische Bundesanstalt, 1998.

Gradmann, Christoph. "Ein Fehlschlag und seine Folgen : Robert Kochs Tuberkulin und die Gründung des Instituts für Infektionskrankheiten in Berlin 1891." In *Strategien der Kausalität : Konzepte der Krankheitsverursachung im 19. und 20. Jahrhundert*, eds. Christoph Gradmann and Thomas Schlich. 29-52. Pfaffenweiler: Centaurus, 1999.

Gradmann, Christoph. "Review of: Heinz-Peter Schmiedebach: Robert Remak (1815-1865) : ein jüdischer Arzt im Spannungsfeld von Wissenschaft und Politik." *Berichte zur Wissenschaftsgeschichte* 22 (1999): 49-51.

Gradmann, Christoph. "Geschichte als Wissenschaft: Ernst Hallier und Emil du Bois-Reymond als Kulturhistoriker." *Medizinhistorisches Journal* 35 (in press)

Gradmann, Christoph. "Koch, Robert." In *Reader's guide to the history of science*, ed. Arne Hessenbruch. London: Dearborn, in press.

Gradmann, Christoph. "Robert Koch and the pressures of scientific research: tuberculosis and tuberculin." *Medical history* 44 (in press)

Gradmann, Christoph and Thomas Schlich, eds. *Strategien der Kausalität : Konzepte der Krankheitsverursachung im 19. und 20. Jahrhundert*. Pfaffenweiler: Centaurus, 1999.

Graßhoff, Gerd see also: Christlieb, Graßhoff et. al.

Graßhoff, Gerd. "Discovery of the Urea cycle : computer models of scientific discovery." In *Computer simulations in science and technology studies*, eds. Petra Ahrweiler and Nigel Gilbert. 71-90. Berlin: Springer, 1998.

Graßhoff, Gerd. "Modelling the astrophysical object SS433 : methodology of model construction by a research collective." *Philosophia naturalis* 35 (1 1998): 161-199.

Graßhoff, Gerd. "Kepler." In *Lexikon der Physik*, ed. Walter Greulich. 217-218. Band 3. Heidelberg: Spektrum-Verlag, 1999.

Graßhoff, Gerd. "Kosmologie." In *Der neue Pauly : Enzyklopädie der Antike in 15 Bänden und Register ; 6*, eds. Hubert Cancik and Helmuth Schneider. 769-778. Stuttgart: Metzler, 1999.

Graßhoff, Gerd. "Instrumente, Forschungspraxis und kausales Schließen." In *Kausales Schließen*, eds. Michael May and Uwe Ostermeier. Bern: Univ. Bern, in press.

Graßhoff, Gerd. "Late Babylonian astronomical diaries." In *Ancient astronomy and divination*, ed. Noel Swerdlow. 97-147. Boston: MIT Press, in press.

Graßhoff, Gerd, Robert Casties, and Kärin Nickelsen. *Zur Theorie des Experiments : Überlegungen am Beispiel der Entdeckung des Harnstoffzyklus*. Bern studies for the history and philosophy of science, Bern: Univ. Bern, in press.

Graßhoff, Gerd and Michael May. "Causal regularities." In *Current issues in causation. Conference proceedings 10.-12.12.98, Konstanz*, ed. Wolfgang Spohn, in press.

Haas, Norbert, Rainer Nägele, and Hans-Jörg Rheinberger, eds. *Liechtensteiner Exkurse III. Aufmerksamkeit*. Eggingen: Isele, 1998.

Hagner, Michael. "Aufmerksamkeit als Ausnahmezustand." In *Aufmerksamkeit*, eds. Norbert Haas, Rainer Nägele, and Hans-Jörg Rheinberger. 273-294. Eggingen: Isele, 1998.

Hagner, Michael. "Jan Evangelista Purkyně." In *Deutsche Biographische Enzyklopädie*, eds. Walther Killy and Rudolf Vierhaus. 91-92. Band 8. München: Saur, 1998.

Hagner, Michael. "Johannes Müller." In *Deutsche Biographische Enzyklopädie*, eds. Walther Killy and Rudolf Vierhaus. 271. Band 7. München: Saur, 1998.

Hagner, Michael. "Review of: S. Th. Soemmerring, Werke. Band 16 und 17. Rezensionen für die Göttingischen Gelehrten Anzeigen." *NTM Neue Serie* 6 (1998): 191-192.

Hagner, Michael. "Review of: Steven Shapin, Die wissenschaftliche Revolution." *Frankfurter Rundschau, Literaturbeilage*, 25. 11. 1998, 13.

Hagner, Michael. "Caspar Friedrich Wolff." In *Deutsche Biographische Enzyklopädie*, eds. Walther Killy and Rudolf Vierhaus. 570-571. 10. München: Saur, 1999.

Hagner, Michael, ed. *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*. Göttingen: Wallstein, 1999.

Hagner, Michael. "Enlightened monsters." In *The sciences in enlightened Europe*, eds. William Clark, Jan Golinski, and Simon Schaffer. 175-217. Chicago, Ill.: Univ. of Chicago Press, 1999.

Hagner, Michael. "Gehirnführung : zur Anatomie der geistigen Funktionen, 1870-1930." In *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*, ed. Michael Hagner. 177-205. Göttingen: Wallstein, 1999.

Hagner, Michael. "Kluge Köpfe und geniale Gehirne : zur Anthropologie des Wissenschaftlers im 19. Jahrhundert." In *Wissenschaft als kulturelle Praxis : 1750-1900*, eds. Hans Erich Bödeker, Peter Hanns Reill, and Jürgen Schlumbohm. 299-333. Göttingen: Vandenhoeck & Ruprecht, 1999.

Hagner, Michael. "Moderne Gehirne." In *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*, ed. Michael Hagner. 7-25. Göttingen: Wallstein-Verlag, 1999.

Hagner, Michael. "Prolegomena to a history of radical brains in the nineteenth century: Physiognomics, phrenology, brain anatomy." *PHYSIS* 36 (1999): 321 – 338

Hagner, Michael. "Review of Winau, Rolf and Müller-Dietz, Heinz: Medizin für den Staat - Medizin für den Krieg : Aspekte zwischen 1914 und 1945. Husum, Matthiesen 1994." *NTM Neue Serie* 7 (1999): 60-61.

Hagner, Michael. "Review of: Eckart, Wolfgang U. and Klaus Volkert: Hermann von Helmholtz. Pfaffenweiler, Centaurus 1996." *Medical History* 43 (1999): 281.

Hagner, Michael. "Review of: Schwarz, Ingo and Wenig, Klaus (eds.): Briefwechsel zwischen Alexander von Humboldt und Emil du Bois-Reymond. Berlin, Akademie-Verl. 1997." *NTM Neue Serie* 7 (1999): 53.

Hagner, Michael. "Review of: Wagener, Silke: Pedelle, Mägde und Lakaien : das Dienstpersonal an der Georg-August-Universität Göttingen 1737-1866. Göttingen, Vandenhoeck & Ruprecht 1996." *Gesnerus* 56 (1999): 159-160.

Hagner, Michael. "Rudolph Wagner." In *Deutsche Biographische Enzyklopädie*, eds. Walther Killy and Rudolf Vierhaus. 289. 10. München: Saur, 1999.

Hagner, Michael. "Values and the body : sketches for a history of psychosomatics in Germany." In *Yearbook of the Collegium Helveticum Zürich*, 355-373. Zürich: Haffmans, 1999.

Hagner, Michael. "Wissenschaftsgeschichte als Experimentalkultur?" *Frankfurter Rundschau*, March 2 1999, 7.

Hagner, Michael. "Hirnforschung als Humanwissenschaft. Das Lokalisationsparadigma im 19. Jahrhundert und frühen 20. Jahrhundert." In *Gehirn und Denken - Kosmos im Kopf*, ed. Deutsches Hygiene-Museum. 30-41. Ostfildern: Cantz, in press.

Hagner, Michael and Cornelius Borck. "Brave neuro-worlds." *Neue Rundschau* 110 (3 1999): 70-88.

Hagner, Michael and Hans-Jörg Rheinberger. "Experimental systems, objects of investigation, and spaces of representation." In *Experimental essays - Versuche zum Experiment*, eds. Michael Heidelberger and Friedrich Steinle. 355-373. Baden-Baden: Nomos-Verlag, 1998.

Hau, Michael see also: Ash and Hau

Hau, Michael. "Gender and aesthetic norms in popular hygienic culture in Germany, 1890-1930." *Social History of Medicine* 12 (2 1999): 271-292.

Hau, Michael. "The holistic gaze in German medicine, 1890-1930." *Bulletin of the history of medicine* (in press)

Heck, Kilian. "Das Grab als Buch : zum Image lutherischer Landesherrn um 1600." In *Bildnis und Image : das Portrait zwischen Intention und Rezeption*, eds. Andreas Koestler and Ernst Seidl. 179-195. Köln: Böhlau, 1998.

Heck, Kilian. "Der Körper und sein Vorurteil : das Bild von den Menschenrassen in Wissenschaft und Alltagswelt." In *Fremdkörper - fremde Körper : von unvermeidlichen Kontakten und widerstreitenden Gefühlen. Katalog zur Ausstellung des Deutschen Hygiene-Museums Dresden*, ed. Annemarie Hürlimann. 166-183. Ostfildern: Cantz, 1999.

Heck, Kilian. "Stammbäume und Webgeburten : ein Kolloquium im Potsdamer Einstein-Forum über Konzepte von Genetik und Genealogie." *Frankfurter Allgemeine Zeitung*, 136 1999, 8.

Heesen, Anke te. "Boxes in nature." *Studies in history and philosophy of science* (in press)

Heesen, Anke te. "Geschlossene und transparente Ordnungen. Sammlungsmöbel und ihre Wahrnehmung in der Aufklärungszeit." In *Wahrnehmung der Natur - Natur der Wahrnehmung. Studien zur Geschichte visueller Kultur um 1800.*, ed. Gabriele Dürbeck. Dresden: Verlag der Kunst, in press.

Heidelberger, Michael and Friedrich Steinle, eds. *Experimental essays : Versuche zum Experiment. Interdisziplinäre Studien ; 3.* Baden-Baden: Nomos-Verlag, 1998.

Helvoort, Ton van. "A century of research into the cause of cancer: is the new Oncogene Paradigm revolutionary?" *History and philosophy of the life sciences* 22 (1 in press)

Helvoort, Ton van. "A dispute over scientific credibility: The struggle for an independent Institute for Cancer Research in pre-world war II Berlin." *Studies in history and philosophy of biological and biomedical sciences* 31 (2 in press)

Helvoort, Ton van. "Scalpel or rays ? Radiotherapy and the struggle for the cancer patient in pre-world war II Germany." *Medical History* 45 (1 in press)

Hiebert, Erwin. "Geschichtliche Betrachtungen über die gemeinsamen Grenzen der exakten Wissenschaften und der Kulturwissenschaften." In *Geschichte der österreichischen Humanwissenschaften*, ed. Karl Acham. 297-321. Wien: Passagen, 1999.

Hoffmann, Christoph. "Nervensystemtelegraphie: Organismus und Apparatur." In *Fundorte des Körpers: Ansätze einer kulturwissenschaftlichen Fossilienkunde*, ed. Dietmar Schmidt. Weimar: Verlag und Datenbank für Geisteswissenschaften, in press.

Hoffmann, Dieter see also: Macrakis and Hoffmann

Hoffmann, Dieter see also: Renn and Hoffmann

Hoffmann, Dieter. "Bethe, H. (S.104), Laue, M. v. (S.587), Lenard, Ph. (S.594), Mach, E. (S.623), Pauli, W. (S.752), Physics (S.765-766), Schrödinger, E. (S.897), Sommerfeld, A. (S.934), Stark, J. (S.948), Weizsäcker, C.F. (S.1062)." In *Modern Germany : an encyclopedia of history, people, and culture, 1871-1990.*, eds. Dieter K. Buse and Jürgen C. Doerr. New York, NY: Garland, 1998.

Hoffmann, Dieter. "Heinrich Hertz and the Berlin school of physics." In *Heinrich Hertz : classical physicists, modern philosopher*, eds. Davis Baird, R. I. G. Hughes, and Alfred Nordmann. 1-8. Dordrecht: Kluwer, 1998.

Hoffmann, Dieter. "Das Physikalische Institut der Berliner Universität." *Physikalische Blätter* 55 (4 1999): 55-57.

Hoffmann, Dieter. "The divided centennial : the 1958 Max Planck celebration(s) in Berlin." *Osiris* 14 (1999): 358-369.

Hoffmann, Dieter. "Geschichte der Physik." In *Lexikon der Physik*, ed. Walter Greulich. 482-491. Band 2. Heidelberg: Spektrum-Verlag, 1999.

- Hoffmann, Dieter. "Physics in Berlin : a walk through the historical city center." *Physics in Perspective* 1 (4 1999): 445-454.
- Hoffmann, Dieter. "Robert Havemann : antifascist, communist, dissident." In *Science under socialism*, eds. Kristie Macrakis and Dieter Hoffmann. 269-285. Cambridge: Harvard Univ. Press, 1999.
- Hoffmann, Dieter. "Robert Ochsenfeld." In *Neue Deutsche Biographie*, 412-413. 19. Berlin: Duncker und Humblot, 1999.
- Hoffmann, Dieter. "Strukturen der Großforschung im Osten Deutschlands." In *Antworten auf die amerikanische Herausforderung. Forschung in der Bundesrepublik und der DDR in den "langen" siebziger Jahren*, eds. Gerhard A. Ritter, Margit Szöllösi-Janze, and Helmuth Trischler. 313-315. Frankfurt am Main: Campus-Verlag, 1999.
- Hoffmann, Dieter, Benoît Severyns, and Raymond G. Stokes, eds. *Science, technology and political change*. Turnhout: Brepols, 1999.
- Höhler, Sabine. "Luftfahrtforschung und Luftfahrtmythos: Das Rätsel der wissenschaftlichen Ballonfahrt um 1900." In *Dokumentation 25. Kongress von Frauen in Naturwissenschaft und Technik, Darmstadt, 13. bis 16. Mai 1999*, Darmstadt: FiT - Frauen in der Technik, in press.
- Höhler, Sabine. "Psychrometer, Variometer, Barograph - Instrumente der Inszenierung von Luftfahrtwissenschaftlern um 1900." In *Instrument - Experiment : historische Studien*, ed. Christoph Meinel. 325-335. Berlin: GNT-Verlag, in press.
- Høyrup, Jens and Peter Damerow, eds. *Changing views on Ancient Near Eastern mathematics*. Berlin: Reimer, in press.
- Hruška, Blahoslav. "Eninnu in Lagasch : neuer Bau eines alten Tempels." *Religio* 5 (1999): 17-32.
- Hruška, Blahoslav. "Zur Rolle der Gelehrsamkeit im alten Mesopotamien." *Novy Orient* 54 (1999): 331-341.
- Hruška, Blahoslav. "Landwirtschaft : A. Ägypten. B. Alter Vorderorient." In *Der neue Pauly : Enzyklopädie der Antike*, ed. Hubert Cancik. Stuttgart: Metzler, in press.
- Huerta, Araceli M., Heladia Salgado, Denis Thieffry, and Julio Collado-Vides. "RegulonDB: A database on transcriptional regulation." *Escherichia coli, Nucleic Acid Research* 26 (1998): 55-59.
- Hulverscheidt, Marion. "Gesundheitliche Folgen der weiblichen Genitalverstümmelung." In *Genitalverstümmelung – eine fundamentale Menschenrechtsverletzung*, ed. Petra Schnüll. 52-60. Göttingen: Terre des Femmes e.V., 1999.
- Hulverscheidt, Marion. "Weibliche Genitalverstümmelung – nicht nur ein Phänomen in Afrika." In *Genitalverstümmelung – eine fundamentale Menschenrechtsverletzung*, ed. Petra Schnüll. 229-239. Göttingen: Terre des Femmes e.V., 1999.
- Hyder, David Jalal. "Helmholtz's naturalised conception of geometry and his spatial theory of signs." *Philosophy of science* 66 (1999): 273-286.

Jansen, Sarah. "Der kranke deutsche Wald: 'Krankheit und Körperlichkeit in der Bekämpfung von Insekten in Deutschland, 1880-1920'." In *Strategien der Kausalität : Konzepte der Krankheitsverursachung im 19. und 20. Jahrhundert*, eds. Christoph Gradmann and Thomas Schlich. 151-184. Pfaffenweiler: Centaurus, 1999.

Jansen, Sarah. "Reinheit und Normalität: ‚Schädlinge‘ als Gefährdungen, statistische und experimentelle Objekte." In *Normalität und Abweichung : Beiträge zur Theorie und Geschichte der Normalisierungsgesellschaft*, eds. Werner Sohn and Herbert Mehrrens. 244-265. Opladen: Westdeutscher Verlag, 1999.

Jansen, Sarah. "‚Sozialparasiten‘ und ‚Tödlichkeitszahlen‘: zu Repräsentationsformen der Schädlingsbekämpfung in Deutschland, 1900-1925'." In *Repräsentationsformen in der Biologie*, ed. Armin Geuss. 117-134. Berlin: Verlag für Wissenschaft und Bildung, 1999.

Jansen, Sarah. "An American insect in imperial Germany : visibility and control in making the Phylloxera in Germany, 1870-1914." *Science in context* (in press)

Jansen, Sarah. "Chemical warfare techniques for insect control : insect ‚pests‘ in Germany before and after World War I." *Endeavour* (in press)

Jansen, Sarah. *‚Schädlinge‘: Geschichte eines wissenschaftlichen und politischen Konstrukts, 1840-1920*. Frankfurt am Main: Campus-Verlag, in press.

Kant, Horst. "Berufsverbote in der deutschen Geschichte - Der Fall Leo Arons." *Physik in der Schule* 36 (6 1998): 235-236.

Kant, Horst. "Der Weg zu Stalins Bombe. Zur Organisation und Entwicklung der physikalischen Wissenschaften von der Oktoberrevolution bis zum Ende der 40er Jahre." In *Wissenschaftsgeschichte in Osteuropa - Europa litterarum artiumque scientiam communicans*, eds. Aloys Henning and Jutta Petersdorf. Wiesbaden: Harrassowitz, 1998.

Kant, Horst. "Einleitungssessay über Alfred Nobel und seine Preise & 27 biographische Einzelbeiträge." In *Harenberg Lexikon der Nobelpreisträger*, 5-15 + div. Dortmund: Harenberg, 1998.

Kant, Horst. "Franz Ernst Neumann - das Königsberger Seminar für mathematische Physik und die Etablierung der theoretischen Physik in Deutschland." *Physik in der Schule* 36 (10 1998): 353-357.

Kant, Horst. "Kalendarium zu ausgewählten Daten der Naturwissenschafts- und Technikgeschichte für 1998." *Physik in der Schule* 36 (1 1998): 39.

Kant, Horst. "Bericht über ein Symposium der Arbeitsgruppe Wissenschaftsgeschichte zur Geschichte der Kaiser-Wilhelm-/Max-Planck-Gesellschaft." *NTM N.S.* 7 (1 1999): 42-43.

Kant, Horst. "The German Uranium project and the Kaiser Wilhelm Institute for Physics." In *Science and Society - History of the Soviet Atomic Project (40's - 50's), Vol. 2; Proceedings of the International Symposium HISAP'96*, eds. E. P. Velichov et al. 57-67. Moskva: IZDAT, 1999.

Kant, Horst. "Kalendarium zu ausgewählten Daten der Naturwissenschafts- und Technikgeschichte für 1999." *Physik in der Schule* 37 (1 1999): 60-61.

Kant, Horst. "Review of: Fölsing, Albrecht: Heinrich Hertz - eine Biographie. Hamburg: Hoffmann und Campe 1997." *Spektrum der Wissenschaft* (2 1999): 82.

Kant, Horst. "Review of: Frenkel, Viktor J.: Professor Friedrich Houtermans - Arbeiten, Leben, Schicksal. St. Petersburg, PIJaf 1997." *Physikalische Blätter* 55 (9 1999): 80.

Kant, Horst. "2 biographische Stichworte: A. Nobel, M. Curie." In *Makers of Western culture, 1800-1914: A biographical dictionary of literary Influences*, eds. Derek Blakeley and John Powell. Westport, Conn.: Greenwood Press, in press.

Kant, Horst. "Arnold Sommerfeld - Kommunikation und Schulbildung." In *Wissenschaftsforschung: Jahrbuch 1998/1999*, eds. Klaus Fuchs-Kittowski, Hiltrun Kretschmer, and Hubert Laitko. Berlin: BdWi-Verl., in press.

Kant, Horst. "Contribution à l'histoire de la physique à Strasbourg 1941-1944." In *Sciences et cultures nationales: Les trois universités de Strasbourg, 1872-1945*, eds. William Shea, Josephine Olf-Nathan, and Mark Walker. Paris: Editions BELIN, in press.

Kant, Horst. "Friedrich Paschen." In *Neue Deutsche Biographie*, ed. Historische Kommission der Bayerischen Akademie der Wissenschaften. 20. Berlin: Duncker & Humblot, in press.

Kant, Horst. "Otto Hahn and the declarations of Mainau and Göttingen." In *Proceedings of the International Symposium HISAP'99*, in press.

Kant, Horst. "Review of: Andreas Fickers: "Der Transistor" als technisches und kulturelles Phänomen. Bassum: GNT-Verl. 1998." *NTM N.S.* 8 (in press)

Kant, Horst. "Review of: Krafft, Fritz: Vorstoß ins Unerkannte - Lexikon großer Naturwissenschaftler. Weinheim 1999." *Chemie in unserer Zeit* (in press)

Kant, Horst. "Rudolf Peierls." In *Neue Deutsche Biographie*, ed. Historische Kommission der Bayerischen Akademie der Wissenschaften. Berlin: Duncker & Humblot, in press.

Kant, Horst. "Stichwort Kaiser-Wilhelm-/Max-Planck-Gesellschaft." In *Reader's guide to the history of science*, ed. Arne Hessenbruch. London: Dearborn, in press.

Kantel, Jörg and Sven Dierig. "Zur Verwaltung großer Datenmengen im WWW. "The Virtual Institute for Physiology Project" (VIPP)." In *Internet- und Intranet-Technologien in der wissenschaftlichen Datenverarbeitung*, eds. Friedrich Kaspar and Hans-Ulrich Zimmermann. 3-23. Göttingen: Gesellschaft für wissenschaftliche Datenverarbeitung, 1999.

Kaufmann, Doris. "Eugenik - Rassenhygiene - Humangenetik : zur lebenswissenschaftlichen Neuordnung der Wirklichkeit in der ersten Hälfte des 20. Jahrhunderts." In *Erfindung des Menschen : Schöpfungsträume und Körperbilder 1500-2000*, ed. Richard van Dülmen. 347-365. Wien: Böhlau, 1998.

Kaufmann, Doris. "Les sexes et la nature humaine dans le 'Voyage autour du monde' de Georg Forster (1771-1775)." *Gradhiva. Revue d'histoire et d'archives de l'anthropologie* 23 (1998): 61-66.

Kaufmann, Doris. "Science as cultural practice : psychiatry in the First World War and Weimar Germany." *Journal of contemporary history* 34 (1 1999): 123-142.

Kaufmann, Doris. "'Widerstandsfähige Gehirne' und 'kampfunlustige Seelen': zur Mentalitäts- und Wissenschaftsgeschichte des 1. Weltkriegs." In *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*, ed. Michael Hagner. 206-223. Göttingen: Wallstein-Verlag, 1999.

Kazemi, Elke. *Die bewegte Seele : das spätantike "Buch über das Wesen der Musik (Kitāb 'unṣur al-mūsīqī)" von Paulos/Būlos in arabischer Übersetzung vor dem Hintergrund der griechischen Ethoslehre*. The Science of Music in Islam ; 5, Frankfurt am Main: Univ. Frankfurt, Inst. f. Gesch. d. Arabisch-Islamischen Wiss., 1999.

Kazemi, Elke see also: Schneider and Kazemi

Kazemi, Elke see also: Schneider, Wolters and Kazemi

Klein, Ursula. "Nature and art in 17th-century French chemical textbooks." In *Reading the book of nature : the other side of the scientific revolution*, eds. Allen G. Debus and Michael T. Walton. 239-250. 1998.

Klein, Ursula. "Paving a way through the jungle of organic chemistry : experimenting within changing systems of order." In *Experimental Essays : Versuche zum Experiment*, eds. Michael Heidelberger and Friedrich Steinle. 251-271. Baden-Baden: Nomos-Verlag, 1998.

Klein, Ursula. "Do we need a philosophy of chemistry?" In *Ars Mutandi: Issues in Philosophy and History of Chemistry*, eds. Nikos Psarros and Kostas Gavroglu. 17-27. Leipzig: Leipziger Univ.-Verl., 1999.

Klein, Ursula. "Techniques of modelling and paper tools in classical chemistry." In *Models as mediators*, eds. Mary S. Morgan and Margret C. Morrison. 146-167. Cambridge: Cambridge Univ. Press, 1999.

Klein, Ursula. "4 entries: Elements; Glauber, Johann Rudolf; Lemery, Nicolas; Libavius, Andreas." In *The scientific revolution : an encyclopedia*, ed. Wilbur Applebaum. New York, NY: Garland, in press.

Klein, Ursula. "Atomic and molecular science in the first half of the XIXth century." In *Storia della scienza. VII: La scienza dell'800, sez.D. Physica*, ed. Jed Z. Buchwald. Rom: Istituto della Enciclopedia Italiana, in press.

Kreß, Angelika and Thomas Potthast. "Diskurse, Wagenburgen und die Allgegenwart der Inszenierung : Überlegungen zur Streitkultur am Beispiel der Gentechnik(debatte)." In *Inszenierungen zur Gentechnik - Konflikte, Kommunikation und Kommerz*, ed. Thomas von Schell. Köln: DuMont, in press.

Küttler, Wolfgang see also: Eichhorn and Küttler

Küttler, Wolfgang. "Geschichtsdenken und historische Wissenschaften im Systemkonflikt." In *Der Ost-West-Konflikt und sein Ende : Beiträge eines Kolloquiums zum 65. Geburtstag von Karl Drechsler*, ed. Wolfgang Küttler. 33-48. Berlin: Trafo-Verlag, 1988.

Küttler, Wolfgang. "Die DDR-Historiographie in der 'Ökumene der Historiker': Selbstverständnis und Praxis als Wissenschaftsdisziplin." In *Historische Zeitschrift. Beiheft 27: Die DDR-Geschichtswissenschaft als Forschungsproblem*, eds. Georg G. Iggers, Konrad H. Jarausch, Matthias Middell, and Martin Sabrow. 108-130. München: Oldenbourg, 1998.

Küttler, Wolfgang. "Marxismus in der Geschichtswissenschaft - Ende oder offene Zukunft? (In Litauisch)." In *Istoriografija ir atvira visuomen'e : tarptautin'es mokslin'es konferencijos Vilniaus universiteto istorijos fakultete medžiaga 1996 09 24-29 : Geschichtswissenschaft und offene Gesellschaft. Materialien der internationalen wissenschaftlichen Tagung an der Historischen Fakultät der Universität Vilnius 1996 09 24-29*, eds. Ursula A. J. Becher, Alfredas Bumblauskas, and Jörn Rösen. 115-138. Vilnius: Vilniaus Univ., 1998.

Küttler, Wolfgang. "Marxismus, kritische Sozialwissenschaft und neuer Kulturalismus." In *Wissenschaft und Politik - Diskurs : Kolloquienbeiträge zu aktuellen Problemen der F&T-Politik*, eds. Hansgünter Meyer and Helmut Steiner. 293-298. Berlin: WiSoS e.V., 1998.

Küttler, Wolfgang. "Marxistische Theorie und Geschichtswissenschaft." In *Geschichte : ein Grundkurs*, ed. Hans-Jürgen Goertz. 652-670. Reinbek bei Hamburg: Rowohlt, 1998.

Küttler, Wolfgang. "Review of: Werner Gephart: Handeln und Kultur : Vielfalt und Einheit der Kulturwissenschaften im Werk Max Webers. Frankfurt/Main, Suhrkamp 1998." *Das Argument : Zeitschrift für Philosophie und Sozialwissenschaften* 40 (6 1998): 877-878.

Küttler, Wolfgang, ed. *Das lange 19. Jahrhundert. Personen - Ereignisse - Ideen - Umwälzungen. Ernst Engelberg zum 90. Geburtstag. 2 Halbbände.* Abhandlungen der Leibniz-Sozietät ; 1. Berlin: Trafo-Verlag, 1999.

Küttler, Wolfgang. "Die marxistisch-leninistische Geschichtswissenschaft und das Systemdenken im Ost-West-Konflikt." In *Globale Konflikte, Erinnerungsarbeit und Neuorientierungen seit 1945*, ed. Wolfgang Küttler. 75-105. Frankfurt am Main: Fischer, 1999.

Küttler, Wolfgang. "Formationstheorie." In *Historisch-kritisches Wörterbuch des Marxismus. Bd. 4: Fabel bis Gegenmacht*, ed. Wolfgang Fritz Haug. 669-680. Hamburg: Argument-Verlag, 1999.

Küttler, Wolfgang. "Historiker und politischer Kopf aus Leidenschaft : Laudatio für Ernst Engelberg." In *Das lange 19. Jahrhundert. Personen - Ereignisse - Ideen - Umwälzungen. Ernst Engelberg zum 90. Geburtstag. 1. Halbband*, ed. Wolfgang Küttler. 13-19. Berlin: Trafo-Verlag, 1999.

Küttler, Wolfgang. "Karl Marx und Max Weber: Möglichkeiten und Grenzen des Fortschrittsdenkens im Verhältnis von Wissenschaft und Praxis." *Das Argument. Zeitschrift für Philosophie und Sozialwissenschaften* 41 (2/3 1999): 327-337.

Küttler, Wolfgang. "Nationalstaat, Kapitalismus, okzidentale Kultur: Deutschland und die Perspektiven der Moderne im Werk von Max Weber." In *Das lange 19. Jahrhundert. Personen - Ereignisse - Ideen - Umwälzungen. Ernst Engelberg zum 90. Geburtstag*, ed. Wolfgang Küttler. 293-317. Berlin: Trafo-Verlag, 1999.

Küttler, Wolfgang. "Review of: Eva Müller, Manfred Neuhaus, Joachim Tesch (eds.): "ich habe einige Dogmen angetastet...". Werk und Wirken von Fritz Behrens. Beiträge des vierten Walter-Markov-Kolloquiums. Leipzig: Rosa-Luxemburg-Stiftung Sachsen 1999." *Das Argument. Zeitschrift für Philosophie und Sozialwissenschaften* 41 (5 1999): 749-750.

Küttler, Wolfgang. "Review of: Gregor Schöllgen, Max Weber. München, Beck 1998." *Das Argument. Zeitschrift für Philosophie und Sozialwissenschaften* 41 (1 1999): 118-119.

Küttler, Wolfgang. "Review of: Helmut Steiner and Wladimir A. Jadow : Russland wohin? Russland aus der Sicht russischer Soziologen (= Social studies on eastern europe, ed. by Helmut Steiner. Vol.1), Berlin, Trafo-Verlag 1999." *Das Argument. Zeitschrift für Philosophie und Sozialwissenschaften* 41 (4 1999): 593-594.

Küttler, Wolfgang. "Review of: Jan Rehmann: Max Weber: Modernisierung als passive Revolution. Kontextstudien zu Politik, Philosophie und Religion im Übergang zum Fordismus. Berlin: Argument 1998." *Das Argument : Zeitschrift für Philosophie und Sozialwissenschaften* 41 (1 1999): 119-122.

Küttler, Wolfgang. "Geschichte als Entwurf gesellschaftlicher Veränderung. Marx im Geschichtsdiskurs der Moderne." In *Zukunft der Geschichte. Historisches Denken an der Schwelle zum 21. Jahrhundert*, ed. Stefan Jordan. 49-60. Berlin: Trafo-Verlag, in press.

Küttler, Wolfgang, Jörn Rüsen, and Ernst Schulin, eds. *Globale Konflikte, Erinnerungsarbeit und Neuorientierungen seit 1945*. Geschichtsdiskurs in fünf Bänden ; 5. Frankfurt am Main: Fischer, 1999.

Küttler, Wolfgang and Walter Schmidt, eds. *Der Ost-West-Konflikt und sein Ende : Beiträge eines Kolloquiums zum 65. Geburtstag von Karl Drechsler*. Gesellschaft, Geschichte, Gegenwart : Schriftenreihe des Vereins Gesellschaftswissenschaftliches Forum e.V. Berlin ; 14. Berlin: Trafo-Verlag, 1998.

Labbé, Morgane. "'Race' et 'nationalité' dans les recensements du Troisième Reich : de l'auto-déclaration au diagnostic racial." *Histoire et mesure* 13 (1/2 1998): 195-223.

Lachmund, Jens. "Between scrutiny and treatment : physical diagnosis and the restructuring of 19th century medical practice." *Sociology of health and illness* 20 (6 1998): 779-801.

Lachmund, Jens. "Review of: Rheinberger, Hans-Jörg, Michael Hagner and Bettina Wahrig-Schmidt (eds.): Räume des Wissens. Berlin, Akademie-Verlag 1997." *Mittelweg* 36 7 (1 1998): 55-56.

Lachmund, Jens. "Making sense of sound: auscultation and lung-sound codification in nineteenth-century French and German medicine." *Science, technology and human values* 24 (4 1999): 419-450.

Laks, André. "Chapitre: Soul, sensation and thought." In *The early Greek philosophers*, ed. A. Long. 250-270. Cambridge: Cambridge Univ. Press, 1999.

Laks, André. "A propos du nouvel Empédocle : les vers 267-290 du poème physique étaient-ils l'hypothèse d'une double zoogonie?" *Hyperboreus* 5 (1999): 15-21.

Laks, André. "Le chapitre 7." In *Lambda de la Métaphysique d'Aristote Symposium Aristotelicum*, Oxford: Oxford Univ. Press, in press.

Landecker, Hannah. "Between beneficence and chattel : the human biological in law and science." *Science in context* 12 (1 1999): 203-225.

Landecker, Hannah. "Immortality, in vitro: a history of the HeLa cell line." In *Biotechnology and culture: bodies, anxieties, ethics*, ed. Paul Brodwin. Bloomington, Indiana: Indiana Univ. Press, in press.

Lefèvre, Wolfgang see also: Damerow and Lefèvre

Lefèvre, Wolfgang. "Hegels Geschichte der Philosophie aus wissenschaftsgeschichtlicher Perspektive." In *Hegel-Jahrbuch 1998*, eds. Andreas Arndt, Karol Bal, and Henning Ottmann. 120-124. Berlin: Akademie-Verlag, 1999.

Lefèvre, Wolfgang. "Darwin, Marx und der garantierte Fortschritt : Materialismus und Entwicklungsdenken im 19. Jahrhundert." In *Materialismus und Spiritualismus zwischen Philosophie und Wissenschaften nach 1848*, eds. Andreas Arndt and Walter Jaeschke. Hamburg: Meiner, in press.

Lefèvre, Wolfgang. "Galileo engineer : art and modern science." *Science in context* (in press)

Lefèvre, Wolfgang. "J. B. Lamarck." In *Klassiker der Biologie, Bd. 1*, ed. Ilse Jahn. München: Beck, in press.

Lefèvre, Wolfgang. "Natural or artificial systems? The 18th-century controversy on classification of animals and plants and its philosophical contexts." In *Between Leibniz, Newton, and Kant - philosophy and science in the 18th century*, ed. Wolfgang Lefèvre. Dordrecht: Kluwer, in press.

Lefèvre, Wolfgang. "Repulsion und Attraktion : der Exkurs 'Die Kantische Konstruktion der Materie aus der Attraktiv- und Repulsivkraft' in Hegels 'Wissenschaft der Logik'." In *Hegels Seinslogik : Interpretationen und Perspektiven*, eds. Andreas Arndt and Christian Iber. Berlin: Akademie-Verlag, in press.

Lefèvre, Wolfgang. "Undurchdringlichkeit." In *Historisches Wörterbuch der Philosophie*, eds. Joachim Ritter and Karlfried Gründer. 11. Basel: Schwabe & Co, in press.

Loza, Carmen Beatriz. "Du bon usage des quipus face à l'administration coloniale espagnole." *Population* 53 (1-2 1998): 139-160.

Loza, Carmen Beatriz. "Juger les chiffres : statut des nombres et pratiques de comptage dans les dénombrements andins, 1542-1560." *Histoire et mesure* 13 (1/2 1998): 13-37.

Loza, Carmen Beatriz. "Quipus y quipolas at the Museum für Völkerkunde, Berlin. Genesis of a reference collection (1872-1999)." *Baessler-Archiv* 47 (1999): 39-75.

Loza, Carmen Beatriz. "El quipu en forma de arco : una nueva variante costeña del Perú prehispánico." *Baessler-Archiv* 48 (in press)

Loza, Carmen Beatriz. "El quipu y la prueba en la practica del derecho de Incias (1550-1570)." *Revista Andina* (in press)

Loza, Carmen Beatriz. "Em modelo de Max Uhle para el estudio del quipu a la luz de sus notas inéditas de trabajo de campo (1894-1897)." *Indiana* 16 (in press)

Loza, Carmen Beatriz. "Quipu." In *Diccionario Histórico de Bolivia*, ed. Grupo de Estudios Históricos. Sucre: Grupo de Estudios Históricos, in press.

Lustig, Abigail J. "George Eliot, Charles Darwin and the labyrinth of history." *Endeavour* 23 (3 1999): 110-113.

Lustig, Abigail J. "Cultivating knowledge in nineteenth-century English gardens." *Science in context* 13 (in press)

Lustig, Abigail J. "Sex, death, and evolution in proto- and metazoa, 1873-1913." *Journal of the history of biology* 33 (in press)

Lüthy, Christoph. "Bruno's 'Area Democriti' and the origins of atomist theory." *Bruniana & Campanelliana* 4 (1998): 59-92.

Lüthy, Christoph. "Review of: Marian Fournier, *The Fabric of Life : Microscopy in the seventeenth century*. Baltimore and London: The Johns Hopkins Univ. Press, 1996." *Technology and Culture* 39 (2 1998): 325-327.

Lynch, William. *Hypothesis, analogy, and Baconian method in early Royal Society*. Stanford, Calif: Stanford Univ. Press, in press.

Lynch, William and Ron Kline. "Engineering practice and engineering ethics." *Science, technology and human values* (in press)

Macrakis, Kristie and Dieter Hoffmann, eds. *Science under socialism*. Cambridge : Harvard Univ. Press, 1999.

May, Michael see also: Graßhoff and May

May, Michael. "Causation and discovery." In *Computer simulations in science and technology studies*, eds. Petra Ahrweiler and Nigel Gilbert. 53-69. Berlin: Springer, 1999.

McLaughlin, Peter see also: Damerow, Freudenthal, McLaughlin and Renn

McLaughlin, Peter. *What functions explain*. New York, NY: Cambridge Univ. Press, in press.

Mendelsohn, J. Andrew. "From eradication to equilibrium : how epidemics became complex after World War I." In *Greater than the parts : holism in biomedicine, 1920 - 1950*, eds. Christopher Lawrence and George Weisz. 303-331. Oxford: Oxford Univ. Press, 1998.

Mendelsohn, J. Andrew. "Das wilde Gehirn : über Natur und Kultur im Zeitalter des Strukturalismus." In *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*, ed. Michael Hagner. 286-316. Göttingen: Wallstein-Verlag, 1999.

Mendelsohn, J. Andrew. "Review of: Karl-Heinz Leven: *Die Geschichte der Infektionskrankheiten: von der Antike bis ins 20. Jahrhundert*. Landsberg/Lech, Ecomed 1997." *Isis* 90 (1999): 351-352.

Mendelsohn, J. Andrew. "Von der Ausrottung zum Gleichgewicht: Wie Epidemien nach dem Ersten Weltkrieg komplex wurden." In *Strategien der Kausalität : Konzepte der Krankheitsverursachung im 19. und 20. Jahrhundert*, eds. Christoph Gradmann and Thomas Schlich. 227-268. Pfaffenweiler: Centaurus-Verlagsgesellschaft, 1999.

Mendelsohn, J. Andrew. "The body between infection and disease : heredity, etiology, and constitution in European scientific medicine, 1890-1940." In *Transmission: Human pathologies between heredity and infection*, eds. Jean-Paul Gaudillière and Ilana Löwy. Amsterdam: Harwood Academic Publishers, in press.

Mendoza, Luis, Denis Thieffry, and Elena R. Alvarez-Buylla. "Genetic control of flower morphogenesis in *Arabidopsis thaliana* : a logical analysis." *Bioinformatics* 15 (1999): 593-606.

Métraux, Alexandre. "La philosophie de la biologie et la conscience naturée." *Annales d'histoire et de philosophie du vivant* 2 (1999): 57-71.

Métraux, Alexandre. "Metamorphosen der Hirnwissenschaft : warum Sigmund Freuds 'Entwurf einer Psychologie' aufgegeben wurde." In *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*, ed. Michael Hagner. 75-109. Göttingen: Wallstein-Verlag, 1999.

Métraux, Alexandre. "Philosophy, neurology, and the pathology of symbolic consciousness : on two unpublished letters from Ernst Cassirer to Kurt Goldstein." *Science in context* 12 (4 1999): 645-660.

Métraux, Alexandre. "Tätigkeit." In *Enzyklopädie Philosophie*, ed. Hans Jörg Sandkühler. 1588-1592. Hamburg: Meiner, 1999.

Mialet, Hélène, ed. *Le sujet de l'invention*. Les Editions des Archives Contemporaines ed., Paris, in press.

Millett, David. "Illustrating a revolution." *Notes and records of the Royal Society of London* 52 (2 1998): 283-305.

Mindell, David, Jérôme Ségala, and Slava Gerovitch. "From communications engineering to communications science: Information theory in the United States, France, and the Soviet Union." In *Science and political ideology: a comparative perspective*, ed. Mark Walker. Amsterdam: Harwood Academic Press, in press.

Mitman, Gregg. *Reel nature: America's romance with wildlife on film*. Cambridge, Mass.: Harvard Univ. Press, 1999.

Moscoso, Javier. "Monsters as evidence : the uses of the abnormal body during the early eighteenth century." *Journal of the history of biology* 31 (3 1998): 355-382.

Moscoso, Javier. "Los efectos de la imaginación : medicina, ciencia y sociedad en el siglo XVIII." *Asclepio : revista de historia de la medicina y de la ciencia* (in press)

Moscoso, Javier and Antonio Lafuente, eds. *Buffon, Georges-Louis Leclerc de: Discurso preliminar de la historia natural*. Madrid: Consejo Superior de Investigaciones Científicas, 1999.

Motzkin, Gabriel. "Love and knowledge in Hermann Cohen's religion of reason." In *Hermann Cohens Religion der Vernunft aus den Quellen des Judentums*, ed. Helmut Holzhey. Hildesheim (u.a.): Olms, in press.

Motzkin, Gabriel. "Representation." *Synthese* (in press)

Müller-Wille, Staffan. *Botanik und weltweiter Handel : zur Begründung eines natürlichen Systems der Pflanzen durch Carl von Linné (1707-1778)*. Studien zur Theorie der Biologie ; 3, Berlin: Verlag für Wissenschaft und Bildung, 1998.

Müller-Wille, Staffan. "Reducing varieties to their species : the Linnean research program and its significance for modern biology." In *Carl Linnaeus and enlightened science in Spain*, ed. Enrique Martínez Ruiz. 113-126. Madrid: Fundacion Bernd Wistedt, 1998.

Müller-Wille, Staffan. "Varietäten auf ihre Arten zurückführen : zu Carl von Linnés Stellung in der Vorgeschichte der Genetik." *Theory in bioscience* 117 (1998): 346-376.

Nummedal, Tara. "Review of Blair, Ann: Theater of Nature: Jean Bodin and Renaissance Science. Princeton, NJ., Princeton Univ. Press 1997." *Renaissance Studies* 13 (2 1999): 237-240.

Olesko, Kathryn M. "The politics of fin-de-siècle physics pedagogy in Europe." *History of physics newsletter : a forum of the American Physical Society* VII (3 1998): 9-10.

Olesko, Kathryn M. "Origins of the research seminar and theoretical physics." In *Storia della scienza. VII: La scienza dell'800, sez. D. Fisica*, ed. Jed Z. Buchwald. Rom: Istituto della Enciclopedia Italiana, in press.

Olesko, Kathryn M. "Science in Germanic Europe." In *Cambridge encyclopedia for the history of science*, eds. Ronald Numbers and David Lindberg. 8: International Science. Cambridge: Cambridge Univ. Press, in press.

Ott, Konrad, Thomas Potthast, Martin Gorke, and Patricia Nevers. "Über die Anfänge des Naturschutzgedankens in Deutschland und den USA im 19. Jahrhundert." In *Naturnutzung und Naturschutz in der europäischen Rechts- und Verwaltungsgeschichte*, ed. Erk Volkmar Heyen. 1-55. Baden-Baden: Nomos-Verlag, 1999.

Pols, Hans. "Geisteskrankheiten heilen : physische Heilmethoden der Vergangenheit (In Niederländisch)." *Versie : Tijdschrift voor gezondheidszorg, burgerschap en politiek* 16 (4 1998): 12-19.

Pols, Hans. "Review of: Eugene Taylor: William James on consciousness beyond the margin. Princeton, NJ., Princeton Univ. Press 1996." *Journal for the history of the behavioral sciences* 34 (3 1998): 333-334.

Pols, Hans. "The repression of war trauma in American psychiatry after World War II." In *Medicine and modern warfare*, eds. Roger Cooter, Mark Harrison, and Steve Sturdy. 251-276. Amsterdam: Rodopi, 1999.

Pols, Hans. "The school as laboratory : a reappraisal of the "invisible period" of the Department of Psychology at the University of Toronto, 1916-1956." *History and philosophy of psychology bulletin* 11 (2 1999): 3-9.

Pols, Hans. "The world as laboratory : strategies of field research developed by mental hygiene psychologists in Toronto, 1920-1950." In *The development of the social sciences in the United States and Canada : the role of philanthropy*, eds. Theresa R. Richardson and Donald Fisher. 115-141. Greenwich, CT: Ablex, 1999.

Pols, Hans. "Psychology." In *The XXth century: 1914 to the present day*, eds. E. K. Brathwaite, S. Gopal, E. Mendelsohn, and S. L. Tikhvinsky. London: Routledge, in press.

Pols, Hans. "The roots of Canadian community psychology in the psychology of human development, Toronto, 1912-1956." *Canadian journal of community mental health* (in press):

Popplow, Marcus. *Neu, nützlich und erfindungsreich : die Idealisierung von Technik in der Frühen Neuzeit*. Cottbuser Studien zur Geschichte von Technik, Arbeit und Umwelt ; 5. Münster: Waxmann, 1998.

Popplow, Marcus. "Heinrich Schickhardt als Ingenieur." In *Heinrich Schickhardt: Baumeister der Renaissance. Leben und Werk des Architekten, Ingenieurs und Städteplaners*, ed. Sönke Lorenz. 75-82. Leinfelden-Echterdingen: DRW Verlag, 1999.

Popplow, Marcus. "Die Natur als Vorbild technischer Entwicklungen - Leonardo da Vinci und die Ingenieure der Renaissance." *Ferrum 72* (in press)

Popplow, Marcus. "Militärtechnische Bildkataloge des Spätmittelalters." In *Krieg im Mittelalter*, ed. Hans-Henning Kortüm. Berlin: Akademie-Verlag, in press.

Popplow, Marcus. "Reproduzierbare Originalität : zur Genese eines Konzeptes technischer Erfindungen in der frühen Neuzeit." In *Erfindungen - Versuch der Annäherung an einen vielschichtigen Begriff*, ed. Gerhard Banse. Münster: Waxmann, in press.

Potthast, Thomas see also: Kreß and Potthast

Potthast, Thomas see also: Ott, Potthast et al.

Potthast, Thomas. "Evolution als Naturschutzziel? Evolutionstheorie, Natur und Ethik in analytischer und utopischer Perspektive." In *Ethik der Biowissenschaften. Geschichte und Theorie*, eds. Eve-Marie Engels, Thomas Junker, and Michael Weingarten. 69-84. Berlin: Verlag für Wissenschaft und Bildung, 1998.

Potthast, Thomas. *Die Evolution und der Naturschutz. Zum Verhältnis von Evolutionsbiologie, Ökologie und Naturethik*. Campus Wissenschaft, Frankfurt am Main: Campus-Verlag, 1999.

Potthast, Thomas. "Review of: Emmrich, Michael: Im Zeitalter der Bio-Macht. 25 Jahre Gentechnik - eine kritische Bilanz. Frankfurt a.M., Mabuse, 1999." *Zeitschrift für medizinische Ethik* 11 (2 1999): 134-136.

Potthast, Thomas. "Theorien, Organismen und Synthesen - Evolutionstheorie und Ökologie im angloamerikanischen und deutschsprachigen Raum bis 1960." In *Die Entstehung der Synthetischen Theorie: Beiträge zur Geschichte der Evolutionsbiologie in Deutschland 1930-1950*, eds. Thomas Junker and Eve-Marie Engels. 259-292. Berlin: Verlag für Wissenschaft und Bildung, 1999.

Potthast, Thomas. "Bioethics and epistemic-moral hybrids: Perspectives from the history of science." *Biomedical ethics newsletter* 5 (1 in press)

Potthast, Thomas. "Funktionssicherung und/oder Aufbruch ins Ungewisse? Anmerkungen zum Prozeßschutz." In *Funktionsbegriff und Unsicherheit in der Ökologie*, ed. Kurt Jax. Frankfurt am Main: Lang, in press.

Potthast, Thomas. "Wo sich Biologie, Ethik und Naturphilosophie treffen (müssen). Epistemologische und moralphilosophische Aspekte der Umweltethik." In *Spektrum der Umweltethik*, ed. Konrad Ott. Marburg: Metropolis, in press.

Potthast, Thomas and Uta Eser. "Systematisierungsvorschläge und vier Thesen zum Verhältnis von Naturschutzbegründungen, Ökologie und Ethik." *Verhandlungen der Gesellschaft für Ökologie* 29 (1999): 579-585.

Proctor, Robert N. "A bitter pill." *The sciences* 39 (May/June 1999): 14-19.

Proctor, Robert N. "'Chasing rainbows : Dawkins's rainbow reduces science to truth, beauty and fantasy' : essay review of Dawkins, Richard: *Unweaving the rainbow: science, delusion, and the popular appetite for wonder*. Boston, Mass., Houghton-Mifflin 1998." *American Scientist* 87 (1999): 170-73.

Proctor, Robert N. "Evolution vs. creationism struggle is nothing new." *Centre Daily Time*, 15.01.1999, 2.

Proctor, Robert N. "Nazi science." *The sciences* 39 (May/June 1999): 3-4.

Proctor, Robert N. *The Nazi war on cancer*. Princeton, NJ: Princeton Univ. Press, 1999.

Proctor, Robert N. "Why did the nazis have the world's most aggressive anti-cancer campaign?" *Endeavour* 23 (1999): 76-79.

Proctor, Robert N. "Nazi-Ärzte, Rassenmedizin und 'Lebensunwertes Leben' : von der Ideologie zur Euthanasie." In *Sterbehilfe-Debatte und NS-Euthanasie*, eds. Clemens Eickhoff and Andreas Frewer, in press.

Proctor, Robert N. "What causes cancer? A political history of recent debates." In *Thinking about evolution: Historical, philosophical and political perspectives*, ed. Rama S. Singh. New York, NY: Cambridge Univ. Press, in press.

Proctor, Robert N. "Wir produzieren Zweifel: Die Wissenschaft der Wirtschaftsverbände." In *Morbus Mohl : die Medien als Gegenstand und Praxisfeld der Gesundheitswissenschaften*, ed. Dietmar Jazbinsek. Opladen: Westdeutscher Verlag, in press.

Puff, Helmut. "Heinrich der Glichezare, the author of 'Reinhart Fuchs'." In *New history of German literature*, ed. David Wellbery. Cambridge, MA: Harvard Univ. Press, in press.

Ramberg, Peter. "Review of: Britta Görs: *Chemischer Atomismus : Anwendung, Veränderung, Alternativen im deutschsprachigen Raum in der zweiten Hälfte des 19. Jahrhunderts*. Berlin, ERS-Verlag 1999." *Historical studies in the physical and biological sciences* (in press)

Ratcliff, Marc see: Sigrist, Barras and Ratcliff

Rauchhaupt, Ulf von. "Das Urknall-Buch : von der physikalischen Theorie zur New-Age-Fabel; Neuerscheinungen von Alan Guth, Lee Smolin und anderen zum Thema Kosmologie." *Die Zeit*, 05.08.1999, 39-40.

Rauchhaupt, Ulf von. "Review of: Collins, Harry and Trevor Pinch: Der Golem der Forschung. Wie unsere Wissenschaft die Natur erfindet. Berlin: Berlin Verlag 1999 ." *Die Zeit*, 02.12.1999 , 63.

Rauchhaupt, Ulf von. "Review of: Gavaghan, Helen: "Something new under the sun : satellites and the beginning of space age". New York, NY, Copernicus/Springer 1998." *Physikalische Blätter* 55 (1 1999): 60.

Rauchhaupt, Ulf von. "Review of: Sokal, Alan et al.: Eleganter Unsinn. München: C. H. Beck 1999." *Die Zeit*, 09.12.1999, 31.

Renn, Jürgen see also: Damerow, Freudenthal, McLaughlin and Renn

Renn, Jürgen. "Review of: Klaus Hentschel: The Einstein tower : an intertexture of dynamic construction, relativity theory and astronomy. Stanford, Stanford Univ. Press 1997." *Physics today* 51 (9 1998): 62-64.

Renn, Jürgen. "Author, Reviewer Debate: Freundlich's role in relativity." *Physics today* 52 (4 1999): 96.

Renn, Jürgen see also: Damerow and Renn

Renn, Jürgen see also: Darrigol and Renn

Renn, Jürgen see also: Goenner, Renn et al.

Renn, Jürgen, Giuseppe Castagnetti, and Peter Damerow. "Albert Einstein : alte und neue Kontexte in Berlin." In *Die Königlich Preußische Akademie der Wissenschaften zu Berlin im Kaiserreich*, ed. Jürgen Kocka. 333-354. Berlin: Akademie-Verlag, 1999.

Renn, Jürgen, Giuseppe Castagnetti, and Simone Rieger. "Adolf von Harnack und Max Planck (1851-1930)." , edited by Kurt Nowak and Gerhard Oexle: Vandenhoeck & Ruprecht, in press.

Renn, Jürgen and Dieter Hoffmann. "Einstein, Albert." In *Lexikon der Physik* , ed. Walter Greulich. 137-141. Band 2. Heidelberg: Spektrum-Verlag, 1999.

Renn, Jürgen and Tilman Sauer. "Il quaderno di appunti zurighese di Einstein e la scoperta delle equazioni del campo della gravitazione nell' anno 1912." *La fisica nella scuola* 31 (1 1998): 8-19.

Renn, Jürgen and Tilman Sauer. "Heuristics and mathematical representation in Einstein's search for a gravitational field equation." In *The expanding worlds of general relativity*, eds. Hubert Goenner, Jürgen Renn, Jim Ritter, and Tilman Sauer. 87-125. Boston: Birkhäuser, 1999.

Renner, Andreas. "Erfindendes Erinnern: Das russische Ethnos im russländischen kulturellen Gedächtnis." *Archiv für Sozialgeschichte* 40 (in press)

Renner, Andreas. *Russischer Nationalismus und Öffentlichkeit im Zarenreich, 1855-1875*. Beiträge zur Geschichte Osteuropas, Köln: Böhlau, in press.

Rheinberger, Hans-Jörg see also: Beurton, Falk and Rheinberger

Rheinberger, Hans-Jörg see also: Ferreira and Rheinberger et. al.

Rheinberger, Hans-Jörg see also: Haas, Nägele and Rheinberger

Rheinberger, Hans-Jörg see also: Hagner and Rheinberger

Rheinberger, Hans-Jörg. "Augenmerk." In *Liechtensteiner Exkurse III. Aufmerksamkeit*, eds. Norbert Haas, Rainer Nägele, and Hans-Jörg Rheinberger. 397-412. Eggingen: Isele, 1998.

Rheinberger, Hans-Jörg. "Bemerkungen zur Geschichte der Molekularbiologie." In *Gen-Welten, Ausstellungskatalog*, ed. Kunst- und Ausstellungshalle der Bundesrepublik Deutschland. 58-64. Bonn: Kunst- und Ausstellungshalle der Bundesrepublik Deutschland GmbH, 1998.

Rheinberger, Hans-Jörg. "Das Experiment und die Ethik des Nichtwissens. Nachwort." In *Jacob, François: Die Maus, die Fliege und der Mensch : über die moderne Genforschung*, 199-204. Berlin: Berlin-Verlag, 1998.

Rheinberger, Hans-Jörg. "Ernest F. Gale and protein synthesis : difficulties in analysing a complex system." *Trends in biochemical sciences* 23 (1998): 362-365.

Rheinberger, Hans-Jörg. "Experimental systems - graphematic spaces." In *Inscribing science : scientific texts and the materiality of communication*, eds. Timothy Lenoir and Hans Ulrich Gumbrecht. 285-303. Stanford, Calif.: Stanford Univ. Press, 1998.

Rheinberger, Hans-Jörg. "From the 'originary phenomenon' to the 'system of pelagic fishery' : Johannes Müller (1801-1858) and the relation between physiology and philosophy." In *From physico-theology to bio-technology : essays in the social and cultural history of biosciences: A Festschrift for Mikulás Teich*, eds. Kurt Bayertz and Roy Porter. 133-152. Amsterdam: Rodopi, 1998.

Rheinberger, Hans-Jörg. "Kurze Geschichte der Molekularbiologie." In *Geschichte der Biologie*, ed. Ilse Jahn. 642-663. Jena: Gustav Fischer, 1998.

Rheinberger, Hans-Jörg. "Wie verändert sich die Biologie? Der Einzug der Molekulargenetik." In *Was wissen Biologen schon vom Leben?*, ed. Andreas Dally. 29-36. Rehburg-Loccum: Evangelische Akademie, Loccumer Protokolle 14/1997, 1998.

Rheinberger, Hans-Jörg. "Wissenschaftsfreiheit und Wissenschaftsförderung. Gedanken zum Verhältnis von Staat und Wissenschaft." *Verlag der Liechtensteinischen Akademischen Gesellschaft, Vaduz, Kleine Schriften* 27 (1998): 25-41.

Rheinberger, Hans-Jörg. "Claude Bernard, Experimentator, Philosoph." *Philosophia Scientiae. Travaux d'histoire et de philosophie des sciences Cahier Spécial* 2 (1998-1999): 147-154.

Rheinberger, Hans-Jörg. "'Alles, was überhaupt zu einer Inskription führen kann.'" In *Wissensbilder. Strategien der Überlieferung*, ed. Ulrich Raulff. 265-277. Berlin: Akademie-Verlag, 1999.

Rheinberger, Hans-Jörg. "Die Evolution des Genbegriffs. Fragmente aus der Perspektive der Molekularbiologie." In *Die Entstehung der Synthetischen Theorie: Beiträge zur Geschichte der Evolutionsbiologie in Deutschland 1930-1950*, eds. Thomas Junker and Eve-Marie Engels. 323-341. Berlin: Verlag Wissenschaft und Bildung, 1999.

Rheinberger, Hans-Jörg. "Ephestia. Alfred Kühns experimenteller Entwurf einer entwicklungsphysiologischen Genetik." *Dahlemer Archivgespräche* 4 (1999): 81-118.

Rheinberger, Hans-Jörg. "Ephestia: The experimental design of Alfred Kühn's physiological genetics." In *Fundamental changes in cellular biology in the 20th century*, eds. Charles Galperin, Scott F. Gilbert, and Brigitte Hoppe. 133-135. Turnhout: Brepols, 1999.

Rheinberger, Hans-Jörg. "Experimental systems : historicity, narration, and deconstruction." In *The science studies reader*, ed. Mario Biagioli. 417-429. New York, NY: Routledge, 1999.

Rheinberger, Hans-Jörg. "Reenacting history. Review of Pickering, Andrew: The mangle of practice. Chicago, Ill., Chicago Univ. Press 1995." *Studies in history and philosophy of science* 30A (1999): 163-166.

Rheinberger, Hans-Jörg. "Repräsentationen der molekularen Biologie." In *Der neue Mensch. Obsessionen des 20. Jahrhunderts. Katalog zur Ausstellung*, eds. Nicola Lepp, Martin Roth, and Klaus Vogel. 81-89. Dresden: Deutsches Hygiene-Museum, 1999.

Rheinberger, Hans-Jörg. "Strukturen des Experimentierens : zum Umgang mit dem Nichtwissen." In *Wissenschaft als kulturelle Praxis : 1750-1900*, eds. Hans Erich Bödeker, Peter Hanns Reill, and Jürgen Schlumbohm. 415- 423. Göttingen: Vandenhoeck & Ruprecht, 1999.

Rheinberger, Hans-Jörg. "Wissenschaftsgeschichte und experimentelle Praxis. Karl-Sudhoff-Gedächtnisvortrag." *Nachrichtenblatt der Deutschen Gesellschaft für Geschichte der Medizin, Naturwissenschaft und Technik* 49 (1999): 198-210.

Rheinberger, Hans-Jörg. "Beyond nature and culture. Modes of reasoning in the age of molecular biology." In *Living and working with the new medical technologies*, ed. Alberto Cambrosio. Cambridge: Cambridge Univ. Press, in press.

Rheinberger, Hans-Jörg. "Cytoplasmic particles. The trajectory of a scientific object." In *Biographies of scientific objects*, ed. Lorraine Daston. Chicago, Ill.: Univ. of Chicago Press, in press.

Rheinberger, Hans-Jörg. "Einträge für das Pschyrembel Wörterbuch Medizingeschichte: Molekularbiologie, Crick, Jacob, Monod, Nirenberg, Watson." In *Pschyrembel Wörterbuch Medizingeschichte*, eds. Werner E. Gerabek and Bernhard D. Haage. Berlin: DeGruyter, in press.

Rheinberger, Hans-Jörg. "Ephestia: Le projet expérimental d'une génétique de la physiologie du développement dans l'oeuvre d'Alfred Kühn." *Revue d'histoire des sciences* (in press)

Rheinberger, Hans-Jörg. "Experiment: Präzision und Bastelei." In *Instrument - Experiment : historische Studien*, ed. Christoph Meinel. 52-60. Berlin: GNT-Verlag, in press.

Rheinberger, Hans-Jörg. "Gene concepts. Fragments from the perspective of molecular biology." In *The concept of the gene in development and evolution*, eds. Peter Beurton, Raphael Falk, and Hans-Jörg Rheinberger. Cambridge: Cambridge Univ. Press, in press.

Rheinberger, Hans-Jörg. "Invisible architectures." *Science in context* (in press)

Rheinberger, Hans-Jörg. "Putting isotopes to work : liquid scintillation counters, 1950-1970." In *Instrumentation between science, state, and industry*, eds. Terry Shinn and Bernward Joerges. Reading: Harwood Academic Publishers, in press.

Rheinberger, Hans-Jörg. "Review of: Engels, Eve-Marie; Junker, Thomas; Weingarten, Michael (eds.): Ethik der Biowissenschaften: Geschichte und Theorie. Verhandlungen zur Geschichte und Theorie der Biologie. Band 1. Berlin, Verlag für Wissenschaft und Bildung 1998." *NTM* (in press)

Rheinberger, Hans-Jörg. "Review of: Holmes, Frederic Lawrence: Antoine Lavoisier - the next crucial year ; or, the sources of his quantitative method in chemistry. Princeton, NJ., Princeton Univ. Press 1998." *Annals of science* (in press)

Rheinberger, Hans-Jörg. "Symbols, icons, indices : a commentary on Lily Kay's 'A book of life'." In *Controlling our destinies : the human genome project from historical, philosophical, social, and ethical perspectives*, ed. Phillip Sloan. 125-130. Notre Dame: Univ. of Notre Dame Press, in press.

Rheinberger, Hans-Jörg. "Virusforschung an den Kaiser-Wilhelm-Instituten für Biochemie und für Biologie, 1937-1945." In *Geschichte der Kaiser-Wilhelm-Gesellschaft im Nationalsozialismus. Bestandsaufnahme und Perspektiven der Forschung*, ed. Doris Kaufmann. Göttingen: Wallstein-Verlag, in press.

Rheinberger, Hans-Jörg see also Hagner and Rheinberger

Ritter, Jim see also: Goenner, Renn, Ritter et al.

Roux, Sophie. "Le scepticisme et les hypothèses de la physique." *Revue de synthèse* 4 (2-3 1998): 211-255.

Roux, Sophie. "La philosophie mécanique ou corpusculaire de Boyle." In *L'atomisme au xviiie et xviiiie siècles*, ed. Jean Salem. 119-133. Paris: Publ. de la Sorbonne, 1999.

Roux, Sophie. "Descartes atomiste?" In *Actes du colloque "Atomism and Continuum in the Seventeenth Century"*, eds. Michel Blay and Egidio Festa. Napoli: Vivarium, in press.

Sarkar, Sahotra see: Thieffry and Sarkar

Satzinger, Helga and Annette Vogt. "Elena Aleksandrovna und Nikolaj Vladimirovič Timoféeff-Ressovsky (1898-1973; 1900-1981)." In *Klassiker der Biologie*, ed. Ilse Jahn. München: Beck, in press.

Sauer, Tilman see: Goenner, Renn, Ritter and Sauer

Sauer, Tilman see: Renn and Sauer

Sauer, Tilman see: Renn, Janssen, Norton, Sauer et al.

Schemmel, Matthias. "Review of: Seitz, Frederick: The science matrix : the journey, travails, triumphs. Berlin, Springer 1998." *Physikalische Blätter* 55 (12 1999): 72.

Schemmel, Matthias. "Karl Schwarzschild." In *Lexikon der Physik*, ed. Walter Greulich. Band 5. Heidelberg: Spektrum-Verlag, in press.

Schickore, Jutta see: Dürbeck, Schickore and Wiesenfeldt

Schiebinger, Londa see also: Blakemore, Cuthbert, Jennett, Porter and Schiebinger

Schiebinger, Londa see also: Creager, Lunbeck and Schiebinger

Schiebinger, Londa. "Gender studies of STS: A look toward the future." *Science, technology and human values* 24 (4 1999): 95-106.

Schiebinger, Londa. *Has feminism changed science?* Cambridge, Mass.: Harvard Univ. Press, 1999.

Schiebinger, Londa. "Has feminism changed science?" *Figurationen* 1 (0 1999): 50-64.

Schiebinger, Londa. "Collecting body parts : Georges Cuvier's hottentot venus." In *Concepts and symbols of the eighteenth century in Europe*, eds. Hans Erich Bödeker and Lieselotte Steinbrügge. Berlin: Nomos-Verlag, in press.

Schiebinger, Londa. *Feminism and the body*. Oxford University Press's in feminism series, Oxford: Oxford Univ. Press, in press.

Schiebinger, Londa. "Has feminism changed science?" *Signs: Journal of women in culture and society* 25 (in press)

Schiebinger, Londa. "The (historical) exclusion of women and the structure of knowledge." In *The Sociology of Science*, eds. Helga Nowotny and Klaus Taschwer. Glos: Elgar, in press.

Schiebinger, Londa. "Nature's unruly body." In *Regimes of description: In the archives of the eighteenth century*, eds. John Bender and Michael Marrinan. Stanford, Calif.: Stanford Univ. Press, in press.

Schiebinger, Londa. "The philosopher's beard: Women and gender in science." In *Science in the eighteenth century*, ed. Roy Porter. Cambridge: Cambridge Univ. Press, in press.

Schiebinger, Londa. "Sites and boundaries: Patterns of inclusion and exclusion." In *Early modern science*, ed. Lorraine Daston. Cambridge: Cambridge Univ. Press, in press.

Schiefsky, Mark. "Review of Fischer, Klaus-Dietrich; Nickel, Diethard: Text and tradition, studies in ancient medicine and its transmission presented to Jutta Kollesch. Leiden, Brill 1998." *Classical world* (in press)

Schloegel, Judy Johns. "Life imitating art, art imaging life: intimate knowledge, agency, and the organism as aesthetic object." *Videnskabsforskning : Danish Newsletter for the Network of History and Philosophy of Science* 20 (1998): 2-18.

Schloegel, Judy Johns. "Essay review of: Rasmussen, Nicolas: Picture control : the electron microscope and the transformation of biology in America, 1940-1960. Stanford, Stanford Univ. Press 1997." *Metascience* 8 (2 1999): 243.

Schloegel, Judy Johns. "From anomaly to unification: Tracy Sonneborn and the species problem in protozoa, 1954-1957." *Journal of the History of Biology* 32 (1 1999): 93-132.

Schmidgen, Henning. "Enthauptet und bewußtlos: Zustände der lebenden Maschine in der Psychologie um 1900." In *Identifikation und Repräsentation*, eds. Alfred Schäfer and Michael Wimmer. 151-167. Opladen: Leske u. Budrich, 1999.

Schmidgen, Henning. "Figuren des Zerebralen in der Philosophie von Gilles Deleuze." In *Ecce cortex : Beiträge zur Geschichte des modernen Gehirns*, ed. Michael Hagner. 317-349. Göttingen: Wallstein-Verlag, 1999.

Schmidgen, Henning. "Wilhelm Wundt et l'unité de la psychologie." *Bulletin de psychologie* 52 (2 1999): 237-246.

Schmidgen, Henning. "Daniel Lagache und die Einheit der Psychologie." *Psychologie und Geschichte* 8 (3/4 in press): 1-18.

Schmidgen, Henning. "William James, The Principles of Psychology (1890)." In *Die Klassiker der Psychologie*, eds. Helmut E. Lück, Rudolf Miller, and Gabi Sewz-Vosshenrich. 61-65. Stuttgart: Kohlhammer, in press.

Schmidgen, Henning. "Zur Genealogie der Reaktionsversuche in der experimentellen Psychologie." In *Instrument - Experiment : historische Studien*, ed. Christoph Meinel. 168-179. Berlin: GNT-Verlag, in press.

Schneider, Hans J. and Elke Kazemi. "Abubacer." In *Enzyklopädie Philosophie und Wissenschaftstheorie I*, ed. Jürgen Mittelstrass. 2nd ed., Vol. 1, in press.

Schneider, Hans J. and Elke Kazemi. "Alfraganus." In *Enzyklopädie Philosophie und Wissenschaftstheorie I*, ed. Jürgen Mittelstrass. 2nd ed., Vol. 1, in press.

Schneider, Hans J. and Elke Kazemi. "Alhazen." In *Enzyklopädie Philosophie und Wissenschaftstheorie I*, ed. Jürgen Mittelstrass. 2nd ed., Vol. 1, in press.

Schneider, Hans J., Gereon Wolters, and Elke Kazemi. "Abul Wafa." In *Enzyklopädie Philosophie und Wissenschaftstheorie I*, ed. Jürgen Mittelstrass. 2nd ed., Vol. 1, in press.

Schoepflin, Urs see also: Glänzel and Schoepflin

Schoepflin, Urs see also: Glänzel, Schubert, Schoepflin and Czerwon

Schoepflin, Urs and Wolfgang Glänzel. "Two decades of "Scientometrics". " *Scientometrics* (in press)

Schüller, Volkmar. "Goethe versus Newton." *Physikalische Blätter* 55 (12 1999): 62-66.

Schüller, Volkmar, ed. *Newton, Isaac : Die mathematischen Prinzipien der Physik*. Berlin: DeGruyter, 1999.

Schüller, Volkmar. "Samuel Clarke's annotations in Jacques Rohault's *Traité de physique*, and how they contributed to popularizing Newton's physics." In *Between Leibniz, Newton, and Kant - philosophy and science in the 18th century*, ed. Wolfgang Lefèvre. Dordrecht: Kluwer, in press.

Ségal, Jérôme see also: Mindell, Ségal and Gerovitch

Ségal, Jérôme. "Du comportement des avions ennemis aux modélisations de la connaissance : la notion scientifique et technique d'information." In *Des Lois de la pensée au constructivisme*:

conceptions et modélisations de l'acte de connaître, ed. Marie-José Durand-Richard. Paris: Editions de la Maison des Sciences de l'Homme, in press.

Ségal, Jérôme. "Review of: Atlan, Henri: La fin du 'tout génétique' ? - Vers de nouveaux paradigmes en biologie. Paris, I.N.R.A. Editions, 1999." *History and philosophy of life sciences* (in press)

Ségal, Jérôme. "L'introduction de la cybernétique en RDA : rencontres avec l'idéologie marxiste." In *Science, ideology and political change*, eds. Dieter Hoffmann, Benoit Severyns, and Raymond Stokes. 67-80. Turnhout: Brepols, 1999.

Ségal, Jérôme. "Naissance d'une culture informationnelle : traces graphiques." *Alliage* 39 (1999): 90-100.

Sibum, H. Otto. "Vosproizvedenie eksperimentov po opredeleniju mehaničeskogo ékvivalenta teploty : točnost' instrumentov i pravil'nost' izmerenij v ranneviktorskoj Anglii." *Voprosy Istorii Éstestvoznaniia i Techniki* (1 1998): 9-46.

Sibum, H. Otto. "Die Sprache der Instrumente : eine Studie zur Praxis und Repräsentation des Experimentierens." In *Experimental Essays - Versuche zum Experiment*, eds. Michael Heidelberger and Friedrich Steinle. 141-156. Baden-Baden: Nomos-Verlag, 1998.

Sibum, H. Otto. "Les gestes de la mesure : Joule, les pratiques de la brasserie et la science." *Annales : histoire, sciences social* (4-5 1998): 745-774.

Sibum, H. Otto. "Mechanical equivalent of heat apparatus." In *Instruments of science : a historical encyclopedia*, eds. Robert Bud and Deborah Warner. 371-373. New York, NY: Garland Publishing, 1998.

Sibum, H. Otto. "An old hand in a new system." In *The invisible industrialist : manufactures and the production of scientific knowledge*, eds. Jean-Paul Gaudillière and Illana Löwy. 23-57. London: Macmillan, 1998.

Sibum, H. Otto. "Experimental history of science." In *Museums of modern science*, ed. Svante Lindqvist. 77-86. Canton, Mass.: Watson, in press.

Sibum, H. Otto. "Experimentelle Wissenschaftsgeschichte." In *Instrument - Experiment : historische Studien*, ed. Christoph Meinel. 61-73. Berlin: GNT-Verlag, in press.

Sibum, H. Otto. "The friction of fluids : making sense of experiment." In *Laboratorium*, eds. Hans Ulrich Obrist and Barbara Vanderlinden. Köln: DuMont, in press.

Sigrist, René. "L'histoire des monocles, ou comment observer les insectes un demi-siècle après Bonnet." In *Louis Jurine: chirurgien et naturaliste (1751-1819)*, eds. René Sigrist, Vincent Barras, and Marc Ratcliff. 181-236. Chêne-Bourg: Georg, 1999.

Sigrist, René. "L'expérimentation comme rhétorique de la preuve: l'exemple du Traité d'insectologie de Charles Bonnet." *Revue d'histoire des sciences* (in press)

Sigrist, René. "Les formes de l'expérimentation chez Charles Bonnet: esquisse d'une typologie fonctionnelle." *Bulletin de la Société d'Histoire et d'Épistémologie des Sciences de la Vie* (in press)

Sigrist, René, Vincent Barras, and Marc Ratcliff, eds. *Louis Jurine: chirurgien et naturaliste (1751-1819)*. Bibliothèque d'histoire des sciences. Chêne-Bourg: Georg, 1999.

Sigurdsson, Skúli. "Um gen og menn." *Læknabladid* 84 (1998): 577-581.

Sigurdsson, Skúli. "Genmang og erfdaenska." *Dagur*, 01.04.1999, 14.

Sigurdsson, Skúli. "Icelanders opt out of genetic database." *Nature* 400 (19.08.1999): 708.

Sigurdsson, Skúli. "Icelandic genes." *Correspondence : an international review of culture and society* (4 1999): 18.

Simon, Jonathan. "The Chemical Revolution and Pharmacy: a disciplinary perspective." *Ambix* 45 (1 1999): 1-13.

Simon, Jonathan. "Naming and toxicity : a history of strychnine." *Studies in History and Philosophy of the Biological and Medical Sciences* 30C (4 1999): 505-525.

Söderqvist, Thomas. "Forskerbiografiens historie (The history of scientific biography)." *Slagmark* (28-29 1999): 41-60.

Spary, Emma. "Histoire naturelle : entre mémoire et raison." *Le cahiers de science et vie* 47 (1998): 70-77.

Spary, Emma. "Ciencia y moda en la ciudad europea." In *Madrid : ciencia y corte*, 211-219. Madrid: artes gráficas palermo, 1999.

Spary, Emma. "Codes of passion : natural history specimens as a polite language in late eighteenth-century France." In *Wissenschaft als kulturelle Praxis : 1750-1900*, eds. Hans Erich Bödeker, Peter Hanns Reill, and Jürgen Schlumbohm. 105-135. Göttingen: Vandenhoeck & Ruprecht, 1999.

Spary, Emma. "Making a science of taste: the revolution, the learned life, and the invention of 'gastronomie'." In *Consumption and culture 1650-1850*, ed. Maxine Berg. 170-182. Manchester: Manchester Univ. Press, 1999.

Spary, Emma. "The 'nature' of enlightenment." In *The sciences in enlightened Europe*, ed. William Clark. 272-304. Chicago, Ill.: Univ. of Chicago Press, 1999.

Spary, Emma. "The performance of surgery in enlightenment France." *Endeavour* 23 (4 1999): 180-183.

Spary, Emma. "This book is a box." Review essay of Anke te Heesen: *Der Weltkasten. Die Geschichte einer Bildenzyklopädie aus dem 18. Jahrhundert*. Göttingen: Wallstein Verlag, 1997." *Studies in history and philosophy of science* 30 (2 1999): 355-362.

Spary, Emma. *Naturalising the tree of liberty: French natural history from old regime to revolution*. Chicago, Ill.: Chicago Univ. Press, in press.

Spary, Emma. "Rococo readings of the book of nature." In *History of the sciences/history of the book*, ed. Marina Frasca Spada. Cambridge: Cambridge Univ. Press, in press.

Stachel, John see: Renn, Janssen, Norton, Sauer and Stachel

Staley, Richard. "Review of Einstein, Albert: The Collected Papers Volume 8. The Berlin Years: Correspondence, 1914-1918. English Translation. Translated from the German by Anna M. Hentschel. Princeton, NJ., Princeton Univ. Press 1998." *Annals of science* (in press)

Staley, Richard. "Review of Brian, Dennis: Einstein, a life. New York, NY, Wiley 1996." *Nuncius* (in press)

Staley, Richard. "Review of: Einstein, Albert: The Collected Papers. Volume 6. The Berlin Years: Writings, 1914-1917. English Translation of Selected Texts. Translated from the German by Alfred Engel. Princeton, NJ., Princeton Univ. Press 1997." *Annals of science* (in press)

Stein, Claudia. "The function of the 'Charlatan' as a means of group distinction and reinforcement of professional hierarchy in the medical community of sixteenth-century Augsburg." *Ludica* (in press)

Steinle, Friedrich see also: Heidelberger and Steinle

Steinle, Friedrich. "Exploratives vs. theoriebestimmtes Experimentieren: Ampères erste Arbeiten zum Elektromagnetismus." In *Experimental essays - Versuche zum Experiment*, eds. Michael Heidelberger and Friedrich Steinle. 272-297. 3. Baden-Baden: Nomos-Verlag, 1998.

Steinle, Friedrich. "Die Vielfalt experimenteller Erfahrung : neue Perspektiven." In *Erfahrungsbegriffe in den Wissenschaften*, ed. Michael Hampe. Darmstadt: Wissenschaftliche Buchgesellschaft, in press.

Steinle, Friedrich. "Electricity at the turn of the 19th century: uses, instrument, concepts." In *Storia della scienza. VII: La scienza dell'800, sez.D. Physica*, ed. Jed Z. Buchwald. Rom: Istituto della Enciclopedia Italiana, in press.

Steinle, Friedrich. "'... et voilà une nouvelle théorie d'aimant': Ampères Weg zur Elektrodynamik." In *Mathesis : Festschrift für Matthias Schramm*, ed. Rüdiger Thiele. 250-281. Bassum: GNT-Verlag, in press.

Steinle, Friedrich. "Experiment, Instrument und Begriffsbildung: Ampère, das Galvanometer und der Stromkreis." In *Instrument - Experiment : historische Studien*, ed. Christoph Meinel. 98-108. Berlin: GNT-Verlag, in press.

Steinle, Friedrich. "Experimental and mathematical electrodynamics: Ampère, Arago and the galvanometer." In *Storia della scienza. VII: La scienza dell'800, sez.D. Physica*, ed. Jed Z. Buchwald. Rom: Istituto della Enciclopedia Italiana, in press.

Steinle, Friedrich. "Faraday, the laboratory and the field." In *Storia della scienza. VII: La scienza dell'800, sez.D. Physica*, ed. Jed Z. Buchwald. Rom: Istituto della Enciclopedia Italiana, in press.

Steinle, Friedrich. "Review of: Rehbock, Theda: Goethe und die "Rettung der Phänomene". Philosophische Kritik am naturwissenschaftlichen Weltbild am Beispiel der Farbenlehre. Konstanz, Verlag am Hockgraben 1995." *Archiv für Geschichte der Philosophie* (in press)

Strasser, Bruno. "Biologie moléculaire et médecine, un mariage heureux?" *Revue médicale de la Suisse Romande* 119 (1999): 993-997.

Strasser, Bruno. "DNA : a history of a thousand heroes." *BioScience* 49 (3 1999): 241-243.

Strasser, Bruno. "Molecular biology, macroscopic history." *BioScience* 49 (11 1999): 929-931.

Strasser, Bruno. "Review of: Chadarevian, Soraya de; Kamminga, Harmke: "Molecularizing biology and medicine. New practices and alliances, 1910s to 1970s". Amsterdam, Harwood Acad. Publ. 1998." *History and philosophy of the life sciences* 21 (1 1999): 102-103.

Strasser, Bruno. "Sickle cell anemia, a molecular disease." *Science* 286 (1999): 1488-1490.

Strasser, Bruno. "Review of Friedberg, Errol C.: Correcting the blueprint of life. Plainview, Cold Spring Harbor Laboratory 1997." *History and philosophy of the life sciences* 21 (2 in press):

Strasser, Bruno. "Review of: Summers, William C.: Félix d'Hérelle and the origins of molecular biology". New Haven, Conn., Yale Univ. Press 1999." *Journal of the history of biology* 33 (1 in press):

Thieffry, Denis see also: Huerta, Salgado, Thieffry et al.

Thieffry, Denis see also: Mendoza, Thieffry et al.

Thieffry, Denis see also: Toni, Parmananda, Bulajich and Thieffry

Thieffry, Denis see also: Toni, Thieffry et al.

Thieffry, Denis. "From experimental embryology to developmental biology : the metamorphoses of the gradient concept." In *Fundamental changes in cellular biology in the 20th century*, eds. Charles Galperin, Scott F. Gilbert, and Brigitte Hoppe. 111-115. Turnhout: Brepols, in press.

Thieffry, Denis. "Rationalizing early embryogenesis in the 1930s: Albert Dalcq on gradients and fields." *Journal of the history of biology* (in press)

Thieffry, Denis and Gerald Hertz. "Bioinformatics in Siberia." *Trends in Genetics* 15 (1999): 8-9.

Thieffry, Denis, Araceli M. Huerta, Ernesto Perez-Rueda, and Julio Collado-Vides. "From specific gene regulation to global regulatory networks: a characterization of Escherichia coli transcriptional network." *BioEssays* 20 (1998): 433-440.

Thieffry, Denis and David Romero. "The modularity of biological regulatory networks." *BioSystems* (in press)

Thieffry, Denis, Heladia Salgado, Araceli M. Huerta, and Julio Collado-Vides. "Prediction of transcriptional regulatory sites in the complete genome sequence of E.coli." *Bioinformatics* 14 (1998): 391-400.

Thieffry, Denis and Sahotra Sarkar. "Forty years under the central dogma." *Trends in Biochemical Sciences* 23 (1998): 312-316.

Thieffry, Denis and Sahotra Sankar. "Postgenomics? An interdisciplinary conference at the Max Planck Institute for the History of Science in Berlin." *BioScience* 49 (3 1999): 223-227.

Thöle, Bernhard. "Die Analogien der Erfahrung." In *Immanuel Kant : Kritik der reinen Vernunft*, eds. Georg Mohr and Marcus Willaschek. 267-296. Berlin: Akademie-Verlag, 1998.

Thöle, Bernhard. "Bewußtsein und Meinungen über Bewußtsein." In *Rationalität, Realismus, Revision : Vorträge des 3. Internationalen Kongresses der Gesellschaft für Analytische Philosophie vom 15. bis zum 18. September 1997 in München*, ed. Julian Nida-Rümelin. 529-535. Berlin: DeGruyter, 1999.

Thöle, Bernhard. "Kritik des reinen Repräsentationalismus." In *Die Zukunft des Wissens*, ed. Jürgen Mittelstraß. 597-604. Konstanz: Univ.-Verl., 1999.

Thöle, Bernhard. "Die Einheit der Erfahrung." In *Erfahrung und Urteilskraft*, ed. Rainer Enskat. Würzburg: Königshausen & Neumann, in press.

Thöle, Bernhard. "Kants Systemidee." In *Architektur und System in der Philosophie Kants*, eds. Hans-Friedrich Fulda, Hans-Dieter Klein, and Jürgen Stolzenberg. Hamburg: Meiner, in press.

Thorpe, Charles R. "Atomic spaces and American culture, Review of: Hales, Peter Bacon: Atomic spaces. Urbana, Univ. of Illinois Press 1997 and Gusterson, Hugh: Nuclear rites. Berkeley, Univ. of Calif. Press 1996." *Social studies of science* 29 (4 1999): 617-627.

Toni, Bourama, Punit Parmananda, Radmila Bulajich, and Denis Thieffry. "The dynamics of a two-dimensional model for electrochemical corrosion using feedback circuit and nullcline analysis." *Journal of Chemical Physics* B102 (1998): 4118-4122.

Toni, Bourama, Denis Thieffry, and Radmila Bulajich. "Feedback loops analysis for chaotic dynamics with an application to Lorenz system." *Fields Institute Communications* 21 (1999): 473-483.

Unguru, Sabetai. "Book review of: Caveing, Maurice: Essai sur le savoir mathématique dans la Mésopotamie et l'Égypte anciennes. Lille, Presses univ. 1994." *Annals of science* 55 (2 1998): 211-212.

Unguru, Sabetai. "Essay review of: Lindberg, David C.: Roger Bacon and the origins of "Perspectiva" in the middle ages : a critical edition and English translation of Bacon's "Perspectiva". Oxford, Oxford Univ. Press 1996." *Speculum : a journal of medieval studies* 73 (4 1998): 1104-1106.

Veit-Brause, Irmline. "Die Interdisziplinarität der Begriffsgeschichte." In *Die Interdisziplinarität der Begriffsgeschichte : in honour of Karlfried Gründer*, ed. Gunter Scholtz. Hamburg: Meiner, in press.

Veit-Brause, Irmline. "Reale und imaginierte Autobiographie." In *Parallelbiographien*, eds. Thomas Keller and Bernd Thum. Strasbourg: Presses Univ. de Strasbourg, in press.

Vidal, Fernando. "La "science de l'homme" : désirs d'unité et juxtapositions encyclopédiques." In *L'histoire des sciences de l'homme : trajectoire, enjeux et questions vives*, ed. Claude Blanckaert. 61-77. Paris: L'Harmattan, 1999.

Vidal, Fernando. "The eighteenth century as "century of psychology". " *Jahrbuch für Recht und Ethik = Annual review of law and ethics* (in press)

Vidal, Fernando. "La psychologie empirique et son historicisation pendant l'Aufklärung." *Revue d'histoire des sciences humaines* (in press)

Vogt, Annette see also: Satzinger and Vogt

Vogt, Annette. "Charlotte Auerbach (S. 768), Mathilde Hertz (S. 854), Estera Tenenbaum (S. 970), Elena A. Timofëeff-Ressovsky (S. 973), Marthe Vogt (S. 982): Kurzbiographien." In *Geschichte der Biologie*, ed. Ilse Jahn. 3. ed., Vol. Jena (u.a.): Gustav Fischer, 1998.

Vogt, Annette. "Die Berliner Familie Remak - eine deutsch-jüdische Geschichte im 19. und 20. Jahrhundert." In *Mathematik im Wandel : Anregungen zum fächerübergreifenden Mathematikunterricht*, ed. Michael Toepell. 331-342. Mathematikgeschichte und Unterricht. Bd.1. Hildesheim: Franzbecker, 1998.

Vogt, Annette. "Die erste Privatdozentin für angewandte Mathematik in Berlin - Hilda Pollaczek-Geiringer." *Berlinische Monatsschrift* 7 (12 1998): 40-45.

Vogt, Annette. "Die Pasternaks in "Charlottengrad". " *Berlinische Monatsschrift* (Heft 9 1998): 39-45.

Vogt, Annette. "Die Spielregeln der Objektivität : die ersten Promotionen und Promotionsversuche von Frauen an der Philosophischen Fakultät der Berliner Friedrich-Wilhelms-Universität 1898 bis 1909." In *Der Eintritt der Frauen in die Gelehrtenrepublik : zur Geschlechterfrage im akademischen Selbstverständnis und in der wissenschaftlichen Praxis am Anfang des 20. Jahrhunderts*, ed. Johanna Bleker. 31-48. Husum: Matthiesen, 1998.

Vogt, Annette. "Ein russisches Forscher-Ehepaar in Berlin-Buch." *Berlinische Monatsschrift* 7 (8 1998): 17-23.

Vogt, Annette. "Frauen erobern die Physik - Physikerinnen an der Berliner Universität und in Instituten der Kaiser-Wilhelm-Gesellschaft von 1900 bis 1945." In *Phasensprung - Physikerinnen stellen sich vor*, eds. Sibylle Petrak and Barbara Sandow. 198-211. Kirchlinteln: Hoffmann & Heuer, 1998.

Vogt, Annette. "Neues aus der Frauen- und Geschlechterforschung. (Sammelrezension)." *IWK (Internationale wissenschaftliche Korrespondenz zur Geschichte der deutschen Arbeiterbewegung)* 34 (2 1998): 219-224.

Vogt, Annette. "Review of: Knobloch, Eberhard: Mathematik an der TH und der TU Berlin : 1770-1988. Berlin, Verl. für Wissenschafts- und Regionalgeschichte 1998." *Berlinische Monatsschrift* 7 (10 1998): 107-108.

Vogt, Annette. "Von Petersburg nach Moskau : zur Geschichte der russisch-sowjetischen Mathematik zwischen 1850 und 1975." In *Wissenschaftsgeschichte in Osteuropa - Europa litterarum artiumque scientiam communicans*, eds. Alois Henning and Jutta Petersdorf. 165-183. Wiesbaden: Harrassowitz, 1998.

Vogt, Annette. "Wie der Universität viel Geld entging : 200 000 Mark hätte die Hanseemann-Stiftung gebracht." *Berliner Monatsschrift* (5 1998): 38-42.

Vogt, Annette. "Zum Gedenken an Ašot Tigranovič Grigor'jan (1910-1997)." *NTM N.S.* 6 (2 1998): 22-123.

Vogt, Annette. "Aufbruch und Verdrängung : Wissenschaftlerinnen an der Berliner Universität zwischen 1918 und 1945/46." In *Frauen an der Humboldt-Universität 1908-1998*, ed. Hans Meyer. 21-48. 99. Berlin: Humboldt-Universität, 1999.

Vogt, Annette. "Berliner Mathematiker zur Frage "Mathematik - entdeckt oder erfunden?" am Beispiel ihrer Gutachten zu Promotionen von Frauen von 1922 bis 1945." In *Mathematik - entdeckt oder erfunden? V. Österreichisches Symposium zur Geschichte der Mathematik*, ed. Christa Binder. 155-173. Wien: Österreichische Gesellschaft für Wissenschaftsgeschichte, 1999.

Vogt, Annette. "Die Wissenschaftlerin Charlotte Auerbach." *Berlinische Monatsschrift* 8 (10 1999): 54-59.

Vogt, Annette. "Eine seltene Karriere. Die Turkologin Annemarie von Gabain." *Berlinische Monatsschrift* 8 (Heft 6 1999): 24-31.

Vogt, Annette. *Elsa Neumann - Berlins erstes Fräulein Doktor*. Berlin: Verl. für Wissenschafts- und Regionalgeschichte Engel, 1999.

Vogt, Annette. "Fellow of the Royal Society - die Wissenschaftlerin Marthe Vogt." *Berlinische Monatsschrift* (11 1999): 44-49.

Vogt, Annette. "Issai Schur - als Wissenschaftler vertrieben." In *Menora. Jahrbuch für deutsch-jüdische Geschichte.*, eds. Julius H. Schöps, Karl E. Grözinger, and Gert Mattenklott. 217-235. 10. Berlin und Bodenheim: Philo-Verlag, 1999.

Vogt, Annette. "Karl Weierstraß' Verbindungen zu Rußland." *Acta Historiae Rerum Naturalium* 3 (1999): 123-138.

Vogt, Annette. "Naturwissenschaftlerinnen-Portraits (6)." In *Aufbrüche. Frauengeschichte(n) aus Tiergarten : 1850-1950. Ausstellungskatalog*, ed. Marlise Hoff. 102-109. Berlin: Kulturamt Tiergarten, 1999.

Vogt, Annette. "Review of: 50 Jahre Max-Planck-Gesellschaft zur Förderung der Wissenschaften. 2 Bände. Berlin: Duncker & Humblot 1998." *Mitteilungen des Vereins für die Geschichte Berlins* 95 (1999): 521-523.

Vogt, Annette. "Review of: Häntzschel, Hiltrud, Bußmann, Hadomad (eds.): Bedrohlich gescheit : ein Jahrhundert Frauen und Wissenschaft in Bayern. München, Beck 1997." *Zeitschrift für Geschichtswissenschaft* 47 (2 1999): 173-174.

Vogt, Annette. "Review of: Häntzschel, Hiltrud, Bußmann, Hadomad (eds.): Bedrohlich gescheit : ein Jahrhundert Frauen und Wissenschaft in Bayern. München, Beck 1997." *NTM* 7 (3 1999): 182.

Vogt, Annette. "Von der Hilfskraft zur Leiterin : die Mathematikerin Erika Pannwitz." *Berlinische Monatsschrift* 8. (5 1999): 18-24.

Vogt, Annette. "Besondere Begabung der Habilitandin' - die Wissenschaftlerin Luise Holzapfel (1900-1963)." *Berlinische Monatsschrift* 9 (3 in press): 80-86.

Vogt, Annette. "Die ersten Karriereschritte - Physikerinnen im Berliner Raum." In *Barrieren und Karrieren*, eds. Elisabeth Dieckmann and Eva Schöck-Quinteros. 195-230. Berlin: Trafo-Verlag, in press.

Vogt, Annette. "Ehrendes Gedenken gegen das Vergessen." *Berlinische Monatsschrift* 9 (1 in press): 20-23.

Vogt, Annette. "Elena Aleksandrovna Timofeeva-Resovskaja - weit mehr als die "Frau ihres Mannes". In *Festschrift für Ilse Jahn zum 75. Geburtstag*, ed. Karl-Friedrich Wessel. 149-170. Bielefeld: Kleine, in press.

Vollmer, Sara. "Two kinds of observation : why van Fraassen was right to make a distinction, but made the wrong one." *Philosophy of science* (in press)

Wahnbaeck, Till. "Die Reaktion der Kurie auf die Begründung des Absolutismus : Fabio Albergati versus Jean Bodin." *Zeitschrift für historische Forschung* 26 (2 1999): 245-267.

Wahnbaeck, Till. "Ferdinando Paoletti georgofilo e il dibattito sul lusso nel Settecento." *I Georgofili. Atti della Accademia dei Georgofili* 45 (1999): 367-389.

Wahsner, Renate see also: Borzeszkowski and Wahsner

Wahsner, Renate. "Brief zur Frage: Was war erhaltenswert in der Philosophie der DDR?" *TOPOS* 10 (1998): 117-139.

Wahsner, Renate. "Diskussionsbeitrag zum Thema 'Streit um die Philosophie der DDR'." *Information Philosophie* (5 1998): 76-77.

Wahsner, Renate. "Hegels spekulativer Geozentrismus." In *Hegels Jenaer Naturphilosophie*, ed. Klaus Vieweg. 299-308. München: Fink, 1998.

Wahsner, Renate. "It is not singularity that governs the nature of things : the principle of isolated individual and its negation by Marx in his doctoral thesis 'Difference between the democritean and epicurean philosophy of nature'." In *Marx's theories today*, eds. Ryszard Panasiuk and Leszek Nowak. 99-111. Amsterdam: Rodopi, 1998.

Wahsner, Renate. *Naturwissenschaft. Bibliothek dialektischer Grundbegriffe*, ed. Andreas Hüllinghorst. Bielefeld: Aisthesis, 1998.

Wahsner, Renate. "Review of: Bondeli, Martin: Der Kantianismus des jungen Hegel : die Kant-Aneignung Hegels auf seinem Weg zum philosophischen System, Hamburg 1997 ; Vieweg, Klaus (Ed.): Hegels Jenaer Naturphilosophie, München 1998 ; Thomas Kalenberg: Die Befreiung der Natur : Natur und Selbstbewußtsein in der Philosophie Hegels, Hamburg 1997." *Philosophische Rundschau* 45 (3 1998): 261-268.

Wahsner, Renate. "Spekulation – Ökonomie – Naturwissenschaften : Schriften zu Marx' Kritik der Hegelschen Dialektik. Reviews of: Saha Wagenknecht: Vom Kopf auf die Füße? Zur Hegelkritik des jungen Marx oder das Problem einer dialektisch-materialistischen Wissenschaftsmethode,

Bonn 1997 ; Hans-Georg Backhaus: Dialektik der Wertform : Untersuchungen zur Marxschen Ökonomiekritik, Freiburg i. Br. 1997 ; Anneliese Griese und Hans Jörg Sandkühler (Eds.): Karl Marx – zwischen Philosophie und Naturwissenschaften, Frankfurt a. M. 1997." *Philosophische Rundschau* 45 (4 1998): 328-334.

Wahsner, Renate. "Demokrit und die Quantenmechanik oder Erwin Schrödingers Rezeption des antiken Atomismus." *Wiener Beiträge zur Geschichte der Neuzeit* 23 (1999): 35-49.

Wahsner, Renate. "Kann die Wissenschaft auf die Philosophie verzichten?" *UNITAT (Wien)* (1 1999): 13.

Wahsner, Renate. "Philosophie als System und Ungeschichtlichkeit der Natur – ein antiquiertes Konzept?" In *Hegel-Jahrbuch 1998*, eds. Andreas Arndt, Karol Bal, and Henning Ottmann. 152-156. Berlin: Akademie-Verlag, 1999.

Wahsner, Renate. "Review of: Baumann, Peter: Kants Philosophie der Erkenntnis. Durchgehender Kommentar zu den Hauptkapiteln der "Kritik der reinen Vernunft". Würzburg: Königshausen & Neumann 1997." *Kant-Studien* 90 (1999): 1-5.

Wahsner, Renate. "Stichwort 'Messen'." In *Enzyklopädie Philosophie*, ed. Hans Jörg Sandkühler. 827-830. Hamburg: Meiner, 1999.

Wahsner, Renate. "Über den 'Ungrund der newtonischen Begriffe und Sätze' : eine metaphysische Diskussion über eine neue Physik." In *Pierre Louis Moreau de Maupertuis : eine Bilanz nach 300 Jahren*, ed. Hartmut Hecht. 261-276. Berlin: Berlin-Verlag, 1999.

Wahsner, Renate. "Das Bedürfnis einer Umgestaltung der Logik ist längst gefühlt' : Hegels Anliegen und der Mißbrauch einer dialektischen Methode." In *Mit und gegen Hegel*, eds. Andreas Knahl, Jan Müller, and Michael Städler. 205-235. Lüneburg: Klampen, in press.

Wahsner, Renate. "'Der Gedanke kann nicht richtiger bestimmt werden, als Newton ihn gegeben hat' : das mathematisch Unendliche und der Newtonsche Bewegungsbegriff im Lichte des begrifflogischen Zusammenhangs von Quantität und Qualität." In *Hegels Seinslogik – Interpretationen und Perspektiven*, eds. Andreas Arndt and Christian Iber. 271-300. Berlin: Akademie-Verlag, in press.

Wahsner, Renate. "Die Positivität einer Weltanschauung. Das Allgemeine und die Kunst des Widerstandes." In *Hegel-Jahrbuch 1999*, eds. Andreas Arndt, Karol Bal, and Henning Ottmann. Berlin: Akademie-Verlag, in press.

Wahsner, Renate. "Die fehlende Kategorie. Das Prinzip der kollektiven Einheit und der philosophische Systembegriff." *Wiener Jahrbuch für Philosophie* (in press)

Wahsner, Renate. "Die Kantsche Synthese von Leibniz und Newton und deren Konsequenzen für den Mechanik-Begriff des deutschen Idealismus." In *Konferenzakten des 9. Internationalen Kant-Kongresses, Berlin, 26. 3.- 31. 3. 2000*, in press.

Wahsner, Renate. "Die Suche nach der objektiven Sinnlichkeit : über den Zusammenhang von Feuerbachs Sensualismus und Helmholtzens Programm einer empirischen Geometrie." In *Materialismus und Spiritualismus : zwischen Philosophie und Wissenschaften nach 1848*, ed. Walter Jaeschke. 203-217. Hamburg: Meiner, in press.

Wahsner, Renate. "Review of: Haste, Gorm, Thomas Mertens and Thomas Scheffer (Eds.): Immanuel Kant über Natur und Gesellschaft. Odense, Odense Univ. Press 1996." *Kant-Studien* (in press)

Walter, Scott. "La vérité en géométrie : sur le rejet mathématique de la doctrine conventionnaliste." *Philosophia Scientiae* 2 (1997-1998): 103-135.

Walter, Scott. "Ether." In *Dictionnaire d'histoire et philosophie des sciences*, ed. Dominique Lecourt. 381-384. Paris: Presses Univ. de France, 1999.

Walter, Scott. "La solution de Kaluza au paradoxe d'Ehrenfest." In *Dimension, dimensions*, ed. Dominique Flament. Paris: Maison des Sciences d'Homme, 1999.

Walter, Scott. "Minkowski, mathematicians, and the mathematical theory of relativity." In *The expanding worlds of general relativity*, eds. Hubert Goenner, Jürgen Renn, Jim Ritter, and Tilman Sauer. 45-86. Boston: Birkhäuser, 1999.

Walter, Scott. "The non-Euclidean style of Minkowskian relativity." In *The symbolic universe : physics and geometry, 1890-1930*, ed. Jeremy Gray. 91-127. Oxford: Oxford Univ. Press, 1999.

Walter, Scott. "Review of: Einstein, Albert: The collected papers, vol. 6. Princeton, NJ., Princeton Univ. Press 1996." *Revue d'histoire des Sciences* 52 (1 1999): 163-164.

Weinig, Paul see also: Abattouy and Weinig

Weinig, Paul. *Aeneam suscipite, Pium recipite. Aeneas Silvius Piccolomini : Studien zur Rezeption eines humanistischen Schriftstellers im Deutschland des 15. Jahrhunderts*. Gratia : Bamberger Schriften zur Renaissanceforschung ; 33, ed. Dieter Wuttke. Wiesbaden: Harrassowitz, 1998.

Wellmann, Janina. "Pariser Wallfahrten : deutsch-französischer Wissenschaftstransfer am Beispiel Lorenz Okens und Etienne Geoffroy Saint-Hilaires." *Francia* (in press)

Wiesenfeldt, Gerhard. "System, Methode und die Freunde der Wahrheit : Theoretisches und Experimentelles in der Naturphilosophie des 17. Jahrhunderts." In *Tagungsdokumentation "Theorien über Theorien über Theorien"*, eds. Anke Jobmann and Bernd Spindler. 97-107. Bielefeld: Institut für Wissenschafts- und Technikforschung, 1999.

Wiesenfeldt, Gerhard see also: Dürbeck, Schickore and Wiesenfeldt

Wiesenfeldt, Gerhard. "Die 'Freiheit beim Philosophieren' und das Theatrum Physicum in Leiden : über die Integration experimenteller Naturlehre in die Universitätskultur des 17. Jahrhunderts." In *Instrument - Experiment : historische Studien*, ed. Christoph Meinel. 269-277. Berlin: GNT-Verlag, in press.

Wiesenfeldt, Gerhard. "Herman Boerhaave." In *Reader's guide to the history of science*, ed. Arne Hessenbruch. London: Dearborn, in press.

Wiesenfeldt, Gerhard. "Instrument makers." In *Reader's guide to the history of science*, ed. Arne Hessenbruch. London: Dearborn, in press.

Wiesenfeldt, Gerhard. "Säkularisierung der Naturerkenntnis: Zur bildlichen Darstellung von Experimenten in Lehrbüchern des 18. Jahrhunderts." In *Wahrnehmung der Natur - Natur der Wahrnehmung. Studien zur Geschichte visueller Kultur um 1800*, eds. Gabriele Dürbeck, Jutta Schickore, and Gerhard Wiesenfeldt. Dresden: Verlag der Kunst, in press.

Wintroub, Michael. "Civilizing the savage and making a king : the Royal Entry Festival of Henri II (Rouen, 1550)." *Sixteenth century journal* 29 (2 1998): 467-496.

Wintroub, Michael. "Taking stock at the end of the world : rites of distinction and practices of collecting in early modern Europe." *Studies in history and philosophy of science* 30 (3 1999): 395-424.

Wintroub, Michael. "The effect of moving and living things': the mirror and the spectacle of the royal entry." In *The living display anthology*, ed. J. Drobnick and J. Fisher. Chicago, Ill.: Univ. of Chicago Press, in press.

Wintroub, Michael. "L'ordre du rituel et l'ordre des choses: l'entrée royale d'Henri II à Rouen (1550)." *Annales : histoire, sciences sociales* (in press)

Preprints 1998-1999

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