



SCIENCE AND LAW

Neuroscience in the Courts— A Revolution in Justice?

New imaging tools that show the brain in action raise the prospect that the courts might someday be able to reliably assess whether a witness has lied during pre-trial statements or whether a candidate for probation has a propensity to violence. But if human actions ever could be explained by a close analysis of the firing of neurons, would a criminal defendant then be able to claim that he is not really guilty but simply the victim of a “broken brain”?

That is the sort of question judges and lawyers may have to grapple with in the courtroom in the future—and at a seminar organized by AAAS, 16 state and federal judges got an intriguing preview of the emerging issues. The seminar, held 29 to 30 June at the Dana Center in Washington, D.C., was co-sponsored by the Federal Judicial Center and the National Center for State Courts, with funding from the Charles A. Dana Foundation.



Barbara Jacobs Rothstein and David Heeger.

Experts told the judges about brain-scanning technologies such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET). They heard about the formation of memory and whether it may be possible to distinguish true memories from false ones. They also heard about the possible neurological bases for violent and antisocial behavior.

The judges broke into teams to consider several hypothetical case studies, including whether a brain scanner that proved capable of identifying a propensity to violence should be used in jail assignments for convicted felons or to help decide whether a job applicant is suitable for employment. In general, the judicial reaction

was cautious, with much talk about how to define “propensity” and whether such judgments can ever be made in isolation.

There was lively discussion about fMRI, a technology that can produce real-time images of people’s brains as they answer questions, listen to sounds, view images, and respond to other stimuli. Some studies have shown that several regions of the brain, including the anterior cingulate cortex, appear to be active when a person is lying. Two private companies already are marketing fMRI “lie detection” services to police departments and U.S. government agencies, including the Department of Defense, the Department of Justice, the National Security Agency, and the CIA.

But David Heeger, a professor of psychology and neural science at New York University, cautioned the judges that fMRI is not a suitable lie detector now and may never fill the bill, even though it has the potential to outperform the traditional polygraph. In key studies, research subjects were instructed to lie and tested in settings where they knew there would be no serious consequences for lying. Moreover, the anterior cingulate cortex and other brain areas implicated in lying appear to play roles in a wide range of cognitive functions. So it is difficult to draw a specific link between activity in these brain regions and lying, critics say.

Such issues are of more than academic interest to the judges. Under the U.S. Supreme Court’s *Daubert* ruling in 1993 and two subsequent rulings, trial judges have a gatekeeping responsibility in determining the validity of scientific evidence and all expert testimony.

“We judges are often at a point where we have to make very important decisions at the cutting edge of the juxtaposition of law and science,” said Barbara Jacobs Rothstein, director of the Federal Judicial Center and a federal judge for the Western District of Washington state.

As science gains a better understanding of the physical basis in the brain for certain behaviors, some specialists argue that concepts such as free will, competency, and legal responsibility may be open to challenge. Against that backdrop, they say, it is important that judges be edu-

cated and informed about the scientific status of such neuroscience methods as imaging studies.

“I think law generally is behind the curve of science,” said Stephen Spindler, a state judge in Indiana. “We don’t get to deal with these things until someone springs them upon us. Law is reactive, not proactive, and we’re getting a preview of what we can expect, maybe not tomorrow or next year, but coming down the pike.”

The judicial seminar continues the effort by AAAS to bring together specialists from diverse fields to talk about the implications of neuroscience. Mark S. Frankel, the head of AAAS’s Scientific Freedom, Responsibility and Law Program, said another neuroscience seminar for judges will be held 7 to 8 December at Stanford University in California.

—Earl Lane

SCIENCE COMMUNICATION

Science, AAAS Assess “State of the Planet”

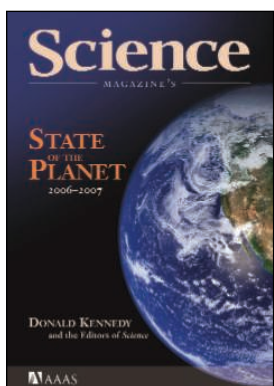
The ability to address the critical environmental issues of our time—such as climate change, the health of Earth’s oceans, and sustainability—is often checked by uncertainty and misunderstanding among policy-makers and the public. Now *Science* and AAAS have published a new volume that is designed to provide a state-of-the-art assessment of the complex, interrelated challenges that will shape our environmental future.

“*Science Magazine’s State of the Planet 2006–2007*” [Island Press, June 2006, 201 pp.; \$16.95 soft/\$32 hard; ISBN: 1597260630] provides a clear, accessible view of scientific consensus on the environmental threats confronting Earth. The new volume includes three dozen essays and news stories, written by some of the world’s most respected researchers, policy experts, and science journalists.

In the book’s introduction, *Science* Editor-in-Chief Donald Kennedy notes that resources essential to life on Earth are closely connected to the health of the environment. The quality of fresh water depends on the condition of watershed forests. Agriculture depends on the vitality of surrounding ecosystems that are home to bees and birds. Climate change affects the distribution of plants and animals in the wild.

“To the editors of *Science*, these relationships—and the changes in them as humans continue to alter the world—comprise the most important and challenging issues societies

face,” Kennedy writes. “Without scientific understanding, those who will make policies in the future will be forced to do so without the most essential tool they could have.”



“Science Magazine’s State of the Planet 2006–2007”

The new book is a compilation of articles previously published in *Science* and recently updated, plus three new summary essays by Kennedy. The articles were chosen and assembled by editors at the journal.

At the heart of the book is a landmark 1968 essay in *Science*, “The Tragedy of the Commons,” by the late Garrett Hardin, formerly a professor of human ecology at the University of California at Santa Barbara. (“The Commons” is a term that describes the environment shared by all of life, and on which all of life depends.) Other essays in the new book originally were published in *Science* in November and December 2003 as part of a series called “The State of the Planet.”

The new book features an international roster of top environmental scholars. One of the essays, “The Struggle to Govern the Commons,” won the 2005 Sustainability Science Award from the Ecological Society of America. It was written by Thomas Dietz, director of the Environmental Science and Policy Program at Michigan State University; Elinor Ostrom, co-director of the Center for the Study of Institutions, Population and Environmental Change at Indiana University; and Paul C. Stern at the Division of Social and Behavioral Sciences and Education at the U.S. National Academies in Washington, D.C.

Among the other contributors:

- Martin Jenkins from the World Conservation Monitoring Centre of the United Nations Environment Programme in Cambridge, U.K., writing on the prospects for biodiversity. Jenkins is co-author of the “World Atlas of Biodiversity”;
- Hajime Akimoto, director of the Atmospheric Composition Research Program at the Frontier Research Center for Global Change in Yokohama, Japan, writing on global air quality;
- Robert T. Watson, chief scientist and director for Environmentally and Socially Sustainable Development at the World Bank, writing on climate change and the Kyoto Protocol; and
- Joel E. Cohen, an award-winning researcher, prolific author and head of the Laboratory of Populations at Rockefeller University and

Columbia University in New York, writing on population.

To order the book, go to www.islandpress.org and search for “State of the Planet.”

SCIENCE POLICY

AAAS Testifies on Stem Cell Research

AAAS CEO Alan I. Leshner recommended to a U.S. Senate panel that federally funded science should explore the broadest possible range of stem cell research, including techniques that require the use of early-stage human embryos.

Leshner, the executive publisher of *Science*, was among those who testified on a bill co-sponsored by U.S. Senators Rick Santorum and Arlen Specter, both Pennsylvania Republicans, to promote stem cell research that does not require the use of human embryos.

Such research is important, Leshner told a subcommittee of the Appropriations Committee on 27 June. But, he added, the most promising avenues to date appear to be derivation of stem cells from early-stage embryos at in vitro fertilization (IVF) clinics or created by somatic cell nuclear transfer. “The alternatives that are now being developed are, in fact, intriguing,” Leshner said, “but we really don’t know what their ultimate utility will be, and each has potential problems or complications.”

Specter said he backs research on alternative stem cell methods, while continuing to push for a vote on legislation he has co-sponsored with Senator Tom Harkin (D–IA) that would authorize federally funded research on new stem cell lines derived from the microscopic embryos left over in the IVF process. President George W. Bush issued a directive in 2001 that federal dollars could be used for research only on embryonic stem cell lines already in existence at that time.

—Earl Lane

ELECTIONS

AAAS Annual Election: Preliminary Announcement

The 2006 AAAS election of general and section officers will be held in September. All members will receive a ballot for election of the president-elect, members of the Board of Directors, and members of the Committee on Nominations. Members registered in one to three sections will receive ballots for election of the chair-elect, member-at-large of the Section Committee, and members of the Electorate Nominating Committee for each section.

Members enrolled in the following sections will also elect Council delegates: Anthropology; Astronomy; Biological Sciences; Chemistry; Geology and Geography; Mathematics; Neuroscience; and Physics.

Candidates for all offices are listed below. Additional names may be placed in nomination for any office by petition submitted to the Chief Executive Officer no later than 25 August. Petitions nominating candidates for president-elect, members of the Board, or members of the Committee on Nominations must bear the signatures of at least 100 members of the Association. Petitions nominating candidates for any section office must bear the signatures of at least 50 members of the section. A petition to place an additional name in nomination for any office must be accompanied by the nominee’s curriculum vitae and statement of acceptance of nomination.

Biographical information for the following candidates will be enclosed with the ballots mailed to members in September.

Slate of Candidates

GENERAL ELECTION

President-Elect: James McCarthy, Harvard University; Richard Meserve, Carnegie Institution of Washington.

Board of Directors: Linda Katehi, University of Illinois, Urbana-Champaign; Clark Spencer Larsen, Ohio State University; Cherry Murray, Lawrence Livermore National Laboratories; David Tirrell, California Institute of Technology.

Committee on Nominations: Floyd Bloom, Neurome Inc.; Rita Colwell, University of Maryland, College Park; Thomas Everhart, California Institute of Technology; Mary Good, University of Arkansas, Little Rock; Jane Lubchenco, Oregon State University; Ronald Phillips, University of Minnesota; Robert Richardson, Cornell University; Warren Washington, National Center for Atmospheric Research.

SECTION ELECTIONS

Agriculture, Food, and Renewable Resources

Chair Elect: Roger N. Beachy, Washington University, St. Louis; Brian A. Larkins, University of Arizona, Tucson.

Member-at-Large of the Section Committee: Charles J. Arntzen, Arizona State University; James D.

Murray, University of California, Davis.
Electorate Nominating Committee: Douglas O. Adams, University of California, Davis; Richard A. Dixon, Samuel Roberts Noble Foundation; Sally A. Mackenzie, University of Nebraska, Lincoln; James E. Womack, Texas A&M University.

Anthropology

Chair Elect: Eugenie C. Scott, National Center for Science Education; Emöke J. E. Szathmáry, University of Manitoba.

Member-at-Large of the Section Committee: Leslie C. Aiello, Wenner-Gren Foundation for Anthropological Research; Dennis H. O'Rourke, University of Utah.

Electorate Nominating Committee: Daniel E. Brown, University of Hawaii, Hilo; Kathleen A. O'Connor, University of Washington; G. Phillip Rightmire, Binghamton University, SUNY; Payson Sheets, University of Colorado, Boulder.

Council Delegate: Michael A. Little, Binghamton University, SUNY; Ellen Messer, Brandeis University.

Astronomy

Chair Elect: Alan P. Boss, Carnegie Institution of Washington; Jill Cornell Tarter, SETI Institute.

Member-at-Large of the Section Committee: Carey Michael Lisse, Johns Hopkins University Applied Physics Laboratory; Tammy A. Smecker-Hane, University of California, Irvine.

Electorate Nominating Committee: Alan Marscher, Boston University; Heidi Newberg, Rensselaer Polytechnic Institute; Saeqa Dil Vrtilek, Smithsonian Astrophysical Observatory; Alwyn Wooten, National Radio Observatory.

Council Delegate: Guiseppina (Pepi) Fabbiano, Smithsonian Astrophysical Observatory; Heidi B. Hammel, Space Science Institute, Boulder.

Atmospheric and Hydrospheric Sciences

Chair Elect: Robert Harriss, Houston Advanced Research Center; Anne M. Thompson, Pennsylvania State University.

Member-at-Large of the Section Committee: Peter H. Gleick, Pacific Institute; James F. Kasting, Pennsylvania State University.

Electorate Nominating Committee: Walter F. Dabberdt, Vaisala, Inc.; Jennifer A. Francis, Rutgers University; Jack A. Kaye, Science Mission Directorate; Patricia Quinn, NOAA Pacific Marine Environmental Laboratory.

Biological Sciences

Chair Elect: H. Jane Brockmann, University of Florida; Mariana Wolfner, Cornell University.

Member-at-Large of the Section Committee: Anne L. Calof, University of California, Irvine; Yolanda P. Cruz, Oberlin College.

Electorate Nominating Committee: Kate Bar-

ald, University of Michigan; Joel Huberman, State University of New York, Buffalo; Maxine Linial, University of Washington; Jon Seger, University of Utah.

Council Delegate: Lois A. Abbott, University of Colorado, Boulder; Enoch Baldwin, University of California, Davis; Brenda Bass, University of Utah; Nancy Beckage, University of California, Riverside; Doug Cole, University of Idaho; Michael Cox, University of Wisconsin; Charles Ettensohn, Carnegie-Mellon; Toby Kellogg, University of Missouri; Catherine Krull, University of Michigan; J. Lawrence Marsh, University of California, Irvine; Michael Nachman, University of Arizona; David Queller, Rice University; Laurel Raftery, Massachusetts General Hospital; Edmund Rucker, University of Missouri, Columbia; Johanna Schmitt, Brown University; Gerald B. Selzer, National Science Foundation; Diane Shakes, College of William and Mary; Rob Steele, University of California, Irvine.

Chemistry

Chair Elect: Steven L. Bernasek, Princeton University; Wayne L. Gladfelter, University of Minnesota.

Member-at-Large of the Section Committee: Dennis A. Dougherty, California Institute of Technology; Galen D. Stucky, University of California, Santa Barbara.

Electorate Nominating Committee: Gregory C. Fu, Massachusetts Institute of Technology; Joseph A. Gardella Jr., State University of New York, Buffalo; Linda C. Hsieh-Wilson, California Institute of Technology; Thomas Kodadek, University of Texas Southwestern Medical Center.

Council Delegate: Andreja Bakac, Iowa State University; Jon Clardy, Harvard Medical School; Mark A. Johnson, Yale University; C. Bradley Moore, Northwestern University; Buddy D. Ratner, University of Washington; Nicholas Winograd, Pennsylvania State University.

Dentistry and Oral Health Sciences

Chair Elect: Adele L. Boskey, Hospital for Special Surgery; Mary MacDougall, University of Alabama, Birmingham.

Member-at-Large of the Section Committee: Susan W. Herring, University of Washington; Paul H. Krebsbach, University of Michigan.

Electorate Nominating Committee: Luisa Ann DiPietro, University of Illinois, Chicago; Pete X. Ma, University of Michigan; Frank C. Nichols, University of Connecticut, Farmington; Ichiro Nishimura, University of California, Los Angeles.

Education

Chair Elect: George D. Nelson, Western Washington University; Gordon E. Uno, University of Oklahoma, Norman.

Member-at-Large of the Section Committee: Jay Labov, National Research Council; Gerald Wheeler, National Science Teachers Association.

Electorate Nominating Committee: Jeanette E. Brown, Hillsborough, NJ; Cathryn A. Manduca, Carleton College; Carlo Parravano, Merck Institute for Science Education; Jodi L. Wesemann, American Chemical Society.

Engineering

Chair Elect: Larry V. McIntire, Georgia Institute of Technology/Emory University; Priscilla P. Nelson, New Jersey Institute of Technology.

Member-at-Large of the Section Committee: Morton H. Friedman, Duke University Medical Center; Debbie A. Niemeier, University of California, Davis.

Electorate Nominating Committee: Mikhail A. Anisimov, University of Maryland, College Park; Rafael L. Bras, Massachusetts Institute of Technology; Melba M. Crawford, University of Texas, Austin; Corinne Lengsfeld, University of Denver.

General Interest in Science and Engineering

Chair Elect: Larry J. Anderson, Centers for Disease Control and Prevention; Barbara Gastel, Texas A&M University.

Member-at-Large of the Section Committee: Lynne Timpani Friedmann, Friedmann Communications; Renata Simone, WGHB Boston.

Electorate Nominating Committee: Earle M. Holland, Ohio State University; Don M. Jordan, University of South Carolina; Earnestine Psalmonds, National Science Foundation; Susan Pschorr, Platypus Technologies, LLC.

Geology and Geography

Chair Elect: Victor R. Baker, University of Arizona, Tucson; Richard A. Marston, Kansas State University.

Member-at-Large of the Section Committee: Sally P. Horn, University of Tennessee, Knoxville; Lonnie G. Thompson, Ohio State University.

Electorate Nominating Committee: Kelly A. Crews-Meyer, University of Texas, Austin; Sherilyn C. Fritz, University of Nebraska, Lincoln; Carol Harden, University of Tennessee; Neil D. Opdyke, University of Florida, Gainesville.

Council Delegate: William E. Easterling, Pennsylvania State University; Douglas J. Sherman, Texas A&M University.

History and Philosophy of Science

Chair Elect: Noretta Koetge, Indiana University; Thomas Nickels, University of Nevada, Reno.

Member-at-Large of the Section Committee: Karen A. Rader, Virginia Commonwealth University; Robert C. Richardson, University of Cincinnati.

Electorate Nominating Committee: Richard M. Burian, Virginia Polytechnic Institute and State University, Blacksburg; David C. Cassidy, Hofstra University; Mark A. Largent, Michigan State University; Kathryn M. Olesko, Georgetown University.

Industrial Science and Technology

Chair Elect: David L. Bodde, Clemson University; Stan Bull, National Renewable Energy Laboratory.

Member-at-Large of the Section Committee: Carol E. Kessler, Pacific Center for Global Security; Thomas Mason, Oak Ridge National Laboratory.

Electorate Nominating Committee: Ana Ivelisse Aviles, National Institute of Standards and Technology; Micah D. Lowenthal, The National Academies; Joyce A. Nettleton, Consultant, Denver, CO; Aaron Ormond, Global Food Technologies.

Information, Computing, and Communication

Chair Elect: Jose-Marie Griffiths, University of North Carolina, Chapel Hill; Michael R. Nelson, IBM Corporation.

Member-at-Large of the Section Committee: Christine L. Borgman, University of California, Los Angeles; Elliot R. Siegel, National Library of Medicine/NIH.

Electorate Nominating Committee: Gladys A. Cotter, U.S. Geological Survey; Deborah Estrin, University of California, Los Angeles; Richard K. Johnson, American University; Fred B. Schneider, Cornell University.

Linguistics and Language Science

Chair Elect: David W. Lightfoot, National Science Foundation; Frederick J. Newmeyer, University of Washington.

Member-at-Large of the Section Committee: Catherine N. Ball, MITRE Corporation; Wendy K. Wilkins, Michigan State University.

Electorate Nominating Committee: Miriam Butt, University of Konstanz; Barbara Lust, Cornell University; Robert E. Remez, Barnard College; Sarah G. Thomason, University of Michigan.

Mathematics

Chair Elect: William Jaco, Oklahoma State University; Warren Page, City University of New York.

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Council Delegate: James H. Curry, University of Colorado, Boulder; Joel L. Lebowitz, Rutgers University.

Medical Sciences

Chair Elect: Gail H. Cassell, Eli Lilly & Co.; Neal Nathanson, University of Pennsylvania Medical Center.

Member-at-Large of the Section Committee: Rafi Ahmed, Emory University, Atlanta; R. Alan B. Ezekowitz, Harvard Medical School.

Electorate Nominating Committee: Carl June, Abramson Family Cancer Research Institute; Michael Lederman, University Hospitals of Cleveland; Ronald Swanstrom, University of North Carolina, Chapel Hill; Peter F. Weller, Harvard Medical School.

Neuroscience

Chair Elect: John H. Byrne, University of Texas Medical School/Health Science Center, Houston; John F. Disterhoft, Northwestern University.

Member-at-Large of the Section Committee: Gail D. Burd, University of Arizona, Tucson; Charles D. Gilbert, Rockefeller University.

Electorate Nominating Committee: Theodore W. Berger, University of Southern California; György Buzsáki, Rutgers University; Alison Goate, Washington University School of Medicine, St. Louis; Gianluca Tosini, Morehouse University School of Medicine.

Council Delegate: Patricia K. Kuhl, University of Washington; Lynn C. Robertson, University of California, Berkeley.

Pharmaceutical Science

Chair Elect: Kenneth L. Audus, University of Kansas, Lawrence; Danny D. Shen, University of Washington.

Member-at-Large of the Section Committee: Michael Mayersohn, University of Arizona, Tucson; Ian A. Blair, University of Pennsylvania.

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Physics

Chair Elect: Anthony M. Johnson, University of Maryland, Baltimore County; Cherry Murray, Lawrence Livermore National Laboratory.

Member-at-Large of the Section Committee: Sally Dawson, Brookhaven National Laboratory; Noémie B. Koller, Rutgers University.

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Barbara Gross Levi, Stanford University; Pierre Meystre, University of Arizona, Tucson.

Council Delegate: Leonard J. Brillson, Ohio State University; W. Carl Lineberger, University of Colorado, Boulder; Luz J. Martinez-Miranda, University of Maryland, College Park; Miriam P. Sarachik, City College of New York.

Psychology

Chair Elect: Lila Gleitman, University of Pennsylvania; Randy Nelson, Ohio State University.

Member-at-Large of the Section Committee: Mike Fanselow, University of California, Los Angeles; Morton Gernsbacher, University of Wisconsin at Madison.

Electorate Nominating Committee: Richard Doty, University of Pennsylvania; Merrill Garrett, University of Arizona; John Kihlstrom, University of California, Berkeley; Martin Sarter, University of Michigan.

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Electorate Nominating Committee: Gary L. Albrecht, University of Illinois at Chicago; Henry E. Brady, University of California, Berkeley; Gary King, Harvard University; Alvin E. Roth, Harvard University.

Societal Impacts of Science and Engineering

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Electorate Nominating Committee: Ann Bostrom, Georgia Institute of Technology; Halina Szejnwald Brown, Clark University; Robert Cook-Deegan, Duke University; David B. Resnik, National Institute of Environmental Health Sciences/NIH.

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Member-at-Large of the Section Committee: Robert E. Fay, Bureau of the Census; Francoise Seiller-Moiseiwitsch, Georgetown University Medical Center.

Electorate Nominating Committee: Norman Breslow, University of Washington; Marie Davidian, North Carolina State University; Fritz Scheuern, National Opinion Research Center; Judith Tanur, Stony Brook University.

Science

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