

*History of Science Society  
2001 Annual Meeting  
Denver, Colorado  
8-11 November, 2001*

## **Listing of Sessions and Abstracts of Papers**

This document contains the information regarding the sessions organized for the History of Science Society's 2001 Annual Meeting. It also contains the abstracts for each of the papers that was presented as part of those sessions.

The sessions are listed sequentially by the time at which they occurred between the 8th and 11th of November, 2001. The listing begins on page 2 and ends on page 13. The abstracts are listed alphabetically by their author's last name, running from page 14 to page 99.

Prior to the creation of this document, abstracts and session information had been available via the Internet through a searchable database.

Created January 18th, 2002 by Roger Turner, HSS Information Manager.

# Sessions

## **2001: A History Odyssey: Science Fiction and the History of Science**

Commentator: Harry Shipman

Featuring Papers by: Mark Adams, Steven Dick, and James Gilbert

## **Practical Mathematics, Mixed Mathematics and Natural Philosophising in the Early 17th Century: Boundaries, Articulations and Power Plays**

Chair: Wilbur Applebaum

Commentator: Wilbur Applebaum

Papers:

*Hydrostatics, Physico-Mathematics and the Origins of Micro-Mechanism: Or What Rene and Isaac Did in 1619*, By John Schuster

*The Idea of a Mathematical Physics in the Early Seventeenth Century*, By Stephen Gaukroger

*Putting Astrology and its Patrons in their Place: Professor Henry Briggs, Sir Christopher Heydon and King James on Astrology, Astronomy and Mathematics*, By Katherine Neal

*The Beginnings of Post-Galilean Natural Philosophical Thought: 1638-1647*, By Luciano Boschiero

## **Rectifying Names, Identifying Things: Philology and Natural History in Germany and China**

Chair: Benjamin Elman

Commentator: Anthony Grafton

Papers:

*The Generality of Language and the Particularity of Nature: Natural History and Bildung in Germany, 1815-1850*, By Denise Phillips

*The Name of the Rose: Naming and the Classification of Nature in the Bencao gangmu*, By Carla Nappi

*Latin Words, Vernacular Worlds: Language and Environment in Early Modern German Natural History*, By Alix Cooper

*Making History Natural: Writing 20th century vernacular into 17th century travels*, By Grace Shen

## **Theory Constructions: The Rise of Theoretical Disciplines in the Early Twentieth Century**

Chair: M. Norton Wise

Commentator: M. Norton Wise

Papers:

*The Fin-de-Siecle Origins of Theoretical Biology*, By Manfred Laubichler

*Engineering Erased: Theoretical Physics and the Rhetoric of Reinheit*, By Suman Seth

*The Use and Disadvantage of Theory: Rickert, Dilthey and the Crisis of Historicism at the Fin-de-Siecle*, By Martin Ruehl

*Forging a Foundational Psychology: Ludwig Binswanger's Turn to Phenomenology*, By Susan Lanzoni

## **Biology in the Public Eye: Authority, Science and Politics in the Cold War**

Chair: Everett Mendelsohn

*The Microbiologist and His Times: Salvador Luria and the Anti-Vietnam War Movement*, By Rena Selya

*Science and Liberty for All: The Biological Sciences Curriculum Study*, By Audra Wolfe

*Linus Pauling's Influence on the Scientific Debate over Fallout Hazards*, By Christopher Jolly  
*C. D. Darlington and the Anglo-American Response to the Lysenko Affair*, By Oren Harman

### **Victorian Science in the Public Sphere**

Chair: Graeme Gooday

Commentator: Graeme Gooday

Papers:

*George Bentham Visits the Crystal Palace*, By Richard Bellon

*Looking the Truth in the Face: Francis Galton and the Criminal Physiognomy*, By John Waller

*Conversazioni and Science in Provincial England*, By Sam Alberti

### **National Scientific Identity in 18th Century Britain and America**

Chair: Keith Benson

Station to Station: Articulating Identity and Nation in Eighteenth Century British Science, By Kevin Grau

*Appropriating a Continent: Natural Science, Geographical Categories, and Anglo-American Identity in the Eighteenth Century*, By James Drake

*Redefining Science in Local Terms: Navigational Science and Centers of Calculation in New England, 1760 to 1800*, By Matthew McKenzie

*The Power and Problem of Authority: Early American History in a Trans-Atlantic Context*, By Margaret Meredith

*Paleontology: "Canadian" fossils / American science*, By Debra Lindsay

### **Evolutionary Theory in Mind, Body, and Society**

Uncertain Organisms: The Struggle for Identity in Cuvier's Comparative Anatomy, By Tobias Cheung

*Darwin on Unconscious Development in Mind and Language*, By Stephen Alter

*Racing Out of Central Asia: Henry Fairfield Osborn and the Origins of Man*, By Brian Regal

*Evolutionary models resonate with social shifts*, By Ayelet Shavit

*Getting Into the Field: Transportation Networks, Colonial Infrastructure, and the Making of Anthropological Knowledge in the Nineteenth Century*, By Jeremy Vetter

### **Balancing Acts (Forum for the History of Science in America, Distinguished Historian Lecture)**

Balancing Acts, By Sally Kohlstedt

### **Experimental Design, Experimental Practice**

Material Culture and Experimental Practice in the Enlightenment Laboratory, By John Dettloff

*Dr Mary Putnam Jacobi and the Forbidden Experiment*, By Joy Harvey

*Sir Ronald Fisher and Randomized Experimental Design*, By Nancy Hall

*Müller's Lab: The Struggle for Personal Space*, By Laura Otis

### **Science and War**

Chair: Alan Beyerchen

MIT's New Masque of Power: Scientific Authority in the Service of the Cold War State, By Michael Dow

*Chemical Warfare Scientists in 1914-1918 Britain: Servants to the War Effort?*, By Marion Girard

*Reimagining Anthrax: Science, Perception, and the Construction of Biological Threat*, By James Nelligan

*The fruits of war: Dutch science under German occupation, 1940-1945*, By Klaas Van Berkel

### **Visualizing Nature**

Chair: Kerry Magruder

*Mapping Bodies and Spaces in Early Modern Italy*, By Daniel Brownstein

*Noise or Nature? Photographing the Invisible around 1900*, By Peter Geimer

*Visuallity and Authority: Machines as Eye-Witnesses*, By Tal Golan

*Imag(e)ining the Laboratory: post-war ionospheric research and the panoramic ionogram*, By Edward Jones-Imhotep

### **Science off the Beaten Path: Magic, Vampires, Spirits and Physiological Sciences**

The natural philosophy of vampires, By Massimo Mazzotti

*Science for the Public: Natural Magic in the Enlightenment*, By Oliver Hochadel

*In Search of William James's Medical Thesis: Physiological Science and Water-Cure Therapies*, By Paul Croce

*When Faith Was Not Enough: The Scientific Study of the Afterlife in France, 1880-1910*, By Sofie Lachapelle

### **Breaking Traditions in the Heavens: Theory, Practice, and Popular Perception**

Chair: Peter Barker

On the natural-philosophical and textual problems of late Renaissance Astrology, By Steven Vanden Broecke

*Traversing the Path of Kepler's Elliptical Orbit: A Close Look at the New Astronomy*, By Prasanta Bandyopadhyay

*"Who was Elisabetha Hevelius? 'Domestic' Astronomy in the Early Modern Period"*, By Voula Saridakis

*No More Magic Moonbeams: Astronomy as Public Science in Nineteenth Century France*, By Theresa Levitt

### **Uses and Abuses of History of Science**

Chair: Jan Golinski

Unappreciated discoveries: how to deal with them?, By Nahum Kipnis

*Historical epistemology or total history? Georges Canguilhem's approach to the history of the sciences*, By Christina Chimisso

*Stephen Jay Gould as Historian of Science: A Quantitative Content Analysis of His Works*, By Michael Shermer

### **Creating Natural Knowledge**

Chair: Karen Reeds

The origins of natural history, By Elihu Gerson

*Reforming Nature: Natural Knowledge in the Vernacular Print Culture of Sixteenth-Century Germany*, By Kathleen Crowther-Heyck

*Hybrid Identities in the Making of Western Science*, By Andrew Jamison

*The Legacy of Francis Lee Jaques: Dioramas in the 20th Century and Beyond*, By Maura Flannery

### **Sex Differences, Aging, and Therapeutics**

Chair: Rima Apple

Sensational Science: Men, Women, and Mesmerism in Wilkie Collins' *A Woman in White* and *The Moonstone*, By Sharrona Pearl

*Sexual Arousal and the CNS: the Contributions of W. Horsley Gantt and Frank A. Beach*, By Joshua Levens

*Menopause: Hers and His? Medical Visions of the Climacteric in the Late 19th Century*, By Sarah Goodfellow

*Science Confronts Aging: The Case of Hormone Replacement Therapy*, By Elizabeth Watkins

### **Building the Next Big Machine**

Chair: Catherine Westfall

Seeing the Future: The Origins of the Next Generation Space Telescope, By Patrick McCray and Robert Smith

*A Laboratory Life: Making Lemonade in High Energy Physics*, By Elizabeth Paris

*Growing Pain: Scientific Knowledge and Organisational Change in Path Breaking Research*, By Harry Collins

*The Next Big Simulation: Computers in the Nuclear Arms Race*, By Anne Fitzpatrick

### **Beyond Cold War Borders: Examining the Politics of Science in International Affairs**

Chair: Spencer Weart

U.S. Science Attaches in the Early Cold War: A Comparative International Perspective, By Ronald Doel

*Philanthropy and the National Security State: The Ford Foundation's Support for European Physics in the late 1950s*, By John Krige

*Regulation and Debate in International Agricultural Industries: The Case of Antibiotic Feed Additives In the U.S. and U.K.*, By Barbara Kimmelman

*Transnational Science, International Affairs: Scientists and Arms Control Initiatives in the 1980s Control Initiatives in the 1980s*, By Kai-Henrik Barth

### **Heroes and Anti-Heroes: Public Images of the Victorian Man of Science**

Chair: Sally Gregory Kohlstedt

Commentator: Sally Gregory Kohlstedt

Papers:

*Scientists as Anti-Heroes: Materialism and Tyndall's Belfast Address*, By Bernard Lightman

*Crowds and Celebrities: Faces of Knowledge in the Pictorial Press*, By James Secord

*"Be what you would seem to be": Samuel Smiles, Thomas Edward, and the Making of a Working-Class Scientific Hero*, By Anne Secord

### **Daily Life in Nineteenth Century European Science**

Chair: Marjorie Levine-Clark

Commentator: Marjorie Levine-Clark

Papers:

*"The more civilized a nation is, the smaller the rooms": Daily Life through the Eyes of Emil du Bois-Reymond*, By Gabriel Finkelstein

*Helmholtz as a Private Man*, By David Cahan

### **Ulterior Motives in Science Inquiry**

Chair: Robert Brain

Commentator: Robert Brain

Papers:

*A.I.Hallowell's Boasian Evolutionism: Human Ir/Rationality in Cross-Cultural, Evolutionary, and Personal Context*, By George Stocking

*The Erotic Sources of Goethe's Science*, By Robert Richards

*Erich Wasmann's Catholic Evolutionism*, By Abigail Lustig

### **Landscapes of Colonial Knowledge: Representing Malaria in Europe, Jerusalem and North Africa**

Chair: Stepahne Castonguay

Theater of Malaria: Demonstrating Transmission in Rome and London, By Douglas Haynes

*Mapping the Marsh: Malaria and the Sharing of Medical Knowledge in Mandatory Palestine*, By Sandy Sufian

*"French Colonial Medicine in the Nineteenth Century*, By Michael Osborne

### **Climate and Culture: Contexts, Concepts, and Choices**

Chair: Ronald Rainger

Commentator: James Fleming

Papers:

*Airs and the Ars Chymia: Early Modern Physico-Chymical Concepts of Atmospheric Change*, By Margaret Garber

*Attitudes Concerning Latitudes: The Origin and Early Evolution of the "Köppen-Zone" System of Climate Classification*, By Mott Greene

*Computing Global Climate Change: The Early Development of General Circulation Models (GCMs) in Britain*, By Sang-Hyun Kim

### **Issues in Graduate Education (Sponsored by the HSS Committee on Education)**

Chair: Pamela Smith

Academic assignments that train historians for public history careers, By Victoria Harden

*What I learned and wished I had learned in my graduate program in the history of science*, By Buhm Soon Park

*Growth of HSTM faculty within a general history department*, By Theodore Porter

*What a liberal arts college is looking for in an HSTM faculty member*, By John Servos

### **Issues in Ecology and Environmentalism**

Chair: David Spanagel

John Bartram and His Contribution to the Theory of Ecological Succession, By Patricia Bunner

*From "Cycle of Life" to "Microbiological Ecology," 1890-1930*, By Lloyd Ackert, Jr.

*From Essential to Endangered: The Species Question in Conservation Biology*, By Mark Madison

### **Science in a Warm Climate: Three Case Studies in Tradition and Innovation**

The Hula and the War Bonnet: Science or Knowledge about Nature in Traditional Oral Societies, By Kathleen Ochs

*Obstetrics and the Inclusion of Women in Mexico's Medical Establishment, 1850-2000*, By Lee Penyak

*Antonio Meucci: How Electrotherapy Gave Birth to Telephony*, By Basilio Catania

### **Science and Society in America**

Chair: R. Hamerla

"An Irreligious Philosopher Must Be Mad:" Public Lectures on Natural Philosophy and the Experiences of Captain John MacPherson in Eighteenth-Century Philadelphia, By Kevin Gumienny

*From Inner-Space to Outer Space: T. Keith Glennan and the Science Managers of the Early Cold War*, By Jason Krupar

*Cultivating Truth: Ralph Waldo Emerson's Life in Science*, By Laura Walls

### **Ecology and the Social Order**

Chair: Gene Cittadino

Commentator: Philip Pauly

Papers:

*Ecology on Trial: East Meets West on the Texas-Oklahoma Border*, By Gene Cittadino

*(Un)orthodox Ecologies: Succession and Social Order in the Works of Marietta Pallis*, By Laura Cameron

*Ethology Goes Environmentalist: Konrad Lorenz' Ecological Politics*, By Thomas Potthast

*From Bauhaus to Animal House: Towards a History of Ecological Architecture*, By Peder Anker

### **Quantification and Modeling in Science and Society**

Chair: Ida Stamhuis

Limits on expectations: Quantification, instrumentation and organisation in 18th century meteorology, By Huib Zuidervaart

*Mimetic experiments: Stanley Jevons, s construction of evidence for theories*, By Harro Maas

*ÆBiologists, not applied statisticians,. statistics and genetics at the beginning of the 20th century'*, By Ida Stamhuis

*Modeling in applied population forecasting prior to World War II*, By Henk Gans

*The emergence of the aggregate variable 'Consumption' and its measuring method, 1920-1955*, By Adrienne Bogaard

### **Race, Class, and Gender in Victorian Britain**

Chair: Michael Reidy

Commentator: Jane Camerini

Papers:

*"We Must Not Forget the Women': Involvement of Women in Victorian Marine Science"*, By Helen Rozwadowski

*"Scientists' and 'Subordinate Labourers': Class and the Creation of Victorian Science"*, By Michael Reidy

*"Race and Science: Cape Colony Natural History as Hybrid Knowledge"*, By Elizabeth Green-Musselman

*"Behind folding shutters of Whittingehame House': managing natural history and domesticity at the country estate after the professional turn"*, By Donald Opitz

### **'Mathematization' Reconsidered: What to do with Mathematics in the Scientific Revolution?**

Chair:

Nuremberg and De revolutionibus: Reflections on the Biography of a "Mathematical" Community, By Karl Galle

*Mathematization and the Language of Nature in the 17th Century*, By David Sepkoski

*Looking High and Low for a New Philosophy: Mathematics and the Early Modern Print Market*, By

Mary Henninger-Voss

*"There was no such thing as the Newtonian Revolution and the French Initiated It:" Newtonian Mechanics in France Before Maupertuis*, By J.B. Shank

### **Practicing the Human Sciences in Fin-de-Siècle France**

Chair: John Brooks III

Commentator: John Brooks III

Papers:

*Durkheim, philosophers, and the moral guidance of the French public*, By Daniela Barberis

*When Natural Space Meets Social Theory: The Circulation of Friedrich Ratzel's Models of Space in French Sociology, History, and Human Geography around 1900*, By Iris Schroeder

*Dangerous minds? The Science of Children's Lies in Fin-de-Siècle France*, By Katharine Norris

### **Extended Organisms: Brains, Mind, and Artificial Intelligence**

Chair: Nadine Weidman

*Mind and Network*, By Hunter Crowther-Heyck

*The Brain as Technology*, By Otniel Dror

*Playing Games: Chess, Automata, and Artificial Intelligence*, By Matthew Wisnioski

*The Organism as Tape: Information Theory, Cybernetics, and the One-Dimensional Model of the Gene*,  
By Joseph November

*From Pascal to Hacking: Discourses Concerning the Machine*, By André LeBlanc

### **Revising Standard Histories**

*The Element of the Table: Classifying Chemical Knowledge, from Affinity to Periodicity*, By Benjamin Cohen

*Voluntarism and Early Modern Science*, By Peter Harrison

*Different voices were heard: Genticists, views in the 1930s and 1940s on the consequences of race crossing*, By Ernest Hook

*Biochemistry with a License: Tobacco Mosaic Virus and the Start of Molecular Biology Research in the Federal Republic of Germany, 1947-1965*, By Jeffrey Lewis

*The Science of the 'Dismal Science:' Politics, Economics and Science in 19th Century Britain*, By Laura Snyder

### **Evolution and 20th Century Astronomy**

Chair: Mark Largent

Commentator: Karl Hufbauer

Papers:

*Evolutionary Thinking in American Astronomy from Lane to Russell*, By David DeVorkin

*Cosmic Evolution and the Biological Universe*, By Steven Dick

*Popular and Pedagogical Uses of Cosmic Evolution*, By JoAnn Palmeri

### **Beyond the Hallowed Halls: Careers in History of Science**

Chair: Nathaniel Comfort

Commentator: Arnold Thackray

Papers:

### **Texts and Contexts in Medieval Science**

Teaching the compotus: A Commentary on Grosseteste's Compotus correctorius in MS Harley 4350, By Matthew Dowd

*Geography in Early Medieval Europe: Decline or Development?*, By Natalia Lozovsky

*The 'Unnamed Master' Revisited: Mathematics, Perspective and Astrology in Roger Bacon and Albertus Magnus*, By H. Darrel Rutkin

### **Psychiatry, Psychology, and Cultural History**

Chair: Hamilton Cravens

Time, psychology, and telegraphy: The technological context of the reaction time experiment, 1860-1880, By Henning Schmidgen

*"Dreams as Experimental Objects in American Psychology"*, By Kenton Kroker

*The Bobby Franks Murder: Leopold Loeb and American Psychiatry in the 1920's*, By Simon Baatz

*From Nervous Weakness to "Future Shock": the Cultural History of Stress, 1890-1970*, By Chloe Silverman

### **Twentieth-Century Physical Theory**

Chair: Richard Beyler

Who Started the Electron Spinning?, By Robert Arns

*Who Started the Electron Spinning?*, By Jeremiah James

*Seeing Double: Shared Identities in Quantum Theory*, By Peter Pesic

*The "Hyperbola of Quantum Chemistry": The Changing Practice and Identity of a Scientific Discipline in the Early Years of Electronic Digital Computers, 1945-1965*, By Buhm Soon Park

### **Universality and Particularity in Scientific Epistemology and Praxis**

Chair: Alan Shapiro

Aristotle's Method of Division in 'Meteorology' IV, By Tiberius Popa

*Seeing, Doing, and Uncovering: Interpreting Bacon's Method in the Early Royal Society of London*, By William Lynch

*The role of visualization in Jean Paul Marat's scientific approach*, By Peter Heering

*Experiments on Nature and Society: The tension between universality and locality in Benjamin*

*Thompson's late eighteenth-century reform projects*, By Anna Maerker

### **Dissent, Controversy, Opposition: Science Marching to a Different Drummer**

Chair: William Summers

Science and Persecution: Joseph Priestley (1733-1804), the Dissenters and Anglican Newtonianism in Late Eighteenth-Century England, By Dan Eshet

*Sound Differences on Tonal Distances. The Controversy Between Carl Stumpf and Wilhelm Wundt*, By Martin Eberhardt

*The Puzzle Posed by Plasticity: Berrill's Denial of Genes for Development*, By Sarhotra Sarkar

*Reconstructing Opposition in Science: The DNA Provirus Hypothesis, the Central Dogma of Molecular Biology, and the Origins of Retrovirology*, By James Marcum

### **Social Science, Social Problems in the Twentieth Century**

Chair: Shirley Roe

Popularizing Eugenics: Sir George Archdall Reid and the Medicalization of Social Problems c.1890-1910., By Mark Russell

*Eradicating Tuberculosis and Promoting Psychoanalysis: Vienna 1918*, By Elizabeth Danto

*"Workers and their families do not eat statistics": Econometrics from the "bottom-up" during World War II*, By Thomas Stapleford  
*Psychiatry and Social Progress after World War II: Julius Schreiber and the Institute for Social Research*, By Paul Theerman

### **Diffusing Science in the Popular Arena**

The many hats of the nineteenth-century science popularizer, By Rebecca Kinraide  
*Shaping Public Perceptions of Science in Late-Nineteenth-Century France: The Role of La Nature*, By Robert Hendrick  
*"Journey to the Invisible World": Popular Microscopy as Popular Culture, 1919-1939*, By Eric Kupferberg  
*Popular Depictions of Scientific Detection*, By Keith Barbera

### **The Exact Sciences in Ancient and Modern Society**

Chair: Robin Rider  
Why Euclid's Optics is Incompatible with Linear Perspective, By Philip Thibodeau  
*The struggle between quaternions and vectors: the historical origin of some misunderstandings in modern algebra*, By Cibelle Silva  
*Tension Between Practical and Theoretical Science in Nineteenth-Century America: The Case of Nathaniel Bowditch*, By Todd Timmons  
*Women Mathematicians in America: The Doctoral Classes of 1940-1959*, By Margaret Murray

### **Re-positioning astronomy: evolving practices, audiences, and institutions.**

Chair: Deborah Warner  
Commentator: Alex Soojung-Kim Pang  
Papers:  
*'The Sun and the Emperor's Government Belong to Everyone': Eclipse Expeditions and the Institutionalization of Astrophysics in France, 1862-1877*, By David Aubin  
*Constructing space for the new astronomy: the public science of J. Norman Lockyer*, By Charlotte Bigg  
*Photogenic Venus: The "Cinematographic Turn" in late nineteenth century astronomy*, By Jimena Canales

### **Ideologies of Managing Science and Technology**

Chair: Everett Mendelsohn  
Commentator: Cathryn Carson  
Papers:  
*Redirecting research: Experiences from the Notgemeinschaft der Deutschen Wissenschaft / Deutsche Forschungsgemeinschaft in the 1920s*, By Jochen Kirchhoff  
*Organizational innovations in electronic component manufacturing in Silicon Valley*, By Christophe Lecuyer  
*Business management philosophies and the Jet Propulsion Lab in the 1990s*, By Peter Westwick

### **The Mutual Dependency of the Public and the Personal in Victorian Science**

Chair: Dorinda Outram  
Commentator: Dorinda Outram  
Papers:

*Childhood and the Reach of Reason in the World of Augustus and Sophie de Morgan*, By Joan Richards

*Statistics and the Unsalvageable Self*, By Theodore Porter

*The Figure of Darwin in Evolutionary Debates: Celebrity and Caricature*, By Janet Browne

### **The Creation of Order: Scientific Classifications in the 18th and 19th Centuries**

Chair: Jed Buchwald

Classification as a mathematical competence among eighteenth-century geometers, By Eric Brian

*'Sandstone can as well hold gold' - Classifying Non-Living Nature, 1730-1770*, By Staffan Mueller-Wille

*Ordering and Labelling - Guyton de Morveaus' and Lavoisiers' Reform of the Chemical Nomenclature*, By Wolfgang Lefevre

*Experiments, formulae, and the order of organic matter*, By Ursula Klein

### **The Exners: Science in a Viennese Bildungsbürger Family**

Chair: Malachi Hacohen

Commentator: Sahotra Sarkar

Papers:

*Family History and the History of Science: The Exners en famille*, By Deborah Coen

*Physiology gains space: On the meaning of Sigmund Exner's Founding of the Phonogrammarchiv*, By Veronika Hofer

*Franz Serafin Exner's Indeterminist Theory of Culture*, By Michael Stoeltzner

### **Manufacturing "Culture": The Culture Concept in Mid-Twentieth Century Social Sciences (Sponsored by the Forum for the History of Human Science)**

Chair: John Gilkeson

Commentator: John Carson

Papers:

*Defining Culture: The Intellectual and Institutional Unification Project of Cold-War Social Science*, By Jamie Cohen-Cole

*Coordinating the "Coordinating Science" for the New World Order: Physical and Cultural Anthropologists in the Postwar United States*, By Joy Rohde

*Diagnosing Culture and Family in the History of Family Therapy*, By Debbie Weinstein

### **Collecting, Exhibiting and Preserving: A Century of Colonial Science in the Pacific, 1850-1950 (Sponsored by the Pacific Circle)**

Chair: Michael Osborne

Commentator: Janet Garber

Papers:

*Natives, God and Health: John Thomas Gulick Collecting in Hawaii*, By Joshua Buhs

*19th-Century Australian Science on Display: Ferdinand von Mueller and the Exhibitions*, By Peter Hoffenberg

*Displacing Frontiers: The Pacific Science Board's Campaign for Conservation*, By Gary Kroll

### **"You Youth are Terrible People . . .": Student Culture and the Moral Economies of Modern Physics**

Chair: Kathryn Olesko

Commentator: Kathryn Olesko

Papers:

*"Crushing the Enemy with His Own Weapon": Maturing Young Soviet Cadres Master Quantum Theory (and Stalinist Culture)*, By Karl Hall

*"Student Radicals" in Science: Youth Cultures and the Roots of Quantum Physics Research in Interwar Japan*, By Kenji Ito

*The Postwar Suburbanization of American Physics*, By David Kaiser

### **The Mathematization of Science**

Chair: Evelyn Fox Keller

Commentator: Evelyn Fox Keller

Papers:

*"What Did Mathematics Do to Physics?"*, By Yves Gingras

*"The Mathematization of Monsters: Isidore Geoffroy Saint-Hilaire's Teratology"*, By Olivier Lagueux

*"Nicolas Rashevsky's Application of Theoretical Physics to Biological Problems, 1930s-40s"*, By Tara Abraham

*"The History of Factor Analysis: An Example of Mathematization in the Humanities"*, By Olivier Martin

### **Internationalization and Trans-national Communication in Mathematics: Influence on Context and Community**

Chair: Joseph Dauben

Commentator: Joseph Dauben

Papers:

*Bridging the Channel: The Contextualization of British and French Contributions to Geometric Probability*, By Karen Parshall

*G. H. Hardy, the London Mathematical Society, and the Rise of British Pure Mathematical Research in the First Half of the Twentieth Century*, By Adrian Rice

*A Case Study in the Evolution of a Mathematical Research Community in Pre-Unification Italy:*

*Barnaba Tortolini (1808-1874) and the Annali di scienze matematiche e fisiche*, By Laura Martini

*Statistics in the U.S. Comes of Age: A Case Study in American Influence Abroad*, By Patti Hunter

### **Atomic Opportunities and Consequences: Postwar Radiobiology in the U.S., U.K., and France**

Chair: David Cantor

*Radiation Genetics as Atomic-Age and Cold-War Eugenics*, By John Beatty

*Proliferating Radioisotopes: The Atomic Energy Commission's Distribution Program and Postwar Biomedical Research*, By Angela Creager

*Normal Pathways: Controlling Isotopes and Building Biomedicine in Postwar France*, By Jean-Paul Gaudillière

*Radiobiology in Postwar Britain*, By Soraya de Chadarevian

*Radiation Studies following World War II: Nuclear Warfare, Radiation Sickness and Curing Childhood Leukemia*, By Jerry Kutcher

### **History and philosophy of science: revisiting a precarious relationship**

Commentator: Richard Burian

Papers:

*The Historicity of Epistemological Terms: Changing Notions of Error in Microscopy*, By Jutta

Schickore

*The role of unexplained coincidences in theory construction and theory choice*, By Michel Janssen  
*From realism to constructivism and back again: remarks on D. Bloor, B. Latour and I. Hacking*, By Ofer Gal

*Experiments in history and philosophy of science*, By Friedrich Steinle

### **Techne and Expert Knowledge in Ancient Greece and Rome**

Chair: Heinrich von Staden

Commentator: Heinrich von Staden

Papers:

*Drawing the Line: Boundary Disputes in the Graeco-Roman Antiquity*, By Serafina Cuomo

*A Geometry of Machines: Hero of Alexandria's Mechanical and Mathematical Treatises*, By Karin Tybjerg

*Does Technology Act Contrary to Nature?*, By Astrid Schuermann

*Techne and Method in Ancient Medicine and Mechanics*, By Mark Schiefsky

### **The Life Sciences and the Crisis of Ethics, 1870-1945**

Commentator: Edward Larson

Papers:

*Darwinism, Monism, and the Search for a Scientific Ethics in Germany, 1890-1914*, By Richard Weikart

*Atheism, Evolution, Nihilism, and a Transcendental Turn: The Question of Secular Ethics in France, 1870-1914*, By Jennifer Hecht

*Evolutionary Ethics and the Dilemmas of Darwinism in Late Nineteenth-Century British Thought*, By Michael Hawkins

*Lives Not Worth Living: Charles Francis Potter, Darwinism, and the Origins of the Euthanasia Movement in America*, By Ian Dowbiggin

### **New Trends in the History of Science: New World Experiences, Spain and the Study of Nature**

Commentator: James Bono

Papers:

*Questionnaires and observing instruments: Standardization, credibility, and control of empirical observations in Spain and Spanish America.*, By Alison Sandman

*How Derivative was Humboldt? Microsomic Nature Narratives in Eighteenth-Century Spanish America and HUmboldt's Ecological Sensibilities.*, By Jorge Cañizares-Esguerra

*The Casa de la Contratación and its Chamber of Knowledge: Empirical Activities in the Spanish Empire*, By Antonio Barrera

### **The Sciences in Conversation with One Another: Meanings and Uses of Newtonianism in the Siècle des lumières**

Conjecture and Empiricism in Enlightenment Life Science, By Mary Terrall

*The 'Newtonian' Defense of Medical Vitalism in Eighteenth-Century France*, By Elizabeth Williams  
*Newton in the Public Sphere of Chemistry*, By Mi Gyung Kim

*Gravitation and Generation: Hypothesis in the Thought of Charles Bonnet and Georges-Louis Le Sage*, By James Evans

# Abstracts

**Abraham, Tara**

*E-mail Address: tabraham@dibinst.mit.edu*

**Taming Organized Complexity: Nicolas Rashevsky's Mathematical Biophysics, 1928-1939**

This paper will explore the work of Nicolas Rashevsky (1899-1972), a Russian émigré theoretical physicist who developed a program in "mathematical biophysics" at the University of Chicago in the 1930s and 1940s. Noting the complexity of many biological phenomena, Rashevsky argued that the methods of theoretical physics - namely mathematics - were needed to "simplify" complex biological processes such as cell division, growth, and neural activity. In contrast to other, contemporary mathematical treatments of biological phenomena, such as Lotka and Volterra's work on species interaction, or Sewall Wright's population genetics, Rashevsky's approach was strongly informed by the methodology of theoretical physics. Rashevsky's goal was to develop a systematic mathematical biology: one that stood in relation to experimental biology in the same way that mathematical physics stood to experimental physics, and he made strong arguments about the worth of a mathematical approach to biology. Rashevsky's work raises important methodological issues within the life sciences. Often, the complexity and uniqueness of biological phenomena are used as an argument for the autonomy of biology from physics, and implicitly from mathematics. Thus, experimentalists often resisted Rashevsky's approach because it ignored the complexity of biological phenomena. Rashevsky, in contrast, argued that it was this very complexity that justified a mathematical approach based on idealization and approximation. In light of this, Rashevsky's work leads to reflections on the use of mathematics in biology as well as on tensions within biology between theoretical and experimental approaches.

**Ackert Jr., Lloyd**

*E-mail Address: lloydack@bellatlantic.net*

**From "Cycle of Life" to "Microbiological Ecology," 1890-1930.**

This paper concerns Sergei Vinogradsky's concept of the natural group of scientists, which included Selman Waksman, René Dubos, Vladimir Vernadsky, and Vasilii Omelianskii. In the 1890s, Vinogradsky (1856-1953) developed an ecological approach to the study of microbes, which emerged from his research on nitrification and resulted in his conceptualization of a new type of respiration called concept of the ure in which microbes regulated the exchange of matter between the inorganic and organic worlds. Interpreting the ideas of Louis Pasteur and Ferdinand Cohn, as a student of Russian plant physiology, Vinogradsky developed a ecology, that is, ecologically. The ecological methods developed by Vinogradsky played out differently in the various contexts to which they migrated. For example, Waksman and his student Dubos, developed a school of ecological soil microbiology at Rutgers University in the 1920s. It was, in part, Waksman's application of Vinogradsky's approach to soil microbiology that led to his discovery of the first antibiotic, streptomycin. In Russia, Vernadsky incorporated Vinogradsky's concept of thesis biosphere concept. Omelianskii, who assisted Vinogradsky at the Institute of Experimental Medicine in St. Petersburg, Russia, between 1891 and 1910, continued Vinogradsky's research program in soil microbiology. Vinogradsky's research on

**Adams, Mark**

*E-mail Address:*

**The Visionary Roots of Arthur C. Clarke**

**Alberti, Sam**

*E-mail Address: alberti@fs4.ma.man.ac.uk*

### **Conversaciones and Science in Provincial England**

Science was enmeshed within the complex of cultural and educational institutions that made up middle-class civic life in provincial Victorian Britain. Nowhere was this more visibly displayed than at a *soirée* or *conversazione*, an exhibition-cum-festival that incorporated fine and industrial art, literature, science, often culminating with music and dancing. The *conversazione* markedly demonstrates two previously understated issues: firstly, the extent to which science was part and parcel of wider civic culture, and secondly, how far the urban middle-class elite used natural knowledge in these forums to assert their cultural maturity. This paper incorporates with a contextualist history of science the techniques of urban and regional historians to examine science in the public sphere, under the civic gaze. Drawing on *soirées* in various sites in a number of towns, I discuss where they were held, who attended them, when they were most popular, and why they were staged. This will illustrate the continuing importance of the accumulation and exhibition of artefacts to Victorian science, and how far science was a symbolic resource, utilised by the *haute bourgeoisie* to promote their own town within the county and country, and their own class and sect within the town.

**Alter, Stephen**

*E-mail Address: salter@gordon.edu*

### **Darwin on Unconscious Development in Mind and Language**

This paper examines Darwin's notion of "unconscious" linguistic behavior and its use in Darwin's argument for the evolutionary development of the human mind. In 1872, Darwin asked the American philosopher Chauncey Wright to give his opinion on a recent debate: should the long-term changes that languages undergo be attributed to choices made by individual speakers? Darwin argued that speakers never intend to change their language, but are like keepers of domestic animals who engage in selective breeding without realizing it--what Darwin called "unconscious selection." Chauncey Wright understood Darwin to refer to the problem of long-term unintended consequences in the social-cultural realm. Yet Darwin actually was interested in a different issue, one he had touched on in his *Descent of Man* (1871) and *Expression of the Emotions in Man and Animals* (1872): what did the notion of "unconscious" or unwilled behavior suggest about the origin of human mental capacities? Darwin thus confused two senses of the term "unconscious": a sociological definition, pertaining to unintended consequences, and a more literal psychological definition, pertaining to innate or habitual behaviors. By blending these, Darwin built a semantic bridge between mental evolution and long-term socio-cultural change. By contrast, Chauncey Wright separated these concepts in his famous 1873 essay "The Evolution of Self-Consciousness." Although most of Wright's essay concerned an aspect of mental evolution, the final pages addressed the question of intentionality in on-going language change. Wright thus signaled a distinction between the literal and figurative senses of "unconscious," a departure from Darwin's ambiguous use of that term.

**Anker, Peder**

*E-mail Address: pederanker@yahoo.com*

### **The Philosopher's Cabin: Towards a History of Ecological Architecture**

This paper examines the history of architecture and ecology. I will focus on the homes of Henry David Thoreau, John Muir, Aldo Leopold and Arne Ness, all celebrated philosophers and founding fathers of deep ecological reasoning. They lived and wrote about ecology in shacks or small cabins in faraway locations. Indeed, Ness is still an active author in his remote cabin Tvergastein at the mountaintop Hallingskarvet at Ustaoset in Norway. I will suggest that these homes have in common an

anti-aesthetic language, since design itself represents an anthropocentric departure from closeness to nature. Their views on the household of nature stands in direct relationship with their homes. The language they used to describe nature is thus understood in the context of the architectural language of their shanties. Contrary to the widely held belief that ecology implies understanding the human condition as being part of nature, I also argue that the deep ecologists have a distant epistemological bird's-eye view and *Weltanschauung*. They all located their home - imaginary or real - on a mountaintop as far as possible from the social realm, but close enough to suggest various moral and political management schemes for our societies and environments.

**Appel, Toby**

*E-mail Address:*

**Arns, Robert**

*E-mail Address: robert.arns@uvm.edu*

**Who Started the Electron Spinning?**

The recognition that a fourth quantum number was required to describe the optical spectra of atoms and that this quantum number was half-integer and associated with the spin of the electron had its beginnings in the time of the semi-classical Bohr-Sommerfeld model of the atom and provided a challenge during the transition from that model to the quantum theory of Heisenberg, Schrödinger, and Dirac. There are many characters in this story of the slow unfolding and clarification of the understanding of electron spin, including Alfred Landé, Wolfgang Pauli, Paul Ehrenfest, Neils Bohr, H. A. Lorentz, Ralph Kronig, George Uhlenbeck, Sam Goudsmit, L. H. Thomas, and P. A. M. Dirac. Although Uhlenbeck and Goudsmit are often singled out as the discoverers of electron spin, there were many steps in the discovery, and the dispute over their primacy provides an interesting example of competition in and communication within the scientific community of the period. In addition, the development of this facet of quantum theory helps illustrate the roots and evolution of quantum theory and the nature of scientific acceptance.

**Aubin, David**

*E-mail Address: aubin@mpiwg-berlin.mpg.de*

**'The Sun and the Emperor's Government Belong to Everyone': Eclipse Expeditions and the Institutionalization of Astrophysics in France, 1862-1877**

Like observatories, scientific travels are among the institutions that have shaped, if only in a more intermittent fashion, the contours of astronomy. In the 1860s and 1870s, the rise of astrophysics was especially dependent on eclipse expeditions, and travel more generally. As the case of Jules Janssen (1824-1902) shows, travel fulfilled several simultaneous goals: (1) eclipse expeditions were of course an unparalleled way to gather evidence about the constitution of the sun (2) the recent revival of the *Service des missions*, an organism sponsored by the Public Instruction Ministry, provided Janssen, who was foreign to the science establishment, with desperately needed funding and legitimacy (3) frequent meeting with foreign astrophysicists laid the basis for an international community exchanging instruments and practical knowledge that was difficult to acquire from reading published accounts and (4) the wide appeal of travel accounts helped gather public support for the burgeoning new astronomy. It is revelatory that while in 1877 a State-sponsored observatory was established for Janssen in a suburb of Paris, he did not relinquish the nomadic aspect of his astrophysics. Finally, this paper will examine the process by which direct government funding of scientific research increased during those decades.

Janssen's rhetorical strategy will highlight the link between national prestige, colonialism, and the emerging theme of the 'decline of French science.'

**Augustine, Dolores**

*E-mail Address: augustid@stjohns.edu*

**Werner Hartmann: An East German Physicist's Fall from Grace**

This paper will focus on an East German physicist who tried to chart a course as an apolitical, but loyal scientist, working to build the foundations for an essential high-tech industry-- microelectronics. Werner Hartmann was a physicist who during the entire course of his career worked in industry, first under the Nazis, then in Soviet captivity, and finally in the German Democratic Republic. A student of Gustav Hertz, he was taken to the Soviet Union to assist with the Soviet atomic program in 1945. Offered excellent working conditions, he returned to the German Democratic Republic in 1955, and became the head of the first major research institute in the field of microelectronics in 1961. He established himself as an institute director of the traditional German type. A skillful organizer, charismatic personality and, above all, visionary scientist, he oversaw the production of the first integrated circuit in the G.D.R. and lay the foundations for the microelectronics industry. Loyal to the Communist régime, he nonetheless did not join the Communist party, and in fact avoided politics as much as possible. He placed his institute and its work first, making considerable demands of resources from the régime. He became involved in controversies with other research institutes. Ultimately, he ran afoul of the system, and was relieved of his duties in 1974 and given meaningless work. This paper will explore and analyze his strategies in dealing with the system and his fall from grace, using archival materials that have become available since 1989.

**Baatz, Simon**

*E-mail Address: simon\_baatz@nlm.nih.gov*

**The Bobby Franks Murder: Leopold-Loeb and American Psychiatry in the 1920's**

In May 1924 Nathan Leopold and Richard Loeb murdered a fourteen-year old boy, Robert Franks. Leopold and Loeb were both teenagers, sons of millionaire Chicago businessmen, and intellectually precocious students at prestigious colleges. The random nature of the murder – Franks was chosen on a whim – and the insouciance of the accused in the courtroom heightened the bizarre and sensational aspects of the case. The plea of guilty by the defendants was calculated by Clarence Darrow, the lead defense attorney, both to avoid a trial by jury – the case became a hearing before a judge to determine sentence – and to argue for mitigation of the sentence on the grounds of mental abnormality. The defense hired a battery of prominent psychiatrists and psychologists to examine the two boys and to demonstrate that they were abnormal. During the hearing, Leopold and Loeb disappeared as protagonists; their fate became almost irrelevant as others used the courtroom battle to advance individual and group agendas. Robert Crowe, state's attorney for Illinois, argued for the execution of the two killers with an eye to re-election in the fall and to outflank rivals in the Republican Party; Darrow continued his life-long campaign against the death penalty; the psychiatrists William White, Bernard Glueck, and William Healy sought to disseminate Freudian ideas to a mass audience, to advance the psychiatric profession and the role of the expert witness, and to transform the insanity defense; Chicago newspapers, inter alia, the Tribune, Daily Journal, and the American, aimed to boost sales by printing lurid and personal details of the testimony. The hearing brought psychoanalytic discourse into the public sphere and introduced Freudian concepts to a greatly expanded audience.

**Bandyopadhyay, Prasanta**

*E-mail Address: PSB@montana.edu*

## **Traversing the Path of Kepler's Elliptical Orbit: A Close Look at the New Astronomy**

Scholars like Caspar, Gingerich, Stephenson and Wilson are correct in pointing out the role of physical/causal consideration in Kepler's search for the first law of planetary orbit, that is the elliptical path of planets. I argue, however, that this interpretation overlooks some of the key factors that constitute the physical/causal interpretation. I further argue that some of the factors that have played key roles in Kepler's search are analogical/probabilistic considerations. Two arguments that support these analogical/probabilistic considerations are (i) Kepler's proof for the elliptical path of planets is not strictly deductive in nature and (ii) Kepler's attempt is to ground astronomy to physics when physics unlike astronomy was taken to be uncertain in those days.

### **Barbera, Keith**

*E-mail Address: keithbarbera@yahoo.com*

#### **Popular Depictions of Scientific Detection**

The American public has long been captivated by stories of crime and its detection. This was especially true during the 1930s, which saw a great push for scientific detection. I analyze the rhetorical tactics of three important popularizers: science journalist Edwin Teale (1889-1980), private detective Luke May (1886-1965), and writer Henry Morton Robinson (1898-1961). In *Popular Science* Teale promoted virtually every new development in forensics. May ran a crime lab, taught criminalistics, and wrote *Scientific Murder Investigation* (1933) and *Crime's Nemesis* (1936). Robinson spread the gospel of scientific policing in *Science versus Crime* (1935). These writers deployed a variety of often contradictory images to lobby for scientific detection. For example, while all three portrayed scientific detection as progressive and rational, they also invoked myth and metaphysics (*Nemesis*, "the eyes of science," folk ideas about blood, "there's a crack in every crime"). They also negotiated tensions in the nature and significance of legal and scientific evidence. Each writer counterbalances the idea that "slender [scientific] clues" (usually microscopic) provide the only proof in many crimes to claims that scientific evidence is merely corroboratory. Furthermore, the relative merits of oral and documentary evidence in court conditioned descriptions of how scientific evidence can "read," "speaks," or is immune from perjury and falsification. The three writers also assimilate science, crime-fighting, and law to each other (e.g., science and detection are described in terms of hunting evidence, method, and procedure are accorded a key role in science and the law). Finally, each write portrays criminalistics as more reliable than criminology (theories of hereditary criminals, criminal stigmata) but translates ideas from the former to the latter: thus, ballistics reveal the "paternity" of bullets, criminals leave their mark (fingerprints) at crime scenes, and crimes manifest invariable patterns (*opus operandi*).

### **Barberis, Daniela**

*E-mail Address: barberis@mpiwg-berlin.mpg.de*

#### **Durkheim, philosophers, and the moral guidance of the French public**

My paper addresses the issues at stake in the relationship between sociology and philosophy in the second half of the nineteenth century by focusing on the debate between Émile Durkheim, who was attempting to found an independent, scientific sociology, and the editors and collaborators of the *Revue de métaphysique et de morale* (RMM), one of the central philosophical journals of the period. The RMM's decision in 1895 to open a new rubric entitled "practical questions/discussion of current issues" was part of a desire to contribute to action and practical life, to take upon themselves the moral responsibility of enlightening the public. The first appearance of the rubric "practical questions's sociology and philosophy" revealed that the journal saw sociology as a competitor of philosophy in its task of guiding public opinion. The philosophers now claimed that they had as much light, or more, to throw on practical moral questions as their rival did, despite its scientific pretensions. The debate between Durkheim and the

RMM over this strongly charged subject thus had high stakes. What discipline provided appropriate guidance for the citizens of the Third Republic? A version of spiritualist philosophy, or the sciences (including the new sciences of psychology and sociology)? This paper examines the arguments presented by both poles of this debate.

**Barrera, Antonio**

*E-mail Address: abarrera@colgate.edu*

**The Casa de la Contratación and its Chamber of Knowledge: Empirical Activities in the Spanish Empire**

This paper discusses the institutionalization of practices for gathering and organizing information about ocean routes and the New World's geography. This paper also discussed the institutionalization of specialized offices for handling information, for conducting research, for updating reports, and for the dissemination and teaching of new information. The institutionalization of these practices emerged from a slow and long process of accommodation to the realities of long-distance control of the New World. I argue that scientific practices, in the context of the Atlantic world, emerged in direct response to imperial and economic needs and interests.

**Barth, Kai-Henrik**

*E-mail Address: khb3@georgetown.edu*

**Transnational Science, International Affairs: Scientists and Arms Control Initiatives in the 1980s**

Relations between the Soviet Union and the United States deteriorated sharply during the early 1980s. The Soviets, irritated by the Reagan Administration's emphasis on "negotiating from strength" and its embrace of a Strategic Defense Initiative, pulled out of all bilateral arms control negotiations in 1983. While diplomatic channels were blocked, some concerned American and Soviet scientists cooperated to develop new arms control measures. Three such efforts were especially important, namely a series of meetings between delegations of the National Academy of Sciences and the Soviet Academy of Sciences; informal contacts between the Federation of American Scientists and Soviet scientists with close ties to Gorbachev; and finally, an unprecedented collaboration between the Natural Resources Defense Council, an American environmental group, and Soviet scientists in support of a nuclear test ban treaty. These cooperative efforts generated new approaches to arms control and provided diplomatic back channels at a time of growing tensions between the superpowers. This paper examines to what extent these transnational networks of scientists succeeded in persuading American and Soviet policy-makers to seek further arms control measures. I explore why Soviet and American scientists were able to collaborate so effectively beyond borders, while their countries' diplomats failed to come to an agreement. I argue that these scientists found common ground, because they shared a professional value of open, transnational cooperation and the belief that arms control was technically feasible and politically desirable.

**Beatty, John**

*E-mail Address: beatty@tc.umn.edu*

**Radiation Genetics as Atomic-Age and Cold-War Eugenics**

World War II marked an important turning point for eugenics in the United States. Consider two images associated with the end of the war: concentration camps and the mushroom cloud. Revelations of the extent of the Holocaust detracted (further) from eugenics. But concerns about radiation-induced mutations resulting from nuclear weapons tests (and possibly nuclear war) figured prominently in the promotion of eugenic reasoning and research. Eugenics, at least in the U.S., was transformed in the postwar years but it certainly survived. I will discuss an "atomic-age" version of eugenics, and also a

more specifically "cold war" version. I will also discuss the role of the Atomic Energy Commission in the patronage of genetics and population genetics, partly motivated by explicitly "eugenic" concerns.

**Bellon, Richard**

*E-mail Address: rbellon@u.washington.edu*

**George Bentham Visits the Crystal Palace**

Over 25,000 people descended on Hyde Park on May Day of 1851 for the opening of the Great Exhibition. The distinguished systematic botanist George Bentham was among the crowd. He had traveled from his home in Herefordshire for the event and remained in London for the next three weeks, visiting the Exhibition most days. This paper will demonstrate that Bentham's ties to the Exhibition ran much deeper than those of a mere tourist. He long insisted that only those botanists with a global perspective could properly classify plants. Examining specimens from all corners of the planet allowed him to recognize connections missed by purely local studies, carried out by those he contemptuously dismissed as "mere Botanicoes." His intellectual authority, therefore, came not only from his theoretical approach but from his practice in a vast herbarium of more than 50,000 specimens accumulated with a global perspective. The rationale of the Great Exhibition rested on the same foundation: like Bentham's herbarium, the collection of the "industry of all nations" allowed spectators to make informed comparative judgments impossible when viewing the materials, machinery, and manufactures in their local contexts. Benthamite systematic botany and the Great Exhibition were reflections of the nineteenth-century preoccupation with replacing the static eye with the panoramic vision. His experience at the Great Exhibition thus allows a close examination of the intersection between the theory and practice of expert gentlemanly natural history and a prevalent way of ordering knowledge and authority in the broader Victorian culture.

**Bigg, Charlotte**

*E-mail Address: bigg@mpiwg-berlin.mpg.de*

**Constructing space for the new astronomy: the public science of J. Norman Lockyer**

The development in the late nineteenth century of a set of instrumental techniques including photometry, spectroscopy and photography signified a new beginning for astronomy, making it possible to study the chemical and physical properties of astronomical bodies. In Europe, this type of research was taken up to an extent in established astronomical observatories, but it was mostly the work of atypical, isolated enthusiasts operating initially without consistent institutional affiliation or legitimacy. In seeking support for their activities, these individuals developed a number of strategies to obtain recognition and financial security. The paper focuses on J. Norman Lockyer, the most vocal of this new breed of astronomers in Britain, as he deployed such strategies from the 1860s to the 1910s, in his various capacities as founder and editor of *Nature*, secretary of the Devonshire Commission, lecturer at the South Kensington Museum, leader of eclipse expeditions, populariser of science and director of the Solar Physics Observatory. Throughout, he worked to foster an identity for the new practice, distinct from positional astronomy, by emphasising different forms of utility, appealing to different audiences, and seeking the support of the State, playing on national prestige and rivalry. Lockyer enrolled astrophysical technologies to produce and convey spectacular images of the new astronomy he drew upon the new visual and literary conventions created within the expanding popular press and scientific educational literature, but was also inspired by British Association gatherings and international exhibitions as he helped construct a distinctive conceptual, institutional and public space for astrophysics.

**Bogaard, van den, Adrienne**

*E-mail Address: a.a.vandenbogaard@tbm.tudelft.nl*

## **The Emergence of the Aggregate Variable "Consumption" and its Measuring Method 1920-1955**

Macro-econometric modeling as an activity by experts, as well as its use in policy-making, have been fully established in the Netherlands since 1955. The emergence of macro-econometric modelling implied representing the national economy in new terms, one of which was, and still is, the aggregate traces the contextual history of this macro-econometric aggregate. The aggregate people who consume and from what has actually been consumed. However, earlier theorising about and measuring of consumption was related to income, and social class. This paper analyses how measurements, mathematical representations, theories of consumption, and political alliances changed simultaneously in the period 1920-1955, resulting in the establishment of

**Boschiero, Luciano**

*E-mail Address: luciano\_boschiero@hotmail.com*

## **The Beginnings of Post-Galilean Natural Philosophical Thought: 1638-1647**

In 1638, five years before Galileo's death, Vincenzo Viviani became Galileo's student--his 'last disciple', as Viviani himself put it. During the following ten years, Viviani and another of Galileo's followers, Evangelista Torricelli, collaborated with their colleagues in Rome and Pisa to water the seeds of natural philosophical thought planted in Florence by Galileo. It is the aim of this paper to explore how Viviani and Torricelli were largely responsible for the post-Galilean movement in Tuscany. Torricelli died in 1647, and activities in Florence quieted down until the foundation of the experimentalist institution, the *Accademia del Cimento* in 1657. Yet the ten years before Torricelli's death are the most critical in Tuscany's seventeenth century history of science, since they show that what was at stake after Galileo's death, and what continued to be at stake during the following decades, was not a strange system of patronage, courtly etiquette, and 'Experimental Science', as some historians would have us believe in their studies of the *Cimento*, but the production of knowledge claims according to the natural philosophical beliefs of these early modern Italian thinkers.

**Brian, Eric**

*E-mail Address: brian@ehess.fr*

## **Classification as a Mathematical Competence Among Eighteenth-Century Geometers**

A basic constituent of the mathematical expertise of eighteenth-century geometers was their ability to conceive a systematic decomposition of the operations to be executed, and subsequently to outline these conceptions on paper in the form of classification schemes. To solve a problem a geometer had to elaborate some formalism and to develop the necessary calculus on the registers of integral and differential calculus improved over the course of the century. But establishing this formalism presupposed a decomposition of the problem at hand by means of classification. A comparative study of the classifications proposed by various French specialists during the eighteenth century shows that the progressive degrees of abstraction involved in mathematical operations were considered to be the primary principles of construction used for these classifications. Simple facts had to be abstracted into quantities, and quantities into well-defined measures which allowed them to be compared.

**Brooke, John**

*E-mail Address:*

## **Science, Religion, and the Unification of Nature**

**Browne, Janet**

*E-mail Address: j.browne@ucl.ac.uk.*

## **Science and the Cult of Celebrity: Charles Darwin in Caricature**

During the last decades of his life Charles Darwin became one of the most famous scientists in Britain, his name inextricably linked with the idea of evolution and with the larger shifts in public opinion gathering pace as the nineteenth century drew to a close. Much of this kind of celebrity can be regarded as an unstoppable consequence of the developing mass-media world. Paradoxically, a very private man was turned into public property. This paper discusses caricatures of Darwin published during his lifetime as a key aspect in the public perception of evolutionary theory. The caricatures, especially cartoons in *Punch*, domesticated Darwin's dangerous theories and the representation of the author as an ape helped readers connect evolutionary theory directly with him, rather than with Wallace or any other thinker. In this way, it is possible to see the cult of celebrity taking a significant role in the popularisation of high science.

### **Brownstein, Daniel**

*E-mail Address: brownst@humnet.ucla.edu*

## **Mapping Bodies and Spaces in Early Modern Italy**

This paper compares the visual modes of presenting information in the fields of anatomy and cartography in the sixteenth century, situating both as new practices that were dependent on visual techniques to elucidate texts. Both have been seen as enabled by new technologies of printing and specifically by the printing of engraved images. Historians have recently also stressed the intellectual impact of the translation of classical texts of the physician Galen and geographer Ptolemy of Alexandria, examining how their works provided new intellectual and practical models. This literature has examined how the cartographer and anatomist transmitted ancient texts in ways that were indebted to humanist methods of analysis and study. Each field used images to establish a new relationship of observer to object, advancing claims of accuracy and precision that legitimated each art. The anatomical diagrams designed by Andreas Vesalius reveal the inner structure of a physical body, exposing its interior to observers through positions they could not themselves occupy. In doing so, they guide viewers through a sense of space that makes the observer virtually a participant in the dissection. In contrast, the graticule of Ptolemaic maps dispenses with an individual point of view, organizing space instead on abstract or symbolic principles. The different ways that each use rhetorical models to organize nature provided a basis for their appeal, and for the creation of each discipline.

### **Buhs, Joshua**

*E-mail Address: jbbuhs@msn.com*

## **Natives, God and Health: John Thomas Gulick Collecting in Hawaii**

What prompted the missionary John Thomas Gulick to collect thousands of shells in Hawaii in 1853? The shells later became the basis for his conclusion that isolation is an important factor in evolution, a claim that influenced Sewall Wright and Ernst Mayr almost a century later. For the most part, those who have studied Gulick ignore the question of why he collected so many shells or gloss over it quickly to get to his evolutionary ideas. This paper tacks differently, dwelling on the question and not answering it by seeing Gulick as a scientist looking ahead to evolution, but seeing him on his own terms. From this position, three interlocking reasons for his commitment to collecting stand out: his life in Hawaii his health and his religious views. Living on a frontier outpost, Gulick was constantly beset by the temptation to shuck traditional morality and "go native." He felt especially vulnerable because he--like the Hawaiians and unlike his family--found great enjoyment in nature, especially shells. Sickly since he was a child, he felt that he lacked the strength to resist moral corruption. Borrowing from Natural Theology and Charles Darwin's *Journal of Researches*, Gulick found a way to justify his interest in nature and shells. Collecting expeditions also proved his strength and vigor.

**Bunner, Patricia**

*E-mail Address: pbunner@wvu.edu*

**John Bartram and His Contribution to the Theory of Ecological Succession**

In 1738 John Bartram (1600-1777), American farmer and plant collector, was one of the first men of science to recognize and describe the concept of ecological succession. As a practitioner of the developing ecology, that is life history study and description of vegetation, which we generally associate with the field of botany, John Bartram, a Quaker and man of the Enlightenment, was among the first to realize that the Baconian emphasis of data observation method promulgated by the Royal Society left room for a systems approach to nature, which enabled the study of nature within a specific locale or what we today would refer to as an ecosystem. This led the way to the modern view of ecology, often said to have its roots with Carolus Linnaeus, but which from the record of his own empirical observations, can be traced to the field investigations of Linnaeus' premier North American contributor, John Bartram.

**Cahan, David**

*E-mail Address: dcahan@unlinfo.unl.edu*

**Habits of the Eye and Mind: Helmholtz as a Private Man**

This presentation depicts some aspects of the moral character and psychology of Hermann von Helmholtz (1821-94). It does so by exploring a variety of his personal, private habits and attitudes towards dress, drinking and smoking, women and marriage (family), money and property, art exhibitions, and various other aspects of his private cultural and civilized activities. It concludes briefly with some speculations as to how Helmholtz's character and psychology may have manifested themselves publicly in his professional life.

**Canales, Jimena**

*E-mail Address: jcanales@fas.harvard.edu*

**Photogenic Venus: The Cinematographic Turn in Late Nineteenth-Century Science**

During the 1870's, scientists around the world disagreed on the type of instruments and methods that should be used for the Venus's 1874 transit across the sun. Occurring only once a century, the transit of Venus promised to close decades of debate surrounding the most important constant of celestial mechanics: the solar parallax. Scientists had long realized that different methods furnished different results, and, even if some agreed on certain methods, differing observations within them rendered all results highly discordant. Among the various methods proposed stood a controversial new instrument provocatively named the *d* Venus at one-second intervals. Invented by the astronomer Jules Janssen, it was arguably the most promising instrument for ending the disagreement on the exact time of Venus's contact with the sun. Yet not everyone agreed. The philosopher Henri Bergson, who criticized the use of sequential photographs during the transit of Venus, urged scientists to hold aside. A second solution did indeed come from Armand Fizeau and Alfred Cornu, who rivaled astronomers' dominance in precision measurements by measuring the speed of light by purely physical means. Yet other astronomers looked neither to photography nor to physics but relied instead on well-trained observers. In this paper I will examine the natives against which it competed, paying attention to the question of how problems of evidence arose within the exact sciences.

**Canizares-Esguerra, Jorge**

*E-mail Address: jc58@acsu.buffalo.edu*

**How Derivative was Humboldt? Microcosmic Nature Narratives in Eighteenth-Century Spanish**

## **America and Humboldt's Ecological Sensibilities**

This paper argues that important ideas attributed to Europeans were in fact part of larger Atlantic dialogues. Without much sense of the intellectual milieu that greeted Alexander Humboldt upon arrival in Spanish America in the 1790s, for example, the narrative that credits him with having "invented" the sciences of bio-geography and ecological thought has gone unchallenged. But Humboldt arrived to a Spanish America humming with discourses of nature in which every patria was cast as a microcosm, a self-sufficient economic space wondrously endowed with an amazing variety of ecological niches. Clearly, Humboldt picked up new ways of reading nature after having been immersed for years in this cultural environment.

### **Catania, Basilio**

*E-mail Address: mark@esanet.it*

#### **Antonio Meucci: How Electrotherapy Gave Birth to Telephony**

In the past ten years, this author has gathered significant information about the pioneering work performed by Antonio Meucci in the invention of the telephone as well as his discovery of some fundamental techniques for telephone transmission. At the same time, authoritative persons and organizations have recently shown increasing interest in Meucci's contributions. The paper deals with Antonio Meucci's first telephonic experiment -- performed in Havana (Cuba) in 1849 -- evidencing how his discovery of electrical transmission of speech stemmed from his experiments on electrotherapy. The state-of-the-art of the time, relating to applications of electricity to both medicine and telecommunications, is discussed.

### **Cheung, Tobias**

*E-mail Address: cheung@wanadoo.fr*

#### **Uncertain Organisms: The Struggle for Identity in Cuvier's Comparative Anatomy**

The paper focuses on the basic tensions between individuality, organismic life, identity and the role of the human in George Cuvier's (1769-1832) comparative anatomy of animal bodies. In the beginning of the development of the life sciences as natural sciences, his anatomical and theoretical writings highlight the struggle for organismic identity in constructing the other as an animal or a human. Cuvier's conceptual frame of an individual organism transforms the difference of measure (as shape or form) into the one of the skin as a metabolic border between a problematic inside and outside. It foreshadows at the same time the dissolution of the rational Ego in biological units as actors in evolution and ecology.

### **Cittadino, Gene**

*E-mail Address: ec15@nyu.edu*

#### **Ecology on Trial: East Meets West on the Texas-Oklahoma Border**

The 1918 discovery of oil in the bed of the Red River bordering Texas and Oklahoma led to a contentious and potentially violent boundary dispute that was eventually resolved by the U.S. Supreme Court. This paper focuses on the extensive and unprecedented use of scientific testimony in the case, particularly that of ecological experts. The resolution of the dispute turned on determining the exact location of the south bank of the river as specified by the 1819 Adams-Onis Treaty between the U.S. and Spain. The U.S., which intervened on the side of Oklahoma, brought in as its star witness plant ecologist Henry Chandler Cowles, a veteran by that time of federal cases involving erroneous land surveys; and it added geographer Isaiah Bowman, fresh from negotiating European boundaries for the Treaty of Versailles. Texas countered with a team of home-grown experts, but its chief ecological witness, University of Texas botanist B. C. Tharp, relied on advice from fellow westerner Frederic Clements. Both the science of ecology, which was new to the courts, and the climax theory, which figured prominently in the testi-

mony, had to be defined and explained repeatedly as the case passed through each venue. Ostensibly a disagreement among experts over the successional stage of the vegetation and the geologic age of a section of the valley, the testimony and cross-examination reflected East-West differences in attitudes toward land use as well as the interpretation and application of relevant scientific theories and evidence.

### **Coen, Deborah**

*E-mail Address: coen@fas.harvard.edu*

#### **Family History and the History of Science**

Over the course of three generations, as pedagogues, theorists, and statesmen, the Exners were among the most influential defenders of liberal humanism, empiricism, and academic freedom at the University of Vienna. What lessons does this "dynastic" phenomenon hold for the history of science during the final half-century of the Habsburg Empire? Recently, German historians have begun to ask under what conditions the *bürgerlich* family fostered progressive values, and when did it instead promote social rigidification. In the case of the Exners, how might the family have helped mediate between intellectual innovation and tradition? My talk will explore the Exners' self-understanding as bearers of a family legacy, and consider the definitions of family relevant to their fields of interest, including pedagogical theory, legal history, and the history of art.

### **Cohen, Benjamin**

*E-mail Address: bcohen@vt.edu*

#### **The Element of the Table: Classifying Chemical Knowledge, from Affinity to Periodicity**

In this paper, I focus on tables of classification in the history of chemistry that preceded the Periodic Table of the 1860s. My purpose is to show that while chemistry's definition and refinement as a theoretical, experimental, rhetorical, and didactic enterprise varied greatly between 1718 (when the first affinity table was published) and 1869 (when Mendeleev announced his periodic law), a continuous ontological role for the chemistry table was sustained. That is, as cognitive tools for research; not just passive representations of order; the tables both described the current collection of knowledge of the basic constituent of chemistry while prescribing future knowledge yet to be gained. Since my study extends across a broad time span, I will focus my talk on the general epistemological significance of tables and taxonomies in the eighteenth and early nineteenth centuries while placing a brief survey of different types of chemical tables within this broader view, paying more attention to inorganic classification schemes than the many interesting types of organic ones. In doing so, I hope to combine rhetorical analyses in science studies that focus on reading historical discourses with studies that take seriously the relevance of visual representation. I read the visual nature of the taxonomies, wherein those organizational devices served as more than just aesthetically elegant holding places for known chemical substances and more than just tools to be used in research.

### **Cohen-Cole, Jamie**

*E-mail Address: jamiicc@princeton.edu*

#### **Defining Culture: The Intellectual and Institutional Unification Project of Cold-War Social Science**

In 1941 a group of researchers at Harvard collaborated on a manifesto which called for integration of the several social sciences into a single field. This text, "Towards a Common Language in the Area of the Social Sciences," gave a three part argument for the unification of Anthropology, Sociology, Psychology, Economics, and Government. First, it claimed that the important features of culture were the broad and systematic regularities which could not be understood by considering only one feature of social life (e.g. the economic) at one time, but instead which could be seen only by standing in several

disciplinary camps at once. Second, these regularities, it was argued, would not only be systematically present in a specific culture, but would be universal features of the social world thus justifying claims for the scientific status of social science. Third, the regularities were not simply a product of observation or the aggregation of the basic facts of everyday social life. Instead, the regularities were themselves causal agents in determining social events. This group of social scientists put their new understanding and explanation of cultural phenomena to two uses. First, through their interest in the multi-disciplinary nature of their enterprise, they changed the definition of the word "culture" and remapped the definition of the term and the intellectual contours of the social sciences. Second, they used this new definition as a weapon in the micro-politics of Harvard's departmental politics. Significantly, it would be a critical piece of their successful effort to join sociology, anthropology, and social psychology into a unified Department of Social Relations.

**Collins, Harry**

*E-mail Address: CollinsHM@Cardiff.ac.uk*

**Growing Pain: Scientific Knowledge and Organizational Change in Path-Breaking Research**

Over a thirty year period the search for gravitational waves using large scale interferometers has grown from a research proposal, to a few small projects, to a billion dollar international enterprise. The American project is known as the Laser Interferometer Gravitational Wave Observatory(LIGO). LIGO's working practices, management style, and scientific goals have changed as the enterprise has become larger. The case study explores the 'logic' of LIGO's sometimes traumatic organisational revolutions and relates them to the changing nature of the science and the political setting in which these are set the future may indicate the extent to which LIGO's science was ready for the degree of 'routinisation' that now characterises it. While the course and character of each upheaval cannot be fully understood without an analysis of the capacities and capabilities of the personnel involved, this study concentrates on structural changes while using the words of individuals to illustrate them.

**Cooper, Alix**

*E-mail Address: acooper@notes.cc.sunysb.edu*

**Latin Words, Vernacular Worlds: Language and Environment in Early Modern German Natural History**

Over the past several decades, historians of early modern science have begun to detail the degree to which, far from hindering the progress of science, the humanistic habits and philological tools developed during the Renaissance actually helped spur the development of increasingly sophisticated systems of describing the natural world, for example in natural history. Examining Renaissance humanists' passion for precision in language, recent scholars have shown how humanists' tendencies to notice discrepancies between classical descriptions and modern species led them to attempt to reconcile these discrepancies, eventually founding a new botany in the process. This paper will argue that a related, but different kind of concern with "language", and with the reconciliation of words and objects, motivated the development of the crucial genre of the local flora in the early modern German territories. Local floras, which catalogued the plants to be found growing within a distinct radius of a town or city, emerged as efforts to mediate between the interregional botanical "republic of letters" and the world of the German town. As the paper will show, a naturalists presented their technical descriptions of plants (color, shape, form, etc.) in the "scientific"/scholarly language of Latin, while then using the vernacular of their civic audience to describe the environments--forests, fields, gardens, swamps--in which these plants were to be found. In the process, the paper will argue, a kind of "bilingualism" emerged in the early modern German local flora, which helped mediate between the desire for international scientific communication and the local representation of what we might now term "local knowledge".

**Creager, Angela**

*E-mail Address: creager@princeton.edu*

**Proliferating Radioisotopes: The Atomic Energy Commission's Distribution Program and Post-war Biomedical Research**

The widespread adoption of radioisotopes as tools in biomedical research was one of the major consequences of the "physicists' war" for postwar life science. The development of a formal infrastructure equipping scientists with radioisotopic tracers was intimately related to the atomic bomb and its political ramifications: In 1946, the newly formed Atomic Energy Commission (AEC) began producing and distributing radioisotopes as a means of promoting the peaceful benefits of the atom. This paper provides a brief political history of the establishment of the AEC's isotope distribution program and the debates it sparked (including whether non-American researchers should be eligible to receive the isotopes). Large-scale radioisotope production for the bomb project had taken place in east Tennessee at Plant X-10; this site was rechristened Oak Ridge National Laboratory in 1948, the center for the AEC's radioisotope distribution program. (As part of its new postwar mission, Oak Ridge also launched its own research programs, including extensive radiobiological investigations.) The use of radioisotopes in biomedical laboratories increased dramatically in the years after the war, stimulating new research directions in existing fields, such as physiology, as well as in emerging fields such as molecular biology. Radioisotopes were also used in field sciences (especially ecology) during the same years they became routine elements of laboratory research. The paper will conclude with some comparative reflections on the impact of the government's radioisotope distribution program for various fields of biological and biomedical research, as well as on the continuing entanglements of radioisotopes with questions of national security.

**Croce, Paul**

*E-mail Address: pcroce@stetson.edu*

**In Search of William James's Medical Thesis: Physiological Science and Water-Cure Therapies**

William James wrote a thesis on the physiological effect of cold in the spring of 1869 as the capstone of his degree from Harvard Medical School. When this work does gain scholarly attention, it is treated as a technical scientific treatise which he completed as an annoying hurdle that supported his professional advancement. Since there is no surviving copy of his medical thesis, it is difficult to challenge this perspective directly. And yet, James's medical situation in the late 1860s, both concerning his own health problems and his research in physiological medicine, suggest that the thesis may not have been the casual effort or even the purely mainstream scientific project it is often assumed to be. While he almost certainly wrote it in a physiologically scientific way, since that would adhere to Harvard's standards in orthodox medicine at the time and would also reflect his current commitments and goals, James also had a wellspring of interest in unorthodox medicine at this time. In particular, he frequented water-cures as the prime way to deal with his chronic health problems. Like many patients of hydrophathy, he took regular applications of water, internally and externally, in carefully prescribed combinations of cold, warm, and hot water. His focus for his thesis on the effects of cold, therefore, was also a major concern of water-cure therapies. It appears likely that he generated many of his ideas for the topic and the questions to be asked in the thesis from exposure to water-cures. This connection may even explain the haste of his work on the thesis, since he was already so familiar with hydrotherapy. But James did not rest content reporting as a water-cure advocate; instead, he directed his physiological research to test the actual scientific effects of changes in temperature. His brief immersion in medical science shows James already engaging in what would become a lifelong concern: he sought to gain scientific understanding of a non-mainstream phenomenon. He did not pursue the field of medicine, but the approaches

he took in his medical education would become a keynote of his intellectual methods.

### **Crowther-Heyck, Hunter**

*E-mail Address: Crowther-Heyck@prodigy.net*

#### **Mind and Network**

The Internet's stunning success has given it a meaning far beyond its raw presence. It has become not only a new medium for communication, but also a new source of models and metaphors for understanding our world and ourselves. Today, we describe all sorts of things, from markets to minds, as networks. Part of the peculiar strength of the Internet as a source of models and metaphors comes from its organic qualities. It is, or is understood to be, flexible, adaptable, decentralized, always growing, always changing. In this paper, I will show that the organic qualities of the Internet are neither accidental nor inevitable. Rather, they were designed into the first computer networks by people, such as J.C.R. Licklider and Robert Taylor, who believed that the human organism (especially its mind) should be the model for the computer and that communication was fundamental to human life. Thus, in many ways, the Internet was the product of the application to computing of a certain set of psychological ideas specifically, ones derived from cognitivist psychology. These ideas turned out to be enormously successful in making computers more efficient and more interactive and so gained increased power to explain human behavior. I will support this argument through an examination of the MIT-ARPA networking community in the 1960s.

### **Crowther-Heyck, Kathleen**

*E-mail Address: kcrowth1@swarthmore.edu*

#### **Reforming Nature: Natural Knowledge in the Vernacular Print Culture of Sixteenth-Century Germany**

Sixteenth-century Germany witnessed a tremendous flourishing of vernacular literature. An unprecedented number and variety of texts were produced for a new group of readers who were literate in German but not Latin. My paper analyzes one under-explored genre of this vernacular literature: texts on the natural world. Numerous books, broadsides and pamphlets on such subjects as the human body, plants, trees, animals, birds, fish, minerals, gemstones and natural marvels rolled off the German presses in the sixteenth century. Taken as a whole, these works indicate a widespread curiosity about the natural world and the human body. My contention is that these texts give valuable insight into the shifting and contested meanings of natural knowledge in early modern Germany. The authors of vernacular texts on medicine and natural history presented nature and natural objects as thoroughly imbued with spiritual significance. In their descriptions of nature, they wove together morality, mythology and practicality into a rich and complicated tapestry. Human beings were surrounded by a world in which the divine and the mundane were thoroughly intertwined. Vernacular authors linked the most profound Christian teachings -- the omnipotence of God, the fallen state of mankind, the promise of redemption -- to earthy advice about growing apple trees and tending sheep. However, views of nature were not necessarily theologically neutral. For some Lutheran writers, the moral and symbolic meanings of plants and animals were consonant with Lutheran theology and not with Catholic. Such authors read the Book of Nature as Protestant propaganda.

### **Cuomo, Serafina**

*E-mail Address: s.cuomo@ic.ac.uk*

#### **Drawing the Line: Boundary Disputes in Graeco-Roman Antiquity**

Where do you draw the line between two fields or properties, when the boundaries are blurred, and each party involved in the dispute declares that they know how things really and truly stand? This

question recurs through the centuries, and is a fascinating lens through which the historian of science can look at issues of geometrical, land-surveying, and legal expertise, and at how competing claims are negotiated by 'knowledgeable' authorities in different political and social situations. The situation this paper will look at is that of Greece in the early Roman Empire, in particular boundary disputes between Delphi and neighbouring communities in the early second century AD. A Roman officer is called on to adjudicate. How does he arrive at his decision, and how does he justify it? What kind of evidence does he use, and what is the role of land-surveyors? What can this particular case tell us about technical expertise, and the role of knowledge in the construction of authority? I will draw on literary, epigraphical, and archaeological sources in order to answer these questions.

**Danto, Elizabeth**

*E-mail Address: edanto@hunter.cuny.edu*

### **Eradicating Tuberculosis and Promoting Psychoanalysis: Vienna 1918**

In an extraordinary series of statements promoting the development of free clinics, Sigmund Freud revealed his ideological alliance to the highly progressive - but little known - Vienna of 1918-1935. It was "Red Vienna" where citizens would have the right to health and welfare, public resources were invested in medical and dental clinics, family assistance programs, and maternal/child consultation centers, and where the concern for public health and urban sanitation led to the introduction of sprinkler trucks and mechanized garbage collection. Freud's 1918 project for "institutions or out-patient clinics ... [where]... treatment will be free," introduces this paper and new findings from the history of psychoanalysis, such as: \* patients of all ages and social classes, ranging in occupational status from professional to unemployed, were treated gratis \* men and women were treated in roughly equal numbers \* Freud's belief that psychoanalysis could be both productive and free of cost was rooted in the progressivism of postwar Vienna. Placed within the cultural context of central Europe at the dawn of modernism, this descriptive and statistical history of the Vienna free clinics replaces psychoanalysis within the history of science. The clinics pioneered treatment and training methodologies still used - and still debated - today. Drawing on archival and oral history research, this exploration shows that the complex civic core of the early psychoanalytic movement was rooted in humanism and in the belief that disenfranchised individuals, families and communities would be empowered by universal access to mental health services.

**Dassow Walls, Laura**

*E-mail Address: wallsl@mail.lafayette.edu*

### **Cultivating Truth: Ralph Waldo Emerson's Life in Science**

Faced in his youth by the spectre of a world governed by chance, Ralph Waldo Emerson willed his own belief in a world governed by moral law. This law was centered in the order of things, God's created universe, Emerson's "Nature." His youthful refutation of skepticism placed knowledge of nature--that is, science--at the heart of his moral universe. Instead of atomistic individualism, Emerson's vision offered the power of collective action, and to express this power Emerson drew his structural metaphors from contemporary natural and physical science: the power of gravity ordered individuals into a system; magnetic polarity oriented each single person into the social field; the method of science organized errant facts into coherent wholes, organic collectives. In this assimilative, generative process, knowledge could be power because the world was bound by moral relation. For Emerson, mind and matter became reciprocal agents of that power: science ruled because science worked. This complex of ideas tied individual and society into an organic whole. The individual discipline of obedience to nature educed the various powers of mind, while the cooperative, collective discipline of cultivating truth implanted science at the heart of American culture.

**de Chadarevian, Soraya**

*E-mail Address: sd10016@hermes.cam.ac.uk*

**Radiobiology in postwar Britain**

Research in radiobiology vastly expanded in post-war Britain. A cornerstone of the Medical Research Council postwar programme in radiobiology was the Radiobiological Research Unit at the Atomic Energy Research Establishment (one of the bomb development sites as well as the main production site for radioisotopes) at Harwell. From its inception in 1947, the location of the unit as well as the direction and scope of its research programme were hotly debated. A period of considerable expansion in the 1950s was followed by a radical reduction of the size of the unit in the late 1960s. The discussions accompanying these moves offer important insights into (quite literally) the place of radiobiology in postwar Britain.

**de Gans, Henk**

*E-mail Address: H.A.Gans@frw.uva.nl*

**Modeling in Applied Population Forecasting Prior to World War II**

The history of population forecasting methodology prior to World War II can be characterized as the success story of the cohort component projection model (CCPM). In a rudimentary form CCPM emerged at the end of the nineteenth century for the first time. The diffusion and further elaboration of CCPM took place in the nineteen twenties and nineteen thirties and at about the early nineteen forties it had become the new standard forecasting model in population forecasting and continued to be so for quite a long period of time. Even now, a century after its first appearance, CCPM is widely used in (applied) population forecasting. The core elements of CCPM are, firstly, the population structure by age/cohort and sex at the beginning of a forecasting interval and, secondly, sets of age/cohort and sex specific rates of the components of population change (mortality and fertility and, occasionally, migration) considered to be valid for the interval considered. Initially, in the last decades of the nineteenth century, the CCPM approach emerged as one out of (at least) three methodological common sense reactions to the dominant –Malthusian- population theory. Again, in the nineteen twenties, which was the period of the true take off, cohort component projection modeling in applied population forecasting was only one out of many methodological answers to practical problems. In the decade of its re-emergence CCPM even had to endure serious attacks from advocates of a successful successor to Malthusian theory, namely the theory of logistic population growth. In this paper the interaction of population law, theory and modelling in both the period of the first appearance of the CCPM approach in population forecasting (the eighteen eighties and eighteen nineties) and that of its re-emergence in the years after World War I is discussed, starting from the view of law, theory and model in Giere's 'constructive realistic' approach in science (R.N. Giere, 1999, 'Science without Laws'. Chicago London.)

**Dettloff, John**

*E-mail Address: dettloff@mpiwg-berlin.mpg.de*

**Material Culture and Experimental Practice in the Enlightenment Laboratory**

This paper investigates the material culture of experimentation in the middle decades of the eighteenth century in France. It explores the mundane conditions of experimental practice in chemical laboratories and their implications for knowledge production by examining a startling and widely-repeated series of experiments on the disappearance of diamonds from sealed crucibles when the vessels were exposed to high heat. In 1771 Jean d'Arcet announced the dissipation of the precious stones through the walls of intensely heated closed capsules. The finding prompted widespread scrutiny and discussion of the limitations of laboratory manipulations, apparatus, and instruments. Several savants

maintained that the diamond trials constituted one of many procedures demonstrating that the objects of chemical research often defied reliable containment, control, and measurement with the available repertoire of laboratory devices. The fugitive properties of gross solids like diamond when subjected to extreme conditions as well as the variety of airs, subtle matters, and imponderable principles that populated eighteenth-century laboratories suggested a fluid physical world which resisted instrumental management and measurement. This view implied that the chemical laboratory did not provide a dependably disciplined space for the conduct of quantitative experiment. According to many Enlightenment chemical practitioners, the mundane conditions of the laboratory substantially constrained both the precision and the certainty that should be ascribed to experimental facts. In contradistinction to conventional historical accounts, this paper will argue that the misgivings expressed by Enlightenment chemists about precision determinations did not result from their ideological opposition to measurement. Instead, their skepticism ensued from their examination of the material and practical strictures of the laboratory.

### **DeVorkin, David**

*E-mail Address: david.devorkin@nasm.si.edu*

#### **Evolutionary Thinking in American Astronomy from Lane to Russell**

Textbooks and popular histories of astronomy have tended to describe late 19th and early 20th century American astronomy as highly empirical. Here we show evidence that evolutionary thinking lies at the base of some major American contributions to astronomy and astrophysics from 1860 through 1920. Highlighted will be the spectral classification schemes from Harvard and Henry Norris Russell's adoption of a spectrum-luminosity diagram to describe his theory of stellar evolution.

### **Dick, Steven**

*E-mail Address: dick.steven@usno.navy.mil*

#### **Cosmic Evolution and the Biological Universe**

The "Biological Universe, the idea that life is abundant throughout the universe, was the ultimate claim for the action of evolution in 20th century astronomy. Cosmic evolution was seen as ending not with a physical universe of planets, stars and galaxies, but with a universe of life, mind and intelligence. Already at the beginning of the century Percival Lowell advanced Mars as a specific case of this view. While it was largely eclipsed during the 1920s and 1930s by James Jeans's planetesimal hypothesis, which implied that planet formation was rare, with the decline of that theory, and observational claims in the 1940s, the biological universe began a career that has continually strengthened during the century. The search for life became a substantial research program, with NASA as its primary patron, and a driver of the U.S. space program. For many the Biological Universe was not only a hypothesis, but a world view with a status similar to Copernicanism and Darwinism, with all the implications implied in science and popular culture. Compelling but very difficult to prove, the search for life beyond Earth is a window on how scientists function at the limits of scientific endeavor.

### **Dick, Steven**

*E-mail Address: dick.steve@usno.navy.mil*

#### **The Biological Universe and Science Fiction**

The idea of a universe full of life - what I term the Biological Universe- is a kind of scientific world view similar in status to the Copernican and Darwinian world views. As such it has implications for society in general. Science fiction may be seen as one way (UFOs are another) that popular culture has elaborated on this world view over the last century. The alien theme in science fiction is closely related to the extraterrestrial life debate, and to science in general. H. G. Wells's War of the Worlds shows the effect of Darwin and Percival Lowell; Arthur C. Clarke, Stanislaw Lem and others were steeped in the

scientific tradition; and many scientists (Fred Hoyle, Harrison Brown, Carl Sagan) wrote science fiction themselves. Due in part to discoveries in science, by the end of the 20th century the alien, barely invented 100 years before, had come to assume a central role in popular culture and scientific imagination. (Nor was the effect only in one direction; many scientists working in the SETI and exobiology programs were influenced by science fiction.) The adaptation of science fiction literature to film only hastened the acceptance of the alien concept among the masses. This is not surprising; alien literature may be viewed as the search for meaning in the cosmic context. There is no better example than Clarke's 2001: A Space Odyssey.

### **Doel, Ronald**

*E-mail Address: doelr@ucs.orst.edu*

#### **U.S. Science Attaches in the Early Cold War: A Comparative International Perspective**

Until World War II, the international activities of science and of the U.S. government were conducted in relative isolation from one another. Yet by the start of the Cold War, scientists became increasingly involved in foreign policy evaluations and decision-making. This was an unprecedented and significant development, creating a new professional role for scientists and new tensions with traditional diplomats and career politicians. One crucial intersection took place in the Department of State, which--like its counterparts in other advanced nations--created science attaché posts in numerous overseas missions. U.S. scientists and national security advisors crafted an ambitious attaché program, justified on intellectual, political, cultural, economic, and covert intelligence-gathering grounds. Nonetheless, the science attaché program was relentlessly attacked by conservatives in Congress and withered under the first Eisenhower administration. Most American scientists concluded that this program had limited influence until it resumed following the Sputnik crisis of 1957. Scientists and politicians in the United Kingdom and Western Europe, however, held a different perspective. U.S. science attaches provided them an important window into Washington's shifting views on international science and foreign policy, offering insight into the extent to which American scientists could (or could not) escape demands for political and ideological conformity. They also helped foreign scientific leaders interpret American attitudes towards large multi-national collaborations such as CERN and the International Geophysical Year. And more than many U.S. scientists sensed, the State Department's attaché program spotlighted U.S. preoccupation with intelligence-gathering, creating significant frictions within the Western scientific community.

### **Dow, Michael**

*E-mail Address: foole@javanet.com*

#### **MIT's New Masque of Power: Scientific Authority in the Service of the Cold War State**

In April of 1949 MIT held a grand Mid-Century Convocation and Inauguration of its new President, James Rhyne Killian. Winston Churchill and President Truman were invited to speak, and so many people came to see them that MIT not only had to rent the Boston Garden, but also to arrange for a giant TV so that another 5000 people could watch in the Rockwell Cage. In part, this was a fund raising exercise, a grander and more impressive version of what all colleges do every alumni weekend, but it was more than that. The Institute had a new president with a new vision for the school, but it also faced an emerging new world offering opportunities and challenges. By 1949 the great conflict between the US and the USSR had begun, even if it wasn't yet quite seen as the Cold War. Churchill had coined the term Iron Curtain in 1946, George Kennan's "X Article" espousing Containment had appeared the year after that, and the Berlin Airlift of 1948 continued on as the Convocation drew nigh. The US government needed to win the American people over to the necessity for this new conflict, and MIT could help them do it. But MIT needed something, too, besides the government funding and political influence it

obviously stood to gain by becoming part of the emerging Cold War military/science juggernaut. The Mid-Century Convocation was also a display of the Institute's scientific and technical prowess, its claim to speak with an authority to be respected not only in academic circles, but in society at large. The mantle of expertise is critical to the career of any individual scientist, and of any scientific institution, as well. While the discovery and/or interpretation of matters of fact are central to scientific practice, before presenting one's results to one's colleagues, one must first convince them to listen. The Mid-Century Convocation was designed to cement MIT's authority in the face of the coming struggle with Communism, not only in the scientific world, but in the popular imagination, as well.

### **Dowbiggin, Ian**

*E-mail Address: idowbiggin@upei.ca*

#### **Lives Not Worth Living: Charles Francis Potter and the Origins of the Euthanasia Movement in America**

In the history of biomedical ethics in twentieth-century America, few individuals stand out more than Charles Francis Potter (1885-1962), founder of the First Humanist Society of New York and religious adviser to Clarence Darrow's defense team at the 1925 Scopes Monkey Trial. Yet Potter remains a largely and strangely neglected figure in twentieth-century American history, given that he did so much to launch the Euthanasia Society of American (ESA) in 1938, the first right-to-die organization in U.S. history. Potter drew heavily on Darwinist evolutionary biology to advocate support for a host of liberal causes, such as pacifism, women's suffrage, and the abolition of capital punishment. To Potter, an ex-Unitarian minister, Christianity had to give way to a new eclectic form of secular and natural religion based heavily on Darwinist evolutionary science. Such a religion, he argued, trumped all orthodox Judeo-Christian doctrines, such as the sacredness of life and the redemptive quality of suffering. This belief led Potter to promote not only voluntary active euthanasia, the deliberate hastening of death requested by a dying patient, but also mercy-killing of the mentally disabled and badly wounded war veterans and compulsory eugenic sterilization of the unfit. The thesis of this paper is that Potter's thinking, far from being idiosyncratic in the way it mixed liberal and illiberal intentions, was shared by many of the early members of the ESA, a sobering fact in light of its similarities to the views of German euthanasia proponents both before and during the Third Reich.

### **Dowd, Matthew**

*E-mail Address: Matthew.F.Dowd.11@nd.edu*

#### **Teaching the compotus: A Commentary on Grosseteste's *Compotus correctorius* in MS Harley 4350**

The *Compotus correctorius* by Robert Grosseteste (c. 1168-1253) is a long technical treatise on the calendar, and the only calendrical work accepted by all modern scholars to be a genuine work of Grosseteste. Surveying a number of manuscripts in British libraries, I found that the *Compotus correctorius* usually is unaccompanied by any sort of commentary. In British Library MS Harley 4350, however, a lengthy marginal commentary accompanies the text. This paper will examine the commentary from Harley 4350, examining both the contents of the commentary itself, and its place within the manuscript as a whole. Preliminary indications suggest that the commentary comes out of an educational setting, but significant questions still remain. The manuscript itself was probably compiled from more than one source, but at least two other items, including Grosseteste's treatise *De spera*, appear to be part of the same original source. Neither of these other two items, however, have a commentary similar to that of the *Compotus correctorius*. It is also curious that one of Grosseteste's astronomical treatises from the same source would receive such attention but not the other and it is particularly interesting that the *Compotus correctorius*, a work which rarely has commentary, should receive such a lengthy treatment.

Finally, there is no ascription for the commentary and determining the source is complicated by the nature of the manuscript.

**Drake, James**

*E-mail Address: drakeja@mscd.edu*

**Appropriating a Continent: Natural Science, Geographical Categories, and Anglo-American Identity in the Eighteenth Century**

In his clarion call for American independence, *Common Sense*, Thomas Paine wrote "there is something very absurd, in supposing a continent to be perpetually governed by an island." To make his point he drew on an analogy from science: "In no instance hath nature made the satellite larger than its primary planet, and as England and America, with respect to each other, reverses the common order of nature, it is evident they belong to different systems." My paper explores how eighteenth-century science underpinned this most important metaphor that colonists drew on to define themselves. Anglo-American colonists formed Continental Associations and a Continental Congress, and died in the Continental Army. In assuming continental identity, they imagined themselves as a community despite their stark differences. The continent worked as an emblem of proto-national community because it meshed with the science of the time, not because colonists actually occupied the continent or a continent even existed as a natural geographical phenomenon. Benedict Anderson has argued in his *Imagined Communities* that print culture is critical in shaping nationalism. While this is undoubtedly true, it fails to adequately explain the rise of nationalism in the British North American colonies. Their print culture was transatlantic and included the West Indies, yet the independence movement was strong only in thirteen mainland colonies. Scientific discourse and geographical categories helped create a shared continental identity within a transatlantic print culture. To belong to the continent was to be aligned with recently revealed natural forces and the future of mankind.

**Dror, Otniel**

*E-mail Address: otniel@md.huji.ac.il*

**The Brain as Technology**

This paper studies the convergence of brain research with the physiology of emotions during the early twentieth century. It argues that the twentieth-century brain entered the laboratory of emotions not as an object of knowledge, but as a technology that promised to overcome the laboratory's resistance to emotions. The brain as emotion-technology restructured the relationships between physiological and psychological forms of knowledge, embodied a new physiological-type emotion, responded to contemporary concerns with the status of animals in physiological laboratories, and excluded the experiencing subject from the physiological study of "emotion." The constitution of the brain as a technology was one central site in which modern physiology of the brain abandoned the psychological, and construed a purely biological model of human experience. The paper also makes a brief excursion into the social history of pain, in order to show that the reactions of physiologists to local political events were instrumental for the construction of the brain as a technology. The constitutive elements that were assembled in creating the brain-as-technology were instrumental for the important studies of James Papez, Paul McClean, and for the modern concept of Limbic System.

**Eberhardt, Martin**

*E-mail Address: eberhardt@bbaw.de*

**Sound Differences on Tonal Distances. The Controversy Between Carl Stumpf and Wilhelm Wundt**

Late 19th-century psychologists were deeply involved in the fundamental battles between the sci-

ences and the humanities. Originally a part of philosophy, psychology developed through the works of physiologically oriented scientists like Gustav Theodor Fechner, Wilhelm Wundt and Hermann Ebbinghaus. As a result, scientific disputes about results and methods as well as academic battles concerning funding, staff and appointments of chairs in philosophy to experimental psychologists involved fundamental controversies about the nature of psychology, its relation to the sciences, and the significance of experimental research for philosophy. The paper illustrates this with regard to the dispute between Carl Stumpf (1848-1936) and Wilhelm Wundt (1832-1920) in 1890-1892. At first, the dispute centered on the perception of tonal distances and the conclusion Wundt draw from experimental data gathered by his pupil Carl Lorenz. But the opponents quickly turned to personal invectives, accusing each other of not behaving and arguing in a proper scientific manner. Historian of psychology Edwin Boring suggested that this was simply an expression of both "giants'" passionate devotion to their science. In contrast, I argue that the dispute between Stumpf and Wundt emerged primarily from opposing views about the nature of psychology and its relation to the sciences. To expose the fundamental disagreements underlying the dispute, I analyze the opponents' technical arguments concerning the experimental results from the Leipzig laboratory. I show that the controversy concerned not only different interpretations of the same facts but also the very conditions of interpreting them and especially the observer's role in experiment.

**Eshet, Dan**

*E-mail Address: [deshet@worldnet.att.net](mailto:deshet@worldnet.att.net)*

### **Science and Persecution: Joseph Priestley (1733-1804), the Dissenters and Anglican Newtonianism in Late Eighteenth-Century England**

In 1794 Joseph Priestley (1733-1804) decided to leave England and emigrate to America. In his farewell sermon he explained his actions and argued that the t odium that [the dissenters] have incurred into o the how little politics of any kind have been my object. And yet, even he was forced to acknowledge that his avowed advocacy of ed him not only to write in defense of the most explosive issues of his time (i.e., the American colonies and the French Revolution), but also to attack the very foundation of Anglicanism. Moreover, Priestley's criticism of the doctrine of the duality of humans, in which he suggested that the human spirit was but a result of some form of organized matter, hit a most painful issue in the mind of many Britons, namely the prospects of afterlife. Based on his scientific inquiries into the properties of light and other forms of matter, this position brought Priestley's career to a halt among scientists who previously supported him and among the clergy. Indeed, when finally a use in 1789, they took care to destroy his laboratory and scientific papers as well. As Priestley explained, plication to which gave some degree of weight to my labours in another field. d science of Priestley has focused on his education and his scientific background, while the social and religious struggles, which conditioned the trajectories of Priestley's personal and professional career, have received scant attention. This historiographical bias has emerged out of the premise that the primary sources of new scientific ideas lie within the disciplinary boundaries and the discursive practices of scientists, even though it is hard to argue that such boundaries were easily defined in late eighteenth-century England. I argue that while the scientific background is important, a close examination of Priestley's scientific work can provide insight into how science was conducted in the social (and geographic) periphery. His science therefore must also be seen through its connection to the persecution of nonconformists in England. My paper concentrates on Priestley's familial background and on his involvement in the struggles of the Rational Dissenters as integral elements in the understanding of his innovative scientific endeavors. I suggest that his interest in the fate of his fellow dissenters drove him to reevaluate the accepted premises of Anglican Newtonianism. As a result of this reevaluation, Priestley revived the materialist psychology of David Hartley (1705-1757) and developed a corpuscular optics. These studies eventually paid off.

They allowed him to propose a new metaphysics with which he hoped not only to shake the beliefs promoted by the Anglican Church but also to undermine the oppressive policies of the English government at home and abroad.

### **Evans, James**

*E-mail Address: jcevans@ups.edu*

#### **Gravitation and Generation: Hypothesis in the Thought of Georges-Louis Le Sage and Charles Bonnet**

Georges-Louis Le Sage (1724-1803) was the inventor of a mechanical explanation of Newton's law of gravitation. Le Sage postulated a sea of ultramundane corpuscles, streaming in all directions and characterized by minute mass, great velocity, and complete inelasticity. Mostly these corpuscles just pass through gross bodies such as apples or planets, but a few are absorbed, leading to all the phenomena of attraction. In a voluminous correspondence with nearly all the savants of the day, Le Sage constantly reshaped his arguments for his system in order to appeal to metaphysicians, mechanics and Newtonians of several varieties. Most of his correspondents recoiled with repugnance. In the preface to his widely read *Contemplation of Nature*, Charles Bonnet (1720-1793) responded to attacks on his own earlier work on generation and to complaints that he hypothesized too freely. Bonnet mentioned two great enigmas that physicists and natural historians had so far been unable to penetrate: the cause of weight and the mystery of generation. And here he inserted a sympathetic reference to Le Sage's attempt to find the true cause of gravity. In Bonnet, then, Le Sage found a kindred spirit--a fellow Genevan who felt one had to take risks to infer the order of nature behind the facts of observation, and who felt that he had been unfairly criticized for doing so, that he had been lumped together with vain and careless systematizers. In this paper I will examine Le Sage's defense of the method of hypothesis and the reactions it provoked in his correspondents, including Charles Bonnet. Was Le Sage's approach to demonstration in physics a radically new epistemology, as some have claimed, or was it merely opportunistic and out of step with its time? Do the deepest mysteries require a special method?

### **Finkelstein, Gabriel**

*E-mail Address: Gabriel.Finkelstein@cudenver.edu*

#### **"The more civilized a nation is, the smaller the rooms": Daily Life through the Eyes of Emil du Bois-Reymond**

Emil du Bois-Reymond's innovations in electrophysiology and essays on science and culture earned him great celebrity in Imperial Germany, so much so that his photograph hung for sale in Berlin shop windows alongside those of the Royal Family. Yet beyond public notoriety du Bois-Reymond also led a rich and interesting private life, one that he documented extensively in dozens of letters sent to his English fiancée Jeannette Claude. Precisely because she was foreign, du Bois-Reymond took great pains to describe their common future in Berlin. This remarkable portrait of daily life provides an almost anthropological account of the workaday world of nineteenth century Germany science.

### **Fitzpatrick, Anne**

*E-mail Address: Afitzpatrick@lanl.gov*

#### **The Next Big Simulation: Computers in the Nuclear Arms Race**

The construction of specialized experimental machines for science research is often carried out on a different time scale than the development of scientific problems these devices are intended to solve. While American and Western European scientists usually justify building newer, bigger scientific machines in terms of national security or other long-term benefits to society, these projects are often completed only after many years. While there is no doubt that scientific practice has become dependent on a

kind of technological infrastructure, this was more so in the West than the former Soviet Union. This paper will compare and evaluate the notion of bigger and better technology in science between the two cultures of America and Russia. In the American nuclear weapons industry, scientists were constantly employing bigger and better high-performance computers, in anticipation of simulating ever-more refined weapons problems in multiple dimensions. Yet the push for computers in America came partly from the computer industry, particularly IBM and other companies. Lacking a commercial computer industry, the Soviets still managed to build sophisticated scientific computers for their nuclear weapons programs, but at a much slower pace than in the United States. Still, the Soviets successfully matched the United States in terms of nuclear stockpile numbers and types of weapons. For what they lacked in material technology, the Soviets compensated by focusing on algorithms and accurate mathematical estimation, and employed scores of people to work out problems by hand. In their own way, Russian algorithms were as powerful tools as American high-speed computers.

### **Flannery, Maura**

*E-mail Address: flannerm@stjohns.edu*

#### **The Legacy of Francis Lee Jaques: Dioramas in the 20th Century and Beyond**

Francis Lee Jaques was one of the most noted painters of natural history diorama backgrounds during the first half of the 20th century. He worked at the American Museum of Natural History in New York for 18 years painting, among other displays, the sky-like ceiling in the Hall of Oceanic Birds and the backdrops for all 18 of its dioramas. After leaving the Museum in 1942, he painted backgrounds for dioramas at a number of institutions including the Bell Museum of Natural History in Minneapolis and the Museum of Science in Boston. In all three of these museums, the Jaques dioramas are still intact, but the museums have chosen different approaches to making these and their other dioramas relevant in the 21st century. This paper will examine Jaques's work as an exemplar of the diorama art form and also explore how these museums are employing the diorama form of display to deal with issues of biodiversity, direct experience of nature, and access for the physically challenged-issues that Jaques would not have been aware of at the time he was producing his art. I will argue that the diorama, in expanded format and within changing contexts, is still a valid and valuable form not only for conveying information about the natural world but for encouraging public appreciation of that world.

### **Gal, Ofer**

*E-mail Address: ofgal@bgumail.bgu.ac.il*

#### **From Realism to Constructivism and back Again**

The eighties realism debate revolved around the following dilemma: what commitment towards science's categories and concepts should arise from acknowledging the absence of independent perspective from which to adjudicate knowledge vis-a-vis nature? Should one, despaired with the possibility to Found these concepts on rock bottom, adopt an empiricist skepticism? Or perhaps the inexistence of external foundations implies rather an immunity for scientific ontology from such epistemological criticism? The debate lost its vivacity once its succeeded in driving out 'logical positivism' and crowning 'realism' its successor as mainstream philosophy of science. Science historians experienced the flight from foundationalism rather as a liberating breakthrough. 'Social constructivism' attempted to hold to both horns of the conundrum insisting on its own scientific merit while denying science any autonomous epistemic dominion of pure reasons. In the name of the scientific values of empirism, objectivity and generality, it demanded causal historical accounts for scientific knowledge as well as its paraphernalia, for its true as well as erroneous claims. Though the empirical success of social constructivism gives credence to its methodological credo, its requirement for symmetry between accounts of truth and error comes at the price of reinforcing a-symmetry between nature and society. Yet it

seems that there is no way to establish a new 'super symmetry' without forsaking the original one how can one let 'things speak for themselves' if not through the a-symmetrical narratives of science? This dilemma seems surprisingly reminiscent of the one above -- might realism come again to the rescue?

**Galle, Karl**

*E-mail Address: k.galle@ic.ac.uk*

**Nuremberg and De revolutionibus: Reflections on the Biography of a "Mathematical" Community**

To an unusual degree among canonical ideas in the history of science, discussions of the Copernican theory have remained largely divorced from both the life and the lifetime of the theory's author. In part, this is due to the relative isolation of Copernicus from his scholarly contemporaries and the paucity of surviving notes related to his astronomical work. In addition, his death within a few months of his book's publication removed him from participating in any of the debates over heliocentrism or from shaping the interpretations that were later made of his work. Hence, our understanding of the nature and content of Copernican thought has been framed primarily by dialogues taking place in subsequent generations, usually many decades if not more than half a century after the book was published. In this paper, I will survey briefly the astronomers and mathematicians in Nuremberg ca. 1470-1550, which included possibly the largest community of mathematical practitioners contemporaneous with Copernicus's life and became the site where *De revolutionibus* was first published in 1543. In addition to speculating on exactly when and how knowledge of Copernicus first reached the city, I will discuss the diverse identities of these practitioners and their connections to Copernicus's work. More broadly, I will argue that the very heterogeneity of their interests and practices suggests that even to the extent that we accept some concept of "mathematization" as a significant element among the changes that shaped early modern science, we need to consider it as a phenomenon that was both socially and philosophically multivalent, varying widely according to the identities of the local practitioners.

**Garber, Margaret**

*E-mail Address: mgarber@helix.ucsd.edu*

**Airs and the Ars Chymiae: Early Modern Physico-Chymical Concepts of Atmospheric Events**

This paper explores a collection of letters and treatises published by Gottfried Wendelin (1580 -1667) regarding a baffling meteorological event popularly referred to as the *ests* that bizarre events such as bloody rains, prodigious thunderstorms and other rials Physicians opportunities to ponder causes of normal atmospheric change. Notable by their exaggerated effects and made more likely by numerous witnesses, ominous events motivated Imperial Physicians to articulate natural causes that might curb popular appetites for causes supernatural or apocalyptic. The correspondence demonstrates a collective effort to arrive at a natural philosophical cause that was also chymical. Knowledge from the *ars chymia* could bring experience to bear upon causes because (the authors presupposed) earth distributed its mineral contents into the air through its own natural chymia. The precise mechanism perpetuating earth's action became pivotal in the debate and the letters provide a preponderance of physico-chymical ned to resolve questions about atmospheric change. Although the authors weighed criteria for truth differently, they attempted to agree upon a nexus of relevant knowledge domains including ancient and recent natural histories, generative theory and chymical experience. Into the balance the authors added the social chymistry of a public who expected regional problems to be solved by renowned locals, those most clearly adept at both truth showing and telling.

**GAUDILLIERE, JEAN-PAUL**

*E-mail Address: gaudilli@ext.jussieu.fr*

### **Normal Pathways: Controlling isotopes and building biomedicine in postwar France.**

In December 1945, the French physician and physicist Louis Bugnard arrived in New York for a scientific voyage of two months in the United States. Bugnard was then the official envoyé from the French Ministry for Health. He was in charge of documenting the status of medical research, and of advancing the collaboration between the two sides of the Atlantic. During his trip Bugnard was fascinated by US instrumentation, in particular the biophysical instrumentation: electron microscopes, electrophysiological apparatuses, cyclotrons and isotopes. Rather than means for curing diseases like cancer, the latter were perceived as elements of a new form of experimental medicine. As he returned to Paris, Bugnard started a laboratory of nuclear medicine with the support of the Rockefeller Foundation. He however was soon nominated head of Institut National d'Hygiene, the medical state research agency. As such he became responsible for authorizing the circulation and the biological uses of radioactive material. This paper will examine the part played by the control of radioisotopes either locally produced (by the French CEA) or imported from the United States in Bugnard's attempt to normalize biomedicine.

### **Gaukroger, Stephen**

*E-mail Address: [stephen.gaukroger@philosophy.usyd.edu.au](mailto:stephen.gaukroger@philosophy.usyd.edu.au)*

### **The Idea of a Mathematical Physics in the Early 17th Century**

In the early decades of the seventeenth century, various attempts were made to develop a quantitative dynamical vocabulary on the basis of work in the practical mathematical disciplines. The paper, which summarises some research undertaken jointly with John Schuster, looks at some of the issues involved in early seventeenth-century thinking on just how a mathematical natural philosophy might be established. The paper focuses on what, prior to the dynamical fleshing out of Galileo's kinematic model by Newton and others, seemed to be the most promising areas of practical mathematics, namely statics and hydrostatics. It contrasts various possible understandings of the role of mathematics in natural philosophy, and distinguishes sharply between the Mechanica approach and Archimedean approaches, and within the latter compares conceptions of statics and hydrostatics and their possible extensions in the work of Galileo, Stevin, Beeckman, and Descartes. Descartes' approach to hydrostatics is quite different from that of his contemporaries, above all in his attempt to provide a natural-philosophical grounding for it, at the same time using it to develop a range of concepts, approaches, and ways of thinking through problems that will shape his mature work in optics and cosmology. These questions will be taken up in John Schuster's paper, which looks at some of the details of Descartes' approach.

### **Geimer, Peter**

*E-mail Address: [geimer@mpiwg-berlin.mpg.de](mailto:geimer@mpiwg-berlin.mpg.de)*

### **Noise or Nature? Photographing the Invisible around 1900**

The talk is based on the observation that every new photographic procedure has produced its own specific chemical and physical accidents that emerged in the shape of disturbing blurs, dots, veils, halos and spots. Since they menaced the photographic task of representing natural phenomena, photographers and scientists described them as 'mysterious phenomena,' 'enemies,' 'parasites,' and 'waste.' I will argue that these photographic accidents are neither defective nor exceptional cases, but on the contrary are constitutive manifestations of photography. Special attention will be dedicated to cases in which photographs functioned as visible (and the only) proof of the existence of certain invisible rays and fluids. Here, scientific representations could resemble those conspicuous blurs and veils that were normally treated as photographic waste. In this scenario, separating facts from artifacts became problematic. Moreover, what first appeared as disturbing accident could later serve as scientific explanation for otherwise inexplicable phenomena. Scientists found themselves involved in a sphere of knowledge in which the interpretation of visual recordings oscillated between accidents and incidents, inscriptions of

noise and inscriptions of nature. In my discussion of some specific cases (e.g. the scientific debate on the fluid photographs that were taken at the Parisian hospital La Salpêtrière) I'd like to show how it could become an act of declaration whether a certain inscription on a photographic plate should be treated as technical noise or as a trace of nature, how distinctions between 'facts' and 'artifacts' became problematic, how 'nature' and 'technology' could intersect.

### **Gerson, Elihu**

*E-mail Address: gerson@ieee.org*

#### **The Origins of Natural History**

The early modern origins of natural history are to be found as much (or more) in the humanistic disciplines as in the sciences traditionally conceived. Natural history as a way of understanding nature developed as one of a group of disciplines (along with the ancestors of philology, history, and geography) devoted to describing the world rather than understanding the causes of things (the province of natural philosophy) or for appreciation and imitation of exemplary works (the province of rhetoric and the fine arts). Comparative biology and other disciplines rooted in the descriptive tradition are thus different from those rooted in the experimental-mechanical tradition. Over time, natural history developed concern with causal analysis, so that we may reasonably bracket natural history with the sciences by the beginning of the nineteenth century. But the differences in origin remain clear in the development of the two traditions.

### **Gilbert, James**

*E-mail Address: James\_B\_Gilbert@umail.umd.edu*

#### **Popularizing Darwin**

In 1925, during the Scopes Trial in Dayton, Tennessee, Edgar Rice Burroughs was asked by the Hearst newspaper chain to comment on the argument between creationism and evolution. There was nothing odd about this request, with its assumption that the author of the Tarzan books and scores of science fiction and adventure stories had something important to add to the debate. Hearst recognized that Burroughs was one of the 20th Century's major popularizers of Darwinian theory. His writings were filled with extended discussions and windy expositions of evolution, hereditarian theories, and ideas about eugenics. Given the very uneven teaching and the rise and fall of Darwinism in American public schools, it is arguable that a great many Americans (in particular boys and young men who were his avid fans) had their most thoroughgoing and explicit exposure to the concepts of evolutionary theory through reading science fiction and other works written by Burroughs over the first half of the 20th Century. Even in the first Tarzan novel, and far more explicitly in later stories, Mendelian hereditarian and Darwinian evolutionary theory are central elements of the plot and recurrent themes. This paper will briefly discuss the teaching of Darwinian theory in public and Catholic high schools before 1960 as a background for exploring what Burroughs had to say about evolution and the peculiar eccentricities of his interpretations. I will pay particular attention to *The Land That Time Forgot*, a trilogy of stories in which Burroughs explores in considerable detail ideas of evolution, eugenics, heredity, and reproduction. My purpose will be to determine what young readers might have concluded from this intensive exposure to ideas (however inaccurate a portrayal of science) that they only occasionally encountered in school. My conclusion is that Burroughs should be taken seriously as one of the important science popularizers of the 20th century. In more general terms, his case suggests the larger conclusion that elementary science education (for better or worse) has been conveyed through popular culture as much as in the classroom.

### **Gingras, Yves**

*E-mail Address: gingras.yves@uqam.ca*

### **What Did Mathematics Do to Physics?**

It is often taken for granted that physics is mathematical and that following the publication of Newton's Principia, every one accepted this as the only way to do physics. This talk will analyse the social effects of the mathematization of Physics in the 18th and 19th centuries. Looking at the process of formation of the field of physics from the point of view of the excluded, we will show that in fact there were strong reactions against the progressive mathematization of gravitation, electricity and magnetism. The aggressivity of those who criticized the abuse of mathematics in physics is an index of the fact that they resented being excluded from a space of discussion (through literary and scientific magazines, Provincial scientific societies and the publication of books) in which they were used to talk and write about natural phenomena using common language and unsophisticated experiments. In other words, paralleling the "Rise of Public Science" analysed by Larry Stewart there was also the creation of a "private science" accessible only to those adequately trained.

### **Girard, Marion**

*E-mail Address: marion.girard@yale.edu*

### **Chemical Warfare Scientists in 1914-1918 Britain: Servants to the War Effort?**

It is accepted that twentieth century wars have incorporated scientific knowledge and applications. As scientists have been integrated into politicians' and servicemen's decision-making and policy world, though, what sort of authority and how independent an identity have they maintained? Have they been subservient, dominant, or independent yet cooperating experts? Looking at one, rich example--British poison gas during World War I--it becomes clear that scientists balanced multiple roles. Studying various committees allows an investigation of how chemists involved in the official war effort interacted with other nonscientific specialists. In some, such as the Scientific Advisory Committee to the War Office, the Board of Trade delegated authority for granting export licenses for chemical goods. In others, scientists were independent consultants. For example, a Royal Society of Chemistry's War Committee answered Lloyd George's questions about possible biological warfare attacks. Finally, in the 1919 Holland Committee, scientists debated with military men about which group should head Britain's chemical warfare center, Porton Down, although both groups recognized that they were each needed in positions of power there. Chemists, the military, and politicians, therefore, learned when to respect their own expertise and when to bow to the knowledge and authority of another group. Scientists, even when absorbed, into the armed services or the war effort, maintained an independent, specifically scientific rather than military world view they kept their identity as scientists even when cooperating with a larger war effort.

### **Golan, Tal**

*E-mail Address: talgolan@actcom.co.il*

### **Visuality and Authority: Machines as Eye-Witnesses**

My talk will deal with the emergence during the late-19th and early-20th centuries of the first visual technologies (photography and radiology) that lay base to post-modern visual culture. Following their careers in the medical and legal spheres, I will describe how these technologies challenged the cultural boundaries between nature and artifice, reality and virtuality, documentation and manipulation, and how they restructured the power relations and the practices of knowledge in the legal and medical cultures.

### **Grau, Kevin**

*E-mail Address: ktgrau@indiana.edu*

### **Station to Station: Articulating Identity and Nation in Eighteenth Century British Science**

The pursuit of Natural Knowledge in eighteenth century Britain was an important activity for producing personal and national identity. The importance of the Royal Society in the eighteenth century depended upon its role in articulating epistemological standards and serving state interests. By considering the antiquarian, military, and scientific works of William Roy (1726-1790) FRS, FSA, it is possible to explore the relationship of science to nation and of the Royal Society to His Majesty's Government in the British Enlightenment. In his antiquarian and scientific work Roy marshalled resources to define and narrate Britain as an historical and geographical truth. Combining the instrumental empiricism characteristic of the Royal Society with the organizational logic of the Office of Ordnance, he created a social pathway for other military engineers and cartographers while naturalizing the ideas of Britain and Britishness. Roy, like Joseph Banks, was ever zealous in the cause of science, not only in service of government, but also for the creation of his own social role. Roy's movement in elite segments of Georgian Britain provides an opportunity to address the network of institutional, intellectual, personal, and political commitments which supported scientific practice. His activities within the Royal Society reveal not only the tensions within British science, but also the ways in which the Society maintained its integrity as a social body and producer of reliable knowledge.

**Green Musselman, Elizabeth**

*E-mail Address: greenmue@southwestern.edu*

**Race and Science: Cape Colony Natural History as Hybrid Knowledge**

Until recently, most studies of science and imperialism have focused on a single expedition or scientist. However, as we know particularly from the recent wealth of studies on science in colonial India, Australia, and Africa, we get a very different picture of how colonial science forms when we plant ourselves within a colonial space, rather than simply following the Europeans as they trek to and from the imperial metropole. In this paper, I present some of the exciting possibilities that open up when we examine the development of sciences within one colonial space, in this case the Cape Colony under earlier British rule and occupation, ca. 1815-70. I will argue here that the process of cultivation, in every sense of that word, lay at the core of the Cape experience. Since the colony began as a garden to supply fresh food to passing ships, cultivation literally formed the colony's *raison d'être*. But cultivation also fueled the colony's expansion and defined the colonial elite's dreams for the European and African populations at the Cape. I will focus in this paper on nineteenth-century British Cape botanists' visions of a cultivated South African society, and the extent to which Africans played a part in that cultivation, both as subjects of improvement and (usually unacknowledged) agents in the expansion of natural historical knowledge. Specifically, I argue that the primary purpose of botanical work in the Cape Colony was to encourage cultivation--both in the agricultural and in the cultural sense. My paper will respond particularly to two articles in the most recent *Osiris* volume: David Wade Chambers and Richard Gillespie's "Locality in the History of Science" and Harriet Deacon's "Racism and Medical Science in South Africa's Cape Colony in the Mid- to Late Nineteenth Century."

**Greene, Mott**

*E-mail Address: greene@ups.edu*

**Attitudes Concerning Latitudes**

A useful example of the details of social construction is the evolution (between 1884 and 1928) of a classification scheme for the earth's climate regimes based (with varying emphases at different times) on agriculture, anthropology, geology, botany, rainfall, temperature, latitude, and proximity to the oceans. This scheme, invented by the German meteorologist Wladimir Köppen (1846-1940) still provides the basic structure geographers and climatologists use to discriminate climate zones. It has a peculiar history, beginning with Köppen's childhood experiences in Russia, and provides a beautiful example of

how a series of narratives based on contingent choices, and anchored in the idiosyncratic, historical experiences of a particular individual, were reified into a formalized conceptual scheme with universal application. As such it is a useful icon of the way many of the earth sciences -- including meteorology, oceanography, geology, and paleontology -- conducted their business in the twentieth century.

**Gregory Kohlstedt, Sally**

*E-mail Address:*

**Gumienny, Kevin**

*E-mail Address: Kevin.Gumienny@sunysb.edu*

**"An Irreligious Philosopher Must Be Mad:" Public Lectures on Natural Philosophy and the Experiences of Captain John MacPherson in Eighteenth-Century Philadelphia**

During the latter half of the eighteenth century, lectures on natural philosophy became popular throughout the transatlantic world. In recent years, much attention has been paid to these lectures by historians of science, especially in their examination of the multiple ways in which science became a popular and legitimate method to understand nature in the eighteenth century. One of the problems encountered by those seeking to trace the influence of natural philosophy lectures, however, has been the difficulties discovering the impact that these presentations had on the lives of their audience. This paper uses the experiences of Captain John MacPherson, a one-armed privateer and accused lunatic who lived in Philadelphia, to explore how one man integrated the knowledge he gained from lectures on natural philosophy into his everyday life. In 1771, MacPherson attended a public course of lectures on natural philosophy given by the College of Philadelphia. The course was designed to promote an orrery designed by David Rittenhouse, a local clockmaker, and to raise enough funds for the College to purchase it. MacPherson paid little attention to the intent of the lecturers. Instead, he used what he learned in the course in other ways, not the least of which was to attempt to use natural philosophy to acquit himself of the charge of insanity that had hung over his head since 1769. It is probable that the experiences of MacPherson were somewhat unique. However, by comparing the differences between what the faculty of the College of Philadelphia intended for their course to accomplish and how MacPherson actually used what he learned, a fine-grained insight can be gained into how lectures on natural philosophy changed the life of at least one member of eighteenth-century American society.

**Hahn, Linda**

*E-mail Address:*

**Hall, Karl**

*E-mail Address: khall@dibinst.mit.edu*

**"Crushing the enemy with his own weapon": Maturing Young Soviet Cadres Master Quantum Theory (and Stalinist Culture)**

In 1927 an observer of Soviet science wryly noted that "youth in revolutionary times is not a minus, but a plus." True to this assessment, the first Soviet students of quantum mechanics exploited their mastery of the esoteric new calculation methods in an effort to create a professional niche for theoretical physics and wrest institutional control from their Old Regime elders. As survivors of the complex social antagonisms within Soviet universities in the 1920's, young theorists like Lev Landau and George

Gamow did not hesitate to use quantum mechanics as a tool for social differentiation marked by the militant values of student culture. They did not take for granted either the transparency or the utility of the new theory as they made concerted efforts to draw "the attention of the cultural world" to their pursuits while also changing the research agendas of physics. Aiming to best their "bourgeois" adversaries in the race for the next "breakthrough on the physics front," they sought out novel collaborations with experimentalists, and forged a culture of theory dynamically engaged with the concerns of Stalinist culture.

### **Hall, Nancy**

*E-mail Address: [nhall@wam.umd.edu](mailto:nhall@wam.umd.edu)*

#### **Sir Ronald Fisher and Randomized Experimental Design**

Today randomization is used routinely in many experimental situations; the randomized trial has become the gold standard in many disciplines. But until the 1920's the preferred method was one of systematic design: the researcher arranged the experimental treatments in a way that in her judgment would give the most reliable results. Sir Ronald A. Fisher changed the course of experimentation and statistics and his principles of randomized experimental design are now basic to scientific experiment. Fisher began advocating randomization in 1925. Then in 1930 in Scotland the Lanarkshire Milk Experiment was conducted, by the Department of Health, to investigate the advantage of giving extra milk, raw or pasteurized, to school children. But the experiment, involving 20,000 children, was poorly designed and ineptly carried out. Sheer size was no substitute for lack of randomization. After the supposed results were announced, Fisher and his good friend "Student" (of Student's t-test) and several others discussed possible ways to salvage the situation, but the Lanarkshire Milk Experiment was a source of community controversy for several years.

### **Hanson, Betsy**

*E-mail Address:*

### **Harden, Victoria**

*E-mail Address: [victoria.harden@nih.gov](mailto:victoria.harden@nih.gov)*

#### **Academic Assignments that Train Historians for Public History Careers**

How can a professor who has spent an entire career in academia prepare students for careers in public history? This paper will suggest strategies for assignments in lieu of--or in addition to--the traditional term paper. Utilizing the traditional content of a course, professors can ask students to demonstrate mastery via activities that build public history skills. This presentation will include handouts.

### **Harman, Oren**

*E-mail Address: [harman@harvard.fas.edu](mailto:harman@harvard.fas.edu)*

#### **C.D. Darlington and the Anglo-American Response to the Lysenko Affair**

This paper considers the role of outspoken British cytogeneticist and evolutionist Cyril Dean Darlington in the reaction of the Anglo-American scientific community to the events in the Soviet Union surrounding what became known as the Lysenko affair. In a highly charged, and uncertain political atmosphere, Western geneticists devised an explicit strategy of response designed to buttress the battle of geneticists in Russia against Lysenko's onslaught. This meant divorcing Lysenko's rise from politics and responding to his claims on a purely scientific level. Darlington rejected this approach and launched a full-scale assault on the Soviet subordination of science to politics and ideology, in complete diver-

gence from his colleagues' strategy. The paper poses the question, Why? As the distinction between political and scientific argument was shattered in the Soviet Union, as political intervention in scientific practice based on philosophical sanction came to be understood as a duty, rather than an evil, and as science itself metamorphosed as a direct consequence of its use in war, scientists in the West were forced to ask themselves difficult questions about the social and political role, legitimacy, and meaning of their profession. United scientifically, but deeply divided politically, they fought over the principles of scientific freedom, and planning, just as their profession was achieving previously unknown social, political, and economic prominence. As will be shown, there are good reasons to use the highly singular, and controversial case of Darlington as an aid to understanding these complex relationships.

### **Harrison, Peter**

*E-mail Address: peter\_harrison@bond.edu.au*

#### **Voluntarism and Early Modern Science**

The idea that divine voluntarism played an important role in the development of an empirical approach to the study of nature is now commonplace amongst historians of the early-modern period. The standard view links the voluntary activity of God, the contingency of the created order, and the requirement that nature be investigated empirically. In this paper I will suggest that the 'voluntarism and science' thesis is attended with numerous difficulties. First, there were significant early modern voluntarists who were not empiricists. Second, the central categories 'voluntarism', 'necessity', and 'contingency' are used with such imprecision and ambiguity as to render many versions of the thesis virtually meaningless. Third, the familiar story about the impact of various forms of medieval voluntarism on the thought of the early modern period is in much of its detail simply wrong. Fourth, close examination of the expressed positions of a number of those early-modern empiricists thought to exemplify the thesis shows that they were not voluntarists in any significant sense of word. Finally, voluntarism is inconsistent with the physico-theological motivations of most early modern natural philosophers, for whom evidence of God's wisdom and goodness can be discerned in the order of creation. The voluntarism and science thesis is fatally flawed and its major contentions should be abandoned.

### **Harvey, Joy**

*E-mail Address: jharvey368@aol.com*

#### **Dr Mary Putnam Jacobi and the Forbidden Experiment**

"Among the experiments that may be tried on man, those that can only harm are forbidden, those that are innocent are permissible, and those that may do good are obligatory", wrote Claude Bernard in 1865. Three years later, when Dr Mary Putnam Jacobi was studying in Paris, she quoted Bernard in a short story that dealt with the ethics of human experimentation. This paper will explore Putnam Jacobi's interest in medical research, her experimental research on animal subjects, her non-invasive human experiments, and her physiological demonstrations at the Woman's Medical College of New York. The material is used to provide a context for her later controversy with her mentor Elizabeth Blackwell over the ethics of animal experimentation and its usefulness in training women physicians.

### **Hawkins, Michael**

*E-mail Address: m.hawkins@kingston.ac.uk*

#### **Evolutionary Ethics and the Dilemmas of Darwinism in British Thought**

Although attempts to ground ethics in the supposed imperatives of evolution preceded Darwin (Positivism offering a prime example), Darwinism opened up the possibility of basing ethics upon not only evolutionary but also genuinely scientific foundations. Several writers sought to understand human development in Darwinian terms of competition, adaptation, selection, struggle and change, and to

explore the implications of this for morality and religion, an exercise that was simultaneously both empirical and normative. This paper explores some of these attempts among British writers of different intellectual orientation and ideological persuasion from the late nineteenth and early 20th centuries, e.g. Leslie Stephen, Benjamin Kidd, Herbert Spencer, Graham Wallas and F.H Bradley. The argument is that such thinkers encountered the dual qualities of Darwinism when applied to social existence as both model and threat. Darwinian nature seemed to provide a dynamic model for understanding human social interactions, but its focus on processes of selection, struggle and extirpation created dilemmas for moral virtues and domestic and international harmony. The tensions between these two features of Darwinism are central to the attempts - and failure - to establish a Darwinian inspired evolutionary ethics.

**Haynes, Douglas**

*E-mail Address: dhaynesd@uci.edu*

**Theater of Malaria: Demonstrating Transmission in Rome and London, 1900**

"Theater of Malaria" focuses on the 1900 demonstration of the transmission of the malaria parasite through the bite of the mosquito. Although malaria was long represented as a sign of the backwardness of the tropical world, the demonstrated of the mosquito-malaria relationship in fact occurred in Europe. Patrick Manson, medical adviser to the Colonial Office who was associated with the 1898 discovery of the role of the mosquito in spreading plasmodia, organized a prophylaxis in Rome and human infection demonstration in London concurrently. The freedom from disease of the occupants of a mosquito-proof hut in Italy and the presence of the clinical signs of disease in human subjects in England bitten by mosquitoes imported from Italy together were designed to display the power of British science to control malaria and hence the tropical world. This study in imperial science not only shows the role of London-based scientists in the creation of knowledge about the periphery. It too reveals how the rhetorical representation of southern Italy as a European analogue to Africa framed the credibility or "truth-value" of the mosquito-malaria demonstration in Europe.

**Hecht, Jennifer**

*E-mail Address: hechtjm@aol.com*

**Atheism, Evolution, Nihilism, and a Transcendental Turn: The Question of Secular Ethics in France, 1870-1914**

The French Third Republic celebrated secularism and scientism and explicitly drew from these ideas the authority for its governance and the style of its swagger. A question of the grounds for morality emerged alongside this scientism. It affected a broad swath of intellectual, artistic, and political questions, varying in relation to levels of religious belief. Most of the population certainly seems to have believed in God, but in Paris in the 1880s and 1890s there was a very vocal, well-supported community of atheists. They were enthusiastic in their atheism, but very worried that civilization's entire moral edifice was now without support. They either became oddly dedicated to a worldwide moral collapse, or they fought against it by showing that the old Judeo-Christian morality was actually somehow coded into the natural or social world. In Neo-Kantian and Bergsonian philosophy, evolutionary theory, Social Darwinism, and Durkheimian sociology, much of the most lasting and innovative work of the period was originally fashioned, at least in part, to address this crucial question of morality without God. For atheists the question was: How can we talk about good and evil now that God is gone? And for the much larger anticlerical community: How can we get citizens to choose good over evil without the invocation of God in the daily life of the state? Their varied and resourceful answers had considerable impact on the modern idea of the state and significantly influenced lines of academic, artistic, and political thought in the twentieth century.

**Heering, Peter**

*E-mail Address: peter.heering@uni-oldenburg.de*

**The Role of Visualization in Jean Paul Marat's Scientific Approach**

Jean Paul Marat is among the persons in pre-Revolutionary France who attempted to establish themselves as natural philosophers but failed. In 1779 he published a short paper on heat, light and electricity. This paper was expanded into three large volumes which appeared between 1780 and 1782. Crucial for Marat's failure was probably the report a committee of the Paris Academy of Science prepared for his optical work of 1780. Although most contemporary scientists were at least very skeptical in respect to Marat's theories some of them accepted his experiments. He developed several new instruments and did not only describe many experiments in his monographs but also performed them in front of an audience. In order to develop an understanding of Marat's experimental practice several of the devices he had described were reconstructed and the experiments were redone. In my paper I am going to use the experiences made in this approach as a basis of the analysis of Marat's experimental practice. In doing so, I am going to present my findings in terms of the 'style of experimentation', an epistemological category I use in expanding Ludwik Fleck's concept of 'style of thought' and 'thought collective' with respect to experimental practice. Thus the aim of my paper is not to discuss singular experiments but to emphasize aspects that can be considered as being characteristic for Marat's style of experimentation, among which visualization plays a crucial role.

**Hendrick, Robert**

*E-mail Address: hendricr@stjohns.edu*

**Shaping Public Perceptions of Science in Late-Nineteenth-Century France: The Role of La Nature**

Science was extraordinarily popular with the educated public in late-nineteenth-century France. Many viewed science as a panacea that could solve the demographic, economic, and military problems facing France and restore it to its former position as Europe's greatest power. Hence, educated French readers took an interest in science and hungered for information about science in terms they could understand. To satisfy this demand, a new profession emerged in Paris, that of science popularization. The popularizers used books, newspapers, and periodicals to reach the reading public. The most successful of these efforts was the weekly science journal, *La Nature*. Founded in Paris in 1873 by Gaston Tissandier, this heavily-illustrated science review specifically targeted a middle-class reading public. In the process of communicating scientific developments to this audience, *La Nature* also consciously defended that audience's ideological positions. My discussion of the first three decades of the journal's history focuses on the level of the science being conveyed to the French elite, on the use of the science content for ideological purposes, and on the appeal of its illustrations to an extremely visually-oriented public. In the process, I demonstrate that *La Nature* shared certain characteristics that have been present in other successful popular science periodicals.

**Henninger-Voss, Mary**

*E-mail Address: voss@phoenix.Princeton.EDU*

**Looking High and Low for a New Philosophy: Mathematics and the Early Modern Print Market**

Thomas Kuhn's emphasis in *The Copernican Revolution* on a "mathematics for mathematicians" that assaults the common-sense perceptions of common sixteenth-century people stands in sharp distinction to interpreters who have looked at a kind of "scientific revolution from below." New historiography on mathematical practitioners has attempted to trace the emergence of the new mathematical philosophy of nature from the precincts of surveyors, navigators, and commercial mathematicians. Other historians

have begun to engage seriously with the role of print culture as a source for public participation in the scientific revolution, as well as an important epistemological framework of the new philosophy. This paper attempts to approach the transformations between 'low' and 'high' mathematical traditions by an examination of the ways in which mathematicians utilized the market of printed books. The production of mathematical books, like many other genres, rested between a new market imperative and an older structure of patronage relationships. In both cases, novelty was demanded, although this novelty often took the inconspicuous form of translations, re-drawn diagrams, and new commentaries on old texts. Nevertheless, the transformative nature of these printed "novelties" made possible transformations in the way mathematical knowledge could be packaged and traded. I will examine the variety of mathematical texts available to early modern readers, and identify meeting points between mathematical traditions. The field of mathematical texts, placed well within the social world of early modern actors, can illuminate the ways in which the increased availability of mathematical texts, and an attendant autodidacticism, fostered both the appropriation of artisanal knowledge by erudite curiosi, and the advancement of mathematicians as philosophers and sages.

### **Hofer, Veronika**

*E-mail Address: Veronika.Hofer@eunet.at*

#### **Physiology gains space. On the meaning of Sigmund Exner's Founding of the Phonogrammarchiv**

This paper addresses the encounter between science and aesthetics as two sides of a characteristic trait of Vienna at the turn of the century. Sigmund Exner's foundation of the world's first sound archive in 1899 represented not just another deed of a member of a family of scientific founders. In order to understand what distinguished the Phonogrammarchiv from similar institutions founded quickly thereafter, we must consider it within the intellectual history of Central Europe. While the Berlin Phonogrammarchiv laid emphasis on creating a systematic musicology, the Viennese aimed at languages, music, sound portraits of renowned personalities, as well as the voices of animals and the cries of children. In search of the idea of culture that stood behind this innovation, we have to take into account that the particular scientific atmosphere of the Habsburg Empire strongly favoured the use of methods from the natural sciences for research in the humanities and the arts. In Vienna, empiricism had eventually become a significant movement through the influence of Franz Brentano, Johann Friedrich Herbart, and Ernst Mach. To be sure, Sigmund Exner was the head of the world-renowned Physiology Department of the University of Vienna, an outstanding researcher in the field of perception, and the respective brain functions. But there was also a specific focus to his research, which induced him to found the Phonogrammarchiv in order to collect the recordings of "acoustical phenomena" originating from nature and culture.

### **Hook, Ernest**

*E-mail Address: ebhook@socrates.berkeley.edu*

#### **Different Voices were Heard: Geneticists' Views in the 1930s and 1940s on the Consequences of Race Crossing**

During the 1930's and 1940's in the USA and Britain William B. Provine (1973) claimed that geneticists changed their minds about the biological effects of race crossing not because of scientific evidence but because of repugnance to Nazi doctrines. I suggest in contrast that there is no evidence that anyone changed their minds about the scientific consequences of race crossing, in response to Nazi doctrines or anything else, but rather, in the USA and Britain different voices spoke up or became silent. Elderly geneticists whom I surveyed could recall no one altering beliefs about any putative adverse consequences of race crossing. Julian Huxley cited evidence that under some circumstances race-crossing could have adverse effects. Thus an alternative more complex view is that: i) there was wide variation

both in the beliefs and the membership of the pertinent scientific communitie(s), ii) the partisans of different views, while not changing their scientific beliefs at the time changed the extent of their expression of these in response to the perceived implications and concern about Nazi racial theories, iii) a new generation of human geneticists subsequently emerged exposed differentially to the evidence pertinent to one position. The last cited factor suggests that social factors did influence alterations in "scientific beliefs" about race crossing, but only indirectly and slowly rather than abruptly as Provine claims. Specifically, the views of scientific communities changed temporally as the membership of those communities changed but not (according to available evidence) the beliefs of any individual members of those communities.

### **Hunter, Patti**

*E-mail Address: phunter@westmont.edu*

#### **Statistics in the U.S. Comes of Age: A Case Study in American Influence Abroad**

"The status of statistics in the rapidly developing countries is not too different from what my generation experienced in the 1920s." So wrote Gertrude Cox in 1966, upon her return from a year as visiting professor and consultant at the University of Cairo, Egypt. Cox had received her education in statistics in the 1920s and '30s, during the formative years of the discipline's professional community in the United States. Her experiences in Egypt in the early 1960s provide evidence that by this time, the statistics community in the United States had matured to such an extent that its members had begun to influence the development of the discipline on an international level. Americans, Cox among them, were providing advice and training to emerging statistics communities abroad, particularly in developing nations. This talk will describe Cox's contributions in Egypt, highlighting their implications for the history of statistics in the United States.

### **Ito, Kenji**

*E-mail Address: kenjiito@fas.harvard.edu*

#### **"Student Radicals" in Science: Youth Cultures and the Roots of Quantum Physics Research in Interwar Japan**

This paper attempts to interpret the earliest Japanese attempts to digest quantum mechanics within the cultural context of the time. In the early 1920s, political, industrial, educational, and scientific landscapes in Japan were changing dramatically along with urbanization, democratization, industrialization, World War I, a huge educational reform, and a severe earthquake. Grown up in a radically changing world, Japanese youth began challenging old values and norms. Late 1920s Japan provided various loci for these rebellious youth: school riots, literary movements, modernist urban lifestyles, political activism, and new academic trends. Although science students were less political than other youth, they, too, had their way of rebellion. Having been stimulated by Einstein's visit in 1922, young physicists in the late 1920s were not satisfied by what the universities had to offer. Some recent graduates of Tokyo University found its physics colloquium boring and fruitless. Frustrated, they formed a study group and tried to learn by themselves something totally new. This splinter group read and translated papers by Heisenberg, Schrödinger, and other founding fathers of quantum mechanics, and published them in 1927. Similarly, around the same time in Kyoto, young physicists, including two future Nobel laureates Tomonaga Shin-itiro and Yukawa Hideki, began studying quantum mechanics on their own, a subject that no professor at the university could teach. For these young people in Tokyo and Kyoto, quantum mechanics was a harbinger of a new age, and learning it was an act of defiance, a revolt against their old professors.

### **James, Jeremiah**

*E-mail Address: jjames@fas.harvard.edu*

### **Naturalizing the Odd-electron Bond**

Chemists and historians of chemistry alike have cited the use of odd-electron bonds as a prominent weak point in valence bond theory when compared to the rival molecular orbital theory. They have characterized odd-electron bonds as ad hoc solutions to the problems presented by a handful of chemical compounds and as poorly supported addenda to a theoretical edifice founded on the electron pair bond. The depth and prevalence of the unease these criticisms reflect suggest that more may be driving them than a minor point in a two-sided theory debate. Indeed closer examination of both published and unpublished sources related to the construction and presentation of odd-electron bond theory by Linus Pauling and his collaborators at Caltech suggests a very different characterization. Pauling et al developed accounts of odd-electron bonds and electron pair bonds not only concurrently but conjointly. Odd-electron bonds were hardly an afterthought. Later separation of odd-electron bonds from electron pair bonds was a multi-step process, completed to differing degrees by Pauling and his detractors, and was conditioned by a network of distinct but interconnected disputes that ranged over several sub-fields of chemistry and predated much of valence bond theory. Opposition to the use of odd-electron bonds in valence bond theory originated in this pre-existing network of commitments and disagreements, and fits poorly with common models that portray theoretical disputes as developing around a single dichotomous split.

### **Jamison, Andrew**

*E-mail Address: andy@i4.auc.dk*

### **Hybrid Identities in the Making of Western Science**

One of the central features of the dominant mode of scientific knowledge production which emerged in Europe was the development of what might be termed hybrid identities. As opposed to the situation in other parts of the world, there were opportunities in Europe for scholars and craftsmen, for artists and engineers and, perhaps most importantly, for philosophers and technicians, to interact and forge social identities that combined characteristics from what had been previously separated spheres of human activity. The construction of these hybrid proto-scientific identities played an important part in shaping new experimental ways of life, as well as in instituting the forms of organization and formulating the discursive frameworks that have proved so powerful in relation to other, non-Western modes of knowledge production. While much attention in recent years has been focused on the actual practices and sites of constructing, or, as Jan Golinski has put it, ral knowledgegghts have only rarely been connected to work on the sociological roots of science of e.g. Edgar Zilsel and Christopher Hill. By focusing on the process of hybridization, and providing examples of several hybrid identities in the 16th and 17th centuries (e.g. Paracelsus, Tycho Brahe, Gerrard Winstanley), I try to link the new croglected broader historical concerns. The paper is a draft chapter of an ongoing ence

### **Janssen, Michael**

*E-mail Address: janss011@tc.umn.edu*

### **The role of unexplained coincidences in theory construction and theory choice**

In developing both special and general relativity, Einstein was guided not by experimental anomalies facing existing theories but by certain striking coincidences left unexplained by these theories. Think of the magnet-conductor example with which he opened the 1905 paper on special relativity and of the equality of inertial and gravitational mass that formed the starting point for the development of general relativity. For Einstein and others, the explanation of such coincidences was an important virtue of the new theories. In my talk I want to explore what philosophers of science have to offer (inferences to common causes and best explanations spring to mind) for a general account of this virtue.

**Jolly, James**

*E-mail Address: jollych@ucs.orst.edu*

**"Linus Pauling's Influence on the Scientific Debate over Fallout Hazards"**

The controversy over possible hazards of fallout from nuclear tests during 1954-1963 involved a myriad of scientific, political, and moral issues. The central scientific question in the controversy was whether radioactive fallout is harmful to humans. Soon after the widely publicized exposure of Marshallese Islanders and Japanese fisherman to radioactive fallout from U. S. bomb tests in the Pacific in 1954, fallout attracted the interest of scientists in many different fields, including health physics, genetics, medicine, radiology, chemistry, and biology. Several scientists who became involved in the debate over fallout hazards became public figures, perhaps no one more so than the Caltech chemist Linus Pauling. Though he has primarily received attention for his efforts to convince the public of the significance of fallout hazards, he also involved himself in debate within the scientific community. Pauling published two scientific papers on fallout hazards in 1958 and 1959. One paper attacked a widely reported article by an AEC affiliated scientist who concluded somatic dangers from fallout were insignificant, if they existed at all. Pauling's other publication raised the specter of a new fallout hazard, carbon-14. My paper, drawing on my dissertation research, examines both how Pauling's articles affected the scientific debate and whether the articles' influence resulted primarily from the scientific ideas they contained or from Pauling's public stature. More generally, this paper explores how the course of scientific debates may be shaped by their public and political aspects.

**Jones-Imhotep, Edward**

*E-mail Address: imhotep@fas.harvard.edu*

**Imag(e)ining the Laboratory: post-war ionospheric research and the panoramic ionogram**

In the late 1940s ionospheric laboratories across the Western Hemisphere, freshly created under the demands of wartime communications and post-war defence, turned overwhelmingly to one image - the panoramic ionogram - as a solution to the problems of knowledge production inherent in their work. This paper explores how the status of these institutions, their very definition as laboratories, was bound up with the production, manipulation and interpretation of scientific images, particularly the panoramic ionogram. Unlike the microphysical investigations and engineering sciences it drew from and fed into, post-war ionospheric research was unable to directly confine, interrogate and discipline its phenomena. Instead, its work focused almost exclusively on a steady flow of visual records drawn from the remote, isolated and often underdisciplined field stations of ionospheric research. The ionogram and the machine that produced it figured as a crucial palliative to social, material and cultural concerns about these sites of experiment and the people who operated them; the image, its varying social relations at centre and periphery, and the metrologies that underwrote its production would serve to crucially define the laboratory against its adjuncts in the field. In order to bring these issues into their sharpest relief, the paper focuses on the particularly illustrative context of ionospheric research in the northern polar regions. In doing so, it hopes to strikingly demonstrate how an enterprise standing astride the morphological and analytic traditions of modern science might tie its understanding of the laboratory to the complex material and social relations surrounding scientific inscriptions.

**Kaiser, David**

*E-mail Address: dikaiser@mit.edu*

**The Postwar Suburbanization of American Physics**

The population of graduate students pursuing Ph.D.s in physics within the United States exploded just months after the end of World War II, as veterans streamed out of the service and back into the

universities. The crush of numbers changed dramatically what daily life was like in American physics departments, and recast what it meant to become a physicist in the United States. With the sudden increase of students, and the equally-sudden prestige enjoyed by physicists after the war, came fears that the new generation's ideas about social and intellectual conformity, about the material comforts to be expected from a life in physics, and about gender roles within the profession showed signs of a more pervasive suburbanization. Norms, assumptions, and aspirations with which contemporary social commentators and subsequent historians have characterized broad swathes of American society after the war found expression, too, within the halls of American physics departments: in everything from graduate students' questionnaires, to junior faculty skits, to department chairs' annual reports. Whether celebrated or feared, many of these newly-fashioned cultural norms infused discussions within American physics departments about how and why to pursue a life in physics, affecting everything from admitting and evaluating students to organizing departmental social events. Forming and maintaining communities of young physicists loomed menacingly large for American physicists after the war --how they handled these challenges and instilled them with meaning reveals much about the places of American physics within American history.

**Kim, Mi-Gyung**

*E-mail Address: migyungkim@aol.com*

### **Newton in the Public Sphere of Chemistry**

Newton is everywhere and nowhere in Enlightenment science. The efforts to identify the main thrust of Eighteenth century sciences under the banner of Newtonianism have proved futile due to its Protean shape, defying efforts by historians to use it as an organizing theme. Detailed studies of Newtonian chemistry, in particular, only led to the conclusion that it ultimately failed to develop a significant relevance to the on-going practice of chemistry. As a consequence, the most sophisticated form of 'Newtonian' chemistry in Enlightenment France developed by Guyton de Morveau (1737-1816) fell into disfavor in the historiography of the Chemical Revolution. If we forego the history-of-ideas tradition in which ideas supposedly determine the development of science, however, we can find alternative ways of discussing the presence of Newton in Enlightenment science. In this paper, I borrow Habermas' notion of 'public sphere' (as modified by Goodman and Bell) to talk about the authority of Newton constructed in the conversational culture of French Enlightenment. The very divide between Newtonians and anti-Newtonians bespeaks Newton's presence as an authoritative figure in this milieu. If Newtonian natural philosophy became an intellectual fashion that replaced Cartesianism in the public language of chemistry, exactly how 'Newtonian' chemistry differed from 'Cartesian' chemistry is not easy to characterize. By situating Guyton's program of affinity chemistry in the context of the French didactic tradition, I will elucidate how the presence of Newton in the public sphere of chemistry affected the development of theoretical chemistry during the Chemical Revolution.

**Kim, Sang-Hyun**

*E-mail Address: s.kim-2@sms.ed.ac.uk*

### **Computing Global Climate Change: The Early Development of General Circulation Models (GCMs) in Britain**

Until relatively recently, studies of climate and its change had been considered largely descriptive without solid theoretical underpinning. They had been rather overlooked by meteorologists and had quite often been left to geographers, geologists or paleobotanists. With the aids of new computing technology, however, climate studies gradually moved towards highly mathematical endeavors. By the late 1970s, climate research became more or less dominated by dynamical meteorologists, atmospheric physicists and physical oceanographers armed with complex numerical modeling as a principal method-

ology. This is not to say that other lines of approach were insignificant. In fact, empirically-oriented climatological works such as those cultivated by Hubert Lamb played an instrumental role in raising the issue of climate change and variability during the 1960s and early 1970s. On the other hand, many meteorologists, from the very beginning, believed that climate and its change could only be properly studied using physico-mathematical models. This tendency was particularly strong in Britain. Since the early 1960s, the British Meteorological Office had begun to devote more of its climate research efforts to the development of general circulation models (GCMs). Consequently, Hubert Lamb, despite his international reputation as a pioneer of historical climatology, faced an increasing lack of support and eventually decided to leave the Office. In this presentation, by tracing the historical and social contexts of early GCM developments in Britain, I will demonstrate that styles of scientific practice, disciplinary traditions, institutional cultures, as well as broad political environments all contributed to the transformation of climate science during the 1960s and 1970s.

**Kimmelman, Barbara**

*E-mail Address: kimmelmanb@philau.edu*

**Regulation and Debate in International Agricultural Industries: The Case of Antibiotic Feed Additives In the U.S. and U.K.**

Between 1948 and 1951 researchers in the United States and Great Britain discovered what is known as the "antibiotic growth effect"--that the feeding of antibiotics at low levels to agricultural animals resulted in enhanced growth. The general tone of both scientific and commercial publications reporting this unexpected effect was enthusiastic--its discovery offered a fascinating scientific problem requiring elucidation and also promised economic benefits to both producers and consumers of meat. But by the 1970s an alternative viewpoint had emerged in the face of growing worldwide concern about microbial resistance to antibiotics and accumulating evidence that agricultural use of antibiotics was a contributing factor. Actions by various national governments, non-governmental organizations, and voluntary associations of scientists and medical practitioners have produced restrictions or bans on routine antibiotic feeding of food animals. But the United States has lagged behind in both national and international initiatives. In this paper, I compare the course of debate and regulatory action in the United States and United Kingdom, and argue that the political culture of the U.S. encourages a voluntary approach to restriction, rather than formal government intervention and regulation, which is tolerated better in Europe.

**Kinraide, Rebecca**

*E-mail Address: kinraide@hotmail.com*

**The many hats of the nineteenth-century science popularizer**

The efforts of nineteenth-century science popularizers to disseminate science to a broad audience have come under much recent investigation by historians of science. However, the many different roles that some of these popularizers played has not been adequately examined. In this paper I will show how the Society for the Diffusion of Useful Knowledge in Britain came to be a leading clearing-house of scientific knowledge in the first half of the nineteenth century. Founded in 1826 as an organization to oversee the publication of inexpensive works on science, history, literature and other forms of the needs of a great diversity of groups. Amateur and professional scientists, inventors, collectors, educators, and the simply curious, looked to the SDUK to provide employment opportunities, chances for publication, promotion, textbooks, and answers to queries. The volume and diversity of both offers of assistance and requests for information indicates that there was a significant portion of the public interested in science who may have felt excluded from the more formal institutions of science. The SDUK solicited correspondence from its working-class readers and subscribers and was therefore viewed as being

approachable by a class of society which had not before been encouraged to participate in science. By meeting the needs of many different groups, the SDUK expanded from being simply a publishing committee into one of the most well-known and well-utilized resources for members of the broader public who wished to contribute to or learn about science.

### **Kipnis, Nahum**

*E-mail Address: nahumk\_99@yahoo.com*

#### **Unappreciated Discoveries: How to Deal with Them?**

Discoveries that were not properly appreciated at their time create historiographical difficulties. An example in question is the discovery of magnetization by electricity. In 1752, B. Franklin, having read that lightning reversed polarity of naval compasses, tried to imitate this phenomenon by a discharge of a Leyden jar through a sewing needle. Between 1752 and 1784, this experiment had been successfully reproduced by a number of scientists who magnetized and demagnetized steel needles and sometimes inverted their polarity. Two explanations were offered. According to F. U. T. Aepinus, electricity was merely a facilitator, with magnetization done by terrestrial magnetism. J. C. Wilcke suggested, however, that both terrestrial magnetism and electricity played a role, and in cases of lightning or needles placed in the direction west-east, electricity prevailed. This debate was not settled at the time, and soon the advance of galvanic electricity diverted scientists to experiments of different kinds. The matter was revived by H. C. Oersted in 1828. He claimed to have provided the first icity and magnetism, invalidating a similar conclusion by Wilcke on the ground that magnetization in the eighteenth-century experiments occurred along the current, while according to Oersted's law, it had to be perpendicular to current. The implication was that the effect observed by Franklin and others was spurious. In fact, it was real, but it could not be explained by Oersted's law. Since Oersted's statement has never been challenged, the following question arises: if proving a connection between electricity and magnetism was a discovery, who should get credit for it? The paper offers suggestions on dealing with such a problem.

### **Kirchhoff, Jochen**

*E-mail Address: Jochen.Kirchhoff@lrz.uni-muenchen.de*

#### **Redirecting research: experiences from the Notgemeinschaft der Deutschen Wissenschaft in the 1920s**

The experience of specialized officials in Prussian higher education laid the foundations for peer review as a means of research management in the 1920's. What was the significance of this organizational innovation? Its genesis is the story of the science funding body called the Notgemeinschaft der deutschen Wissenschaft (Emergency Association in Aid of German Science), founded in 1920, and developing into the famous Deutsche Forschungsgemeinschaft (DFG) in 1930. Covering a broad range of disciplines from the natural sciences to the humanities, tradition guaranteed freedom of research when turning in an application, and quality control by expert committees of fellow scientists secured a standard of excellence. In this way, self-governance of research was built into the funding organization, and this has always been cited as its most important feature. However, I will argue that the Notgemeinschaft did not in fact solidify its position because of the scientific successes processed through its single-researcher system. Peer review could also intervene at an early stage in research, i.e., in research conceptualization. The Notgemeinschaft actually established itself by assembling large research ventures and brokering these big projects with peer review committee members. Examples include the famous "Meteor" expedition to map deep-sea currents in the Atlantic and large-scale population studies under the heading of "race science." The organization of teamwork in the Notgemeinschaft reflects the growing need for cooperation, larger instruments and coordination in scientific research during the 1920's, at a time when the Notgemeinschaft had to reconcile its new management solutions

with previous understandings of research policy. Although the DFG became famous first and foremost for its peer review system of single-researcher grants, it acquired a stable position within the German innovation system of the Weimar Republic because it managed to direct research at this larger scale.

### **Klein, Ursula**

*E-mail Address: klein@mpiwg-berlin.de*

#### **Experiments, Formulae, and the Order of Organic Matter**

European chemists' classification of organic substances changed dramatically after 1830. The new mode of classification focused on the composition and "binary constitution" of organic compounds, investigated by experiments, rather than on the observable properties and natural origins of organic matter. It represented an entirely new order of epistemic objects aligned with a new concept of the "organic." This paper studies the historical origins of this new chemical order and the collective resources of its construction. It pays particular attention to problems linked to chemists' earlier attempts to fit the experimentally created "artificial" derivatives of "natural" organic substances, i.e., materials extracted from plants and animals, into the existing taxonomic tree. Furthermore, it illuminates the relation between the new mode of classification and the new mode of representing the composition and constitution of chemical compounds by means of Berzelian formulae, introduced in 1813.

### **Krige, John**

*E-mail Address: John.Krige@hts.gatech.edu*

#### **Philanthropy and the National Security State: The Ford Foundation's Support for European Physics in the late 1950s**

"Philanthropy and diplomacy", Volker Berghahn has argued, "became close partners in the cold culture wars of the post-1945 era". A "symbiotic" relationship was established between the big Foundations and Washington such that the former effectively "allowed themselves to be used as private instruments of public policy". In this paper I want to explore this claim by describing the support for European physics by the Ford Foundation in the 1950s. This support had two major moments. The first was in 1955, and coincided with the Atoms-for-Peace conference in Geneva. The Eisenhower administration's plan to encourage international exchange in the nuclear field was used by officers in Ford to justify their support for CERN (which they mistakenly labeled the European Organization for Nuclear Energy) and for Niels Bohr's Institute in Copenhagen. The second wave of support occurred in the immediate post-Sputnik era. It was deliberately coordinated with an initiative taken inside NATO to strengthen western science in the face of a presumed Soviet threat. The officers of the Foundation were always emphatic that these funds were not intended to finance scientific research, and were coherent with Ford's mission to promote American style democracy in Europe. This paper will explore their political and ideological agenda, and show how their wish to strengthen science, especially physics, in Europe dovetailed with the needs of the national security state in the 1950s.

### **Kroker, Kenton**

*E-mail Address: kenton.kroker@utoronto.ca*

#### **"Dreams and Rapid Eye Movement as Experimental Objects in American Psychology"**

Since its professional and disciplinary consolidation at the beginning of the twentieth century, American psychology has devised numerous experimental models, all of which have some claim to being the foundation of a scientific psychology. Kurt Danziger (1990) and Martin Kusch (1999) have argued that psychological practices maintain their authoritative status by drawing upon and reconstructing existing social structures. In Ian Hacking's (1999) terminology, psychology is organized around interactive kinds. These discussions, however, do not address the mediating role of instruments in modern psychology.

The history of twentieth-century dream research provides a case in point. When Eugene Aserinsky and Nathaniel Kleitman first announced their discovery of rapid eye movement (REM) in 1953, they described it as an objective sign of dreaming. This discovery (and its acceptance) was historically contingent. It rested upon a series of developments in psychology and neurophysiology that had international origins, but peculiarly American applications. The former included the use of sleep deprivation as an experimental model by the French psychologist, Henri Piéron, around 1907, and the development of the human electroencephalogram (EEG) by the German psychiatrist, Hans Berger, in 1929. These two investigative strategies began to coalesce at the University of Chicago during the 1930s, when the problem of sleep emerged as an important biomedical problem at the same time that psychoanalytic psychiatry was reviving the dream. The convergence of these two fields through the shared practice of physiological inscription generated the phenomena that became known as rapid eye movement.

**Kroll, Gary**

*E-mail Address: gmkroll@ou.edu*

**Displacing Frontiers: The Pacific Science Board's Campaign for Conservation**

This paper examines the work of the Pacific Science Board, an arm of the National Research Council established to facilitate the work of American naturalists and anthropologists in the Pacific territories that fell under U.S. trusteeship after World War II. The PSB functioned as a scientific advisory board that provided the U.S. Navy with the information for sustaining both military colonization and the benevolent governance of indigenous cultures. I introduce the history of the PSB as a new "big natural history," a federally-funded effort to systematize and catalog Micronesia's natural and human resources. I will also focus on the initiative to conserve and preserve island landscapes, a primary concern of western naturalists at the end of the nineteenth century and start of the twentieth. PSB bureaucrats and field workers viewed the Micronesian landscape as an extension of the American frontier, and they transported those values forged in the American west to the Pacific. In the final analysis, the conservation campaign in Micronesia failed not only because the goal was incompatible with the military concerns of the U.S. government, but also because American naturalists viewed the region as a new U.S. territory. They displaced their conceptions of the American frontier west on to a distant Pacific region that resisted the tradition of American conservation strategies.

**Krupar, Jason**

*E-mail Address: kruparj@hotmail.com*

**From Inner-Space to Outer Space: T. Keith Glennan and the Science Managers of the Early Cold War**

During his professional career, T. Keith Glennan served as the President of the Case Institute of Technology, a Commissioner of the U.S. Atomic Energy Commission (AEC), and the first Administrator of the National Aeronautics and Space Agency (NASA). Any one of these accomplishments might have served as the capstones event in a distinguished career. Yet, Glennan undertook all three, sometimes simultaneously. Glennan's multiple roles as a science/innovation manager typified in many ways the growing influence in the immediate post-WWII years of the scientific/technical expert. The diversity of Glennan's positions indicated both a level of managerial flexibility and innovation. The purpose of this paper is to analyze the increased influence of science/innovation managers in the early Cold War, using Glennan's career as a case study. The success of wartime scientific and technical programs, such as the Manhattan Project of the development of radar, convinced politicians and the public to place their trust in the capabilities of science to resolve critical issues. In addition, this study intends to explore what constituted scientific expertise. Within science management differences developed between scientific specialists promoted to managerial positions and innovation managers who assumed leadership posts.

Like several of his contemporaries, Glennan participated in the creation of science/technological policies from multiple positions. He served in key roles in two of the critical, post-war agencies, the AEC and NASA. As a Commissioner and Administrator, Glennan encouraged the exploration of nuclear energy and proposed the development of a sustainable, economic satellite program. Finally, this paper studies the legacy Glennan and the early Cold War technology experts left the nation. Increased reliance upon expertise in matters of national defense and space exploration limited real public debate on these issues. Glennan considered these subjects and his thoughts provide insight into how science/innovation managers regarded their growing influences in the Cold War.

### **Kubrick and Arthur C. Clarke ,Stanley**

*E-mail Address:*

#### **2001: A Space Odyssey**

What are you doing, Dave? Watching Stanley Kubrick's classic film, of course. The movie will screen at 8:30pm, Thursday the 8th, in Grand Ballroom II at the Adam's Mark. After the plenary session and the reception, watch the film as it should be seen, on the big screen. Don't throw a wrench into your conference plans by missing it.

### **Kupferberg, Eric**

*E-mail Address: edkupfer@mit.edu*

#### **"Journey to the Invisible World": Popular Microscopy as Popular Culture, 1919-1939**

The paper investigates dozens of articles and books on popular microscopy during the interwar period to argue that this literature offered more than a simple guide to collecting and mounting slides for home use. The microscope and its increasing popularity comprised part of an effort to bring laboratory science into the home. As an example of amateur science, home microscopy served as an act of guided imagination. The articles provided models for the conduct of "good" science, weaving traditional 19th century portrayals of science as an individualized and applied activity with an advocacy of a new biology that was to become a highly technical and institutionalized enterprise. Moreover, the "journeys to the invisible world" offered a wealth of allegories for modern living in an urbanized world, issuing moral pronouncements on issues of race and colonization. One could "explore unknown waters" and "jungles on stale bread," in order to "hunt big game," or examine "invisible chemists" and "nature's factors" as one "created new worlds" with their microscope. Viewed within a tradition of travel writing, accounts of "big game hunters," and the emergence of the United States as a world power, the articles participated in a larger colonial discourse prevalent during the first half of this century. Popular science, in this regard, provided an opportunity for a culture to think out loud. Articles on home microscopy can therefore be read as attempt to make sense of the American experience with colonization, the continuing problem of racial difference, and the place of science in mediating social conflict.

### **Kutcher, Gerald**

*E-mail Address: gk2002@columbia.edu*

#### **Radiation Studies following World War II: Nuclear Warfare, Radiation Sickness and Curing Childhood Leukemia.**

The constellation of whole body radiation effects -- nausea vomiting, internal bleeding, infections and finally death -- was first framed as "radiation sickness" following the atomic bomb attacks on Hiroshima and Nagasaki. The syndrome took on renewed interest for military planners as the cold war set in. During the same period another and seemingly unrelated problem, the treatment of childhood leukemia with radiation took on new life following radiation biology experiments at Harwell, which showed that radiation sickness might be cured with bone marrow transplants. During this period radia-

tion researchers worked both sides of the military/cancer therapy boundary and pitched their studies to military and civilian agencies including the Department of Defense, the National Cancer Institute and the Atomic Energy Commission. Indeed, to speak of a boundary is not appropriate given the deeply entwined character of the research efforts and the funding sources. Nevertheless, the history of these events by the victors, medical researchers who announced a cure for leukemia in the late 1970s, has not only a strong boundary between the two research problems, but medical researchers have effectively written out all vestiges of the military paternity of leukemia therapy. This presentation will try to recover some of the contingent and embedded character of military and cancer therapy research.

### **Lachapelle, Sofie**

*E-mail Address: Sofie.Lachapelle.1@nd.edu*

#### **When Faith Was Not Enough: The Scientific Study of the Afterlife in France, 1880-1910**

Scientific spiritists of late nineteenth-century France found both the materialistic conception of death and the religious faith in the afterlife to be unsatisfying concepts. They hoped to build a new religion in which the methods of science could provide evidence for religious beliefs. In this paper, I will discuss some of their ideas on the scientific study of life after death. For Gabriel Delanne, Camille Flammarion, Gustave Geley, Louis Figuier, and others, death was not the end, but this conviction required scientific proof. They were not a unified or an organized group what needed to be proven and what constituted a scientific proof differed for each of them. But whether they believed in the existence of a soul independent of the human body or in reincarnation, faith was not enough one had to appeal to logic, observations, experiments, and sometimes morals and ethics to justify this assumption. Scientific spiritists borrowed metaphors from biology, evolutionary science, and astronomy to bring credibility and authority to their argument. By importing scientific concepts into the study of the afterlife, they refused to base their beliefs on faith alone and rejected the uncertainty given by science on life after death. The bridge they built between faith and reason illustrates a way in which the two need not be regarded as opposites. The story of their study of the afterlife highlights some of the complexities of the relationship between science and religion at the time.

### **Lagueux, Olivier**

*E-mail Address: lolivier@mac.com*

#### **The Mathematization of Monsters: Isidore Geoffroy Saint-Hilaire's Teratology**

If not for the encouragement of his father, Isidore Geoffroy Saint-Hilaire (1805-1861) would probably have become a mathematician. Educated at the École Polytechnique in Paris, where a mathematical spirit prevailed from abstruse theoretical discussions down to practical engineering applications, he ended up studying medicine and natural history. While Isidore's early taxonomical and anatomical papers were somewhat classical, his later morphological works show his natural inclination toward mathematics. In his 3-volume treatise on organic anomalies (1832-37), one finds not only geometrical diagrams, but also statistics and equations. As double-monsters were characterized by an axis of symmetry--the two fused individuals that compose them being placed on each side of that imaginary axis--Isidore superimposed x and y coordinates to depictions of these anomalous newborns. He went as far as developing algebraic series to account for the various forms of a given type of monstrosity. While caloric, motion, or gravitation inspired Étienne Geoffroy Saint-Hilaire (1772-1844), his son Isidore preferred the reassuring coldness of mathematics. As a predictive tool, the younger Geoffroy chose analytical geometry over outmoded chemical affinities, which indicates the impact mathematicians like Monge and Lagrange had on French science. While the two Geoffroys shared a strong interest for teratology, they applied to this new science divergent methods. "Among the works that are common to the father and the son," wrote the Academician Jean-Baptiste Dumas, "at least according to their topic,

nothing illustrates better this difference in working procedures than the whole research on monstrosities to which they devoted themselves".

**Lanzoni, Susan**

*E-mail Address: slanzoni@fas.harvard.edu*

**Forging a foundational psychology: Ludwig Binswanger's turn to phenomenology**

In German-speaking nations of the early twentieth century, the adoption of natural scientific methods in the new discipline of psychology met with resistance from a number of psychologists and psychiatrists. Many were particularly intent upon retaining the experiencing self or subject as the centerpiece of any scientific psychology. The Swiss psychiatrist Ludwig Binswanger endorsed this view in his little-known book of 1922, *Introduction to the Problems of General Psychology*. Binswanger's aim in this work, and in his psychiatric lectures of the period, was twofold: 1) to establish a firm scientific basis for the clinical encounter with the patient, and 2) to lay a theoretical foundation for a psychology of the person, which would not only focus on cognition, but also embrace the ethical and aesthetic dimensions of personhood. In this paper, I examine Binswanger's attempt to lay a theoretical groundwork for a subject-oriented psychology, in light of both his professional duties as the director of a psychiatric asylum, and in view of the larger cultural discourse on the role of meaning and value in the scientific realm. In attempting to rescue the beleaguered subject from the onslaught of what he saw as a natural scientific fragmentation, Binswanger steered a course between biological constitutionalists (Kretschmer) on the one hand, and characterologists (Jaspers, Spranger) on the other. In doing so, he turned to the phenomenological approaches of Max Scheler and Edmund Husserl, which held that one could directly intuit (*Anschauung*) the essences of the psychological realities of the other. Understood as both theory and research method, phenomenology occupied an ambiguous role in this endeavor, but nonetheless gave Binswanger a means to focus on experiential meanings in what he viewed as an increasingly 'disenchanted' scientific world.

**Lassman, Tom**

*E-mail Address: toml@chemheritage.org*

**What I Learned and Wished I had Learned in my Graduate Program in the History of Science**

What does a historian trained at a major research university find when he/she accepts a position in public history? Graduate programs typically train students for university careers. Little emphasis is placed on alternative careers outside the academy. Pedagogy and public history, for example, receive scant attention in graduate curricula. This paper will address from the perspective of a recent Ph.D. the strengths and weaknesses perceived in the graduate training of historians. Specific examples of on-the-job training that proved necessary will be offered and evaluated for those skills that might have been included in a graduate program.

**Lassman, Tom**

*E-mail Address:*

**What I learned and what I Wish I had Learned in my Graduate Program in the History of Science**

**Laubichler, Manfred**

*E-mail Address: manfredl@princeton.edu*

**Fin-de-Siècle Origins of Theoretical Biology**

The early decades of the 20th century saw the rise of a discourse of theoretical biology among experimental biologists from a variety of disciplines, physicians, and some philosophers and historians. Theo-

retical biology was initially most prominent in the context of German culture (Germany and Austria), but it also attracted Dutch, British and Russian scientists. Many of the topics, such as the problem of the autonomy of biology, the question of vitalism, teleology and mechanism, or the phenomena of organic regulation and stability that characterized this discourse resonated with the larger intellectual public concerned with questions raised by the experience of modernity. Furthermore, biology was not the only discipline in which theoretical or foundational questions became prominent during the first decades of the 20th century. In its expression as "Allgemeine Biologie" (General Biology) theoretical biology was part of a larger trend that included "general" works as both introductory texts as well as foundational treatises in many disciplines. The existence of such works in related disciplines points to cultural roots as well as internal factors in the emergence of the discourse of theoretical biology. This paper will analyze theoretical biology as both a response to Fin-de-Siecle culture as well as a major resource for ideas that had considerable impact in a variety of other disciplines ranging from political science to history, psychology, anthropology and art history. By demonstrating how the discourse of theoretical biology was integrated with related developments in other areas I will highlight some of the specificities of the move towards theoretical and foundations disciplines that characterized Fin-de-Siecle culture in the German speaking countries.

### **LeBlanc, André**

*E-mail Address: andre.leblanc@internet.uqam.ca*

#### **From Pascal to Hacking: Discourses Concerning the Machine**

In his famous wager, Pascal maintained that one comes to believe in God by first pretending to believe. He observed that when the body, or the machine, performs symbolic acts of faith, it pulls the mind along with it so that the person automatically internalizes the represented belief. He argued that it was through this same mechanism that all our beliefs are created: it is custom which conditions us to believe, for instance, in the divinity of the king, in the righteousness of our country or in our personal identity. This paper will demonstrate hitherto unnoticed parallels between Pascal's ideas and those defended by the philosopher Ian Hacking. Hacking and other thinkers influenced by Michel Foucault have demonstrated how culture shapes and gives rise to perceived psychiatric illnesses like dissociative identity disorder (formerly multiple personality disorder) and pathological fugue. Pascal's "Discourse concerning the machine", the title of the wager, adds a psychological dimension to these demonstrations. After describing the ways in which Pascal's ideas complement and support Hacking's historically oriented approach to the constitution of "human kinds", the paper will briefly discuss some of the challenges Pascal poses for this type of historiography.

### **Lecuyer, Christophe**

*E-mail Address: clecuyer@dibinst.mit.edu*

#### **Organizational Innovations in Electronic Component Manufacturing in the Silicon Valley**

Electronic component firms in the Silicon Valley pioneered new forms of organization from the early 1940s to the mid-1960s. Technical entrepreneurs in the power tube, microwave tube, and semiconductor industries built flat organizations with few hierarchical layers. They granted substantial autonomy to their engineering staff and organized research and development around independent teams. They also gave unusual financial incentives to their employees through profit sharing, stock ownership, and stock option programs. I argue that these innovations were shaped by the entrepreneurs, professional and political ideologies. They were also fashioned by the imperative of competing with Eastern industrial giants through speed, flexibility, innovation, and the manufacture of high quality products. Finally, the entrepreneurs' interest in experimenting with new management methods was reinforced by the threat of union organizing. Seeing unionization as a death threat to their firms, flexible production practices, local

entrepreneurs fought the unions by introducing new management techniques and employee incentive programs. I claim that these organizational innovations gave corporations in the Silicon Valley a substantial competitive advantage over their more traditional Eastern counterparts. These innovations were adopted by computer and disk drive firms in Silicon Valley in the 1970s and a wide range of industrial sectors in the 1980s and early 1990s.

**Lefevre, Wolfgang**

*E-mail Address: wlef@mpiwg-berlin.mpg.de*

**Ordering and Labelling - Guyton de Morveaus' and Lavoisier's' Reform of the Chemical Nomenclature**

The Méthode de nomenclature chimique composed by Guyton de Morveau, Lavoisier, Bertholet, Fourcroy, and others, published 1787 in Paris, contains a classificatory table of chemical substances. The Méthode is well known as a chief means of promoting Lavoisier's anti-phlogistic chemical theory. However, the specific relations between nomenclature, classification, and the new chemical theory are far from obvious. The paper will argue that the impact of Lavoisier's peculiar theory on both the nomenclature and the classification of the Méthode was less consequential for subsequent classificatory and nomenclatorial efforts in chemistry than those features that were neutral with respect to the phlogiston/oxygen controversy. In particular, the paper will critically investigate the assumption that these latter features were due to certain general linguistic rules of systematic nomenclatures rather than the deeply rooted conceptual frameworks of eighteenth-century chemistry.

**Levens, Joshua**

*E-mail Address: JPL12@jhunix.hcf.jhu.edu*

**Sexual Arousal and the Central Nervous System: the Contributions of W. Horsley Gantt and Frank A. Beach**

The study of sexual arousal and mating behavior was a pivotal area of research for the development of behavioral endocrinology as a comparative science. In this emerging field, ideas about male-female differences in humans were informed by studies of these differences in animal species. One such research problem was susceptibility to conditioning in males and females. In explaining the differential rates of marginal sexual practices (e.g., voyeurism, masochism, transvestism, and transsexualism) between men and women, researchers of human sexual behavior in the 1940s and 1950s, such as Alfred C. Kinsey, claimed that men were more easily conditioned than women. This conclusion about human sexual behavior was based on a body of evidence that included canine sex research performed by W. Horsley Gantt, the first American student of Pavlov and director of the Pavlovian Laboratory at the Johns Hopkins Medical School (1929-1964), and Frank A. Beach, a student of Karl Lashley, whose text *Hormones and Behavior* (1948) helped to define the field of behavioral endocrinology. Building from Gantt's observations that the sexual behaviors of male dogs were more easily conditioned than those of females, Beach claimed that this revealed an underlying difference in the neural mediation of these behaviors. He identified hormones as more important for lower vertebrates and females, and cortical mechanisms as more important for higher vertebrates and males. The different experimental settings they employed--Gantt's laboratory and Beach "field" experiments--shaped their views of sexual differences in the canine brain.

**Levitt, Theresa**

*E-mail Address: levitt@fas.harvard.edu*

**No More Magic Moonbeams: Astronomy as Public Science in Nineteenth Century France**

France seemed under the shadow of some dark star in 1832. Newspapers reported the unnerving

appearances of comets, eclipses, earthquakes, unexplained fires, strange miasmas, and crop failures alongside an increasingly agitated urban population. A cholera epidemic capped off the list of natural traumas and, through the death of General Lamarque, set off a wave of violent rioting in Paris. In the months that followed, the director of the Paris Observatory, François Arago, launched a massive campaign to debunk old wives tales claiming that celestial phenomena could influence events on Earth. He made no secret of linking the rioters' disappointing behavior with the ignorant superstitions still pervasive among certain segments of the population. This paper examines his two principal venues, free lectures at the Observatory and a general audience almanac from the Bureau des Longitudes, as sites where Arago sought to construct the properly reasoning public required by the fledgling constitutional monarchy he helped construct in 1830. It intersects with themes on the popular representation of science, efforts at public education, and the role of science in politics and civil society.

**Lewis, Jeffrey**

*E-mail Address: lewis.317@osu.edu*

**Biochemistry with a License: Tobacco Mosaic Virus and the Start of Molecular Biology Research in the Federal Republic of Germany, 1937-1965**

Beginning in 1937, an interdisciplinary group of researchers was assembled in Berlin with the goal of using viruses, particularly tobacco mosaic virus (TMV), as tools for solving basic problems such as biological heredity. During the war the group was evacuated to the city of Tübingen, where they established a research program that made significant contributions to molecular biology research. In the fifties they discovered that TMV RNA transmits genetic information, not the protein that the TMV RNA molecule is single-stranded and that specific, predictable mutations could be induced in TMV RNA using nitrous acid as a mutagenic agent. All of this work contributed to the solving of the genetic code in the early sixties. The importance of the German research was widely recognized at the time but it has not been included as part of the history of molecular biology. This omission stems from the emphasis in the historiography on DNA research, bacteriophages as experimental objects, and the importance of new techniques from physics for approaching biological problems. Contrary to these trends, the Tübingen researchers used RNA viruses and basic strategies from biology and especially biochemistry to make their contributions. Their work stands as a counterexample to Erwin Chargaff's oft-cited definition of molecular biology as the practice of biochemistry without a license. Therefore, attention to the German research tradition in molecular biology produces a richer, more nuanced historical understanding of this crucial field of modern science.

**Lightman, Bernard**

*E-mail Address: lightman@yorku.ca*

**Scientists as Anti-Heroes: Materialism and Tyndall's Belfast Address**

Before the Belfast Address, the physicist John Tyndall was usually cast in a positive light in the periodical press, albeit with some reservations, and he was not labeled as a materialist. But after the Belfast Address he was portrayed as an aggressive, dishonest, devious, and distinctly unBritish materialist. Even in the 1870's, the charge of materialism was a serious one. It grouped Tyndall together with lower class atheists, casting aspersions on his status as a member of the intellectual elite. Moreover Tyndall became a symbol of everything that was wrong with modern science and scientists in general. By depicting the scientist as the most powerful embodiment of modern materialism, defenders of the Christian establishment could use the periodical press to discredit the philosophical basis of scientific naturalism, re-evaluate the cultural authority of Tyndall and his allies, and assign a more limited role to scientists in modern culture. The controversy over the Belfast Address provided members of the Anglican intellectual elite the opportunity to cleanse science of its materialism and reclaim it for Christianity.

This involved a sweeping indictment of modern scientific culture and of the cultural organs which had facilitated the spread of scientific materialism.

**Lindsay, Debra**

*E-mail Address: dlindsay@unbsj.ca*

**Paleontology: "Canadian" Fossils / American science**

Paleontology is one of the most popular sciences among hobbyists-- fossils are frequently the focus of how-to books, discovery books, and field-guides. This popularity is long-standing and my paper takes a case study approach to show how the relationship between scientist and collector contributed to the growth of paleontology in the United States. More specifically, I focus on the transnational context of science by examining the collaboration between Canadians and C.D. Walcott, Director of the U.S.G.S. (1894-1907) and Secretary of the Smithsonian Institution (1907-27). Walcott cultivated friendships with G.F. Matthew (Saint John, NB), J.W. Dawson, A.R.C. Selwyn, Robert Bell, Joseph Whiteaves, Henri Ami, Elkanah Billins and others. Collaborators were essential to Walcott's career; their contributions were significant in building his reputation as an invertebrate paleontologist and in the emergence of the Smithsonian as a center of paleontological research. Similarly, attempts to advance "Canadian" science required peers and publishers beyond national boundaries. Local, national and international recognition were imperative and, over time, Canadians increasingly collaborated with the U.S. scientific community rather than with the U.K. Paleontological investigations were a part of this realignment. The fact that so much of Walcott's research took place in Canadian fossil fields and in association with Canadians, provides an example of how transnationalism shaped one North American science. My study focuses on the reciprocal benefits of a dynamic which masked appropriation and nationalism with claims of disinterestedness and universalism.

**Lozovsky, Natalia**

*E-mail Address: lozovsky@ucsu.colorado.edu*

**Geography in Early Medieval Europe: Decline or Development?**

Early medieval Latin geographical writings puzzle the modern mind. Medieval scholars and teachers, ignoring contemporary realities, persistently reproduced the image of the world, essentially inherited from Antiquity and updated information drawn from the Bible. Does this mean that geography in the early Middle Ages was suffering permanent decline, as many historians claim? Or did people in the Middle Ages pursue an entirely different form of knowledge, obeying rules and norms foreign to modern geography? If the latter is true, then how should we approach the study of these rules and norms? My paper will focus on several contexts which help us understand the purpose and character of early medieval geographical studies: biblical commentaries, school practice, and philosophical ideas. The picture of theoretical geographical knowledge which emerges out of the study of these contexts presents a type of knowledge which possessed specifically medieval characteristics: it provided material for contemplation and education rather than serving the practical needs of everyday life. Far from being in decline, this branch of knowledge, just like other medieval sciences, demonstrated its own rhythms of development. Thus the study of the main characteristics and evolution of medieval geography allows us to understand this specific phenomenon and at the same time brings us closer to interpreting pre-modern sciences in general.

**Lustig, Abigail**

*E-mail Address: lustig@mpiwg-berlin.mpg.de*

**Erich Wasmann's Catholic Evolutionism**

In this talk, I will discuss how the German Jesuit evolutionist entomologist Erich Wasmann's (1859-

1931) faith and his Jesuit philosophical training intersected to reconcile evolution and Catholicism by delineating the philosophical limits of science: Wasmann demarcated a material and historical world, which science can describe, and the realm of subjective experience and the soul, which it cannot. Wasmann's evolution contrasted (and conflicted) strongly with contemporary German atheistic and anticlerical monistic evolutionary biology, and I will discuss Wasmann's very public debates with monism's prophet, Ernst Haeckel. Finally, I will briefly contrast Wasmann's Catholic evolutionism with Teilhard de Chardin's, and conclude with some remarks on the diverse influences of religious faith in evolutionary biology.

### **Lynch, William**

*E-mail Address: ae8917@wayne.edu*

#### **Seeing, Doing, and Uncovering: Interpreting Bacon's Method in the Early Royal Society of London**

Rejecting the view that methodology acts more as window dressing than a program that can help direct research practice, I argue that Francis Bacon's program for methodological reform shaped the Royal Society's earliest work in important, if often contradictory, ways. The Royal Society developed Bacon's programs in different directions, building upon a richer understanding of Bacon's methodological program than the undirected empiricism often associated with his name. Bacon's call for a focus on "things themselves" built upon three distinct images of objects of knowledge. Identifying a threefold metaphorical ontology of objects of knowledge and corresponding objectivities at the core of Bacon's method, I argue that the Royal Society was more sophisticated and unified in their methodological approach than is commonly accepted. At the same time, development of their interpretations of Bacon's legacy ultimately pulled in different directions. Specular objects of knowledge privileged passive observation and justified an empiricist objectivity. Pulling in a different direction, manipulated objects of art or manual objects emphasized an engaged, constructivist objectivity, where knowing is doing. Finally, a vision of underlying forms as generative objects of knowledge, combinable like letters of the alphabet to produce phenomena at will, defined a theoretical concept of objectivity. These components of Bacon's method inform in different ways the early publications of the Royal Society by John Evelyn, Robert Hooke, John Wilkins, Thomas Sprat, and John Graunt. The Royal Society developed an ambitious inductive program employing hypotheses, active powers, and the disciplined use of analogy.

### **Maas, Harro**

*E-mail Address: harro@fee.uva.nl*

#### **Mimetic Experiments: Stanley Jevons's Construction of Evidence for Theories**

William Stanley Jevons (1835-1882) is commonly considered one of the great 19th century innovators in economics. Until to date, however, his empirical work in economics is considered quite apart from his theoretical innovations. My argument in this paper is that Jevons's empirical and theoretical work are much more interwoven than such an account suggests. Jevons's experimental practices in meteorology (on cloud formation) are illuminating here. As many experimental scientists, Jevons was fully aware that empirical data do not speak for themselves: the experimental scientist is not a passive observer, perceiving reality and only then arriving at an explanation. Rather, he uses experimental practices to reveal the phenomena from the data, the actual observations are loaded with error. One might think of these phenomena in terms of essential characteristics or mean values. Phenomena could then be further analysed to reveal the natural laws they obeyed. For Jevons, these laws were stable functional relationships. The step from phenomena to laws depended critically upon the role of analogy, given the many possible mathematical relations consistent with the phenomena. In a nutshell, this procedure can be seen in Jevons' experiments on cloud formation, in his *Principles of Science*, and also in his statistical studies in

economics. Jevons' experiments on clouds will serve as a kind of format from which it is evident that his general approach to science did not involve a split between pure theory and statistics, but was rather motivated by a unified framework in which analogical reasoning played a dominant role.

**Madison, Mark**

*E-mail Address: mark\_madison@fws.gov*

**From Essential to Endangered: The Species Question in Conservation Biology**

The case of red wolf reintroduction questions the popular and scientific understanding of the term "species" in the Endangered Species Act (ESA). The red wolf (*Canis rufus*) once ranged widely over the southeastern United States yet by the 1970s it was considered America's most endangered mammalian species. In the wake of the 1973 Endangered Species Act the Red Wolf Recovery Program was implemented. However, successful reintroduction was thwarted by new more rigorous definitions of species. Interbreeding with coyotes led to difficulties in identifying "pure" red wolves and DNA analysis began to call into question the legitimacy of the entire species. Failing to meet the guidelines for a biological or a phylogenetic species, the red wolf found itself outside clear protection of the Act. Biological essentialism (or speciesism) seems to have rendered the ESA impossible to enforce. Ironically the stresses that may have led the red wolf to adapt a hybrid survival strategy are the same environmental stresses that created the ESA in the first place.

**Maerker, Anna**

*E-mail Address: akm23@cornell.edu*

**Experiments on Nature and Society: The tension between universality and locality in Benjamin Thompson's late eighteenth-century reform projects**

In the last decades of the eighteenth century, the absolutist ruler of Bavaria, Elector Karl Theodor, employed the American-born military expert and natural philosopher Benjamin Thompson (Count Rumford) to design and carry out a number of military and social reforms. During his time as Karl Theodor's aide-de-camp, Thompson continued to conduct experiments on topics including nutrition and the propagation of heat, part of an overall program of rationalizing social order by basing it on universal laws of (human and physical) nature. Thompson envisioned his rationalizations as universally applicable: he attempted to transfer them to different national contexts by means of standardized practices and procedures, tables, instructions, and institutions. I situate this study of Thompson's Bavarian reforms within a recent development in the historiography of the sciences of the Enlightenment which critically reassesses both the attempts by which eighteenth-century scientists worked to achieve universality, and the tendency in scholarship to take the unity of "Enlightened science" as a given. By looking at scientific practice, and especially at the production of inscriptions and representations, Science Technology Studies analyzes how scientists construct universality. My aim is to take those analytical tools developed in Sto investigate the means Thompson employed to base his reform projects on universal laws and to support his universalizing goal. In particular, I ask how his project, in confrontation with political practice, was reshaped in the tension between the universal and the local.

**Marcum, James**

*E-mail Address: marcum@westmont.edu*

**Reconstructing Opposition in Science: The DNA Provirus Hypothesis, the Central Dogma of Molecular Biology, and the Origins of Retrovirology**

Reconstructing opposition to novel ideas in science is often problematic, especially when the sources for the reconstruction are accounts written by scientists involved in the conflict. Reconstructing opposition to the DNA provirus hypothesis exemplifies several of these problems. In 1964 the Wisconsin

virologist Howard Temin proposed a hypothesis to explain infection in fowls, by a cancer-producing virus that contained only RNA. His hypothesis reversed the normal flow of genetic information from DNA to RNA, as ordained by the central dogma of molecular biology. Although there was opposition to his hypothesis it was widely accepted by the scientific community, after the discovery of reverse transcriptase in 1970. Most retrospective accounts of Temin after the discovery have portrayed him as a renegade who was on the fringe of mainstream virology, because his hypothesis challenged the central dogma, but who was vindicated for his perseverance. Temin himself in his Nobel Prize speech of 1975 narrated a similar story about the opposition to his hypothesis. Is this opposition, however, that Temin and others depict in their retrospective accounts accurate? I argue that members of the oncogenic virology community opposed Temin's hypothesis not simply because it was viewed as a counter instance to the central dogma, but more importantly because his empirical evidence for substantiating it was considered inconclusive. What objective has the retrospective accounts of the opposition to the DNA hypothesis, by Temin and others, served? I propose that these accounts played a significant role in establishing retrovirology as a subdiscipline within the oncogenic virology community.

### **Martin, Olivier**

*E-mail Address: olivier.martin@paris5.sorbonne.fr*

#### **The History of Factor Analysis : an Example of Mathematization in Human Sciences**

The topic is to identify the main ideas and concepts associated to factor analysis methods : a historical perspective is proposed. The original ideas of factor analysis can be found in Spearman's psychological research. During the first decades of the XXth century, he tried to identify factors of mind that is to say factors participating to mental activities. The statistical tools used by Spearman progressively dissociate themselves from the psychological theories. The factor theory of Spearman become an abstract and universal method which can find applications in psychology and every other discipline. Psychologists and mathematicians, especially Thomson, Thurstone and Hotelling, participate to the development of this autonomous method called factor analysis method. Beyond our historical analysis of the 1900-1940 period, we propose a reflection on the role of mathematical formalism in human science through the example of factorial analysis method.

### **Martini, Laura**

*E-mail Address: lm4x@virginia.edu*

#### **A Case-Study in The Evolution of a Mathematical Research Community in Pre-Unification Italy: Barnaba Tortolini (1808-1874) and the Annali di scienze matematiche e fisiche**

The decades following the Congress of Vienna (1814-1815) witnessed a growing climate of scientific unification within the Italian states. The congresses of Italian scientists, held annually from 1839 to 1847, represented a first step toward the creation of a national scientific community. The failure of the wars of independence of 1848-1849 did not extinguish the patriotic feelings for a political and a scientific unification. In 1850, Barnaba Tortolini (1808-1874), professor of higher calculus at the University of Rome, founded the Annali di scienze matematiche e fisiche (1850-1857). With this journal, Tortolini hoped to serve the publication needs of the mathematical and physical sciences and to raise the profile of Italian science at home and abroad. In this talk, I will discuss the role the journal played in the process of the creation of a national mathematical culture and in the evolution of an Italian mathematical community within the changing mathematical and political context of pre-unification Italy.

### **Mazzotti, Massimo**

*E-mail Address: mmazzotti@dibinst.mit.edu*

#### **The natural philosophy of vampires**

At the dawn of the Enlightenment, news about phenomena of vampirism arriving from the southeastern borders of the Austrian empire caused unprecedented concerns in the European intelligentsia. In particular, in towns like Vienna, Leipzig, Rome, and Naples a number of physicians, ecclesiastics, and university professors of philosophy debated the revolutionary possibility that a corpse could be animated by something other than a spiritual soul. At a time when questions of witchcraft had lost their status as respectable scientific issues, vampirism was actually deemed worthy of serious consideration. I shall explore some of the most interesting philosophical and scientific aspects of this debate, and I'll argue that the vampire became a distinctive myth in modern European culture because it could be used as a conceptual space for the discussion of subversive philosophical doctrines.

**McKenzie, Matthew**

*E-mail Address: mgmk@nh.ultranet.com*

**Redefining Science in Local Terms: Navigational Science and Centers of Calculation in New England, 1760 to 1800**

Recent studies by David Phillip Miller and John Gascoigne have painted a picture of late 18th century British Imperial science as isolated spokes of information, power and patronage emanating from a central London hub. Historians of American science, such as John C. Greene, have argued that American scientific correspondents with London acted merely as data collectors for London and hoped to gain recognition from members of the Royal Society. Archival resources from the Massachusetts Historical Society and the Peabody Essex Museum challenge this image of how science was organized and defined in late 18th century America. Looking beyond theoretical science practiced by learned societies, new centers of calculation emerged in North America to challenge London authority. In particular, marine societies formed in the middle of the 18th century in Boston, Salem, and Newburyport that embraced leadership roles in navigational science. By collecting, analyzing and evaluating members' logbooks and observations, they challenged British exclusiveness in navigational research, and came to manage harbor pilots, review nautical charts, publish nautical observations and evaluate navigational publications. Rather than dependent upon an imperial hub, local centers of calculation emerged to address immediate navigational concerns. Marine societies can also be seen as learned societies that shared what Roger Hahn has argued were "the trade-marks of all groups seriously concerned with the promotion of science." Marine societies differed from traditional learned societies, however, in that they evaluated membership, scientific research, and publications upon vocational experience and practice, rather than theory. Consequently, marine societies represent a brief moment when practice and theory coexisted as equally valid sources of scientific validation.

**Meredith, Margaret**

*E-mail Address: meredith@helix.ucsd.edu*

**The Power and Problem of Authority: Early American History in a Trans-Atlantic Context**

Historians of early American natural history have experienced difficulties in accounting for the impact of European scientific ideas in North America. It is widely perceived that until the mid-nineteenth century, there was little or no American scientific enterprise to speak of and that Americans were dependent upon Europe for most of their scientific knowledge. European ideas are said to influence American practitioners of science until they became professional and respectable sometime between the 1830s and 1850s. The mechanics of this relationship of dependency are portrayed as a process of diffusion, in which the dissemination of natural knowledge is likened to the spread of a contagious disease. Natural knowledge diffuses out among the populace and, whether it is taken up is usually portrayed as a matter of how educated, intelligent, or professionally trained a person is. This paper is concerned with how Americans judged European scientific claims. I argue that the authority of European scientific

claims was hard won. I want to use this paper to explore the particular problems posed by the transatlantic context of early American natural history in which European-authored texts were the main source of knowledge about American natural productions. I will draw upon two episodes in an important international and European-dominated controversy in natural history over the reality of extinction in the late eighteenth and early nineteenth centuries. The two episodes, which involve the statesman Thomas Jefferson and the naturalist Benjamin Smith Barton, respectively, illustrate different dimensions the problem of authority posed in a transatlantic context.

### **Mueller-Wille, Staffan**

*E-mail Address: smuewi@gmx.net*

#### **'Sandstone can as well hold gold' - Classifying Non-Living Nature, 1730-1770**

In 1758, A. F. Cronstedt proposed a classification of minerals that deviated considerably from previous classifications, notably that in Linnaeus' *Systema naturae*. The paper will analyse the two classifications and the arguments raised in their favour. It will show that these classifications, though incommensurable, could coexist as their differences were the result of different, yet equally valid approaches: Linnaeus' classification took individual rocks as its object, and rested on collection and comparison as a differentiating operation, while Cronstedt's classification took the "pure" mineral components of rocks as its object and rested on blowpipe analysis as its differentiating operation. Thus, while Linnaeus remained within the well-established, disciplinary confines of natural history, Cronstedt transcended these on the basis of a new technology. The historical impulse for this departure will be located in a heated debate between Swedish and German metallurgists concerning the reality of "new" metals like nickel, whose discovery was announced by Cronstedt in 1751.

### **Murray, Margaret**

*E-mail Address: murray@math.vt.edu*

#### **Women Mathematicians in America: The Doctoral Classes of 1940-1959**

In this paper, I discuss the approximately 200 women who earned Ph.D.s in mathematics from American colleges and universities during the years 1940-1959. During this period, American mathematics experienced an unprecedented growth in power, prestige, and Federal support; at the same time, the presence of women in mathematics at the doctoral level plunged to an all-time low. I examine some of the factors which brought about the reduced visibility of women in American mathematics during this period. I also describe the general characteristics of this generation of American women in mathematics, including: socioeconomic backgrounds; undergraduate origins; doctoral institutions; employment patterns; scholarly productivity; and experiences of discrimination. I discuss the impact of Title IX upon these women at mid-career and after. This research is based in part upon oral history interviews conducted with 36 of the 200 women who earned doctorates in mathematics during this period, as discussed in my recent book, *Women Becoming Mathematicians: Creating a Professional Identity in Post-World War II America* (MIT Press, 2000).

### **Nappi, Carla**

*E-mail Address: cmakler@princeton.edu*

#### **The Name of the Rose: Naming and the classification of nature in the Bencao gangmu**

Language plays an integral part in determining and shaping the categories that we use to understand the natural world. The naming of natural objects allows one to categorize and objectify nature, subsuming the natural world into an ordered system that is (claimed to be) easier to understand, to control, and to use. This paper will explore the connection between naming and taxonomy in natural history by examining Li Shizhen's *Bencao gangmu*, a sixteenth-century Chinese compendium of materia medica

that shaped the landscape of Chinese natural history, influenced European natural history and embodied a particular means of classifying plants, animals and other natural objects and products. How did this singular text incorporate many diverse epistemological tools into a single system of ordering nature? This paper will investigate the use of literary allusions, mythical accounts, lexicographical data and empirical observation in creating a textual landscape for the Bencao gangmu, and will explore the influence naming in this varied literary topology on the natural classification scheme that resulted.

**Neal, Katherine**

*E-mail Address: kneal@scifac.usyd.edu.au*

**Putting Astrology and its Patrons in their Place: Professor Henry Briggs, Sir Christopher Heydon and King James on Astrology**

In the early 1600s the Gresham Professor of Geometry Henry Briggs and the astrologer Sir Christopher Heydon corresponded about astrology and astronomy. These letters are particularly interesting in that in a period where astrology was generally considered a viable scholarly pursuit, Briggs was firmly opposed to it. The astrologer William Lilly called Briggs "the most satirical man against it [astrology] that hath been known." This paper argues that Briggs's stance should be seen as an early effort towards pushing astrology away from any association with astronomy and mathematics. Briggs drew sharp boundaries between these subjects, and he would only collaborate with Heydon on purely astronomical and mathematical work. This refusal is made more telling by the differences in their respective ranks. Briggs's arguments against astronomy will be analyzed in the context of King James's disapproval of the subject together with the increasing number of tracts, including Heydon's, discussing astronomy's validity. The episode will be viewed as an instance of early 17th century negotiations over the proper boundaries and articulations among the mixed mathematical and practical mathematical fields, and tensions regarding the roles of mathematicians as practitioners, protégés and men of gentlemanly, natural philosophical learning.

**Nelligan, James**

*E-mail Address: jnelliga@uiuc.edu*

**Reimagining Anthrax: Science, Perception, and the Construction of Biological Threat**

When Major Leon Fox of the Army Medical Corps published his authoritative treatise on biological weapons (BW) in 1933, scientific knowledge about disease and disease transmission was in many ways still very primitive. The production of biological weapons demanded the strict command of every aspect of a pathogen's life cycle. For Fox and most scientists of the interwar period interested in organic weapons systems, the science and engineering necessary to fuse biology to technology in order to produce useful and effective biological ordinance was seemingly too complex and too costly for a BW program to be practical or possible. Intelligence reports in 1941-42 concerning the efforts of foreign BW research forced the American government, and subsequently American scientists, to reconsider biological weapons. By 1943, Camp Detrick, the future hub of the America's bioweapons program, was conducting weapons research near Frederick, Maryland. By 1945, the construction of a full-scale BW weapons facility was well underway. This paper investigates the fundamental shift in perception that occurred in the early war years, the critical period when biological weapons ceased to be viewed as science fiction and American scientists began aggressively pursuing the production of field-grade BW ordinance. Similarly, it explores the role that the perception of external threats played in shaping the science of biological warfare.

**Norris, Katharine**

*E-mail Address: khnorris@hss.caltech.edu*

## **Dangerous Minds? The Science of Children's Lies in Fin-de-Siecle France**

In October 1882, a curious debate broke out at the Société Médico-Psychologique, France's premier psychiatric association. Introducing the case of the notorious "child K," a five-year-old boy whose attempts to murder his one-year-old brother had made national headlines, society president Eugène Dally warned his audience not to let the apparent gravity of the boy's condition blind them to a more fundamental scientific truth: all children, he declared, were "essentially liars, eager to deceive" childhood was "the age of lying." Effectively challenging widely accepted and supposedly enlightened visions of childhood as a period of innocence and sincerity, Dally's indictment initiated a lengthy, wide-ranging, and virtually unexplored debate which offers privileged insight into the cultural and scientific landscape of the late nineteenth and early twentieth centuries. As practitioners of the emerging human sciences, from criminology to child psychiatry, experimental psychology to sociology, submitted children's mendacity to rigorous analysis, they raised fundamental questions, not only about the nature of scientific evidence and expertise, but also about the power of that expertise to ensure the future of a modern, republican polity. By focusing on the efforts of a wide variety of specialists to understand a particularly vexing scientific problem, this paper directly confronts the intertwined origins of the modern human sciences and their relationship to some of the most pressing political and social issues of their era.

### **November, Joseph**

*E-mail Address: november@princeton.edu*

## **The Organism as Tape: Information Theory, Cybernetics, and the One-Dimensional Model of the Gene**

In *Who Wrote the Book of Life*, Lily Kay touched on a remarkable transformation: "[t]he organism would be compressed into a sequence, its functions collapsed into a message inscribed in a one-dimensional DNA tape." I will follow the organism, specifically the gene, as it was reduced to the one-dimensional structure it has become today, and I will examine how biologists used information theory and cybernetics to make sense of their new tape model as they applied it to their own three-dimensional world. I hope that by viewing biologists' use of information theory and cybernetics in the broader context of a shift to a one-dimensional model of the gene, we will obtain a better understanding of the nature of the information and regulation metaphors that currently permeate molecular biology. Specifically, I will discuss: 1.) the emergence of the one-dimensional model of the gene and Henry Quastler's use of information theory in the early 1950s to try to make sense of the new model 2.) the use of information theory and cybernetics by biological theorists, namely Howard H. Pattee in 1963 and C.H. Waddington in 1967-1972, who tried to apply the one-dimensional model of the gene to the three-dimensional world 3.) the rise of anti-reductionism - or neo-vitalism - when information theory and cybernetics failed to provide biologists with a feasible means of bridging the gap between their one-dimensional model of the gene and the complexity of three-dimensional life.

### **Ochs, Kathleen**

*E-mail Address: kochs@mines.edu*

## **The Hula and the War Bonnet: Science or Knowledge about Nature in Traditional Oral Societies**

This paper looks at how traditional, oral societies learn, store, and transmit knowledge about nature. I became interested during an NEH seminar in Hawaii. At a traditional hula ceremony, the first dance taught how to plant and irrigate taro, with the men showing the motions while the chanter elaborated the details. I was struck, among other things, by the fun these people had transmitting technological information compared to the suffering of modern students. Another time, a traditional religious practitioner explained a geological formation consisting of three low hills it existed because the gods had compas-

sion for three humans beings and turned them into these hills so they could be forever together. During the lectures, an anthropologist showed that the construction of a South American war bonnet required astronomical, biological, geological, and several other types of modern scientific knowledge. The "science textbook" was the making of the war bonnet. This talk describes some contributions of modern anthropologists that describe oral intellectual systems and specific bodies of scientific knowledge in oral societies. Thanks to work of modern scholars, historians of science can begin to construct much better accounts of oral scientific intellectual systems than the previous ones which tended to consider the predecessors to modern science childish at best. Finally, I compare and contrast science of oral societies and literate modern science, arguing that historians can learn much about both systems through such comparisons.

**Opitz, Donald**

*E-mail Address: opit0002@tc.umn.edu*

**'Behind folding shutters of Whittingehame House': country-house science and domesticity after the professional turn**

A strong theme in the history of Victorian science is the primacy of laboratory-based research in academic and government institutions by the latter half of the nineteenth century, especially among a rising professional class. This narrative emphasises the displacement of women and amateurs from the centre of science where new, professional men of science claim a dominant position. This process, as historians also recognise, depended on an increasing bureaucratisation of (private) family life and (public) work and the decline of the aristocracy alongside the rise of the middle and professional classes. Yet, as I show in this paper, a strong tradition of private research among aristocratic circles persisted throughout and beyond these developments. Moreover, within the aristocratic tradition, gentlewomen enjoyed much flexibility to pursue their scientific interests both independently and jointly with others in their families. With a focus on the case of natural history practice at the Balfour country estate, Whittingehame, I argue that the country house provides a critical context in which to analyse the impact of gender in the aristocratic practice of science, with implications that pose a serious challenge to the received narrative concerning the fate of women's roles in science after the professional turn.

**Osborne, Michael**

*E-mail Address: osborne@humanitas.ucsb.edu*

**French Colonial Medicine in the Nineteenth Century**

For most of the nineteenth century the challenge of administering the French colonies fell to the Ministry of the Navy. This responsibility included training physicians and surgeons for what the navy regarded as a distinctive genre of healing and for medical careers likely to include the demands of colonial duty, shipboard service, and tending to the health needs of prisoners and thousands of workers in the naval arsenals. Training for such tasks was accomplished through service in the "great school of the sea," and by taking special classes at naval medical and post-graduate schools in the French provinces. Representations of naval and colonial medicine constructed by its practitioners argued that their craft was an art distinct from the sorts of medicine promoted by the civil faculties of medicine such as the Paris clinical school. The paper examines and evaluates these arguments for a distinctiveness and separateness from civilian medicine on three levels; those of ideas of disease, career advancement and training, and the highly gendered conditions of naval and colonial medical practice.

**Otis, Laura**

*E-mail Address: otis@mpiwg-berlin.mpg.de*

**Müller's Lab: The Struggle for Personal Space**

What is a "lab"? How do individuals cooperate to solve scientific problems, and how do personal, political, and logistical factors affect their decisions about what experiments to perform? To what extent do the ideas emerging from a "lab" depend on the lab's physical space, which shapes the interactions within a Principle Investigator's (PI's) group? To address these questions, I will focus on the troubled group of physiologist Johannes Müller in Berlin. Between 1833 and 1858, Müller's students included Jakob Henle, Theodor Schwann, Hermann Helmholtz, Emil Dubois-Reymond, and Ernst Haeckel. The close quarters in which they worked made their relationships crucial, for Müller never had a lab in the modern sense. He and his students performed their experiments either in a few small rooms adjacent to the medical dissecting hall or at Müller's anatomical museum. Schwann did the studies leading to cell theory in a hotel room on Friedrichstrasse. In trying to reconstruct the ways these scientists developed their ideas, we can work only with their conflicting stories about what occurred in their laboratory space. Nicholas Jardine has proposed that DuBois-Reymond's and Virchow's accounts of Müller serve the students' own interests, establishing their PI as a precursor who paved the way for their own achievements. In seeking the origin of scientific ideas, we must interpret two layers of texts shaped by personal perspectives: those published to present observations to other scientists, and those published to tell historians how this science was done.

**Palmeri, JoAnn**

*E-mail Address: palmerij@ou.edu*

**Popular and Pedagogical Uses of Cosmic Evolution**

By the end of the 20th century, evolution had become a theme pervading the physical as well as biological and social sciences. In the process, the theme of Cosmic Evolution has become the standard narrative backdrop against which scientists have presented unifying and integrating accounts of science and the cosmos. The pervasive and compelling nature of such accounts has led many observers to characterize the theme of Cosmic Evolution as the myth of our time - a creation epic, a secular story of origins. Since the 1950s astronomers have played a key role in contributing to the construction of this narrative, which has been most recently characterized as The Epic of Evolution. In this paper I examine the contributions of astronomers to the creation, popularization and promotion of the epic theme of Cosmic Evolution.

**Pang, Alex**

*E-mail Address:*

**Paris, Elizabeth**

*E-mail Address: eparis@dibinst.mit.edu*

**A Laboratory's Life: Consequences of Not Being Allowed to Build the Next Machine**

At the end of August 1965, the physicists at the Cambridge Electron Accelerator Laboratory in Massachusetts (CEA) received the disappointing news. Their appeals had failed. The Atomic Energy Commission had awarded the right to build the United States' first electron-positron colliding beam storage ring to the Stanford Linear Accelerator Center in California (SLAC). Despite losing the storage ring competition, however, the Cambridge group did not lose their passion for the project. Desperate to continue both operating their laboratory and exploring this new frontier, they embarked on a course which would beget brilliant innovation as well as extensive experience, both frustrating and practical. Furthermore, the results from the soon-to-be-eclipsed university facility lived constantly in the shadow of the impending construction of SLAC's purpose-built ring. A cynical eye might see CEA's struggles as

a result of the loss of funding and as merely a desperate attempt to keep the laboratory in business. However, the negative assessments lead one to dismiss the importance of what emerged from these contingent pressures. The original designs for the first U.S. electron-positron collider anticipated amperes of current and multi-bunch operation, features which would not be realized in any machine for decades. Yet, early proposals had depended on these to achieve reaction rates large enough to make a twelve- to eighteen-million-dollar machine appear worth building. The design improvements and experienced personnel garnered due to the enforced seat-of-the-pants operation at CEA provided invaluable contributions towards avoiding such seeming necessities and insuring the configuration's future success. Indeed, SLAC's own ring would have suffered greatly without them.

### **Park, Buhm Soon**

*E-mail Address: parkb@od.nih.gov*

#### **The "Hyperbola of Quantum Chemistry": The Changing Practice and Identity of a Scientific Discipline in the Early Years of Electronic Digital Computers, 1945-1965**

This paper will examine the ways in which the development of computing technology affected quantum chemistry, intellectually and socially, in the two decades after 1945. Except for those fields directly related to military projects and weather forecasting, no other scientific discipline more eagerly explored and substantially benefited from the growing power of electronic digital computers in their early years than quantum chemistry. Quantum chemists sought to take advantage of high-speed computers, and organized meetings and conferences to exchange information on how to improve computation. I will argue that the development of quantum chemistry shows the subtle and complicated role of computers in shaping disciplinary identity. On the one hand, new possibilities opened up by electronic digital computers contributed to the formation of a community in quantum chemistry but, on the other hand, this community soon encountered the problem of communication between groups that differed in the degree of reliance they placed on computers. This problem was closely intertwined with the epistemological question as to the legitimacy of two different approaches to computation: the *ab initio* method, which used no empirical data except fundamental constants to solve the Schrödinger equation, and the semiempirical method, which simplified computational problems by neglecting some factors and using empirical parameters. Various answers to the epistemological question were contingent upon the status of computing technology as much as upon the personal commitments and interests of quantum chemists.

### **Parshall, Karen**

*E-mail Address: khp3k@virginia.edu*

#### **Bridging the Channel: The Contextualization of British and French Contributions to Geometric Probability**

Geometric probability began in 1777 with the Comte de Buffon's formulation of what has since become known as the "Buffon needle problem." Little was done on the theory behind this problem following Pierre Simon Laplace's treatment of it in 1812 until it became a topic of interest in England and France in the 1860s. Using geometric probability as a case study, this paper will explore the national contexts in which British and French mathematicians worked. It will highlight the subtly different ways in which mathematical theories can develop in different national contexts by focusing on the work and institutional settings of James Joseph Sylvester and William Morgan Crofton in Britain and of Joseph-Emile Barbier and Joseph Bertrand in France. It will also examine some of the factors that both facilitated and militated against scientific communication across the English Channel in the latter half of the nineteenth century.

**Pearl, Sharrona**

*E-mail Address: spearl@fas.harvard.edu*

**Sensational Science: Men, Women, and Mesmerism in Wilkie Collins' *A Woman in White* and *The Moonstone***

In this talk, I will examine the work of Victorian sensation novelist Wilkie Collins, and that role that mesmerism plays in his texts. Collins both challenges and reinscribes traditional Victorian ideas. His books expose and interrogate gender and class inequalities, and he acts as a sometimes less-than-enthusiastic, but still obvious, social critic. The conclusions of his novels often serve to justify the issues that he raises, undermining but not invalidating his earlier critical examinations. The tensions in his texts between social criticism and social discipline have rendered Collins' books contested sites of knowledge, both historically and in present scholarship. In this paper I will examine this tension through the medium of mesmerism, another highly contested site of Victorian knowledge. Collins employs this extremely contentious and extremely popular science and its relationship to notions of gender in two of his texts, *The Woman in White* and *The Moonstone*. My project, then, is twofold: I wish to examine the role that mesmerism plays in presenting ideas about gender, at times challenging traditional norms but ultimately supporting notions of female passivity and male activity. In tandem with my analysis of mesmerism and gender, I will show how mesmerism plays a surprisingly authoritative role in these texts despite its status as an unstable science. I will suggest that for this reason, mesmerism is the perfect tool for Collins to both expose and then legitimize these gender divisions since the very medium of his examination is itself fraught with tension and surrounded by debate.

**Penyak, Lee**

*E-mail Address: leepenyak@yahoo.com*

**Obstetrics and the Inclusion of Women in Mexico's Medical Establishment, 1850-2000**

Scholars have studied midwifery and obstetrics in Mexico primarily to highlight how male doctors systematically excluded females from the medical profession. This paper will demonstrate that the growth of obstetrics medicine in the nineteenth century actually served as a launching pad for the successful inclusion of women into all branches of medicine by the end of the twentieth century. The author examines grades, inter-departmental correspondence, course objectives, and graduation statistics from Mexico's medical institutions, and also compares Mexico's maternal and infant mortality rates with those of 'Western' and other Latin American countries. He contends that radical changes in birthing practices over the last two centuries have had positive benefits for both female practitioners and their clients.

**Pesic, Peter**

*E-mail Address: ppesic@mail.sjcsf.edu*

**Seeing Double: Shared Identities in Quantum Theory**

The radical loss of individuality of electrons and other fundamental entities is a central theme of quantum theory, though it has usually been treated as a subsidiary issue, a consequence of other, more fundamental postulates. The history of this loss of individuality leads back to the work of Max Planck, where it was a crucial, if hidden step in his thinking. Only in 1911 did Ladislav Natanson and Paul Ehrenfest first call attention to it. It became an ever more important countertheme to better-known developments in the theory--its development by Einstein, Bose, and Schrödinger enabled crucial steps towards the new quantum theory. With the advent of the Pauli exclusion principle and quantum statistics, this radical indistinguishability or identity became a central element of the new understanding of the periodic table as well as of the quantum theory of fields. Detailed mathematical and physical arguments argue that identity should be regarded as a fundamental principle of quantum theory. As such, it makes that enigmatic theory far more intelligible. Moreover, its subtle, often hidden place in the

development of that theory opens a new perspective on the history of physics.

**Phillips, Denise**

*E-mail Address: phillips@fas.harvard.edu*

**The Generality of Language and the Particularity of Science: Natural History and Classical Bildung in Germany, 1815-1850**

Over the first decades of the 19th century, interest in natural history expanded rapidly within German-speaking Europe, as natural scientific civic associations sprung up in towns across the German Confederation. Over the same period, however, attempts to win a greater place for natural history in the secondary school curriculum met with a great deal of resistance. According to natural history's critics, this menial study of material particulars was entirely unsuited to the high moral mission of the German Gymnasium only the lofty universals of Classical language study could properly mold the young pupil. As these school debates revealed, the moral status of natural history was ambiguous in mid-19th century Germany, and naturalists existed somewhat uneasily within the broader culture of erudition central to the German Bildungsbürgertum. Naturalists (and their allies inside the German liberal movement) lobbied to expand the boundaries of humanist Bildung to include the study of nature. At the same time, many natural historians continued to draw on humanist traditions in their scientific work, offering their research as practical examples that natural scientific and philological forms of understanding could be compatible.

**Popa, Tiberiu**

*E-mail Address: tmpst26+@pitt.edu*

**Aristotle's Method of Division in 'Meteorology' IV**

Aristotle's handling of diairesis (division) in his biological treatises has been a matter of intense debate. In the past scholars attempted to prove that the divisions to which Aristotle had appealed were comparable with methods of classification used in modern biology. More recently, scholars have turned their attention to the question whether the prescriptions Aristotle offered in theoretical works are compatible with the various ways in which diairesis was put to work in specific biological contexts. I believe that further light can be shed on this problem by properly investigating Aristotle's 'chemical treatise' - book IV of his Meteorology, which has rightly been considered a prolegomenon to Aristotelian biology. The deployment of scientific method in this treatise has gone particularly understudied. The chief function of the book seems to be that of providing a reliable and clearly articulated (generic) classification of homoiomere or uniform materials. In Meteorology IV Aristotle consistently outlines classes of materials that share certain dispositional differentiae (e.g. 'melttables', 'cuttables') or a certain 'chemical' composition (e.g. 'mostly earthy'). In doing so, he resorts to several differentiae simultaneously, to successive differentiation (i.e. differentiae logically entailing other differentiae), and even to negative distinctive properties (adunamiai). My main claim is that these features of the method of division essentially conform to theoretical precepts put forth in Aristotle's Posterior Analytics and coincide with crucial aspects of diairesis in the biological treatises.

**Porter, Theodore**

*E-mail Address: tporter@history.ucla.edu*

**Statistics and the Unsalvageable Self**

Karl Pearson explained the virtues of science in moral and social terms, as providing means for excluding what is merely personal or biased, and preserving only what is equally valid for everyone. He developed this philosophical position in response to some very personal worries about egoism, supported also by his reading of literary works such as Ibsen's Doll's House and Meredith's The Egoist. The

capacity to rise above self was also essential to an ideal of service valued by Oxbridge elites. Statistics, to which he turned with much excitement about 1892, exemplified for him these virtues in more than one sense, since it provided a rigorous, self-denying method which, by its concentration on mass phenomena, reflected also the insignificance of mere individuals. Pearson even indulged, in his Grammar of Science, the Machian view that "Das Ich ist unrettbar," there is no stable self. Yet this doctrine of science, endorsed so warmly, was also for him the core of a tragic view of his own career, as he worried that his descendants would remember nothing of his labors and his bold, synthetic vision but a formula, to which the name "Pearson" might be attached. He was, perhaps, snared by a contradiction, but a rich and fascinating one, of quite general significance, involving the relations of the personal to the objective.

### **Porter, Theodore**

*E-mail Address: tporter@history.ucla.edu*

#### **Growth of HSTM Faculty within a General History Department**

In many large universities, HSTM faculty are placed administratively in the History Department rather than a specialized Department of HSTM. What does this mean for graduate students seeking teaching positions? This paper will address the growth of HSTM faculty within the History Department of one large research university, UCLA, and will discuss the qualifications looked for by faculty when new hires are contemplated.

### **Potthast, Thomas**

*E-mail Address: potthast@mpiwg-berlin.mpg.de*

#### **Ethology goes Environmentalist: Konrad Lorenz' Ecological Politics**

Ethological issues of the human condition as a driving force for environmental degradation have been discussed as intensely as the ecological affairs. Environmentally oriented ethologists around Konrad Lorenz (1903-1989) contributed significantly to the making of a 'scientific' discourse of environmentalism in Germany. In this paper, environmentalist transformations of Lorenz, among others, will be sketched from the invention of ethology as an evolutionist discipline up to the 1940s, its career among ecological doomsday writers in the 1950s to the production of Lorenz as leading writer and activist for environmental politics mainly since the 1960s. It shall be argued that he and other ethologists made possible theoretical as well as personal links between classical nature protection and the emerging ecology-based environmental approaches. This resulted in an unstable coalition of culturally diverse groups which nevertheless gained social power by building a common 'scientific' anthropological framework for ecological politics.

### **Regal, Brian**

*E-mail Address: bregal@tciedu.com*

#### **Racing Out of Central Asia: Henry Fairfield Osborn and the Origins of Man**

There has been much work done on the role of race in the study of human evolution, but little on the role of race in the study of human origins. Henry Fairfield Osborn (1857-1935), evolutionary biologist, paleontologist, and longtime head of the American Museum of Natural History, developed a theory of human origins which was heavily invested in racist thinking. His extensive publishing in books, journals, and newspapers, coupled with his high public profile helped establish his views of race and human origins in the popular consciousness. Osborn's theory was that the first humans had appeared in Central Asia as a group only tangentially related to the primates. These early 'Dawn Men' then split to form the various archaic peoples (Neanderthals, Cro-Magnons, and others) and then the different modern races. Osborn's underlying methodology was to create orthogenic family trees which effectively separated all human groups into distinct species with little or no direct kinship. In this way he could

keep Nordics and Anglo-Saxons safe from the contamination of other and 'lesser' orders. He spent most of his career attempting to prove his assertions through the collection of fossil evidence, and promoting his ideas to the wider world. His efforts included becoming active in the eugenics and immigration restriction movements as well as sponsoring the famous Central Asiatic Expeditions to 'Outer Mongolia' led by Roy Chapman Andrews. This paper will examine the racial thinking in Osborn's work and how it evolved over time.

**Reidy, Michael**

*E-mail Address: mreidy@montana.edu*

**'Scientists' and 'Subordinate Labourers': Class and the Creation of Victorian Science**

William Whewell coined the term "scientist" in 1833 owing to the dramatic changes that occurred in science in the early Victorian era. Natural philosophers transformed our understanding of light, heat, electricity and magnetism, and consolidated the fields of chemistry, physics, and geology. Furthermore, Susan Faye Cannon noted in this same period a change in focus to global, geophysical research in Britain. This changed natural philosophy in Britain from a limited and domestic undertaking, receiving parsimonious state support and embracing little communication among scientists of different nations, to a worldwide and relatively well-financed scientific practice that extended far beyond the confines of Britain. Historians have since taken up Cannon's initial analysis with enthusiasm, but they have failed to link this prevalent type of research to the broader trend of professionalization of the discipline. In this paper, I will demonstrate that Humboldtian initiatives relied on a broad base of support and a far-reaching network of observers that included large segments of the working classes. These "subordinate labourers" -- one of Whewell's favorite phrases -- not only furthered the acquisition of accurate observational data, but they also built the scientific instruments, advanced methods of mathematical analysis, suggested new areas of research, and were the first to apply the results to the testing of theory. They were essential participants in British geophysical research. However, I also will demonstrate the manner in which the elite theorists in Britain effectively excluded the working classes from the scientific establishment, and thereby created the niche of the modern "scientist."

**Rice, Adrian**

*E-mail Address: arice4@rmc.edu*

**G.H. Hardy, the London Mathematical Society, and the rise of British pure mathematical research in the first half of the 20th century**

It has often been observed that the early years of the 20th century witnessed a significant and noticeable resurgence, both at home and abroad, in the research profile of British pure mathematicians. Invariably, in these observations, it is the name of G.H. Hardy (1877-1947) which features most prominently as the driving force behind this revival. But how accurate is this interpretation? For many years during this period Hardy occupied prominent positions in the London Mathematical Society, which grew considerably in size and stature at this time. The fact that the Society was de facto the mouthpiece of the British pure mathematical community, nationally and internationally, gives rise to a number of intriguing questions. In particular, to what extent were the changes in fortune of the London Mathematical Society and British pure mathematics connected, and how much can be directly attributed to Hardy? This paper is the first step in a re-evaluation of Hardy's influence on the British mathematical community, its international reputation and its pure mathematics, during the first half of the twentieth century, with particular reference to his relationship with the London Mathematical Society.

**Richards, Joan**

*E-mail Address: Joan\_Richards@brown.edu*

## **Childhood and the Reach of Reason in the World of Augustus and Sophia De Morgan**

Both Augustus and Sophia De Morgan were Victorian radicals who were passionately committed to the development of a rational society. For Augustus the essence of this rationality was to be found in mathematics: his life work was to understand and teach his subject in such a way that that it would serve as a proper model for rational thought. Sophia was wholly supportive of her husband's efforts, but the view of rationality she espoused rested on a more variegated base of medical/scientific theorizing and was expressed in social outreach projects. Together the De Morgans raised seven children to be responsible members of the rational society they were constructing. This paper will explore the views of rationality the De Morgan's were developing in their public lives and the relation of those views to the ways they approached the challenge of raising rational children.

### **Richards, Robert**

*E-mail Address: r-richards@uchicago.edu*

#### **The Erotic Sources of Goethe's Science**

Goethe's morphological ideas have several sources: his empirical investigations of plant and animal structures, his philosophical ideas (especially those drawn from Spinoza and Herder) and his conceptions of previous scientific theories, and his erotic experiences in Italy. The first two kinds of sources are standardly recruited by historians as the causal sources of particular scientific theories. The last sort is usually viewed with suspicion. In this paper I will sketch the history of Goethe's initial formulation of his morphological ideas and then consider the kind of justification that might be offered both for a causal analysis of theories generally and for the quite personal--psychological--explanation I offer in my historical sketch. Two dilemmas becomes immediately apparent. The more closely the historian ties a causal analysis to particular times and situations, the less a universal application would seem possible for that scientific theory---it would be just one more singular event. Yet scientific theories claim universality. How to square these conflicting considerations? Moreover, psychological desires of a definitely non-scientific sort would seem to have little explanatory value. What kind of evidence would recuperate appeal to psychological causes of scientific ideas? Can poetry be mined for biographical information and demonstration without violating modernist and post-modernist sensibilities?

### **Robert W. Smith ,Patrick McCray**

*E-mail Address: rwsmith@ualberta.ca*

#### **Seeing the Future: The Origins of the Next Generation Space Telescope**

Even before the enormously complex and costly Hubble Space Telescope was launched into space in 1990, indeed even before the design of the Telescope was complete, astronomers were laying plans for its successor. In this paper we explore the early history of what was to become known as the Next Generation Space Telescope (NGST). We will analyze how different communities sought to cope with the demands of making crucial scientific, technological, financial, and organizational choices in the face of incomplete knowledge and uncertain political realities.

### **Rohde, Joy**

*E-mail Address: rohdejoy@hotmail.com*

#### **Coordinating the "Coordinating Science" for the New World Order: Physical and Cultural Anthropologists in the Postwar United States**

In 1945, Columbia anthropologist Ralph Linton echoed the widespread call for collaborative scientific research among the social sciences. Linton and his colleagues claimed that anthropology would be the ng scienceace, democracy and stability. With the formation of the United Nations Educational, Scientific, and Cultural Organization (UNESCO), anthropologists stepped forward to apply their knowl-

edge to the creation of international scientific statements on race and the universal rights of man. Yet postwar anthropology was itself rife with internal conflict for much of the twentieth century, physical and cultural anthropologists remained divided over the relationship between culture and biology, diffusion and evolution, dynamic societies and static races. Informed by the 42 and gripped by the postwar drive for tolerance and equality, these two antagonistic camps sought to reintegrate their disciplines in the name of global human welfare. Physical and cultural anthropologists proposed definitions of culture that would remove the boundary separating the fields and concurrently shape the future of the discipline to meet the needs of a postwar world. This paper will examine the ways in which physical and cultural anthropologists reformulated the notion of culture and negotiated its complicated relationships with biology and evolution in an unsuccessful attempt to forge consensus within and beyond the discipline.

**Rothenberg, Marc**

*E-mail Address:*

**Rozwadowski, Helen**

*E-mail Address: helenroz@mac.com*

**"We must not forget the women": Involvement of women in Victorian marine science**

The entry of women into the ocean sciences has been recent and hard-won. Oceanographers, and most historians until recently, have believed that this very male-dominated field had been so since its inception, usually taken to be the famous four-year circumnavigation of HMS Challenger in the 1870s. Investigation of marine fauna during the Victorian era, however, was hardly limited to the naval and exploratory expeditions which circled the globe demonstrating imperial might. While such cruises represented one progenitor of oceanography, others provided much wider social access to the sea. As the vogue of sea bathing for health reasons broadened into the seaside holiday, marine natural history offered an uplifting excuse for men, women, and children alike to indulge in the pleasures of beach combing. Marine zoology proved popular to women, as did certain other fields such as botany and entomology, because collecting provided healthy outdoor activity yet did not necessitate shooting or skinning animals. The youthful sport of yachting provided them access to a genteel version of the maritime world through which they could collect and study marine fauna and flora. The exit of women from ocean science was, as in other fields, in part forced by professional marine scientists, especially as governments began to hire biologists to study declines in commercial fisheries. This trend coincided with the decreasing use yachts and private patrons for ocean science, leaving women stranded on shore.

**Ruehl, Martin**

*E-mail Address: mar23@cam.ac.uk*

**The Use and Disadvantage of Theory: Dilthey, Rickert and the Crisis of Historicism in Fin-de-Siècle Germany**

This paper examines a 'theory construction' in Imperial Germany that has been largely neglected so far by historians of science: the attempt of hermeneutic and neo-Kantian philosophers, at the end of the nineteenth century, to provide historicism (Historismus) with a new theoretical foundation. By the 1880s, the idealistic bases of historicism had all but crumbled under the onslaught of positivism. According to most recent scholars in the field of German Geschichtswissenschaft, the theoretical writings of Wilhelm Dilthey and Heinrich Rickert in the 1890s effectively helped historicism to overcome its fin-de-siècle crisis and gave it a new lease on life which only ran out in the 1960s. This paper, by contrast, argues that the historiographical theories developed by Dilthey and Rickert transformed the very essence

of historicism and prepared the ground for Max Weber's re-definition of history as a Kulturwissenschaft in the 1900s. Especially Rickert fundamentally qualified the traditional historicist claims to objectivity, universality and social as well as national relevance. The use of theory, thus, proved to be a deeply ambivalent rescue operation for historicism at the turn of the century.

**Russell, Mark**

*E-mail Address: mrussell@vt.edu*

**Popularizing Eugenics: Sir George Archdall Reid and the Medicalization of Social Problems c.1890-1910.**

Sir George Archdall Reid played an important but overlooked role in the extension and application of biological theory to human problems, an intellectual trend which culminated in the rise of the eugenics movement. Reid's career straddled two crucial periods in the growth of this movement--namely, before and after the re-discovery of Mendel's work in 1900. As alcoholism specialist, medical doctor, and author of widely used medical textbooks, Reid held a particularly useful position from which to broadcast his belief in the reduction of social problems to biological and hereditary causes. The present essay explores the development and impact of Reid's work in the context of the growth of scientific studies of human heredity, the medical educational curriculum, and the larger social-political context of the eugenics movement. I argue that Reid's work presents a remarkable example of the dynamic interaction of social and scientific goals in this era. By appeal to the biological and hereditary basis of human temperament and character, eugenically minded scientists and physicians ultimately rendered a wide array of socially problematic behaviors 'treatable,' using methods as extreme as sterilization and human breeding. I argue that Reid's role in the growth and legitimacy of this movement deserves reappraisal.

**Rutkin, H. Darrel**

*E-mail Address: drutkin@indiana.edu*

**The 'Unnamed Master' Revisited: Mathematics, Perspective and Astrology in Roger Bacon and Albertus Magnus**

In his *Opus tertium* (1266-67), Roger Bacon attacks a well-known contemporary, the "unnamed master," as ignorant of perspective and mathematics, both of which are central to Roger's natural philosophy. The scholarly status questionis identifies the "unnamed master" as Albertus Magnus. But when we compare Roger's own definitions of perspective and mathematics--and their relation to astrology--with the treatment of these subjects in Albertus's extensive natural philosophical opera, the likelihood of this identification diminishes significantly. Such a comparison will be the subject of my talk.

**Sandman, Alison**

*E-mail Address: Alison\_Sandman@brown.edu*

**Questionnaires and observing instruments: Standardization, credibility, and control of empirical observations in Spain and Spanish America.**

In this paper I examine attempts by Spanish chart makers at the end of the sixteenth century to find a way to gather reliable information about the New World. Chart makers based in Seville struggled to reconcile a variety of reports, ranging from the voyage accounts of the individual pilots to lunar eclipse observations. The contradictions in these reports, however, made it clear that the empirical information they required to make their charts was often of questionable reliability. Since sending highly-educated (and thus more credible) observers proved prohibitively expensive, the chart makers instead worked to develop printed instructions, detailed questionnaires, and special-purpose observing instruments, designed to constrain the actions of the observers already present in the New World. Though they met with varying success, the details of their attempts indicate both the importance of the observers' personal

experiences in the New World, and the chart makers desire to separate those experiences from the interpretations and calculations needed to make use of them. The chart makers tried to increase the credibility of their network of observers by standardizing the reports and limiting their scope, thus making the skill of the observer less important and asserting their own control.

### **Saridakis, Voula**

*E-mail Address: saridakis@ameritech.net*

#### **"Who was Elisabetha Hevelius? 'Domestic' Astronomy in the Early Modern Period"**

Who was Elisabetha Hevelius? In a number of current scholarly works, there appears an image of Elisabetha using a sextant and compiling measurements together with her husband - the famous European astronomer, Johannes Hevelius of Danzig. But how extensive was her astronomical knowledge? And what role did she play as a woman astronomer in the seventeenth century? In this paper, I briefly discuss her life and involvement with her husband's work. Elisabetha broke traditions of the early modern period by circumventing limitations imposed on her and entering into a healthy professional collaboration with her husband. More specifically, she served a dual role as both astronomical assistant and housekeeper. She was accepted by most of her contemporaries in this dual role, despite restrictions on what she could and could not do in terms of astronomical practice. Nevertheless, she ultimately played a significant role in promoting her husband's work before and especially after his death.

### **Sarkar, Sahotra**

*E-mail Address: sarkar@mail.utexas.edu*

#### **The Puzzle Posed by Plasticity: Berrill's Denial of Genes for Development**

In 1948 Waddington claimed that that "it has always been clear that, since genes are the determinants of the characters of an animal, they must also provide a set of terms in which we shall eventually be able to give a causal account of development which is, at its own level of analysis, complete and comprehensive (1948, 128)." While the 1950s forced Waddington to reticulate his models of gene action to accommodate the complexities of phenogenesis (Sarkar 1999), genetics began an unfriendly take-over of embryology, replacing the problems of morphogenesis with that of cell differentiation (Gilbert 1996). Yet, returning to Waddington (1948), and contrasting it to Weiss (1940), Berrill (1961) produced the last major embryological work rejecting genetics and, concomitantly, molecularization in embryology. The first part of this paper argues that Berrill's apparently retrograde position was significantly motivated by a special appreciation of phenotypic plasticity. The second part speculates that plasticity was central to Berrill's developmental world-view because of his concentration on development in tunicates. Until about 1960 model systems such as tunicates were central to developmental biology (a term that Berrill coined in the early 1950s) because of its morphogenetic orientation. When classical genetics, which had no place for plasticity, finally succeeded in co-opting developmental biology to its own framework of cell differentiation through gene regulation (which Waddington endorsed in 1962), tunicates gradually became marginalized as model systems.

### **Schickore, Jutta**

*E-mail Address: jschickore@dibinst.mit.edu*

#### **The Historicity of Epistemological Terms: Changing Notions of Error in Microscopy**

Recently, historians of science have argued that not only scientific problems and concepts are subject to fundamental changes but that meta-scientific, epistemological concepts such as explanation, proof, and objectivity emerge out of specific historical settings, are intimately related to substantive scientific beliefs, and change over time. In my contribution, I present this view and consider its significance for philosophy of science. To do so, I focus on a specific case: the changing notions of error in microscopy.

In the 1830s and 1840s, the concept of microscopical error was completely transformed. In the preceding decades, the source of error was located in the observer's mind and tied to the notion of spontaneity of reasoning. After about 1830, the troublesome properties of physical objects and organs also came to be regarded as sources of error. The case illustrates the extent to which the mechanisms for disciplining the investigator and regulating the management of instruments and objects were shaped by prevailing notions of error. The study can thus serve as a corrective for our present, very general accounts of the role of discipline in knowledge production. With respect to this case, I argue that gauging past epistemological concepts against present ones can help uncover the assumptions and presuppositions implicit in current epistemological notions and clarify our normative intuitions about science, experience, and knowledge.

**Schiefsky, Mark**

*E-mail Address: mjschief@fas.harvard.edu*

**Technê and Method in Ancient Medicine and Mechanics**

In ancient Greece from at least the fifth century BCE, the concept of technê or expert knowledge was closely associated with the idea of method. My goal in this paper is to discuss three aspects of this association in two traditions of Greek scientific and practical activity, each of which was considered to be a technê: Hippocratic medicine and Alexandrian mechanics. First, authors in both traditions stress that practitioners have a systematic method for attaining the results at which they aim, and do not proceed in a chance or arbitrary fashion. Secondly, in both traditions this systematic method is supposed to be grounded in a body of theoretical knowledge. This knowledge enables a doctor to explain the effectiveness of a cure by appealing to the behavior of humors in the body, and a mechanical practitioner to explain the operation of a complex machine in terms of simpler ones, such as the balance or lever. Thirdly, this theoretical knowledge is reached by a process of discovery that involves appeal to analogies with familiar objects to gain knowledge of the invisible or unknown—thus medical authors draw analogies with cooking to explain the behavior of substances in the body, and mechanical writers draw analogies between complex machines and simple ones to explain the former in terms of the latter. These parallels testify to a striking continuity in Greek conceptions of technê across different disciplines and to the richness of these ancient discussions for the study of the history of scientific method.

**Schmidgen, Henning**

*E-mail Address: schmidg@mpiwg-berlin.mpg.de*

**Time, Psychology, and Telegraphy: The Technological Context of the Reaction Time Experiment, 1860-1880**

The "reaction experiment with the Hipp chronoscope" is one of the classical experiments of modern psychology. In Wilhelm Wundt's (1832-1920) laboratory as well as in many other psychological laboratories modelled after the Leipzig lab, experimental research on reaction time was (and sometimes still is) a key issue. This paper investigates the technological and cultural contexts of the reaction time experiment and argues that development in time measurement and communication in other areas of science and technology (astronomy, clock industry) were decisive for shaping laboratory techniques and concepts in psychology. The chronoscope was constructed by Matthias Hipp (1813-1893) in the late 1840s. In 1861 the astronomer Adolphe Hirsch (1830-1901) used the chronoscope to measure observational errors ("personal equation"). Hirsch's observatory at Neuchâtel (Switzerland) served to control the quality of clocks produced in the nearby Jura mountains. Hipp provided the observatory with a telegraphic system that sent time signals to the centers of clock production. Hipp also lent Hirsch the chronoscope he used in his experiments. I argue that telegraphic time technology was decisive for the theories and practices of Wundt's physiological psychology. Wundt dealt with psychological processes in

terms of "sending" and "receiving" signals. The accurate communication of time signals was a central problematic for the development of techniques to measure those psychological processes.

### **Schroeder, Iris**

*E-mail Address: [schroeder@mpiwg-berlin.mpg.de](mailto:schroeder@mpiwg-berlin.mpg.de)*

#### **When Natural Space Meets Social Theory : The Circulation of Friedrich Ratzel's Models of Space in French Sociology, History, and Human Geography around 1900**

Taking up the arguments of the German geographer Friedrich Ratzel, French social scientists of the late nineteenth century started to reconsider the concept of "spatial spaces", which were to be explored with respect to their different spatial dimensions, sociologists and historians, too, started exploring the spatial settings of their research by problematizing the effects of spatial features on their corresponding human settlements. However, approaches in sociology, history and in the later so called human geography considerably varied, enlarging Ratzel's initial set of questions. Sociologists like Emile Durkheim, historians like Lucien Febvre or geographers like Paul Vidal de la Blache were mostly interested in the interdependencies of a wide range of different spatial as well as social and ethnographical factors. In my paper I will explore the different ways in which Ratzel's question of how "nature" influenced "mankind" was taken up while at the same time being rejected because of its inherent determinism. Focussing on scientific practices, especially the setting up of new scientific classificatory schemes and surveys, my paper explores how social scientists succeeded in making up spaces. My aim is to show by what means these spaces were being furnished by a rich set of all kinds of spatial as well as other features that were being tentatively put on the front stage of an encompassing research agenda. In fact, this research agenda combined questions of Nature with the newly discovered social.

### **Schuermann, Astrid**

*E-mail Address: [Astrid.Schuermann@tu-berlin.de](mailto:Astrid.Schuermann@tu-berlin.de)*

#### **Does Technology Act Contrary to Nature? Aristotle on Physis and Techne**

Dealing with technological progress in antiquity, Aristotle is thought to be responsible for differentiating science from engineering by using the terms "in accordance with nature" or "natural" (*kata physin*) and "contrary to nature" or "artificial" (*para physin*). These ideas, developed by the German historian of science Fritz Krafft, imply that scientists are only allowed to observe changes that happen spontaneously and without human interference. They shall not experiment or describe their results mathematically. On the other hand technologists can use all these procedures because they only deal with changes contrary to nature. In modern terms, science was in deficit and could not support technological progress. In my lecture I would like to point out that this opinion is wrong. Aristotle deals with changes "in accordance with nature" and "contrary to nature" in his "Physics" because both can be found in nature without human influence. He differentiates nature from technology by arguing that there is an ontological dichotomy. Natural things carry the capacity to change in themselves whereas technological artefacts do not have anything like that. They are made by human beings imitating nature. Aristotle not only talks of imitating nature but of supporting and completing nature. Engineers are thus able to imitate both kinds of processes, *kata* and *para physin*, in their aim to change the human environment according to human needs. The ability of engineering (*techne*) is a major intellectual moment of human beings compared to animals or plants. Aristotle uses his definition of changes *kata* or *para physin* in his "Politics" to legitimize the social order. His cosmology is a means to underline and strengthen his ideas about supremacy of Greeks over barbarians, men over slaves, men over women and children. His philosophy as a whole is based on the difference between "normally" and "contrary to nature". From these considerations it is clear that Aristotle in his "Physics" wanted to substantiate his ideas about biological evolution. To think about technological progress in antiquity therefore must mean to look at the emergence of a technologi-

cal science, mainly mechanics, and its interdependence with the development of ancient societies.

**Schuster, John**

*E-mail Address: j.a.schuster@unsw.edu.au*

**Hydrostatics, Physico-Mathematics and the Origins of Micro-Mechanism: Or, What René and Isaac Did in 1619**

In 1619 the twenty-three year old René Descartes and his thirty-one year old mentor, Isaac Beeckman, were trying to invent, and practice, a discipline they called hings, they spent a week trying to reduce to corpuscular-mechanical terms Simon Stevin's recent remarkable findings concerning the hydrostatic paradox. This paper, based on research pursued with Stephen Gaukroger, argues that this little studied, and less understood episode opens for us a unique window on the beginnings of Descartes' long term agenda in micro-mechanism, and its attendant dynamical concepts, its promise and its pitfalls. Additionally, we argue that Descartes and Beeckman's precocious posturing is a particular instance of the more general early 17th century phenomenon of alternative natural philosophers variously striving to appropriate and command the findings and tools of the so-called 'mixed mathematical sciences.' The paper also throws light on some larger Scientific Revolution narratives, from Duhem to Dear, which partially misjudge the relations between the traditional mixed mathematical sciences and natural philosophical novelty in the 17th century.

**Secord, Anne**

*E-mail Address: pas6@hermes.cam.ac.uk*

**"Be what you would seem to be": Samuel Smiles, Thomas Edward, and the Making of a Working-class Scientific Hero**

Samuel Smiles is best known for his ideology of self-help, which he promoted as the basis of individual and national progress. His biographies of engineers and industrial entrepreneurs represent the conception of one culture expressed through shared moral values, and throw light on the function of heroes for fostering progress. Less familiar are Smiles's biographies of working-class naturalists, which emphasise that progress, ensured primarily through soundness of character, was not always accompanied by commercial success or social mobility. By writing about the selfless devotion of poverty-stricken men to the pursuit of science, Smiles hoped to challenge accusations that his ideology valued only material success. I suggest, however, that working-class autodidacts who did not escape their own culture presented Smiles with especially acute problems as there was no guarantee that the values encapsulated by self-help were fully internalised and shared across class lines. Smiles's 1876 biography of the impoverished Scottish naturalist and shoemaker Thomas Edward allows us to explore this in unexpected ways. My paper will discuss the making of a Victorian scientific hero, who, in the process, came to feel that he had been robbed of his life.

**Secord, James**

*E-mail Address: jas1010@hermes.cam.ac.uk*

**Crowds and Celebrities: Faces of Knowledge in the Pictorial Press**

The rise of the large-format illustrated newspaper press in Europe, America, and Australia during the 1840s and 1850s transformed perceptions of politicians, religious leaders, criminals, actors, singers, and other 'men and women of the time'. The layouts for these journals juxtaposed pictures of massed urban crowds with finely detailed portraits of individuals. In this paper, I examine a number of crucial cases, ranging from accounts of the funeral of the chemist John Dalton to reports of national and international scientific meetings, to discuss the role of this new form of graphic journalism in creating the figure of the scientist.

**Selya, Rena**

*E-mail Address: selya@fas.harvard.edu*

**The Microbiologist and His Times: Salvador Luria and the Anti-Vietnam War Movement**

Throughout his scientific career in the United States, geneticist Salvador Luria took an active interest in the social and political issues that defined American public life in the Cold War era. The height of his involvement came during the Vietnam War years, when he took public stances both within the scientific community and within the Boston intellectual community against U.S. involvement in Vietnam. This paper will examine the various strategies Luria used as a scientific authority trying to effect scientific and political change during the 1960s. I will present Luria's work as President of the American Society for Microbiology to end that organization's role in assisting the U. S. Army in developing biological weapons. His widely publicized presidential address announcing the end of that relationship, he Microbiologist and His Times, e responsibility that all scientists have to ensure that their work is not used for harmful means. This paper will also describe Luria's participation in the Boston Area Faculty Group on Public Issues (BAFGOPI), an ad hoc committee of academics who mobilized their colleagues around the country to protest the Vietnam War and other US policies in the popular press. Luria's stature within the scientific community gave him a measure of cultural capital that he used as part of the protest movement against the war. This case of the biologist as public citizen provides an opportunity to consider not only the role biology played in Cold War military strategies, but also kind of authority biologists commanded in the public sphere.

**Sepkoski, David**

*E-mail Address: sepk0003@tc.umn.edu*

**Mathematization and the 'Language of Nature' in the 17th Century**

Although an older historiography of 'mathematization' in the scientific revolution associated with the work of Alexandre Koyré, E.J. Dijksterhuis and others presents the development of mathematics from Galileo to Newton as a philosophically continuous process, more recent studies have suggested that mathematical beliefs actually varied more widely. Contemporary debates over the foundations of mathematics demonstrate that mathematization meant different things to different practitioners, and the historiographical notion that mathematics was universally recognized as a single, fundamental 'language of nature' has become problematic. While Kepler, Galileo and Descartes may have had an almost Platonic faith in the correspondence between linguistic and mathematical representations and physical reality, an alternative tradition -- characterized by the 'nominalist' philosophies of Pierre Gassendi and Thomas Hobbes -- held that such representations were justified only by human convention. This tradition influenced the mathematical beliefs of practitioners such as John Wallis, Isaac Barrow, and Isaac Newton, and their work reveals how different approaches to the philosophy of language and representation produced different strategies for 'reading' the mathematical text of nature. My paper will examine the mathematical philosophies of Gassendi, Barrow and Newton, arguing that their methods and assumptions -- about the reality of mathematical objects and the signification of geometrical and algebraic symbols, for example -- reflect concerns that were central to the empiricist philosophy of representation. Taken together, this group articulated a coherent critique of Cartesian mathematization that played a vital role in the development of 17th century mathematical epistemology, and influenced debates about the application of mathematics to nature well into the next century.

**Servos, John**

*E-mail Address: jwservos@amherst.edu*

**What a Liberal Arts College is Looking for in an HSTM Faculty Member**

Many new PhDs in HSTM seek jobs in liberal arts colleges. These institutions may emphasize teaching more than research and may not have more than the single HSTM faculty member in their History Department. This paper will discuss the qualifications that a liberal arts college looks for when it decides to hire a historian trained in HSTM.

**Seth, Suman**

*E-mail Address: sseth@princeton.edu*

**When is a Crisis not a Crisis? Theoretical Physics in the Fin-de-Siècle**

Theoretical physics occupied a peculiar position as an area of research prior to the early twentieth century. Although taught at an increasing number of institutions after the unification of Germany in 1871, the number of Ordinarius (full) professorships in the subject remained small, and even among its pedagogues and practitioners there seems to have been little consensus concerning its precise character. How then can one speak of 'theoretical physics' in this period? This paper does so by emphasising the deep connections, the almost symbiotic relationship, between the rise of theoretical physics and the heated debates over the so-called failure of the mechanical world-view. In both the content and the mode of the discourse over the appropriate foundations for physics one can see many elements that characterise theoretical physics after the turn of the century. The response to the Machian criticism of mechanics is discussed in particular detail. In addition, the paper challenges the common characterisation of the fin-de-siècle as the time of the crisis of classical physics. Crisis, it is argued, is a post-hoc category. What later participants and historians have called crisis is better understood as the practice of theoretical physics.

**Shank, J.B.**

*E-mail Address: jbs Shank@tc.umn.edu*

**"There was no such thing as the Newtonian Revolution and the French Initiated It:" Newtonian Mechanics in France Before Maupertuis**

"There was no such thing as the Newtonian Revolution and the French initiated it:" Newtonian Mechanics in France Before Maupertuis Like Steven Shapin's *The Scientific Revolution* (Chicago, 1996) from which I draw my title, my paper is an attempt to re-conceptualize a canonical component of the classically conceived "Scientific Revolution." In the classic narrative, first authored by the French philosophes (especially Voltaire and d'Alembert) and then instituted as a founding disciplinary structure of the history of science by Koyrè, Hall, Dijksterhuis and others, Newton "synthesizes" the "Scientific Revolution" by uniting the experimental and mathematical impulses which gave rise to modern science after 1600. He also completes it by using his synthetic method to establish the foundations of modern mechanics once and for all. Conceived this way, eighteenth-century physical science becomes the epigone of the "Newtonian Revolution," adding, in A.R. Hall's canonical formulation, "an elegance and a precision" not present in Newton's more "fumbling" system, but contributing no innovations that were not "derivative" or characteristic of a "second order of discovery." The French play a schizophrenic role in this classic story because while they at first let their parochial attachment to "Cartesianism" blind them from Newton's achievements, they stunningly change roles after 1730 so as to become the leading torchbearers of the "Newtonian Revolution." The recent historiography of the "Newtonian Revolution" and its eighteenth-century legacies has completely undermined this traditional account, yet surprisingly little attention has been given to re-framing the history of early-eighteenth-century French science in light of this new understanding. My paper will argue that the French reception of Newton's *Principia* was completely different than the traditional scholarship would lead us to believe, and that when properly understood the early students of Newton in France are better seen as important contributors to the Continental creation of Newtonian mechanics itself.

**Shavit, Ayelet**

*E-mail Address: ashavit@kfar-giladi.org.il*

**Evolutionary models resonate with social shifts**

Evolutionary models and evolutionary terms - such as 'group' or 'individual' - often associate with social values. Over 70 years, the evolution of altruism by group selection remains unresolved yet thriving. I will suggest, that the resonance between empirical models and social values can explain to a certain extent the open-ended practice of the group selection debate. The scope of this paper does not enable a full historical argument but only points at some dominant shifts concerning group selection. In the first half of the last century, group selection was directly used to support conflicting - pacifist or nationalistic - social values. In the last three decades, different selection models presuppose relatively similar worldviews though avoiding direct social implications. If the history of group selection still echoes with conflicting values, and if 'individual selection' associates exclusively with democracy, a researcher may feel obliged to state his or her opinion on group selection. However, since the present substructure of group selection resembles that of individual selection, then empirically distinguishing groups from individuals can lose much of its appeal. The social resonance of evolutionary theory may partly explain a converse situation: where many researchers participate in an empirical debate over altruism by group selection, but only few experiments are found, and even the strongest experimental attempts do not clearly differentiate groups from individuals.

**Shen, Grace**

*E-mail Address: gyshen@fas.harvard.edu*

**Making History Natural: Writing 20th century vernacular into 17th century travels**

After the fall of the Ming Dynasty to Qing rulership (in 1644), Chinese scholars, such as Gu Yanwu, championed a new form of Classical study which employed critical philological methods to re-evaluate the textual canon and to search for both the roots of defeat and the seeds of renewal. Many of the founders of this school of textual criticism refused to serve the new Qing dynasty and concentrated on philological scholarship. They also engaged in "practical studies" including natural historical and military-strategic surveys. Interestingly, just as Ming loyalists revised their approach to linguistic studies and explored their natural world as a means of cultural renewal, 20th century Chinese reformers called for the replacement of Classical Chinese by the vernacular and advocated scientific research in order to make China more "fit." Not surprisingly, then, stories of Ming loyalist resistance to 17th century Manchu conquest played an important role in the patriotic imagination of 20th century Chinese intellectuals. This paper engages modern Chinese ideas about the relationship between language and science by analyzing how Ting Wen-chiang, the famous 20th century Chinese geologist, re-imagined the philological and natural historical work of the 17th century scholars, Xu Xiake and Song Yingxiang in light of perceived analogies between his own time period and theirs. In particular, I consider the ways in which Ting's use of the modern Chinese vernacular subtly changes the qualities of Xu and Song's writings.

**Shermer, Michael**

*E-mail Address: skepticmag@aol.com*

**Stephen Jay Gould as Historian of Science: A Quantitative Content Analysis of His Works**

Science historian Ronald Numbers once remarked that the two most influential historians of science of the 20th century were Thomas Kuhn and Stephen Jay Gould. All science historians are deeply familiar with Kuhn's work and influence, and all know of the remarkable impact Gould has had on evolutionary theory. But little attention has been paid to the depth, scope, and importance of Gould's role as historian of science. Shermer will present the results of an extensive quantitative content analysis of

Gould's 22 books, 300 Natural History essays, 101 book reviews, and 479 scientific papers, in terms of their subject (Evolutionary Theory, History of Science/Science Studies, Natural History, Paleontology/Geology, Social Science/Commentary), and themata (Theory-Data, Time's Arrow-Time's Cycle, Adaptationism-Nonadaptationism, Punctuationism-Gradualism, Contingency-Necessity). Special emphasis will be placed on the interaction between the subjects and themata in Gould's work, how Gould has used the history of science to reinforce his evolutionary theory (and vice versa), and how his unique philosophy of science has influenced both his evolutionary theory and his history of science. That philosophy can best be summed up through what Shermer calls Darwin's Dictum (from an 1861 letter written by Darwin): "All observation must be for or against some view if it is to be of any service." Gould has followed Darwin's Dictum throughout his career and his extensive writings on the history of science.

### **Silva, Cibelle**

*E-mail Address: cibelle@ifi.unicamp.br*

#### **The struggle between quaternions and vectors: the historical origin of some misunderstandings in modern algebra**

Vectors and quaternions are quite different mathematical quantities because they have different symmetry properties. However, Gibbs and Heaviside created their vector system starting from the quaternion system invented by Hamilton. They identified a pure quaternion as a vector and introduced some changes in the product of two vectors defined by Hamilton without realizing that the scalar product and vector product cannot be interpreted as the scalar part and vector part of the quaternion product. Towards the end of the 19th century some authors perceived that there was an incompatibility between vector and quaternion formalisms, but the central problem was not altogether clear. This paper will show that the main difficulty arose from Hamilton's contradictory use of  $i$ ,  $j$ ,  $k$  both as versors and as vectors.

### **Silverman, Chloe**

*E-mail Address: chloes@sas.upenn.edu*

#### **From Nervous Weakness to "Future Shock": the Cultural History of Stress, 1890-1970**

This paper discusses the history of discourses of systemic stress and adaptation in American popular culture. Speculations on the somatic effects of social change have occupied popular and scientific discourse, as anxieties about the present were expressed in terms of hopes for the future predicated on the capacity for conscious human adaptation to social and environmental change. Theories of adaptive failure, figured as failures of communication between mind and body as well as species adaptation, influenced research in physiology, but have a related history in popular discourse, especially among public intellectuals of the American middle and upper classes. These theories have been altered in the service of different ideologies. In the 1890s George Beard's "nervous weakness" reflected anxieties about industrialization and urban life, while Walter Cannon's later popular work on homeostasis and psychosomatic medicine offered a Progressive vision of a just society organized on the model of a self-regulating organism. Alvin Toffler's "future shock," (1970) presented an organism in need of active intervention in the process of self-maintenance. Responsibility for equilibrium had increasingly turned from the society to the individual as American culture embraced a "therapeutic idealism" (Lears, 1994). This paper considers how public representations of psychosomatic responses to stress reflected and influenced changing patterns of economic production and the organization of public and private life. The public circulation of discourses about adaptive responses represents more than the diffusion of progressive scientific knowledge. As treatments for stress become increasingly commercialized and consumer-oriented, theories played a material role in the construction of markets, consumers and desires.

**Snyder, Laura**

*E-mail Address: snyderl@stjohns.edu*

**The Science of the 'Dismal Science:' Politics, Economics and Science in 19th Century Britain**

As is well known, there was much debate in 19th century Britain over the proper method of science. What is not well known is that much of this debate was fueled by controversies of the time over political and economic issues such as the repeal of the Corn Laws and the enactment of the New Poor Law of 1834. Indeed, discussion of the proper method of natural science was very much influenced by discussion of the proper method of the economy. This is clearly seen in the work of Richard Jones, William Whewell, and John Stuart Mill. Jones and Whewell oppose Ricardian economics and its deductive methodology, in part because of its use in support of the New Poor Law legislation, which called for an end to parish relief and added a workhouse requirement for the poor. Instead, Whewell and Jones attempt to develop an alternative inductive political economy. This becomes part of a general project of championing induction against the *f* thought. On the other hand, Mill and the philosophical radicals were in favor of the New Poor Law amendment, and consequently Mill developed a deductivist, Ricardian methodology of political economy in order to justify it. Mill tells us in his *Autobiography* that he was motivated to write *System of Logic* by his desire to find a method which would cope successfully in the social sciences, especially the science of political economy. Thus his view of a methodology for the natural sciences was clearly influenced by his goal of developing a methodology suitable to lead to the desired positions in political economy. The 19th-century discussion about science, then, was very often at least subtextually a debate about politics and economics.

**Stamhuis, Ida**

*E-mail Address: stamhuis@nat.vu.nl* *Genetics at the Beginning of the 20th Century*

y the Mendelian C.B. Davenport contrasted the Mendelians with the biometricians in the beginning of the twentieth century. However Mendelian genetics was the result of the introduction of probabilistic and statistical methods in thinking on heredity. On the basis of a number of publications, of Johann Gregor Mendel, Hugo de Vries, Wilhelm Johannsen and others, this paper will demonstrate that the statistical approach played an essential role in the development of their ideas on heredity. As a result of a probabilistic and statistical approach Mendel discovered, and De Vries rediscovered, Mendel's laws. Additionally, Wilhelm Johannsen discussed this approach in chapter after chapter of his book *Er Exacten Erblchkeitslehre*. How it could happen that in the controversy between Mendelians and biometricians differences of opinion on statistical modeling came to play such an important role.

**Stapleford, Thomas**

*E-mail Address: tstaplef@fas.harvard.edu*

**"Workers and their families do not eat statistics": Econometrics from the "bottom-up" during World War II**

Fearing a repeat of the dramatic price increases that accompanied World War I, the US government acted to prevent similar price escalation during World War II. As part of this effort, the National War Labor Board used the Bureau of Labor Statistics' "cost-of-living" index to limit wage increases. In response, organized labor attacked both the NWLB's decision and the index itself, charging that the BLS was systematically underestimating the rise in the "cost of living." The battle led to several committee reviews of the index, all of which generally exonerated the BLS over labor's objections. My paper examines the dispute as a conflict between professional statisticians and a vision of econometrics built from the "bottom-up." On an overt level, the debate covered a wide range of issues: the meaning of "cost of living," the purpose of the index, the role of the Bureau, the significance and utility of a "statistical

average," as well as theoretical problems in price index calculation. At the same time, the very different professional cultures of the statisticians and the labor leaders led to a host of unarticulated issues that complicated the struggle. At its heart, the dispute hinged on who had the right to define the "cost of living": statisticians or working-class consumers (repeatedly gendered as "housewives" in labor's rhetoric). Overall, the debate allows me to examine several themes--like the production of econometric knowledge by the state, gender and consumer statistics, and "bottom-up" views of statistics--within a narrow historical episode.

### **Steinle, Friedrich**

*E-mail Address: steinle@mpiwg-berlin.mpg.de*

#### **Experiments in History and Philosophy of Science**

Recent historical and philosophical studies into research practice (Hacking, Gooding, Burian, Heidelberger) have shown that experimentation, far from being just a means for theory-testing, often has decisive functions in generating and stabilizing concepts and theories. This opens new perspectives into the significance of experimentation on a fundamental epistemic level. These epistemological insights, obtained through ground of historical studies, indicate that differentiated epistemological accounts of experiments need a serious look at history and historicity. But there is also the reverse direction. Recent historical accounts of experiment, of its materiality, locality and social setting, sometimes suffer from not including points such as the type of knowledge sought for and the relation between theorizing and experimenting. Experimental practice may be seriously misrepresented when those epistemological considerations are not included. In my talk, I will exemplify the problem by analyzing the case of exploratory experimentation, largely overlooked in the traditional philosophy of science. That it escaped attention for so long has to do both with its epistemological status and with the fact that it typically did (and does) not appear in the public statements of scientists, even if it constituted a major part of the work. The case illustrates the shortcomings of focussing exclusively either on historical context or on epistemological issues. Experimentation is a field in which combining philosophical and historical competences is not only an added bonus, but an essential requirement.

### **Stocking, George**

*E-mail Address: g-stocking@uchicago.edu*

#### **A.I.Hallowell's Boasian Evolutionism: Human Ir/Rationality in Cross-cultural, Evolutionary, and Personal Context**

Fifty years ago, the social psychologist Anne Roe conducted research on the intellectual creativity of sixty-four elite male native-born American scientists, including a life history interview, psychological testing (TAT's and Rorschachs), and a disguised intelligence test, followed up in 1962 by a second interview of those then surviving. Among the sixty-four were eight anthropologists, one of whom (A.I. Hallowell) was a member of the committee supervising my doctoral dissertation at the University of Pennsylvania in the late 1950s. With the possibility of a study of the group of eight in mind--as exemplary of anthropology in the United States in the post World War II Period--the present paper considers Hallowell's anthropological thought in such contexts as: his early socialism and pacifism, his training in Boasian culturalist anthropology, his fieldwork among the Ojibwa, his relation to the "outside" world during the depression, World War II, and the early Cold War, and the homicidal/matricidal career of his adopted son. While the latter tragic story may or may not have been an "ulterior motive" of the shift in Hallowell's anthropology from an orthodox Boasian culturalism to uncharacteristically Boasian interest in the evolution of human nature, it seems quite likely that my relationship to Hallowell was an "ulterior motive" for this paper.

**Stoeltzner, Michael**

*E-mail Address: Michael.Stoeltzner@sbg.ac.at*

**Franz Serafin Exner's Indeterminist Theory of Culture**

During almost one generation the experimentalist Franz Serafin Exner (1849-1926) was the center of Vienna's physical life. Yet beyond his activities as founder of the Institute of Radium Research and in finally overcoming the housing malaise of Viennese physics, he also had considerable influence on the formation of a specifically Viennese brand of indeterminism in physics. As early as in his inaugural address as Rector of the University of Vienna in 1908, Exner subscribed to the relative frequency interpretation of probability giving thus Boltzmann's legacy a new twist and extending indeterminism to a general paradigm embracing both the sciences and the humanities. The strict deterministic laws of macroscopic physics obtained in the limit of very many random events while the number of single events relevant in humanistic disciplines was at best sufficient to ascertain weak regularities, such as a global tendency towards the most probable state. Exner's unified outlook was not reductionist rather it resembled the unification intended by Alexander von Humboldt's physical description of the world. In a posthumous manuscript "From Chaos to the Present" Exner even considered culture as a natural product supervening on the various rising and declining peoples. By separating the individual microscopic and the ideal macroscopic level, Exner's indeterminist theory thus simultaneously opposed the Spenglerian anti-scientific challenge by claiming steady progress on the level of ideas and joined in with the pessimist criticism of civilization and the death of the arts.

**Sufian, Sandy**

*E-mail Address: sufians@ohsu.edu*

**Mapping the Marsh: Malaria and the Sharing of Medical Knowledge in Mandatory Palestine, 1920-1947**

This paper will explore the exchange of scientific information on malaria and swamp land among Zionist and American (Rockefeller Foundation) malariologists and British health officials in Palestine. In particular, the presenter will discuss the inclusion of Zionist malaria surveys and Rockefeller Foundation surveys within the annual British Department of Health reports. This inclusion reflected scientific collaboration in anti-malaria work between the two parties as seen most clearly in the establishment of the American Jewish Joint Distribution Committee's Malaria Research Unit and of the Rockefeller Foundation's Malaria Survey Section as part of the British Department of Health (until 1930). Such partnership, in addition to the same use of colonial medical discourses and techniques, suggests not only a shared imagining of Palestine, of the non-utility of swamp land and of the Palestinian Arabs who used it, but also a medical way of promoting Zionist settlement agendas in Palestine while utilizing Jewish and American capital investment for Palestine's development. Like other malaria work done in British colonies at the time, British, American and Zionist efforts to combat malaria as documented in malaria reports took a vector control approach to combating malaria which involved large engineering projects, detailed hydrographic surveys, and 'species sanitation.' These techniques were undertaken as opposed to a broad, horizontal public health perspective to attacking the problem. In so doing, the measurements emphasize a scientific rationality where swamps and spleens are mapped and medicalized while human subjects became largely invisible. The political use of malaria reports will form the last part of the paper. Even though malaria information was shared, these reports were often upheld or utilized for different ends. Besides promoting national settlement, Zionist officials often used malaria surveys as evidence of their efforts to develop the country (in contradistinction to their Palestinian Arab counterparts who were thought as allowing the land to remain 'fallow' and 'neglected'). For their part, the British generally upheld malaria information as proof of their effective rule. In addition, the British administration used malaria surveys to construct practical ways of preventing military fatalities from the

disease. Zionist claims regarding their development activities based on their surveys ultimately become the basis for a debate between the British administration and the Zionists about the differential development of Palestine by the Arabs and Jews. This debate will be outlined in the concluding part of the paper.

**Terrall, Mary**

*E-mail Address: terrall@history.ucla.edu*

**Conjecture and Empiricism in Enlightenment Life Science**

By the mid-18th century, whenever the question of how to understand the generation of living forms came up, it brought along related philosophical, theological and methodological freight. The ramifications of the problem of generation extended across several disciplines, and involved overlapping sets of medical men, academic anatomists, experimenters, natural historians, readers and philosophers. It was not a problem that found a ready solution no consensus was reached. Some writers were willing, even eager, to peer beyond the visible to speculate about fundamental forces and principles others recoiled with something like repugnance. The interplay between eager speculation and prudent restraint characterized this discursive terrain, and gave an edge of danger, a whiff of suspicion, to theories of generation that went beyond the mechanical to give matter self-directing powers. Conjecture as a mode of inquiry had gained credibility through the "Queries" appended to Newton's Opticks. Furthermore, men of science like Buffon and Maupertuis justified the forces of organization by analogy to the "penetrating" force of gravity, referring (at least implicitly) back to Newton's authority once again. Their critics argued on much the same ground as those who objected to gravity as an unnecessary and perhaps dangerous occult force. In spite of these resonances, Newtonian language and concepts were transformed when they moved into the complex discursive terrain of French Enlightenment science.

**Thackray,Arnold**

*E-mail Address:*

**Theerman, Paul**

*E-mail Address: paul\_theerman@nlm.nih.gov*

**Psychiatry and Social Progress after World War II: Julius Schreiber and the National Institute for Social Relations**

In the years immediately after World War II, a short-lived organization, the National Institute for Social Relations, promoted the alleviation of social ills through applied psychiatry. The Institute was the work of Dr. Julius Schreiber, a psychiatrist who had achieved morale successes in the war effort, first in at Army camps in California and then at the Pentagon, where he worked with the Menningers. Schreiber founded his Institute in Washington immediately after the war. He hoped to apply the insights that he had gained during the war to settle classic American problems of religious and racial prejudice and social anomie. The Institute made strategic alliances with social progressives and interfaith religious organizations. It created an active outreach and education program. Ultimately, though, the Institute could not become self-supporting. After two years, it disbanded, and Schreiber entered private practice, although he continued as an active speaker on psychiatry and social issues throughout his professional life. This paper will trace the life of this organization and its activities, and it will place these in the context of the immediate post-war era. The success of the war effort led many to think that the same coordinated application of resources, using the latest scientific principles, could attack and overcome the social ills that had re-emerged after the war. Schreiber's Institute was part of this hopeful era, as well as

part of the general disillusionment shortly afterwards.

### **Thibodeau, Philip**

*E-mail Address: pthib@arches.uga.edu*

#### **Why Euclid's Optics is Incompatible with Linear Perspective**

In his famous monograph, *Perspective as Symbolic Form*, Erwin Panofsky attempted to explain the failure of ancient Greek painters to develop consistent linear perspective. He correctly claimed that Euclid's *Optics*, Proposition 8 (magnitudes at disparate intervals are not seen as proportional to their distances,) would preclude the development of the geometric constructions such perspective requires. But Panofsky also took the proposition to express the Greeks' supposed awareness of curves created in the visual field by the retina. In fact, the proposition has no basis in actual perception, but is deduced directly from the axioms of the *Optics*. Proposition 8 is valid in terms of those axioms, and its negation invalid. Since the proposition entails that parallel straight lines will appear to be both straight and converging, the visual space studied in Euclid's *Optics* is non-Euclidean. Now the *Optics*' analysis of rectilinear figures is, when compared to its study of the appearances of spheres and circles, fairly crude. The reason is that rectilinear figures like squares generate paradoxical appearances, while circular figures do not. Euclid halted his investigation of rectilinear figures prematurely, to avoid the paradoxes but this left him unable to explore the constructions linear perspective uses. Thus, if linear perspective methods are to progress, one must ignore Proposition 8. And as Panofsky has also shown, that is precisely what the Renaissance did.

### **Timmons, Todd**

*E-mail Address: ttimmons@systema.westark.edu*

#### **Tension Between Practical and Theoretical Science in Nineteenth-Century America: The Case of Nathaniel Bowditch**

Nathaniel Bowditch was one of the leading mathematicians and scientists in early nineteenth-century America. His life and works illustrate the tension between practical and theoretical science during this period. The *New American Practical Navigator* was, and still is, a classic in navigation that earned Bowditch the respect of sailors and practical men of science throughout the world. His other major work, a translation and commentary on Laplace's *Mécanique Céleste* brought praise from the great mathematical astronomers of Europe. Although his fame resulted in several offers for academic positions, Bowditch chose to remain in his work as actuary and executive of several New England insurance companies. This paper will explore Bowditch's scientific career and how it relates to larger questions involving the nature of early American science.

### **Touwaide, Alain**

*E-mail Address: atouwaide@hotmail.com*

#### **Arabic Medicine in Greek Translation - How was it Translated ?**

Among the ca. 2,200 manuscripts that contain Greek medical texts, around 200 preserve material of all kind (from full treatises to brief notes and recipes) that is entitled as translated from Arabic or that can be identified as such. These texts, produced from the 11th century to the 15th, come from Southern Italy (11th century) or the Eastern parts of the Byzantine Empire (mainly during the 14th and 15th centuries) and deal mainly with pharmacology. In this paper, I shall focus on the techniques of translation. In preparing a critical edition of these texts, indeed, I have identified the original of some texts or copies of the first generation. The examination of these codices brings new light on the act of translating, not known through explicit statements. Among the results of the enquiry, it appears that the translations of the first period were probably prepared by bilingual doctors (especially in Southern Italy), while those

of a later period were done in collaboration by Arabic and Greek speaking people, working first on a transliteration of the Arabic text transliterated into Greek alphabet and, then, translating it properly. These conclusions are of primary importance because they probably can be transferred to other enterprises of translation (e.g. the translation of Greek science into Latin in the Late Antique World or into Arabic during the 9th century). This will contribute to a better understanding of the process of transfer of knowledge in the medieval Mediterranean.

**Touwaide, Alain**

*E-mail Address:*

**Arabic Medicine in Greek Translation--How was it Translated?**

**Turner, Roger**

*E-mail Address: hssexec@u.washington.edu*

**Tybjerg, Karin**

*E-mail Address: kt206@cam.ac.uk*

**A Geometry of Machines: Hero of Alexandria's Mechanical and Mathematical Treatises**

Hero of Alexandria's treatises on geometry, measurement and mechanics provide an intriguing mixture of systematic geometrical treatment and consideration of practical issues. They include strictly geometrical formulae for calculating areas, but they also deal with practical situations such as tunnel construction or the measurement of land. This mixture of interests makes Hero's work difficult to place and it is often characterized vaguely and unhelpfully as 'applied mathematics'. In my paper I shall explore in more detail how Hero combines the incontrovertibility of geometry with his own claims to practical consequence. Hero associates his work with geometry he makes frequent references to Archimedes and he constructs Archimedes as an authority of mechanics rather than geometry. He also expresses practical problems, for example tunnel construction, in a formulaic style similar to Euclidean demonstrations. At the same time he shows how geometry affords control in political situations such as the distribution of land or siege-war. Hero thus employs the high epistemological status of mathematics to project an image of mechanics as a systematic discipline. But he does more than that. He makes mechanical devices and methods part of geometry so that geometry can be complete only when mechanical devices are included. Moreover Hero shows how his combination of mechanical and practical expertise affords control over the environment and over enemies in situations of war. Hero of Alexandria's use of geometry makes manifest how 'mixed' or technical forms of knowledge appropriated and redefined disciplinary categories to make powerful claims to expertise.

**Van Berkel, Klaas**

*E-mail Address: k.van.berkel@let.rug.nl*

**The fruits of war. Dutch science under German occupation, 1940-1945**

When Hitler Germany invaded one European country after another, serious scientific work was soon interrupted until well after the war. This may be true for countries in Eastern Europe, but whether it is also true for countries in Northern and Western Europe is open to discussion. A close look at for instance Dutch science in this period reveals some of the complexities of this problem. After the initial disarray Dutch scientists found many ways to continue their research in more or less normal ways only during the final year of the war scientific work really collapsed, as can be demonstrated in the case of physics.

On the other hand, for those scientists who indeed had to abandon their laboratories, this sometimes only forced them to discontinue research programs that had long lost their fruitfulness and to redirect their research in ways that paid off surprisingly well after the war. Here the development of Dutch astronomy during and after the war is a good example. Of course, the war should not be regarded as a blessing in disguise, but it certainly wasn't the total disaster conventional wisdom has made us believe it was.

**Vanden Broecke, Steven**

*E-mail Address: steven.vandenbroecke@arts.kuleuven.ac.be*

**On the Natural-Philosophical and Textual Problems of Late Renaissance Astrology**

This paper discusses the various strategies by which high-profile astrologers of the 16th-century aimed at countering the enormous natural-philosophical and textual problems which Giovanni Pico's Disputations had thrown up in 1495. While Pico had suggested that each planet imparted identical effects to the sublunar realm, most astrologers clinged to the Ptolemaic idea that these effects were different for each celestial body. In order to establish the specific nature of each planet's influence, many took up a grand project of weather-observation in order to reconstruct astrological physics. Medical astrology, which advocated a moderate use of astro-meteorology for diagnosis, prognosis as well as therapy, stimulated this approach. Another model was found in the ancient parapegmata ascribed to farmers, pilots and physicians. These traditional models severely restricted both the traditional textual canon and the number of astrological parameters. Although some parts of astrological practice were supposedly open to contemporary verification and/or reconstruction, many others were not. One of the foremost examples of the latter category are the astrological houses. Renaissance astrological theorists generally took the existence of astrological houses, which seemed to be warranted by ancient experience, for granted. But this did not address another problem: how to dissolve the conflicting statements of various authoritative texts (e.g. Ptolemy vs. Firmicus Maternus) concerning the true method of house-division. This problem is discussed as an example of the responses to Pico's exposure of the internal contradictions of the astrological textual canon.

**Vetter, Jeremy**

*E-mail Address: jvetter@sas.upenn.edu*

**Getting Into the Field: Transportation Networks, Colonial Infrastructure, and the Making of Anthropological Knowledge in the Nineteenth Century**

In order to do scientific research in the field, the scientist must be able to get to the field site, be sustained while residing there, and return home safely--this seems obvious, almost trivial. Yet these practical aspects of doing field work are not incidental preconditions to the conduct of scientific research on the contrary, they are often crucial in shaping research directions, perceptions, and interpretations. This paper follows scientists into the field, by land and sea, to see how they took advantage of expanding transportation networks and colonial infrastructure in the nineteenth century to make their work possible. In particular, it examines how these practical issues of doing science in the field influenced the making of knowledge about human beings and their societies, which was integral to the emerging discipline of anthropology. It approaches this question through two contrasting examples: the anthropological work of Alfred Russel Wallace during his voyage by sea among the islands and peninsulas of the East Indies from 1848 to 1862, and the studies of American Indians through overland expeditions in the western United States by John Wesley Powell and others associated with the Bureau of American Ethnology a few decades later. By uncovering the role that getting into the field played in the making of knowledge there, this paper explores both the special characteristics of anthropology as a discipline with human subjects, and the more general features of scientific field practice in places with rapidly expanding transportation networks and colonial infrastructure for managing cross-cultural interactions.

**Waller, John**

*E-mail Address: jwaller1@hotmail.com*

**Protecting the Lineage: Doctors, Disease and Nineteenth-Century Marital Advice**

Belief in the heritability of chronic maladies such as scrofula, gout, consumption and insanity achieved the status of a core paradigmatic assumption among doctors of the early nineteenth century. These supposedly hereditary diseases were commonly described as highly resistant to therapeutic intervention and likely to entail on subsequent generations lives of suffering and stigmatization. Reflecting on this, most medical writers who wrote on the theme of inherited malady concurred in reproving the marriage of anyone carrying hereditary taints. Those who eschewed medical advice and had children with the consumptive, insane or scrofulous were also roundly condemned by doctors for irresponsibility and callous egoism. In scores of advice manuals, the necessity for marital decisions to be grounded in physiology as much as economics and aesthetics was repeatedly extolled. And by the middle decades of the century, debate as to the propriety of avoiding marriages with the hereditarily ill had emerged as a powerful medical discourse. Not least because these medical injunctions have been almost entirely overlooked by historians, the aims of this paper are to trace how medical ideas of hereditary disease were disseminated into the public sphere and how, once there, they impacted upon reproductive thought and behavior. Concentrating on medical advice manuals written for a wide audience, I will also consider the strategic underpinnings of the increasing stress placed by nineteenth-century doctors on the subject of heredity disease; the receptivity of the public to medical hereditarianism; and, finally, the broader implications this discourse had for the later emergence of organized eugenics movements in both Britain and America.

**Watkins, Elizabeth**

*E-mail Address: ewatkins@andrew.cmu.edu*

**Science Confronts Aging: The Case of Hormone Replacement Therapy**

This paper explores the role of scientists in the successful marketing of hormone replacement therapy to older women and their physicians. In the mid to late 1970s, the fate of estrogen replacement therapy was very much in question, because scientific studies had demonstrated that estrogen use increased the risk of endometrial cancer. In the 1980s, however, laboratory, clinical, and epidemiological data helped to revive the popularity of hormone replacement for postmenopausal women, by demonstrating that this drug therapy could prevent, or at least forestall, the development of osteoporosis. Pharmaceutical manufacturers used scientific studies to recapture the market for hormone replacement, by advertising the drugs' alleged long-term health benefits. The expanded recommendation for prescribing hormone therapy to prevent osteoporosis in older women was based on scientific studies that convinced both government advisors and practicing physicians of the validity of estrogen's protection against bone loss. These investigations - some carefully conceived and carried out, others sloppily designed and executed - were highly valued and influential in shifting the pendulum of approval toward long-term use of hormone therapy. In the late 20th century, doctors increasingly relied on laboratory scientists to help them make diagnoses (witness the profusion of laboratory tests) and determine treatments (thanks to the multitude of new drugs flowing from academic and industrial labs). In this paper, I argue that the prescription and use of hormone replacement drugs were influenced by the increasingly authoritative voices of laboratory and epidemiological researchers, even though their results were not only contradictory, but also difficult to interpret.

**Weikart, Richard**

*E-mail Address: rweikart@toto.csustan.edu*

## **Darwinism, Monism, and the Search for a Scientific Ethics in Germany, 1890-1914**

Around 1900 German intellectuals grappled with the implications of secularization for ethics. Catholics and Protestants routinely accused scientific materialists, positivists, and monists with undermining the (religious) basis for ethics. Many materialists and monists admitted that their world view overturned many traditional moral values, but most hoped to replace Judeo-Christian ethics with a secularized or even "scientific" ethics. Many organizations sprang up in Germany to promote a "new ethics": the Society for Ethical Culture, the Monist League, the International Society for Ethics and Culture, the Society for Race Hygiene, and the League for the Protection of Mothers, to name a few. For some leading intellectuals, especially scientists and physicians, Darwinism played a key role in this attempt to reformulate ethics on a non-religious basis. The leading psychiatrist August Forel and some other leading Darwinists argued that Darwinism proved that morals were mutable and relative. Forel, Ernst Haeckel, and many other Darwinists criticized Christian morality for emphasizing compassion and pity for the weak to the detriment of self-assertion and self-preservation. However, they still maintained the necessity for altruism, since it was grounded in social instincts, a product of Darwinian natural selection. Forel, Haeckel, and many leading eugenicists, including the ethical philosopher Christian von Ehrenfels, exalted biological evolution itself to the status of a moral goal. According to them, whatever promotes evolutionary progress is morally good, while whatever stymies it is morally bad.

### **Weinstein, Debbie**

*E-mail Address: dfweinst@fas.harvard.edu*

#### **Diagnosing Culture and Family in the History of Family Therapy**

This paper traces the various uses of the culture concept by family system therapists and theorists who were interested in the impact of culture on the relationship between family and mental illness. Developed as a new field of psychotherapy in the 1950s and 1960s, family therapy was predicated on several assumptions: the universal existence of an identifiable unit called the family, the link between individual psychological distress and the family system, the ability to distinguish a normal family from a pathological family, and the possibility of providing treatment to a pathological family. Many family therapists drew on contemporary sociological and anthropological notions of culture as a framework for understanding the nature of "the family" as their central category of analysis. Discussions in the main family therapy journal, *Family Process*, exemplified the multiple meanings attributed to the culture concept, ranging from the values and patterns linking individuals to a particular society, to the cause of variation in families' function and structure, to the marker of differences in psychopathology. Such meanings were embedded in the journal's many articles on cross-cultural topics, such as a Malaysian experience of cross-cultural family therapy, the role of family conflict in the psychopathology of the Israeli kibbutz child, and multi-generational attitudes toward psychosis in Norwegian families. While cross-cultural studies held the potential to broaden the application of family therapy, they also paradoxically challenged some of the field's basic premises.

### **Westwick, Peter**

*E-mail Address: westwick@hss.caltech.edu*

#### **Business Management Philosophies and the Jet Propulsion Lab in the 1990s**

In the 1990s the administrators of NASA's Jet Propulsion Lab struggled to adapt to the post-Cold War space program. JPL managers sought answers to their problems in industrial management philosophies. They seized on two related approaches: Total Quality Management, a trend then sweeping corporate America, which emphasized customer service and employee empowerment and process-based management, which focused not on particular tasks but on abstract processes, captured in a profusion of flow-charts. These management philosophies reflect a general shift in corporate organization in the last

quarter of the twentieth century, away from the classic hierarchical structure of the vertically integrated firm to a flexible, non-hierarchical structure that responds to mobility and flux. They also suggest a reaction against technoscientific rationalism in their lingo of enabling, nurturing, and partnering. The theoretical interest taken by scientists and engineers in management techniques is itself an interesting phenomenon: one does not expect to find clippings from *Fortune* and the *Harvard Business Review* in the reading files of scientists. Instead of taking scientific approaches and applying them to management, as in the Taylorism of the 1920s or the systems engineering of the 1950s and 1960s, JPL took industrial techniques and applied them to science and technology. But techniques for managing manufacturing processes proved difficult to transfer to a research environment and despite a quantitative side that emphasized measurable "metrics," their holistic vocabulary encountered resistance among hard-headed technical staff in the laboratory.

### **Williams, Elizabeth**

*E-mail Address: williea@Okstate.edu*

#### **The "Newtonian" Defense of Medical Vitalism in Eighteenth-Century France**

It is a commonplace of medical history that vitalism re-emerged in the mid-eighteenth century to contest iatromechanist doctrines that had come to dominate medical theory in Europe. The precise character of the iatromechanism challenged by vitalists has, however, been little explored and has often been characterized simply as a blend of Cartesian and Newtonian elements. It has therefore been commonly assumed that medical vitalists deplored all mechanist theorists, including Newton. This paper seeks to modify this view by focusing on the uses to which the label "Newtonian" was put by vitalist theorists of the Montpellier school. At mid-century, in the work of Theophile de Bordeu and his close associate, the physician and chemist G.F. Venel, hostility to Newton was, indeed, an important feature of vitalist thinking. But by the 1770s, the principal standard-bearer of Montpellier vitalism, Paul-Joseph Barthez, invoked Newton's name to defend his own use of a concept of vital "force" that mechanist-minded critics denigrated as "occult." Praising Newton, Barthez and his disciples sought to associate their own approach with his by arguing that the effects of vital force could be demonstrated even if its ultimate nature could not be defined. Yet in this vitalist use of "Newtonianism," no mention was made of the centrality of mathematical demonstration to Newton or of the vitalists' own skepticism about the potential and utility of mathematics in the science of life. This paper will argue that Barthezian-style "Newtonianism" constituted protective coloring, a rhetorical strategy intended to associate vitalism with the mainstream movement of inductive science while claiming Newton himself as an ally in the struggle against the theoretical "excesses" of medical mechanists.

### **Wisnioski, Matthew**

*E-mail Address: mwisnios@princeton.edu*

#### **Playing Games: Chess, Automata, and Artificial Intelligence**

Chess has been described as the *Drosophila* of artificial intelligence (AI). Indeed, for the past fifty years almost every public headline about AI has referred to a machine's ability to play chess, a trend that culminated spectacularly in the 1997 Kasparov vs. Deep Blue challenge. Yet, I contend, aside from its initial incorporation into the study of intelligent machines in the late 1940s, chess has played a minimal role in the AI research program. How, then, do we explain the seemingly disparate focus on chess inside and outside of the AI community? I attempt to answer this question by investigating how and why chess came to be associated with AI, and how that perception has persisted in popular culture. I do so by examining technical literature on chess and computers, popular science magazines and books, science fiction, and cultural artifacts. I also address the long cultural traditions of chess and automata. The questions I pose include the following: Why is the ability to play chess considered to be indicative of

intelligence? Why do people believe that automata can think? What do rocket-powered Frisbees have to do with AI? Most important, what do historians of science and technology studying modernity gain by examining popular culture?

**Wolfe, Audra**

*E-mail Address: [awolfe@sas.upenn.edu](mailto:awolfe@sas.upenn.edu)*

**Science and Liberty for All: The Biological Sciences Curriculum Study**

The 1957 launch of Sputnik catalyzed nascent efforts to upgrade American schools. Many blamed the United States' perceived shortcomings on an educational system that valued social skills over scientific and technical knowledge. University scientists spearheaded a number of experimental educational programs designed to close the "gap" between cutting-edge research and secondary education. Unlike the Physical Sciences Curriculum Study or the Illinois Mathematics Study Group, the Biological Sciences Curriculum Study (BSCS) imagined itself as an organization that worked closely with educational professionals and attempted to reach all high school students. Early archival documents from the BSCS show that its leaders hoped that teaching students about evolution would prepare them for citizenship in the nuclear and space age. Since biology was the only science course taken by eight of ten high school students, the BSCS saw a "tremendous opportunity and grave responsibility" to inculcate a scientific worldview in students, regardless of ability or vocational preferences. The idea that familiarity with science would improve democracy was not new-but whereas public understanding of science programs separated science from its public, the BSCS advanced an inclusive philosophy that encouraged students to participate in the scientific enterprise through laboratory experiments and research. BSCS leadership saw themselves as stewards of American democracy, ensuring a better future by exposing schoolchildren to the latest discoveries of the biological sciences. This paper examines the urges behind and the ironies inherent in an inclusive scientific program that brought elite university scientists directly in contact with American students, parents, and teachers.