Richard Finno is professor of civil and environmental engineering at McCormick School of Engineering and Applied Science. His research combines theory and practice to reconcile full-scale field performance of earth-supported structures with analytical and numerical predictions. An article about his research may be found on page 29. Photo by Andrew Campbell.

Dorothy Roberts, Kirkland & Ellis Professor of Law, joined Northwestern’s School of Law faculty in fall 1998 with a joint appointment as a faculty fellow at the Institute for Policy Research. She is a frequent speaker and prolific scholar on issues related to race, gender, and the law. Her latest book, *Fatal Invention: How Science, Politics, and Big Business Recreate Race in the Twenty-first Century*, will be published by The New Press in July. Read more about it on page 41. Photo by Randy Lee Belice.

Gad Allon (left) is associate professor of managerial economics and decision sciences at Kellogg School of Management. His research interests include operations management in general, and service operations and operations strategy in particular. Achal Bassamboo is associate professor of managerial economics and decision sciences at Kellogg School of Management. His current research involves designing flexible service systems with a focus on capacity planning and effects of parameter uncertainty. Find out more about their research on page 21. Photo by Andrew Campbell.

Miriam Gamoran Sherin is associate professor of learning sciences at the School of Education and Social Policy. Sherin’s research interests include mathematics teaching and learning, teacher cognition, and teacher education. Her forthcoming book *Mathematics Teacher Noticing: Seeing Through Teachers’ Eyes* will be published in 2011 by Taylor and Francis. Her Research Excellence article may be found on page 44. Photo by Bruce Sherin.
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Dear Colleagues,

Looking back on the nearly quarter century since I arrived here as an assistant professor in 1988, there is no doubt: Northwestern has made tremendous progress. The map for that journey was provided by two strategic plans, *The Highest Order of Excellence* (1998–2002) and *The Highest Order of Excellence II* (2005–10). We are about to launch our next major strategic plan — a plan built with guidance from across the University, founded on our current excellence, and offering a vision of outstanding teaching, the development of transformative leaders, and research of the highest impact.
An obvious sign of the growth and strength of our enterprise is the enormous building program that has completely changed the landscape of the Evanston and Chicago campuses. Major reconstruction of the Technological Institute began in 1990 and was completed in 1999. Today, there is again construction at Tech: one addition is being built on the north side of the building between the B and C wings, with another going up on the south side between the F and G wings. Next door to Tech stands the Ford Motor Company Engineering Design Center, which opened in 2005.
East of Tech there are Cook Hall (completed in 1992); Patrick G. and Shirley W. Ryan Hall (2002), which began life as the Center for Nanofabrication and Molecular Self-Assembly and contained one of the first federally funded nanofabrication facilities in the nation; the Arthur and Gladys Pancoe Life Sciences Pavilion (2003); and the Richard and Barbara Silverman Hall for Molecular Therapeutics and Diagnostics, which opened last year. On the Chicago campus, there were renovations and build outs in the Ward, Morton, Searle, Tarry, and Olson buildings in the early 2000s, and the Robert H. Lurie Medical Research Center opened in 2005. Almost all of this construction was anticipated and advanced by the former strategic plans.

Not surprisingly with all these new buildings, the number of laboratories overseen by the Office for Research Safety has increased dramatically. Back in 1989 ORS supported about 500 laboratories; now ORS oversees nearly 1,500 laboratories across two campuses.

**Growth in Research Volume**

Accompanying the building growth has been an amazing growth in research. In 1988 Northwestern had an excellent year for research awards: achieving its highest volume of research awards — almost $88 million dollars, an impressive increase of 15 percent over the previous year. Yet even adjusted for inflation ($162 million in today’s dollars), the awards of 1988 are eclipsed by this year’s $557.4 million in awards, a historic peak that represents an increase of 17 percent ($79.5 million) over last year.

This increase is due in part, but not completely, to Northwestern’s 279 awards totaling $72 million in funding from the American Recovery and Reinvestment Act (ARRA). Two hundred and sixty-five faculty members are principal investigators on those grants.

**Faculty Matters**

Buildings, lab space, and research award totals certainly matter, but the foundation of a great research university is its faculty. Previous strategic plans have mapped out faculty growth, and endowments raised through Campaign Northwestern have helped the University increase the size of its faculty and strengthen key disciplines.

This fall, we’ve seen an array of honors awarded to our faculty members. Of course, our star faculty member this year is Dale Mortensen who won the Nobel Prize in economics (see p. 15).

Chad Mirkin, who joined Northwestern’s department of chemistry in 1991, is now internationally renowned for his research in nanotechnology and its applications. This year he was elected a member of the Institute of Medicine, making him the first person in the Midwest and only the 10th in the world to be elected to all three branches of the National Academies. (Mirkin was elected to the National Academy of Sciences earlier this year and to the National Academy of Engineering in 2009.)

Two other members of the chemistry faculty received high honors this fall from the American Chemical Society. Richard Silverman received the society’s Award for Important Discoveries in Medicinally Active Substances. Tobin Marks was honored with the Arthur Cope Scholar Award, which recognizes excellence in organic chemistry.

Harold Kung, chemical and biological engineering, received the Gabor A. Somorjai Award for Creative Research in Catalysis from the American Chemical Society. The award recognizes outstanding theoretical, experimental, or developmental research resulting in the advancement of understanding or application of catalysis.

Five Northwestern faculty members were inducted into the American Academy of Arts and Sciences, one of the nation’s oldest and most prestigious honorary societies, which recognizes leaders in research, scholarship, business, the arts and public affairs. They are David Ferster, neurobiology and physiology; John Hagan, sociology; Monica Olvera de la Cruz, materials science and engineering; Morton Schapiro, economics and University president; and David Seidman, materials science and engineering.

In addition, two faculty members have been awarded the highest honor given by the U.S. government to outstanding scientists and engineers who are in the early stages of their independent research careers. Malcolm MacIver, biomedical and mechanical engineering, and Emily Weiss, chemistry (see p. 51), received the Presidential Early Career Award for Scientists and Engineers, travelled to the White House to meet President Obama, and attended an awards ceremony.

A complete list of faculty honors achieved in 2010 can be found beginning on page 9.

**The Intellectual Community of Students**

One of the more significant changes at Northwestern in recent years has been the implementation of the University-wide policy that guarantees four years of year-round support to all new PhD students. No doubt this factor — plus the increasing strength of our graduate
programs — contributes to the considerable improvement in both selectivity and yield in both PhD and masters’ program in the past few years. Selectivity describes the percentage of those admitted compared to those who applied; a lower percentage indicates a higher selectivity. Selectivity in 1988 was 48.4 percent; in 2010 it was 16.9 percent. Yield, the percentage of those accepted who choose to enroll, also improved: 26.9 percent of those accepted enrolled in 1988; in 2010, 42 percent of those accepted enrolled. The Graduate School took the lead on and deserves significant credit for fostering this enormous positive change.

Research isn’t restricted to graduate students and postdocs at Northwestern. This year the Office of the Provost launched a comprehensive new website, www.undergradresearch.northwestern.edu, that provides information about undergraduate research opportunities. Today’s Northwestern undergraduates engage in research on campus, across the country, and in distant parts of the globe. Among other things, the site explains what research can look like in different disciplines: natural science and engineering, social sciences and journalism, and arts, humanities, and performance.

One of the forces beyond campus that has influenced all of us has been the increase in globalization. Back in 2002 the implementation report on The Highest Order of Excellence described the expansion and enhancement of study abroad opportunities for undergraduates: “Participation increased from 251 participants in the class of 1998 to 365 participants in the class of 2002.” This year the Roberta Buffett Center for International and Comparative Studies launched a comprehensive global opportunities website, www.global.northwestern.edu, that provides users with instant access to information on 263 international programs currently offered through Northwestern; that’s more programs than there were individual participants in the class of 1998. In the class of 2010, 693 graduating seniors (34 percent) had studied abroad.

The Collaborative Environment

One of Northwestern’s unique selling points to faculty as well as students has been its reputation for interdisciplinary activities. We’re the right size for such collaborations — not too big, not too small. One of The Highest Order of Excellence plans that fostered interdisciplinarity was the creation of domain dinners, in which interdisciplinary “domains” of interested faculty members developed symposiums. The concept evolved to include events built around specific topics beyond the original eight domains. The free interchange of ideas during the formal presentations and at the dinners immediately following in several cases were the seeds for new research centers.

While it’s difficult to ascertain the roots of each interdisciplinary research center, the soil in which they have grown has certainly been fertile. Currently there are 26 University research centers not attached to a specific school or college, up from 11 in 1988. Eight of those 11 are still in existence in some form, including the Program of African Studies, which celebrated its 60th anniversary in 2008. The Materials Research Center was also well established, having been created in 1960. The Center for Urban Affairs and Policy Research, which became the Institute for Policy Research, celebrated its 40th anniversary in 2008. I’d like to recognize Fay Lomax Cook, who will be stepping down as IPR director in 2011 after 15 years of helping IPR bridge the gap between the social sciences and social policies. I will miss her calm and confident leadership.

This year we added five exciting new University research centers: the Center for Interdisciplinary Exploration and Research in Astrophysics, the Non-Equilibrium Energy Research Center, the Center for Molecular Innovation and Drug Discovery, the Physical Sciences Oncology Center, and the Proteomics Center of Excellence.

The Northwestern University I first came to in 1988 has grown and prospered in many ways in the years I’ve been here. In my roles as vice president for research, faculty member and University citizen, I have seen the positive changes brought by this guided growth. We can all take great pride in Northwestern’s position in the U.S. News & World Report rankings of Best National Universities, from 23 in 1990 to 12 in 2008, 2009, and 2010.

To quote the implementation report on the first The Highest Order of Excellence plan, “Hardly a corner of the campus has gone untouched in some way. . . . Change itself has increasingly become a way of life on campus.” Change continues to be the norm, leading Northwestern to have ever-greater impact. Thanks to past and future strategic plans, it will be this sort of deliberate change that guides faculty, students, and staff to new successes in the years ahead. I look forward to the journey.

Sincerely,

Vice President for Research
Awards and Recognition

The excellence of the University’s research enterprise derives from the excellence of Northwestern’s faculty. Faculty generate new knowledge; perform innovative research; attract, teach, and mentor exceptional students; and engage in activities that benefit and enrich society. Our faculty does its best work when they produce transformative research as well as graduates who will conduct transformative work themselves throughout their careers.

While funding levels for sponsored research provide one clear indicator of the vitality of the University’s research enterprise, the distinction of Northwestern’s faculty is also indicated by membership in prestigious national academies and societies, awards from the best grant and fellowship programs, citations, and other recognition and honors.

This report focuses on both the financials of research excellence — sponsored project awards, expenditures, and proposals — and on more individual faculty accomplishments during the past year. It also places Northwestern research within a benchmark group of universities. By putting our efforts in a context that considers peer institutions, based on the Consortium on Financing Higher Education (COFHE) groupings, we are better able to compare University benchmarks for research. Our COFHE cohort includes private schools that attract a national undergraduate applicant pool and have characteristics in common that permit each school’s inclusion in various cooperative studies.

Members of National Academies and Societies

One of the highest honors for faculty is election to prestigious national academies and societies such as the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The National Academies bring together committees of experts in all areas of scientific and technological endeavor.

### National Academy of Sciences Membership with Current Affiliation

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<th>University</th>
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### National Academy of Engineering Membership with Current Affiliation

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These experts serve pro bono to address critical national issues and give advice to the federal government and the public.

This year, Chad Mirkin, chemistry, was elected to both the Institute of Medicine and National Academy of Sciences. He became a member of the National Academy of Engineering in 2009. He is the first person at Northwestern and in the Midwest and only the 10th in the world to be elected to all three branches of the National Academies. Mirkin is the George B. Rathmann Professor of Chemistry and professor of medicine, chemical and biological engineering, biomedical engineering, and materials science and engineering and director of Northwestern’s International Institute for Nanotechnology.

The National Academy of Sciences welcomed Richard P. Van Duyne, chemistry, in addition to Mirkin. Van Duyne, the Charles E. and Emma H. Morrison Professor of Chemistry, discovered surface-enhanced Raman spectroscopy in 1977, which is now widely recognized as the most sensitive form of spectroscopy capable of identifying molecules.

The National Academy of Engineering elected as a member Gregory B. Olson, the Walter P. Murphy Professor of Materials Science and Engineering. He was cited for his contribution to research, development, implementation, and teaching of science-based materials by design. Olson is considered one of the founders of computational materials design, having developed a systematic science-based approach for designing alloys that takes the desired properties and calculates the optimum composition and processing route.

CAREER Awards from the National Science Foundation

The Faculty Early Career Development Program (CAREER) Program is the National Science Foundation’s most prestigious award program for new faculty members. CAREER awards recognize and support the early career-development activities of those teacher-scholars who are most likely to become the academic leaders of the 21st century. Five Northwestern faculty members were recipients of NSF CAREER Awards in 2010:

Jose E. Andrade, civil and environmental engineering

Darren Gergle, communication studies

Jiaxing Huang, materials science and engineering

Matthew Hurtgen, Earth and planetary science

Cheng Sun, mechanical engineering

With a total of 34 NSF CAREER Awards from 2005 through 2010, Northwestern ranks 6th among its peer universities.
Citations
Among the nation’s most important researchers are those faculty members whose influence is demonstrated by the citations to their published work in the literature of their fields. In this way, their colleagues acknowledge their intellectual debt to these individuals. Researchers who have made fundamental contributions to the advancement of science and technology in recent decades are recognized in this list.

In 2010, 44 Northwestern faculty members appeared on the Institute for Scientific Information list of highly cited researchers. This list is made up of less than half a percent of the more than 5 million researchers indexed in the ISI database. The following Northwestern faculty are among the most-cited researchers worldwide (in their respective categories):

James C. Anderson, Economics/Business
Alvin Bayliss, Mathematics
Zdeněk P. Bažant, Engineering
Ted Belytschko, Engineering
Robert Ogden Bonow, Clinical Medicine
Lawrence J. Christiano, Economics/Business
Stephen H. Davis, Engineering
Greg J. Duncan, Social Sciences, General
Alice H. Eagly, Psychology/Psychiatry
Martin Stewart Eichenbaum, Economics/Business
Katherine Theresa Faber, Materials Science
Arthur J. Freeman, Physics
Robert J. Gordon, Economics/Business
Ranjay Gulati, Economics/Business
John Hagan, Social Sciences, General
Michael L. Honig, Computer Science
Yonggang Huang, Engineering
James Arthur Ibers, Chemistry
Leon M. Keer, Engineering
Robert Andrew Lamb, Microbiology
Wing Kam Liu, Engineering
Tobin J. Marks, Chemistry
Thomas O. Mason, Materials Science
Bernard J. Matkowsky, Mathematics
M.-Marcel Mesulam, Neuroscience
Richard J. Miller, Neuroscience, Pharmacology
Chad Mirkin, Chemistry
Jorge Nocedal, Mathematics
Robert H. Porter, Economics/Business
Mark A. Ratner, Chemistry
Martin H. Redish, Social Sciences, General
Sergio Rebelo, Economics/Business
Michael Schmitt, Physics
Robert Schlemmer, Immunology
Patricia G. Spear, Microbiology
Jeremiah Stamler, Clinical Medicine
Seth Stein, Geosciences
Allen Tafove, Computer Science
Martin A. Tanner, Mathematics
Peter W. Voorhees, Materials Science
Julia R. Weertman, Materials Science
Michael D. Whinston, Economics/Business
Steven Mark Wolinsky, Microbiology
Edward J. Zajac, Economics, Business
2010 Faculty Recognition and Honors

Each year the President and the Provost host a faculty recognition dinner honoring members of the Northwestern faculty who have brought distinction to the University. Northwestern’s Office of Administration and Planning, in conjunction with the faculty honors committee, compiles a comprehensive list of faculty awards and honors. The faculty honors committee then selects those faculty members recognized for the most prestigious honors for University recognition. The following faculty members were honored at the faculty recognition dinner last October for bringing distinction to Northwestern by their important recognition from societies and agencies outside the University in 2009–10:

Jan D. Achenbach, mechanical engineering and civil and environmental engineering: Theodore von Karman Medal, American Society of Civil Engineers

Nidhi Agrawal, marketing: Marketing Science Institute Young Scholar

Jose E. Andrade, civil and environmental engineering: Faculty Early Career Development (CAREER) Award, NSF

Baris Ata, managerial economics and decision sciences: best paper, service science, 2009, Institute for Operations Research and the Management Sciences

Vadim Backman, biomedical engineering: fellow, American Institute of Medical and Biological Engineers

Mark E. Beeman, psychology: fellow, Association for Psychological Science

Eula R. Biss, English: award in criticism, National Book Critics Circle

Galen Bodenhausen, marketing: fellow, Society of Experimental Social Psychology; fellow, Midwestern Psychological Association

Robert Bonow, medicine: James B. Herrick Award for Outstanding Achievement in Clinical Cardiology, American Heath Association

Kathryn G. Bosher, classics: faculty fellow, Loeb Classical Library Foundation

Katharine H. Breen, English: Charles A. Ryskamp Research Fellowship, American Council of Learned Societies

Dirk Brockman, engineering sciences and applied mathematics: Young Scientist Award, Physics of Socio-Economics Systems Division, German Physical Society

Bruce G. Carruthers, sociology: Viviana Zelizer Distinguished Scholarship Award; 2008–09 best book, American Sociological Association

Anthony S. Chen, sociology: 2010 Gladys M. Kammerer Award (cowinner); 2010, best book, section on race, ethnicity, and politics; 2010 J. David Greenstone Award, section on politics and history (cowinner), all from American Political Science Association

Dane Chetkovich, neuroscience: Derek Denny-Brown Young Scholar Award, American Neurological Association

Alok N. Choudhary, electrical engineering and computer science: fellow, Association for Computing Machinery; fellow, American Association for the Advancement of Science

James Conley, managerial economics and decision sciences: Alexander von Humboldt Foundation Transcoop Fellow, 2008–11, Alexander von Humboldt Foundation

James N. Druckman, political science: Paul Lazarsfeld Best Paper Award, American Political Science Association

Jeffrey C. Ely, economics: fellow, Econometric Society

Steven G. Epstein, sociology: 2009 Ludwik Fleck Book Prize, Society for Social Studies of Science

Betsy J. Erkkila, English: fellow, John Simon Guggenheim Memorial Foundation; Fulbright Scholar

Wendy N. Espeland, sociology: 2009 Clifford Geertz Award for Best Article, culture section, American Sociological Association; 2009 Philip D. Shelton Prize for Outstanding Legal Education Research, Law School Admissions Council

David L. Ferster, neurology and physiology: fellow, American Academy of Arts and Sciences

David Figlio, education and social policy: Outstanding Service Award, American Education Finance Association

Gary A. Fine, sociology: fellow, Center for the Advanced Study of the Behavioral Sciences;
and fellow, John Simon Guggenheim Memorial Foundation

Eli J. Finkel, psychology: Gerald R. Miller Award for Early Career Achievement, International Association for Relational Research

Richard J. Finno, civil and environmental engineering: Harry Schnabel Jr. Award, American Society of Civil Engineers

Brodwyn Fischer, history: Warren Dean Memorial Prize, Conference on Latin American History; Biennial Award, Urban History Association; Frederick Burckhardt Fellowship, American Council of Learned Societies

Jerry Goldman, political science: Award for Teaching Innovation in Political Science, Congressional Quarterly Press

Dongning Guo, electrical engineering and computer science: Marconi Prize Paper Award, Institute of Electrical and Electronics Engineers

John L. Hagan, sociology: fellow, American Academy of Arts and Sciences; and fellow, The Rockefeller Foundation, Bellagio Center

Mark Hersam, materials sciences and engineering: Outstanding Young Investigator Award, Materials Research Society

Paul Hirsch, management and organizations: 2009 best symposium award, organization and management theory division, Academy of Management


Joshua E. Horvath, theatre: sound design, Joseph Jefferson Awards

Jiaxing Huang, materials science and engineering: Faculty Early Career Development (CAREER) Award, NSF

Yonggang Huang, civil and environmental engineering: 2010 Charles Russ Richards Memorial Award, American Society of Mechanical Engineers

Matthew Hurtgen, earth and planetary science: Faculty Early Career Development (CAREER) Award, NSF

J. Larry Jameson, dean, Feinberg School of Medicine: Rodman E. Sheen and Thomas G. Sheehan Award, Bank of America

Mercouri Kanatzidis, chemistry: fellow, Materials Research Society

William L. Kath, engineering sciences and applied mathematics: fellow, Society for Industrial and Applied Mathematics

Rajeev Kinra, history: fellowship, National Endowment for the Humanities

William L. Klein, neurobiology and physiology: Zenith Fellows Award, Alzheimer’s Association

Robert Korajczyk, finance: first place, Crowell Memorial Research Paper Prize, PanAgora Asset Management Quantitative Research Institute

Bryna R. Kra, mathematics: Levi L. Conant Prize, American Mathematical Society

Steven Krug, pediatrics: 2009 Jim Seidel Lifetime Achievement Award, section on emergency medicine, American Academy of Pediatrics

Prem Kumar, electrical engineering and computer science: fellow, International Society for Optical Engineering

Cristina Lafont, philosophy: Spinoza Chair in Philosophy, University of Amsterdam; fellow, Wissenschaftskolleg zu Berlin

Robert A. Lamb, molecular biosciences: honorary doctor of science, University of Birmingham

Carol Lee, education and social policy: 2010 Lifetime Achievement Award, American Association of Colleges for Teacher Education; President's Pacesetters Award, American Association of Blacks in Higher Education

Paul M. Leonard, communication studies: Sloan Industry Studies Fellowship, Alfred P. Sloan Foundation

Chang Liu, mechanical engineering: fellow, Institute of Electrical and Electronics Engineers

Donald Lloyd-Jones, preventive medicine: Chairman’s Award, American Heart Association

Alicia I. Löffler, associate vice president for research and Health Industry Management Program: Innovator Award, Association for Women in Science

Richard M. Longnecker, microbiology and immunology: fellow, American Academy of Microbiology

Michael M. Loriaux, political science: Charles Taylor Award, American Political Science Association
John A. Lynn, history, best subsequent book award, Phi Alpha Theta History Honor Society

Malcolm MacIver, mechanical engineering: Presidential Early Career Award for Scientists and Engineers

James L. Mahoney, political science and sociology: David Collier Mid-Career Achievement Award, Consortium for Qualitative Research Methods

Grégoire Mallard, sociology: 2009 best dissertation award, Université Paris Est

Yuri I. Manin, mathematics: 2010 Bolyai Prize, Hungarian Academy of Sciences

Tobin J. Marks, chemistry: Wilhelm Manchot Prize, Technical University of Munich

Kate Masur, history: Charles A. Ryskamp Research Fellowship, American Council of Learned Societies

David Matsa, finance: CRA International Award for the Best Corporate Finance Paper, Western Finance Association

David McLean, neurobiology and physiology: Searle Scholar, Searle Scholar Program

Phillip B. Messersmith, biomedical engineering: fellow, Royal Society of Chemistry

Marsel Mesulam, neurology: 2010 Bengt Winblad Lifetime Achievement Award, Alzheimer’s Association

Chad A. Mirkin, medicine, chemical and biological engineering, biomedical engineering and materials science and engineering: Einstein Professor, Chinese Academy of Sciences; member, National Academy of Sciences; Mack Award, Ohio State University

Hooman Mohseni, electrical engineering and computer science: fellow, International Society for Optical Engineering

Adilson E. Motter, physics and astronomy: Early Career Investigator Award for Energy Research, Northwestern University-Argonne National Laboratory

Edward Muir, history: distinguished achievement award, Andrew W. Mellon Foundation

Keith Murnighan, management and organizations, honorary doctor of science (economics), London Business School

Stephen Nelson, political science: Helen Dwight Reid Award, American Political Science Association

Brian C. Odom, physics and astronomy: research fellowship, Alfred P. Sloan Foundation

Gregory B. Olson, materials science and engineering: member, National Academy of Engineering

Monica Olvera de la Cruz, materials science and engineering: fellow, U.S. Department of Defense National Security Science and Engineering Faculty Fellowship; fellow, American Academy of Arts and Sciences


Ken Paller, psychology: Senator Mark Hatfield Award, Alzheimer’s Association

Yohanan Petrovsky-Shtern, history: best publication in 10 years introducing new significant sources on the history of the Russian Empire and the USSR, Ab Imperio Journal

Janet B. Pierrehumbert, linguistics: Erskine Fellowship, University of Canterbury

Heather W. Pinkett, molecular biosciences: Pew Scholar in the Biomedical Sciences, Pew Charitable Trusts

Robert H. Porter, economics: distinguished fellow, Industrial Organization Society

Giorgio E. Primiceri, economics: research fellowship, Alfred P. Sloan Foundation

Yi Qian, marketing: best paper award, Journal of Marketing Science Conference

Mark Ratner, chemistry: fellow, American Chemical Society

Paola Sapienza, finance: Smith Breeden Prize for Distinguished Paper in Journal of Finance, American Finance Association

Morton Schapiro, economics, University president: fellow, American Academy of Arts and Sciences

David N. Seidman, materials science and engineering: fellow, Materials Research Society; fellow, American Academy of Arts and Sciences
Lonnie D. Shea, chemical and biological engineering: fellow, American Institute of Medical and Biological Engineers
Surendra P. Shah, civil and environmental engineering: foreign member, Chinese Academy of Engineering
Leena Sharma, medicine: 2009 International Clinical Research Award, Osteoarthritis Research Society
Maureen Smith, genetic medicine: 2009 Natalie Weissberger Paul National Achievement Award, National Society of Genetic Counselors
Vivasvan Soni, English: sabbatical fellowship, American Philosophical Society
Nathaniel Soper, surgery: Distinguished Service Award, Society of American Gastrointestinal and Endoscopic Surgeons
Janine Spencer, French and Italian: Dorothy Ludwig Excellence in Teaching Award, American Association of Teachers of French
Peter C. Stair, chemistry: George A. Olah Award in Hydrocarbon and Petroleum Chemistry, American Chemical Society
Seth A. Stein, Earth and planetary sciences: member, Academia Europaea; Stephan Mueller Medal, European Geosciences Union
Margot M. Steinhart, French and Italian: Florence Steiner Award for Leadership in Foreign Language Education, American Council on the Teaching of Foreign Languages
Paula Stern, molecular pharmacology and biochemistry: The American Society for Bone and Mineral Research created the Paula Stern Achievement Award in her honor
Brian Sternthal, marketing: Fellow in Consumer Behavior Award; Lifetime Achievement Award for Consumer Research, Association for Consumer Research
Sir Fraser Stoddart, chemistry: Royal Medal, Royal Society of Edinburgh
Cheng Sun, mechanical engineering: Faculty Early Career Development (CAREER) Award, NSF
D. James Surmeier Jr., physiology: fellow, American Association for the Advancement of Science
Allen Tafove, electrical engineering and computer science: Chen-To Tai Distinguished Educator Award, IEEE Antennas and Propagation Society
Ajit C. Tamhane, industrial engineering and management sciences: fellow, Institute of Mathematical Statistics
Hans Thomalla, music studies: fellowship, Heinrich Strobel Foundation
John M. Torkelson, chemical and biological engineering: Outstanding Teaching Award, American Society for Engineering Education
Richard P. Van Duyne, chemistry: Award in Analytical Chemistry, American Chemical Society; member, National Academy of Sciences; Charles N. Reilley Award in Electroanalytical Chemistry, Society for Electroanalytical Chemistry
Annette Vissing-Jorgensen, finance: Argentum Prize for Best Symposium Paper on Private Equity and Funds of Private Equity, European Finance Association
Q. Jane Wang, mechanical engineering: fellow, American Society of Mechanical Engineers
Diane Wayne, medicine: 2010 Parker J. Palmer Courage to Teach Award, Accreditation Council for Graduate Medical Education
Klaus Weber, management and organizations: 2009 Clifford Geertz Best Article Prize, section on culture, American Sociological Association
Emily A. Weiss, chemistry: New Faculty Award, Camille and Henry Dreyfus Foundation; Early Career Research Program Award, Department of Energy
Tuwanda Williamson, family and community medicine: 2009 Pfizer Teacher Development Award, American Academy of Family Physicians Foundation
Michael S. Wolf, medicine: J. William Fulbright Foreign Scholarship, general medicine division
Jane Wu, neurology: elected member, Association of American Physicians
Jay Alan Yim, music studies: commission, New York Philharmonic
Research Fellowships

While competition for external undergraduate research sponsorships is fierce at the national level, Northwestern students do well in competing for prestigious fellowships. Of the 111 Northwestern students or recent graduates who applied, 20 were awarded highly sought-after Fulbright fellowships in 2010, the sixth highest result among American universities.

Northwestern graduate students also fare well in attaining NSF graduate research fellowships. Nineteen were awarded NSF fellowships in 2010, putting Northwestern in ninth position among its benchmark cohort of Consortium on Financing Higher Education institutions.

NSF Graduate Research Fellowships

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<tr>
<th>Institution</th>
<th>2006</th>
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<th>2008</th>
<th>2009</th>
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<tr>
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Source: https://www.fastlane.nsf.gov/grfp/AwardeeList.do?method=loadAwardeeList

Northwestern Undergraduate Awards

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<th>Year</th>
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Excellence in Schools and Programs

Northwestern’s schools and graduate programs generally are ranked highly in “American’s Best Graduate Schools,” published in *U.S. News & World Report*. The following table highlights the Northwestern schools and some programs that recently have been ranked. For a complete listing, visit www.adminplan.northwestern.edu/ir/data-book.

Northwestern University Graduate and Professional School Program Rankings

<table>
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<tr>
<th>School/Program</th>
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<td>School of Management (US News)</td>
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<td>Feinberg School of Medicine</td>
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<td>Economics</td>
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<td>Political Science</td>
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</tbody>
</table>

1. Rankings are from *U.S. News & World Report* unless otherwise noted.
2. Empty cell denotes no rankings on category in that year.
3. Subcategories/specialties are not ranked each year, though sometimes listed in the current magazine with old rankings.
MORTENSEN RECEIVES NOBEL PRIZE

Dale Mortensen, economics, refers jokingly to a corner of his office in Andersen Hall as his “trophy wall.” The top of a large, gray filing cabinet next to his office door displays a gold key to the city from the mayor of Evanston, a plaque for an Institute for the Study of Labor Economics prize he received in 2005, and another plaque for his Society of Labor Economics Mincer Prize from 2007.

Now Mortensen can add the 2010 Nobel Prize for Economics to this collection.

The prize recognizes three decades of work that Mortensen completed with Peter Diamond of the Massachusetts Institute of Technology and Christopher Pissarides of the London School of Economics and Political Science. Together, they developed a framework that seeks to explain why there can be so many people unemployed at the same time as there are a large number of job openings. The model helps describe the ways in which unemployment, job vacancies, and wages are affected by regulation and economic policy and can also be applied to other areas, including housing markets and even marriage.

“It’s a model that has social implications that are interesting and useful,” Mortensen says. “Within the framework, you can talk about the potential effects of different labor market policies, and you can construct virtual experiments to see what those effects are.”

Mortensen met Diamond in the 1970s because they were doing similar work. Their relationship grew in the 1980s when Mortensen says, they were “sort of feeding off one another.” In 1990 Pissarides wrote a book called Equilibrium of Unemployment, for which Mortensen wrote a long review. Afterwards, they worked together for 10 years and finished a second edition of Pissarides’s book that incorporated research from their collaboration. Now Mortensen considers them both good friends. “We have a long association and know each other well,” he says.
Mortensen discovered his passion for economics during his undergraduate career at Willamette University in Salem, Oregon. He enjoyed math in high school and then developed an interest in social history. “I started to wonder if I could combine analytic problem solving with an interest in social issues, and economics seemed like the right place,” he says. Then he adds with a laugh, “It turns out I was right.”

Propped against the wall behind Mortensen’s key to the city and plaques is a poster-sized photo of his family that was taken at O’Hare International Airport when he arrived home from Aarhus University in Denmark where he serves as the Niels Bohr Visiting Professor of Economics. He was greeted by a surprise “welcome home” event that included Northwestern’s brass band as well as some of his family. In the photo Mortensen stands in the back with his son on his right and his two daughters on the left. His daughter Julie holds a colorful sign that says, “Congrats Daddy!” His wife, children’s spouses, and assistant are also in the photo. The rest of the space is filled with the smiling faces of five of his eight grandchildren.

Mortensen used part of his Nobel money — the three economists share a total of $1.5 million — to transport his entire family to Stockholm for the awards ceremony. “They were very excited,” he says. “All of us went — even all eight grandchildren.”

Mortensen’s family is one reason that he chose to spend his entire career at Northwestern. He joined the faculty as an assistant professor of economics in 1965 after earning his PhD at Carnegie-Mellon University. Now in his 45th year at the University, he serves as the Ida C. Cook Professor of Economics, a research associate of the National Bureau of Economic Research, and a research fellow of the Institute for the Study of Labor.

“One of my colleagues said Northwestern must have been a good match for me,” he says. “It’s a great environment, and we got attached to the community. All of our kids were raised here.”

His son and older daughter graduated from Northwestern along with his son-in-law who was a Wildcat cheerleader.

Mortensen was in Denmark when the Secretary of the Royal Swedish Academy of Sciences called him about the Nobel Prize. He was having lunch with colleagues when the call came. Afterward, he was swept up into a whirlwind of media calls, receptions, and ceremonies.

“Winning a Nobel wasn’t something I really dreamed about,” he says. “It was a fun ‘what if,’ but not something I thought about often.”

For more information about Mortensen’s work, visit his website at http://sites.google.com/site/dalemortensensite. — by Amanda Morris
SPECIAL LIBRARIES: NORTHWESTERN’S GOLD MINE

In the midst of the Information Age, we have instant access to knowledge. Type a search term into Google or Wikipedia, and answers arrive in milliseconds. It allows us to complete research, pajama-clad, without even leaving our desks. Right?

Roberto Sarmiento disagrees.
he calls “one of the civil engineering wonders of the world.” The first time he joined the trip four years ago, he had six months to prepare his lecture. He immediately called the Transportation Library.

“I knew the basics about the canal,” Schofer says. “But I’m an engineer. I wanted to dig in and put together something with technical substance.”

Before Sarmiento came to Northwestern in 1998, he was the head librarian at the Panama Canal Commission Technical Resources Center in Panama. But he didn’t need to return to Panama to uncover materials for Schofer. Sarmiento and Transportation Library reference librarian Kay Geary pointed Schofer to journals and historic documents from the years 1904 to 1914 when the canal was constructed. All this was housed in Northwestern’s Libraries. One of the books was edited by the original engineers of the project. Another had an article by Theodore Roosevelt, who was President when the project began.

“To me, this was gold,” Schofer says. “I was able to give a lecture that went back to the original material.”

What resulted was a lecture so popular that it now lives off the cruise ship. Schofer has been asked to repeat his talk at conferences and meetings. Due to its enthusiastic reception, the lecture was further developed and improved for the February trip. Schofer will add original photographs to his presentation, which he found when Sarmiento put him in contact with the current head librarian at the Panama Canal.

“This is the value of dealing with a person who really knows the field,” Schofer says. “They know who and where to call. I talked to Roberto in the morning, and by afternoon I had an e-mail from the guy who runs the library in Panama.”

“Joe is a nice guy,” Sarmiento says. “But what I did for Joe, we would do for any faculty member or graduate student at Northwestern. I don’t care if we have to call China. If a faculty member needs something, then we will move heaven and earth to find it.”

Sarmiento is not joking. He has contacted China to find information about high-speed trains. He has also contacted Australia and Sweden, utilizing his global network of transportation information professionals. A member of the Special Libraries Association, Sarmiento has developed ties with colleagues worldwide. He emphasizes that the professionals at other
transportation libraries see themselves as partners who work together, not adversaries. “We have the best collection in the world,” he says. “But we don’t have everything.”

More frequently, Sarmiento and his team field calls for materials at Northwestern from researchers or agencies throughout the U.S. and around the world. Established in 1955, Northwestern’s Transportation Library is the largest collection of transportation information in the country and has an international clientele. It is the main reason that Sarmiento joined the University.

“I came here for the opportunity to work at the best library in my profession — the transportation information world,” he says.

Schofer’s concern is that students and newer faculty members turn to the Internet before taking advantage of the library resources at Northwestern. He challenges teachers to give students thought-provoking problems without obvious answers that can easily be found online.

“Reference librarians are trained in library science, and they know how to find information much more effectively than the rest of us,” he says.

So, the next time a research topic arises, go ahead and turn to Google. And search for the “Northwestern Library.” Or just go to www.library.northwestern.edu.

— by Amanda Morris
Results showed significant correlations between the participation in school music ensembles and variables including socioeconomic status (SES), ethnicity, native language, standardized test scores, and grade point average. Certain groups of students (English-language learners, Hispanics and those in the lowest SES quartiles) were significantly underrepresented in music programs whereas others (white students, native English speakers, students in the upper SES quartiles) were overrepresented.

This work follows a book that Abril coedited in 2009, *Musical Experiences in Our Lives: Things We Learn and Meanings We Make* (Rowman & Littlefield 2009), which examines the diverse ways humans engage with, learn from, and construct meaning around musical experiences, from birth to older adulthood.

Abril’s research aims to reveal issues, challenges, strengths, and limitations of music education as a way to inform arts education professionals, principals, and policy makers.

**Carlos Abril**

**Bienen School of Music**

**School Music that Makes the Grade**

With the advent of iPods, music downloading, and music-based video games, technology has changed the way people understand, learn, and listen to music. But according to research by Carlos Abril, music education, music courses in schools have changed very little in the past 60 years.

Through a series of studies published in the *Journal of Research in Music Education*, Abril and a colleague from Indiana University examined the status and condition of music in K-12 schools across the country. Findings revealed that music courses are offered in an overwhelming number of schools and that school principals are generally pleased with the contribution music makes to the overall school curriculum. Music education in secondary schools was found to consist primarily of large performance ensembles, such as concert bands and choirs. Research also found that composing music was the least prevalent music-learning outcome perceived to result from K-12 school music education. Secondary school principals surveyed expressed interest in expanding course offerings to include guitar, technology, and piano. Given the current distinction students make between “real music” and “school music,” and the findings from these studies, music education programs may need to change in order to remain relevant and meaningful.

In a forthcoming publication in the *Journal of Research in Music Education*, Abril and Kenneth Elpus (PhD candidate in music education) construct a national demographic profile of high school music students using data from the National Center for Educational Statistics.
Cheap Talk in Operations

You know the drill: dial a customer service number and prepare to wait as the automated message begins: “We are currently assisting other customers. Your call will be answered in the order it was received.” Recorded delay announcements such as these are nothing new, but their strategic use is proving to be a surprisingly complex game played between customers and service providers. Gad Allon and Achal Bassamboo, both managerial economics and decision sciences, are interested in how delay announcements can be used most efficiently at both ends of the phone line — by service providers and customers alike. Their theoretical research, which is rooted in both game theory and queuing theory, shows that strategic use of wait messages can ultimately improve firm profits and utility to customers.

The information given in delay notifications is inherently cheap talk — it costs the firm little to provide, it is non-binding, and the customer has no way to verify it. A crucial element of this game is the amount of information that firms provide in the delay announcements they play for customers who call in. Some give no indication of the queue length or wait time. Others may fully disclose the congestion level with a message such as “You are seventh in line to speak to an agent.” Southwest Airlines, for example, tells callers whether they have less than one minute to wait, between seven and ten minutes, or more than ten minutes. Allon and Bassamboo show that depending on the level of patience exhibited by the firm and the customers, different outcomes are to be expected. In particular, if the firm and the customers have similar patience levels, the firm may use a simple language (with as few as two “signals”) to communicate the congestion level to its customers so it is mutually beneficial.

Many firms already employ delay announcements, but modeling how they affect customers could be a way to improve profits without resorting to pricing tools. Firms should use consistent language and tell the truth. But when it comes to the whole truth and nothing but the truth? Maybe try some intentional vagueness instead.
Pablo J. Boczkowski
School of Communication
Institute for Policy Research

More Information, Less News
Before news organizations began putting their content online, people got the news in print or on TV and almost always outside of work. But now most of us keep an eye on the headlines from our desks, and we have become accustomed to instant access to a growing supply of constantly updated stories on the Web. This transformation in the amount of news available as well as how we consume it is the starting point for Pablo J. Boczkowski’s new book, *News at Work: Imitation in an Age of Information Abundance*, published by the University of Chicago Press in September 2010. Boczkowski, media, technology and society, argues that this transformation has been coupled with an unexpected development in editorial labor: rival news organizations can now keep better tabs on the competition and imitate them, resulting in a decrease in the diversity of the news.

Peeking inside the newsrooms where journalists create stories and the work settings where the public reads them, Boczkowski reveals why journalists contribute to the growing similarity of news — even though they dislike it — while consumers acquiesce to a media system they find increasingly dissatisfying. As Stanford sociologist Walter W. Powell noted, the account presented in *News at Work* is “both fascinating and deeply worrying, and is guaranteed to provoke debate.”

Comparing and contrasting developments in the leading print and online media of Argentina with similar trends in the United States, Boczkowski’s new book offers an enlightening perspective on living in a world with more information but less news.
Weinberg College of Arts and Sciences

The Evolution of Trust

Bruce Carruthers, sociology, studies the legal and economic institutions that undergird market economies. He has studied these institutions historically and comparatively, and as a sociologist is mindful of the social aspects of economic life. Currently, he is writing a book on the history of credit in the United States, roughly between 1800 and 1950. He studies credit from the perspective of trust. How did lenders decide whom to trust? Which borrowers were deemed likely to keep their promises?

For credit transactions, the problem of trust has evolved considerably since the early 19th century. At first, creditworthiness was determined primarily on personal grounds, and through social networks. That is, people were more likely to deem trustworthy others whose personal character or reputation they knew, and to whom they were connected through some social tie (as friends, family, neighbors, and others). Since then, lending has become much more anonymous and less network-based.

Carruthers focuses on the invention of credit rating in the middle of the 19th century, which played a large role in this change. Credit rating was invented by the predecessors of Dun and Bradstreet, and addressed trade credit. John Moody emulated the method when he began to rate railway bonds in 1909, and since then credit rating has become a pervasive tool for lenders and regulators.

Early rating agencies gathered confidential information about small firms and used it to calculate ratings that they published and sold to their clients. Using historical archives, Carruthers is able to link this confidential information with the published ratings to see how they were calculated and how useful they really were. It turns out that the accuracy of the ratings was not the only concern of the rating agencies, for they were also deeply worried about the protection of intellectual property, and their exposure to lawsuits.

The clippings above are credit ratings that were issued quarterly by R.G. Dun, circa 1866.
Shari Seidman Diamond
School of Law
Institute for Policy Research

Understanding Juries
Shari Seidman Diamond, law instruction, was at first skeptical about the wisdom of entrusting the jury, a collection of amateurs, with important decisions. However, her research, which most recently included a study of the deliberations of 50 civil juries, has provided evidence that the jury is a strikingly capable human decision-making body. Her studies also reveal missed opportunities to optimize jury performance.

According to standard lore, jurors ignore or are hopelessly confused by the instructions on the law they receive at the end of a trial. Diamond and her colleagues provide evidence contradicting that received wisdom. They show that jurors generally pay substantial attention to the instructions and, although they sometimes struggle, generally achieve a reasonable grasp of the law they are asked to apply. When communication breaks down, the breakdown typically stems from more fundamental sources than simply opaque legal language, including structural problems and ambiguities in the underlying law. Diamond’s research (funded by the NSF, the State Justice Institute, and the American Bar Foundation) demonstrates why it will take more than a plain English movement to maximize genuine harmony between laypersons and jury instructions on the law.

Diamond’s studies reveal that juries take advantage of the abilities of members who have a better understanding of the evidence. But she also shows that jurors with ill-conceived perceptions actually can improve the thoroughness of deliberations because they force better-informed jurors to justify their positions. Her work also shows why some modern changes in the jury system have been ill-conceived: the trend toward reductions in jury size in some jurisdictions not only decreases the representativeness of the jury, but also reduces the availability of well-informed jurors and the ability to take advantage of the commonsense experience. The notion of blank slate juror impartiality is misconceived; maximizing diversity in the jury pool, minimizing occupational exclusions and excuses, and moving back to larger juries are effective ways to maximize jury impartiality and competence.
Autocratic and totalitarian regimes such as those in the Soviet Union, Eastern Europe, and Latin America in the second half of the 20th century — or China, Cuba, and North Korea today — have been notorious for suppressing freedom of the press. By depriving citizens from access to truthful information, these governments tried to prevent unrest and ensure stability of the regime. Yet some autocratic governments voluntarily opt for openness and media freedom, the most famous example being perhaps Mikhail Gorbachev’s policy of glasnost, which was declared in 1987, two years after his ascension to power in the USSR. Since autocrats are perceived as unlikely to benefit from openness policies, such decisions were typically thought to be concessions to internal opposition or to external pressure.

Georgy Egorov, managerial economics and decision sciences, in a joint paper with Sergei Guriev and Konstantin Sonin from the New Economic School in Moscow, challenges this view. They suggest that a free press has a unique benefit for government: it enhances its ability to collect information and thus monitor and incentivize ministers, bureaucrats, and local governors. Egorov argues that the necessity to collect information is stronger when the country cannot rely on the windfall of petrodollars. In this case, a country needs to fight corruption in order to grow and develop economically. In contrast, concessions to opposition forces should be expected when the government is unable to compensate citizens with public goods: it should not matter whether the government is short on petrodollars or on dollars in general.

Analysis of data for 148 countries from 1992 to 2007 reveals a pattern: An increase in oil price or production or a discovery of new oil reserves hurt media freedom in autocracies, but not in democracies. At the same time, an increase in government expenditures barely has any effect on media freedom. Therefore, petrodollars are a curse for a free press, but tax revenues are not: this argues against the concessions-to-opposition storyline.

Between 1985, when Gorbachev proclaimed perestroika — modernization of stagnating Soviet economy — and 1987, when he declared the policy of glasnost, oil prices fell by more than 50 percent. Is it thanks to the price of oil that we live in a world without the Berlin Wall?
Lee Epstein
School of Law
Institute for Policy Research

Judges’ Gender Affects Their Decisions

Female judges are more likely to vote in favor of plaintiffs in sexual discrimination cases, according to research by Lee Epstein, law instruction. The study, which analyzes individual and panel effects on voting patterns, demonstrates the probability of judges voting in favor of the plaintiff in a Title VII sexual discrimination case increases by 10 percent when the judge is female, Epstein says. Men who are on a mixed panel with females are also more likely to vote in favor of the plaintiff, she adds.

Epstein, whose work focuses on the U.S. Supreme Court and judicial behavior, analyzed the voting patterns of appellate court judges in several cases within 13 different areas of law. These cases addressed matters ranging from affirmative action to campaign finance between 1976 and 2002.

The study reveals that sexual discrimination is the only area in which gender affects voting patterns, even when considering cases involving abortion or capital punishment. The research may not affect the overall pattern of decision making in the judges panel, but Epstein said her results may lead to an increase in the number of women on judging panels for court decisions. Of the cases studied, only 32 percent included one woman on a judging panel of three, and only 5 percent included two women. There were no cases that had three female judges. Epstein plans to incorporate her findings in a book.

Last year she received an ARRA award from the National Science Foundation to support her work in updating the U.S. Supreme Court Judicial Database, broadening its scope by adding many more cases — the 19,675 resolved between 1792, the year of the Court’s first published decision, and 1946, the earliest year in the current database.

Epstein holds the Henry Wade Rogers Professorship, a University-wide chair. She also is a fellow of the American Academy of Arts and Sciences and the American Academy of Political and Social Science.

— Adapted from a Daily Northwestern article by Vasiliki Mitrakos.
Virtue and Vaccine

New medical technologies are often the object of controversy — perhaps never more so than when they intrude into the politically charged domains of sexuality and morality. A case in point is the development of a new vaccine designed to prevent cervical and other cancers by stopping the spread of human papillomavirus (HPV), a sexually transmitted infection. Steven Epstein, sociology, and his coeditors have produced a new volume, Three Shots at Prevention, that traces the history and uptake of HPV vaccines and reveals the tight intertwining of notions of risk, health, and sexual morality in U.S. society in recent years.

The strong push toward universal vaccination of girls in countries like the United States has raised concerns about over-hasty assessments of safety and efficacy, the overriding of beliefs about morality and family values, and overly aggressive pharmaceutical marketing. Yet the story of HPV vaccines is also a story about those who are left out — including millions of people in poorer countries, where the vaccine may simply be unaffordable despite higher incidences of cervical cancer, but also distinct groups within medically privileged countries — and how they may fight to gain access to the fruits of biomedical progress.

In his own research, Epstein (who directs Northwestern’s Science in Human Culture Program) examines the approval of HPV vaccines by federal health agencies and finds less overt controversy than had been anticipated by many commentators. Through comparisons with other cases, he identifies the specific factors that have led to the emergence of a widespread consensus about the virtues of these new vaccines.
David Figlio
School of Education and Social Policy
Institute for Policy Research

School Vouchers: Help or Harm?

School voucher programs providing low-income students with financial assistance to attend private schools are becoming increasingly popular in the U.S., but they remain very controversial. A major source of this controversy involves what effects vouchers may have on public schools. Supporters of school vouchers argue that public schools will become more effective when forced to compete for students, while voucher opponents worry that the best students might depart public schools for the private sector, thereby worsening public school classes. Knowing which of these arguments are correct is difficult, as it is typically impossible to successfully disentangle the effects of school vouchers from other factors associated with school success.

David Figlio, human development and social policy, is taking a fresh look at this puzzle by studying the Florida Tax Credit Scholarship Program, the country’s largest publicly funded school voucher program. In research funded by the U.S. Department of Education, the National Institutes of Child Health and Human Development, and the Florida Department of Education, Figlio and Northwestern graduate student Cassandra Hart have developed new methods for identifying whether school vouchers help or harm public schools.

Their research suggests that neither the hopes of supporters nor the fears of opponents have been fully realized. Florida students who use vouchers to leave public schools tend to be the lowest performing students in a school, rather than the other way around. When students move to private schools, they perform about as well as they would have had they remained in public schools, and parents report greater satisfaction in the student-school match. That said, the competition from school vouchers modestly improves the public schools that serve low-income students. While Figlio cautions against extrapolating these findings to very large programs — fewer than 30,000 students currently use vouchers in Florida — he says that offering school vouchers to low-income students may help not only those who choose to use them, but those who do not.
Richard Finno
McCormick School of Engineering and Applied Science

Digging into the Data

Richard Finno, civil and environmental engineering, and his research group address a huge problem in urban construction: ground movement caused by excavations for new structures and tunnels. His work involves real-time sensing and numerical analysis to allow continuously updated predictions of ground movements that develop as excavation proceeds. With this unprecedented flow of information, adjustments to construction procedures can be implemented in a timely fashion before any damage is done to nearby structures or utilities.

Finno’s work combines several areas of research, including field instrumentation and sensors with wireless communication capabilities, data storage and display, and intelligent, self-updating numerical models to simulate the actual excavation and support process. Results of numerical simulations provide predictions of anticipated ground and structure movements. An extensive laboratory experimental program provided the basis for models that represent the stress-strain behavior of the soils in the numerical simulations, a key ingredient in the prediction process. These new technologies and improvements were checked during development, and ultimately verified, in the field in real time during excavation projects.

This adaptive management method of optimizing performance predictions has been applied to excavations throughout the country, including a number of projects in the Chicago area, such as the design and construction of the excavation support systems for the Block 37 development and the Robert H. Lurie Comprehensive Cancer Research Center of Northwestern University. Finno’s team also has applied it at the Olive 8 high-rise development in Seattle and the renovation of the Museum of Fine Arts in Boston.

In these projects, urban congestion dictated ground-movement limits of as little as one inch for excavations as deep as 70 feet, restrictions that have necessarily advanced the state of the art. The work has been accomplished with extensive in-kind support of contractors, such as Case Foundation Company, Turner Construction Company, Thacher Engineering Corporation, Hayward-Baker and Schnabel Foundation Company, engineering firms including STS Consultants, AECOM, and GeoEngineers, and the Board of Underground of the City of Chicago. The work is funded by the NSF and the Infrastructure Technology Institute at Northwestern.
Latin America contains some of the most unequal societies on the planet, and such inequality has been central to the region’s historical development. Few features of Latin American politics, economies, societies, or cultures can be explained without some reference to extreme social inequality, and the stark contrast between natural riches and human poverty has been a regional emblem for centuries. How can all of this be explained? Is inequality a legacy of colonialism, a product of underdevelopment, the fruit of racism or exploitation? Does it spring from state weakness or state design, from institutional exclusion or bureaucratic overreach? Has it been eased by economic growth, democracy, education, legal reform, or urbanization? Have the poor themselves had any success in overcoming it?

These questions are at the heart of Brodwyn Fischer’s research on the history of modern Brazil. Fischer, history, has sought to move beyond historical paradigms born of the European or U.S. experiences, considering how Brazil, like most other countries in the global south, has produced forms of inequality that are often quite different from those of the North Atlantic world.

Her recent book, *A Poverty of Rights*, argues that much of Brazil’s urban inequality is rooted in poor peoples’ weak citizenship and legal status. This “rights poverty” is all the more intractable because it has become woven into urban economies and politics, the basis of power and profit for multiple constituencies. *A Poverty of Rights* has been recognized with prizes from the Urban History Association, the Conference on Latin American History, the Brazilian Studies Association, and the Social Science History Association, which also devoted a conference panel to the book in November 2010.

Fischer’s current work seeks to extend her research on inequality into new thematic terrain, including Brazilian race relations and the “great migrations” that transformed Brazil from a rural to an urban nation from the late 19th to the mid-20th century. Fischer’s current research abroad is supported by a Fulbright-Hays grant, and she was one of nine scholars nationwide to receive a 2010 Frederick Burkhardt fellowship from the American Council of Learned Societies.
Cells Sticking Together: The Importance of Calcium Homeostasis in The Epidermis

Cell adhesion plays a crucial role in embryogenesis, differentiation of adult tissues, and wound healing. Kathleen Green, pathology, and researchers in her laboratory study the function and regulation of cadherin adhesion molecules and their associated proteins, which are building blocks used to construct junctions between cells. These junctions are sites where mechanical and chemical signaling pathways intersect to coordinate cell functions important for controlling cell growth and survival, cell motility, and tissue morphogenesis.

Cell-cell junctions known as desmosomes are abundant in tissues that experience mechanical stress. Interfering with desmosome assembly and organization results in devastating skin disorders and lethal heart arrhythmias. While congenital disorders are frequently due to mutations in genes encoding the junction molecules themselves, this isn’t always the case. One such disorder that caught the attention of the Green lab is a skin disease called Darier’s Disease (DD), a rare genetic disorder characterized by blistering and scaling skin lesions. At a cellular level one observes loss of adhesion between epidermal skin cells (keratinocytes) and structural defects in desmosomes.

Investigators discovered that the disease, rather than being caused by mutations in desmosome molecules, is caused by mutations in a calcium pump localized on the endoplasmic reticulum membranes, a major regulator of intracellular calcium homeostasis.

Along with collaborators at Northwestern including Murali Prakriya, molecular pharmacology and biological chemistry, and Mitchell Denning at Loyola, Ryan Hobbs and his colleagues in the Green lab uncovered a connection between defects in activation of the enzyme protein kinase C (PKC) and a protein called desmoplakin in cells lacking the DD pump. Desmoplakin was cloned and characterized in the late 1980s by the Green lab, and shown to anchor the intermediate filament cytoskeleton to the desmosome, an association required for normal tissue integrity. Further research determined that restoring PKC signaling rescues cell-cell adhesion in DD cells and may have therapeutic benefit for patients with this disorder.

Skin disease studies in the Green lab are supported by grants from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), including an ARRA supplement.
Performing One’s Identity
The focus of E. Patrick Johnson’s research is how individuals perform their racial, gender, sexual, and class identity. What Johnson, performance studies, frames as performance covers various modes of human communication — from language use to storytelling to cultural rituals. In addition to examining how others perform their identity, he adapts his research for the stage to further engage questions of social and political efficacy, advocacy, and ethics.

The most recent example of this dual method of presenting research is his oral history of African American gay men who were born, raised, and continue to live in the American South, which culminated in the book, *Sweet Tea: Black Gay Men of the South*. He adapted some of the oral histories collected in the book into a play, *Sweet Tea*, which also includes his own story as the researcher/performer and as a black gay man from the South. The book exists as a scholarly archive, while the performance exists as that archive brought to life.

Compelled by an ethical stance common among performance scholars, Johnson uses the play not only to speak about the men, but also to and with them. This dialogic approach to writing provided Johnson with an opportunity to highlight the power dynamic between the men he interviews and himself and to expose his own challenges, joys, and sorrows as a black gay Southerner. Indeed, the play employs art as activism and advocacy on behalf of this marginalized group.

As playwright and performer, Johnson serves as a mediator between the audience and his absent research subjects; yet he still communicates the substance of their lives (and his own) in ways that alter others’ perceptions and belief systems about homosexuality — especially in the South.
Camelia Kuhnen
Kellogg School of Management

Money on the Brain
Camelia Kuhnen, finance, studies the brain mechanisms responsible for financial choices. She has documented that brain areas that generate emotional states and guide behavior in primitive circumstances (such as seeking food or avoiding predators) are also important for processing information about monetary reward, punishment, and risk. In the paper “The Influence of Affect on Beliefs, Preferences and Financial Decisions,” forthcoming in the *Journal of Financial and Quantitative Analysis*, Kuhnen and coauthor Brian Knutson of Stanford University study whether emotions affect financial choices by modifying people’s risk tolerance or how they learn from new financial information.

In an experimental setting, the authors observed participants’ financial choices and measured their beliefs about the possible payoffs of available investments. Changes in emotional states were induced through experimental manipulations or resulted from participants’ investing activity.

The authors found that two emotional states, excitement and anxiety, influence risk preferences and the way people learn in markets. The propensity to take risks is increased by excitement and decreased by anxiety. The learning process is influenced by whether an individual experiences a good or poor outcome, whether that outcome is better or worse than that of investments not chosen, and whether that outcome does or doesn’t confirm prior choices. These events generate either excitement or anxiety by triggering activation in emotional brain areas and influence the encoding of new information conveyed by the events.

For example, people do not fully incorporate news about investment options that contradict their prior actions. And events that generate positive affect, as when new information validates subjects’ prior choices, lead people to be more confident in their ability to identify the quality of the available investment options. Hence emotions change the way we learn in financial markets and the amount of risk we’re willing to bear.
Tsutomu Kume
Feinberg School of Medicine

New Insights into Cardiovascular Development and Disease

The cardiovascular system is the first functional unit to form during embryonic development and is essential for the growth and nurture of other developing organs. Failure to form the cardiovascular system often leads to embryonic lethality and inherited disorders of the cardiovascular system are quite common in humans. The causes and underlying developmental mechanisms of these disorders, however, are poorly understood.

Tsutomu Kume, medicine, and his laboratory are working to better understand this process using mice as animal models. About a decade ago Kume discovered that the Foxc1 and Foxc2 genes are important for cardiovascular development. Specifically, his research is being conducted to elucidate the molecular basis for the role of Foxc1 and Foxc2 in the differentiation of arteries and veins. Given that arteries and veins are morphologically and physiologically distinct, it was, until recently, believed that they are differentiated from primitive blood vessels according to changes in blood flow and physiological factors. It has now become evident, however, that this process is established by genetic mechanisms before circulation begins in the embryo. Kume’s research group is seeking to define the molecular hierarchies that act at the nexus of arterial and venous differentiation.

His laboratory also is interested in understanding angiogenesis — the formation of new blood vessels from preexisting vessels — which is essential not only for embryonic development, but also for maintenance of adult tissues. This process is tightly regulated by the balance of pro- and anti-angiogenic factors, and many of these molecules are involved in both embryonic and pathological angiogenesis. Kume and his team have found that Foxc1 and Foxc2 control pathological angiogenesis in tumors and injured corneas. Kume believes that elucidation of Foxc function will likely address a fundamental question: how do blood vessels form normally and go awry in the development of many diseases. The long-term goal of Kume’s research is to provide new insights into the mechanisms that lead to the development of therapeutic strategies designed to treat clinically relevant conditions of pathological angiogenesis under ischemia (a restriction in blood supply), including myocardial infarction, known as a heart attack.

Kume’s research is supported by NIH grants from the National Heart, Lung and Blood Institute and the National Eye Institute.

CD31 immunostaining of blood vessels in a mouse embryo at embryonic day 9.5. A vascular network for blood circulation has already formed.
A Global State of Accountability

In the absence of a world state, can global institutions such as the World Trade Organization, the International Monetary Fund, or the World Bank be made accountable to all those subject to their decisions? The goal of making global institutions more democratically accountable seems highly desirable. Yet there is an apparent inconsistency in demanding that global institutions be accountable to all those subject to their decisions while also demanding that the members of these institutions, as representatives of states, simultaneously remain accountable to the citizens of their own countries for the special responsibilities they have towards them.

This difficulty seems insurmountable in light of the widespread acceptance of a state-centric conception of human rights, according to which states bear primary responsibility for the protection of the rights and interests of their own citizens. It is on this basis that delegates of member states in global institutions feel obligated to protect and promote the interests and rights of their own citizens and not those of all people subject to their decisions.

Under current conditions of globalization, however, the state-centric conception of human rights is becoming increasingly implausible: States are bound to fail to protect the rights of their citizens when potential violations stem from transnational regulations or are perpetrated by nonstate actors.

Recent work by Cristina Lafont, philosophy, aims to articulate an alternative, pluralist conception of human rights that would show how specific rights obligations can be legally entrenched in global institutions while at the same time maintaining the obligations traditionally ascribed to states. One consequence of this conception is that the global and domestic responsibilities of representatives of member states are understood as significantly different and thus can be discharged simultaneously. This in turn offers normative support to the demand that global institutions be accountable to all those subject to their decisions even in the absence of a world state.
Joshua Leonard
McCormick School of Engineering
and Applied Science

Using Synthetic Biology to Engineer Living Devices

Microscopic devices that patrol the body seeking signs of disease have long been the purview of science fiction — like the craft from the classic film Fantastic Voyage. Now, according to Joshua Leonard, chemical and biological engineering, an emerging technical discipline termed synthetic biology provides a framework for developing biological devices that can be programmed to carry out specific tasks, bringing this dream a step closer to reality. Leonard and his research group are pioneering a technology suite that will make it possible to custom-program immune cells to treat cancer.

A major barrier to cancer treatment is that tumors acquire the ability to evade and co-opt the body’s immune response to further their own survival. Leonard’s group is targeting this persistent challenge via a novel approach — programming cells to travel to tumor sites, correct the immune dysfunction, and induce the body to control the tumor and prevent disease. In this way, Leonard’s group looks at cells as devices that receive inputs, process information, and perform useful functions. By introducing new genetic “software” into cells, they are building “devices” that function in ways that natural immune cells do not — for example, by marshaling a potent immune response in the normally immune-suppressive microenvironment surrounding a tumor.

Leonard’s group is engineering novel protein-based sensors that allow a cell to detect molecules produced by tumors. These sensors are then coupled through signaling networks to synthetic genetic circuits that process information, detecting states such as the presence or absence of environmental cues that specifically identify a tumor microenvironment. Finally, these circuits control the expression of genes encoding immune regulating proteins, such as particular potent cytokines. Thus, the engineered cells are programmed to induce potent immune stimulation only at the site of the tumor, an approach that could vastly improve both safety and efficacy over existing therapies. Related efforts focus on diagnostic biosensing and treatments for various other chronic diseases.

Leonard’s work in synthetic biology is supported by the National Academies Keck Futures Initiative and the NSF.
Overcoming Transplant Rejection

The research being done by Xunrong Luo, medicine, and her laboratory primarily focuses on methods of overcoming rejection of organ and tissue transplantations. The basic principle is to trick the body’s immune system to see foreign organs or tissues as “self” and accept the transplanted organs or tissues without further immunosuppressive medications instead of mounting a rejection response.

The need to avoid immunosuppression stems from the fact that almost all currently used immunosuppressive medications nonspecifically weaken the immune system. This predisposes the hosts to opportunistic infections as well as possible aggressive malignancies. In addition, most of these medications also have significant metabolic side effects that affect the overall health of transplant recipients.

Luo’s work attempts to re-educate the host’s immune system to induce transplant tolerance using two different approaches. The first is a form of “negative vaccination.” In this approach, the host is exposed to donor antigens prior to transplantation in the form of intravenous infusion of cells from the donor’s spleen that are treated with a chemical cross-linker called ethylene carbodiimide. This form of negative vaccination effectively controls the antidonor responses such that transplanted grafts are permanently protected (defined as more than 100 days) as compared with untreated recipients, who reject their graft within 25 to 20 days.

The second approach takes advantage of a unique cell population called “regulatory cells” that are capable of suppressing a body’s immune responses. Luo and her lab have established a system that allows effective generation and expansion of large numbers of such regulatory cells in tissue cultures. These cells can then be infused into transplant recipients or co-transplanted with tissue or cells. Both methods of delivery have shown that such tissue culture-generated regulatory T cells are effective at controlling transplant rejection and prolonging transplant graft survival.

Luo’s work is funded by the NIH and the Juvenile Diabetes Research Foundation. Part of the work was also funded by the American Recovery and Reinvestment Act.
Richard McGee  
Feinberg School of Medicine  

Researching the Researchers  
The research conducted by Richard McGee, associate dean of faculty affairs at Feinberg School of Medicine, is very different from most because he studies researchers themselves. He examines the approaches used to guide students and young professionals to becoming skilled scientists. Unlike medical and other professional training, research training relies predominantly on informal mentoring and is not guided by a standardized test of knowledge or skills. Although mentoring has many strengths, it also has a number of limitations that become problematic as time for mentoring is squeezed out by competing clinical, research, and other responsibilities. A number of years ago, McGee started asking the question: “What if we viewed the development of scientific talents as a science rather than something that just happens?” This question is especially important from the perspective of increasing the contributions of women and individuals from underrepresented ethnic and racial groups to biomedical research.

The research done by McGee’s group uses methods and theories provided by the social sciences, like sociology. The researchers use interviews to understand the experiences, thinking, and decisions of students. Information gathered in interviews is then studied from social science perspectives. One important perspective is called “communities of practice,” which provides insights into how newcomers become full members of a group (like a student joining a research group) or inadvertently become marginalized. Other key perspectives being studied include the processes by which students acquire an identity as a scientist and how they accumulate the “social capital” that is needed to succeed in the scientific community.

One long-term study of McGee’s begun in 2008 and funded by two NIH grants and an ARRA Supplement will follow upwards of 400 students beginning in college and through graduate school to understand how young scientists fine tune their career decisions. By comparing men and women and different racial and ethnic groups, McGee hopes to uncover new insights into why faculty diversity has been so difficult to achieve.

A new study of McGee’s, funded by an NIH Director’s Pathfinder Award to Promote Diversity in the Biomedical Workforce, will develop, test, and study a novel coaching model that takes what is being learned in McGee’s research and applies it to a new paradigm for developing scientific talent. The Pathfinder award will allow McGee and his research group to test this new model in a true randomized controlled trial.
Optimizing Health Care Decisions
Sanjay Mehrotra, industrial engineering and management sciences, conducts research in optimization methodologies and their applications to health care and bioinformatics problems. The problems he studies may involve multiple decision makers who have different goals and may provide imprecise data for model specifications. While his research centers on the use of such methodologies for improvements in health care, other application areas that benefit from his research include energy systems, public policy, logistics and transportation, business management, finance, and design. The decisions being made in these areas may be expressed as either real or integer variables, and the requirements may be expressed as deterministic or random constraints.

Mehrotra’s work involves both predictive and descriptive modeling of systems as well as algorithmic analysis of these models. To implement the models, he uses large-scale computing. His approach, dubbed the “Mehrotra Predictor-Corrector Method,” is quite popular for solving optimization problems involving continuous variables. By using novel risk-adjusted multiple objective models, his research team recently demonstrated that New York and Chicago are not adequately funded under the U.S. Urban Area Security Initiative program. The study results, released just prior to the failed New York bombing attempt in May, received immediate media attention.

Mehrotra’s research team worked with the Department of Surgery in the Feinberg School of Medicine and found that the requirements imposed by the Accreditation Council for Graduate Medical Education on U.S. medical residents are not being met — research suggesting that a shift in national educational approach may be necessary. Mehrotra also is working with transplant physicians on problems of geographical disparities resulting from ad hoc policies in national organ-allocation programs. Additionally, he collaborates with the medical informatics group at Northwestern on medical record access policies and with Northwestern Memorial Hospital to improve hospital operational efficiency.

Mehrotra’s work is funded by the NSF, the Office of Naval Research, the Department of Energy, and the NIH.
Annual Report 2010 | Excellence in Research

Ken Paller
Weinberg College of Arts and Sciences

Hidden Mechanisms of Human Memory

Our activities each day require remembering an endless number of things — from where we placed our keys to who we need to meet and how to complete various tasks. To accurately remember all these things, a complex set of brain functions comes into play. Memory experiments aim to reveal how these feats are accomplished.

When people recognize an object that was viewed moments earlier, they typically are aware of remembering. However, memory can also be expressed with no awareness of memory retrieval. These unconscious types of memory depend on different brain mechanisms and are usually preserved in people with amnesia.

Experiments from the laboratory of Ken Paller, psychology, indicate that the ability to remember which of two objects was viewed earlier could sometimes be driven by unconscious memory. Electrical patterns of brain activity show whether recognition occurred with or without the awareness of memory retrieval. When participants were unaware of retrieval, they recognized objects with high accuracy but claimed to be guessing.

Remembering depends on learning and retrieving, but also on preserving memory storage in the meantime. Mounting evidence suggests that memory preservation partially depends on sleep. Paller’s findings published in Science show that sounds played during sleep can function as reminders of stored information from prior learning. In this study, memories were selectively strengthened during a nap by sounds so soft that participants did not notice them.

This research illuminates several memory mechanisms that typically escape awareness. Through collaborations with the Feinberg School of Medicine, Paller’s team also investigates memory dysfunction in Alzheimer’s disease.

His research is funded by the NSF, the NIH, the Alzheimer’s Association, and the State of Illinois.

People can recognize colorful objects like these without knowing it.

Panels A and B show neural signals of recognizing with and without awareness of memory retrieval, respectively. Colors indicate average electrical potentials on the scalp for a series of eight 100-millisecond intervals starting when objects appeared, as reported in a paper in Nature Neuroscience.
Dorothy Roberts
School of Law and Institute for Policy Research

Written in Our Genes? Social Implications of Race-based Science and Technology

A decade ago, the Human Genome Project proved that human beings are not naturally divided by race. But for the last five years, Dorothy Roberts, law and Institute for Policy Research, has documented how the emerging fields of population genomics, personalized medicine, genetic genealogy, and DNA databanks are resuscitating race as a biological category written in our genes. In 2005, for example, the FDA approved the first race-specific drug, a therapy for African American heart failure patients.

Supported by four prestigious grants — an NSF Scholar’s Award, a Robert Wood Johnson Foundation Health Investigator Award, a fellowship at Stanford’s Center for the Comparative Study of Race and Ethnicity, and the 2010 Dorothy Ann and Clarence L. Ver Steeg Distinguished Research Fellowship — Roberts studied academic and media reports of new race-based biotechnologies and interviewed dozens of researchers at the forefront of the scientific and political debates about them. Her project also uses legal theories of racial equality to analyze the relationship between growing race consciousness in science and political contests over race consciousness in social policy. She situates the development of race-based biotechnologies within political debates about the validity and proper use of race as a category in science, law, and social policy.

Roberts’s book, Fatal Invention: How Science, Government, and Big Business Re-create Race in the 21st Century, will be published by The New Press in 2011. Roberts hopes her project will contribute to scientific research and public policy on race by helping scientists, policy makers, and the broader public better understand the social implications of race-based science and technology in the context of political and legal debates about racial equality. The ethical framework it proposes will provide practical guidance to researchers and policy makers charged with determining the proper role of race as a scientific category.
Developing “Green” Biological Catalysts

Metalloenzymes are proteins that use metal ions to catalyze fundamental chemical reactions. Amy Rosenzweig, molecular biosciences, and her group use X-ray crystallography to generate three-dimensional pictures of single metalloenzyme molecules. In a 2005 *Nature* article, they determined the molecular structure of nature’s predominant methane oxidation catalyst, a metalloenzyme called particulate methane monooxygenase (pMMO). pMMO converts methane, the most inert hydrocarbon, to methanol. This reaction is the first step in the metabolic pathway of methanotrophs, bacteria that use methane as their sole source of carbon and energy. This research project was particularly challenging because pMMO is a membrane-bound enzyme. Because membrane proteins are located in the hydrophobic lipid bilayers of cells and are notoriously difficult to isolate, very few have been characterized in molecular detail.

Methane oxidation presents a formidable problem to industry in terms of cost, requirements for high temperature and pressure, and the production of toxic waste. By contrast, the pMMO enzyme performs this chemistry under ambient conditions in an environmentally friendly way. Thus, knowledge of the pMMO catalytic site may impact the use of methane as an alternative energy source by facilitating the development of new “green” catalysts.

Despite the structure Rosenzweig and her lab determined in 2005 and extensive research efforts by them and other laboratories, the exact nature of the enzyme’s catalytic site has not been established and has been intensely controversial. In an article published in 2010 in *Nature*, Rosenzweig and her group pinpointed the location of the active site in the structure, showed that the enzyme requires copper, and prepared synthetic protein fragments that do the chemistry in the absence of the membrane-bound regions of the protein. These synthetic protein fragments might ultimately be developed into a new type of biological catalyst.

Rosenzweig’s research is funded by the NIH National Institute of General Medical Sciences.
Rediscovery of a Forgotten Donatello

In 2006 at the Beinecke Library at Yale University, Marco Ruffini, French and Italian, found previously unknown handwritten annotations to a copy of Giorgio Vasari’s *Lives of the Artists* (1550), the most important source on Italian Renaissance art. The annotations, written a few years after the publication of the volume, record a work ignored by Vasari: a monumental wooden crucifix attributed to the early Renaissance master Donatello in the church of Santa Maria dei Servi in Padua, Italy. The sculpture was very well-known at the time thanks to a miracle that took place in 1512. Ecclesiastical sources record that the image perspired blood continuously for fifteen days in 1512 and that the miracle gained immediate popularity.

In spite of its monumentality, outstanding formal qualities, and uninterrupted visibility in one of the most central churches of Padua for more than five centuries, the crucifix is virtually unknown to art historians. It is mentioned only in a 1935 monograph on Donatello by the German scholar Hans Kauffmann as an anonymous copy of the famous bronze crucifix Donatello executed also in Padua for the Basilica del Santo between 1444 and 1449.

Ruffini shared his findings with the Italian art historian and Donatello expert Francesco Caglioti. The two worked closely together for more than three years in Rome, Florence, and Padua uncovering two other manuscript sources from the same period that corroborate the attribution of the sculpture to the Florentine master. This evidence was confirmed by Caglioti’s scrupulous examination of the work itself in comparison to the artist’s other works and other crucifixes of the period.

Ruffini and Caglioti revealed the results of their studies at the University of Trento and at the Kunsthistorisches Institut in Florence and published them in the scholarly journal *Prospettiva*. The attribution is so far unanimously accepted, and the discovery was celebrated in the Italian media.
Mathematics teachers today face challenges like never before. There is pressure for teachers to meet rigorous external standards for student learning while simultaneously creating classroom environments in which students’ own ideas are valued. These demands increasingly require teachers to think quickly and deeply about their students’ ideas. As Miriam Sherin, education and social policy, explains, “Classrooms are complex environments in which many things happen at once. Teachers must continually decide where to focus their attention and instructional efforts.” Making the challenges even more difficult is the fact that students’ ideas can be complicated and may not be articulated clearly. Thus, while teachers are expected to quickly diagnose students’ understandings, making sense of students’ ideas in the midst of instruction can be quite difficult.

Sherin and her colleagues examine how video can help teachers develop the ability to identify and interpret significant interactions in the classroom. Her research is informed by the work of anthropologist Charles Goodwin who introduced the concept of “professional vision.”

"If you’re a detective, you get really good at noticing what’s important when you see a crime scene,” Sherin notes. “We’re investigating teachers’ professional vision. How do teachers make sense of what’s happening in a classroom? And how might video help them learn to more effectively pay attention to and make sense of students’ ideas?"

A central focus of Sherin’s research has been video clubs in which groups of teachers meet together to watch and discuss excerpts of videos from their classrooms. Sherin has documented that video clubs prompt teachers to increase their attention to their students’ thinking, both in the video club meetings and in their subsequent instruction. Furthermore, through ongoing video club meetings, teachers develop effective strategies for interpreting students’ ideas — strategies that they subsequently apply during teaching, thereby increasing opportunities for student learning.

Sherin’s research has been supported by the NSF, the Spencer Foundation, the Martinson Family Foundation, and the Arthur Vining Davis Foundations.
Randy Snurr, chemical and biological engineering, and his research group are using molecular-level modeling to help develop new nanoporous materials for a number of problems related to energy and environmental issues. These materials, which have pores on the nanometer-length scale, can be used to recognize and discriminate between different gas molecules. For example, some materials selectively adsorb carbon dioxide in the presence of nitrogen and show promise for removing carbon dioxide from the exhaust of coal-fired power plants as part of a carbon capture and sequestration strategy. In another application, Snurr and his collaborators try to use the nanometer-scale pores to store molecules, such as hydrogen.

Storing hydrogen is one of the most difficult problems in developing a hydrogen economy. Hydrogen is a common fuel for highly efficient fuel-cell vehicles, but it is extremely difficult to store this light gas in a car without using extremely high pressures and heavy tanks. As part of a Department of Energy-sponsored project, Snurr and his collaborators are developing porous, "spongy" materials that can adsorb large amounts of hydrogen and could, thus, be used in the fuel tanks of future vehicles.

A promising class of nanoporous materials for hydrogen storage are the metal-organic frameworks, or MOFs. These materials are synthesized in a building-block approach from inorganic “corners” connected by organic “linker” molecules. These building blocks self-assemble to create nanoscale scaffolds with well-controlled pore sizes, pore architectures, and chemical functionality. MOFs are known to have extremely high surface area per unit mass, providing lots of surface that hydrogen molecules can interact with. One strategy for improving hydrogen storage in MOFs is to work on increasing surface area per gram. Recently, Snurr was part of a team that produced the material with the largest surface area ever synthesized: over 6,000 square meters per gram, roughly the area of a football field in something the weight of a paperclip.
Lynn Spigel, radio/television/film, is a cultural historian who focuses on media, technology, and family life. Her work explores how media technologies are integrated into the home and how they both reinforce and disrupt traditional patterns of family life. Her book *Make Room for TV* (University of Chicago Press, 1992) examines television’s arrival in the home in the 1950s.

Spigel finds that TV penetrated American homes faster than any other previous technology, and there was widespread anxiety about what TV would do to family life. Spigel analyzes the way women’s magazines, films, television programs, and other venues of popular culture depicted television as a potentially threatening force. She also explores the way advertisers and networks attempted to persuade the public that TV would be just the opposite — a boon to family togetherness and even civic engagement.

In her subsequent books and essays, Spigel shows how many of the same anxieties voiced about television in the 1950s are now being voiced in relation to the Internet, video games, and other new media technologies. Spigel argues that in order to understand the effects of media on culture we also need to understand the effects of culture on media.

Her recent book, *TV by Design* (University of Chicago Press, 2009) uncovers the virtually uncharted history of television’s relationship to modern painting and design. Spigel shows how TV was instrumental in introducing the public to the latest trends in art and design.

Currently, Spigel is writing about “smart homes” (or homes based on digital architecture, Internet connectivity, and ubiquitous computing). She explores smart homes in relation to the longer history of twentieth century modern architecture and modernist utopias. From this historical perspective, she analyzes cultural fantasies about home, gender, class and race in digital culture today.
Creating an Invisibility Cloak for Terahertz Waves

The visual appearance of objects is determined by the extent to which they modify light due to geometric scattering and material absorption. Thus in order to hide an object from being detected, the changes to the light in both its geometry and spectrum must be concealed. This is the job of the invisibility cloak being developed by Cheng Sun, mechanical engineering.

Sun is interested in photonic and acoustic metamaterials, a new class of artificial materials engineered to provide properties not readily available in nature. Those properties originate from structure rather than composition and result from engineering the inclusion of small inhomogeneities (materials having different electron densities) to create effective macroscopic behavior — i.e., behavior that can be seen by the naked eye. His previous research has led to the successful demonstration of negative refraction of light and optical imaging with superior resolution beyond the diffraction limit.

The invisibility cloak Sun is designing can be used to hide a real object from being detected by a terahertz (10^{12} hertz or THz) wave. By transforming space and light propagation using metamaterials with spatially varying refractive indexes, the object can be perceived as having reduced number of dimensions in the form of points, lines, and thin sheets, making it undetectable because of its scattered field. The invisibility cloak consists of a reflective bump. By engineering the refractive index distribution above the reflective surface, the pathway difference of the lights reflected by the bump surface are fully compensated for, so the reflected light remains undisturbed. Because of the reflected light, the reflected bump is perceived as a flat surface, and so one can hide an object beneath the bump without its being detected.

The unique vibrational, rotational, and translational responses of materials within the THz domain carry unique molecular signatures that are generally absent in optical, microwave, and X-ray frequencies. The ability to manipulate THz wave propagation by engineering metamaterials undoubtedly will initiate new possibilities for a variety of intriguing THz applications with unprecedented functionalities.
Some people argue that the minimum wage helps workers who have jobs but hurts those who do not. Yet one has to factor that in many cases, workers also receive tips, commissions, or bonuses to provide incentives to work hard in an environment where effort cannot easily be monitored directly.

Jeroen Swinkels, management and strategy, and his colleague Ohad Kadan at Washington University in St. Louis found that in workplaces offering incentive pay, an increase in the minimum wage hurts not just job seekers but also those who are already employed.

Employers find it is more costly to induce effort when there is less ability to punish workers for poor performance by lowering payments. Kadan and Swinkels, however, identify an additional factor that affects how the desired level of work is spread across employees in the workplace. They have shown that when employers raise the minimum wage, more effort is required from the workers they continue to employ. Their research also shows that workplaces will cut output or service levels. Employment thus takes a double hit: there is less work to be done overall and it is concentrated on fewer employees. Finally, because employment falls, work contracts need not be as attractive to bring the necessary number of workers into the sector. As a result, workers who maintain their positions may end up with compensation packages in which the minimum wage has gone up but incentive pay is adjusted in such a way that the workers are worse off overall.

This idea — that a more restrictive minimum payment can leave workers worse off — can also be applied to relations between a firm and its suppliers. For example, allowing more generous damages in contractual relations between a firm and its suppliers may lead to contracts in which, even though the payoff to the supplier under poor performance is worse, the contract is nonetheless preferred by the supplier.
Addressing Common Health Disparities in Uncommonly Studied Populations

Linda A. Teplin, psychiatry, studies populations that fall into the interstices between the mental health and criminal justice systems. Public health researchers seldom investigate incarcerated populations and how incarceration affects health. Criminologists rarely study health issues. Most large-scale longitudinal epidemiologic surveys systematically exclude persons who are incarcerated at follow-up, an omission that biases findings because those with the worst outcomes are not represented. Excluding incarcerated populations especially underrepresents African American males because, according to Department of Justice statistics, nearly 1 in 9 African American males, ages 25 to 34, is incarcerated at any given time.

Teplin’s current investigation, the Northwestern Project (originally the Northwestern Juvenile Project but renamed now that participants are adults) is the first large-scale longitudinal study of health needs and outcomes of delinquent youth. Findings from Teplin’s landmark studies have shaped U.S. public health policy. Results have been cited in Supreme Court amicus briefs, congressional hearings, and Surgeon General reports.

More than 1800 juvenile detainees, ages 10 to 18, were enrolled between 1995 and 1998. Teplin’s research group tracks and periodically reinterviews them. Although most participants now live in the community, project staff interview participants wherever they are living, whether in correctional facilities or not.

The Northwestern Project initially focused on psychiatric disorders. As participants have aged, the focus has changed to address emerging threats to health: continued drug and alcohol abuse, HIV/AIDS risk, and HIV infection. More than any other racial or ethnic group, African Americans are disproportionately incarcerated and affected by HIV/AIDS. For example, although African Americans comprise only 12 percent of the general population, they comprise about 40 percent of incarcerated youth and adults and nearly half of new cases of HIV. To reflect Teplin’s new focus, the University has changed the name of her research program to Health Disparities and Public Policy. The program complements other work on health disparities at Northwestern, among them: Romana Hasnain-Wynia’s studies of quality of care; Lindsay Chase Lansdale’s studies integrating the social, life, and biomedical sciences; and Martha Daviglus’ work on health disparities in the epidemiology of cardiovascular and other chronic disease.

Teplin’s research group has recently received grants from the NIH (National Institute on Drug Abuse and National Institute on Alcohol Abuse and Alcoholism) and the Department of Justice (Office of Juvenile Justice and Delinquency Prevention) to examine how patterns of incarceration, release, and reentry into the justice system affect drug and alcohol abuse, HIV/AIDS risk behaviors, and HIV infection. One unexpected finding: the death rate. To date, 103 participants in the project have died — most violently and the majority from homicide.

This pie chart, excerpted from an article published in Pediatrics in 2005, shows the causes of death among 65 youth who died as of March 31, 2004; 51 were male, 14 were female.
Environmental sustainability is increasingly seen as a societal responsibility, but achieving sustainability requires cultural and political change as much as improved scientific understanding. Klaus Weber, management and organizations and Northwestern Institute for Sustainable Practice, researches the historical and contemporary role of social movements in defining the relationship between business and the natural environment.

Weber seeks to understand the various pathways through which movements — collective efforts that challenge authorities and common practices — shape the environmental behavior of corporations and consumers. Weber analyzes data collected through systematic observation of behavior in real-life situations, in-depth interviews, and documents produced by activist organizations, businesses, and the news media to understand how activists influence public sentiment, corporate and consumer decisions, and the development of new technologies.

Weber’s research addresses questions such as: Why are genetically modified crops common in the United States but virtually banned in the European Union? Why did a few entrepreneurs begin to develop wind turbines and solar panels decades ago when oil was abundant and cheap? And why do consumers and companies in different countries have different priorities when it comes to sustainability?

A central insight of his research is that deeply held cultural beliefs are key to answering these questions. For example, his recent article, “Forage for Thought: Mobilizing Codes in the Movement for Grass-fed Meat and Dairy Products” published in Administrative Science Quarterly — winner of the Clifford Geertz Award from the American Sociological Association — showed how “cultural codes” of naturalness and authenticity guided farmers’ innovations. These common codes also allowed farmers to find a common language with consumers to form a new market for these products. In other research, Weber documents the social processes through which pressure groups outside and green activists inside companies influence corporate environmental practices.

Weber’s research suggests that strengthening grassroots networks in civil society are critical for driving economies towards greater sustainability.
Emily Weiss  
Weinberg College of Arts and Sciences

The Dynamics of Photo-excited Quantum Dots

Emily Weiss, chemistry, and her research group focus on the optical and electronic properties of nanostructures, structures measured in nanometers (a nanometer is the size of a single molecule). They are concentrating on quantum dots (semiconductor nanocrystals). They functionalize the quantum dots with various organic and organometallic molecules and monitor the evolution of the photo-excited states of these inorganic-organic hybrid materials using time-resolved optical spectroscopies.

The optical spectra of quantum dots can be tuned by their size, which makes them potentially useful for applications that depend on light absorption or emission, such as fluorescence sensing and tagging, and serving as active materials within photovoltaic (electric current-producing) and photocatalytic (reaction-accelerating) cells.

Like all nanostructures, quantum dots have a very high surface-area to volume ratio. The surface of the quantum dot can limit its performance in all of the applications mentioned above because the surface is an unnaturally terminated semiconductor lattice. This means that it is composed of hundreds of incompletely coordinated metal ions that serve as thermodynamic trap sites for excitonic charge carriers that are supposed to be performing a function such as charge transfer or radiative recombination.

Weiss’s research aims not to change the effects of the surface on the optical properties of quantum dots, but rather — through functionalization with rationally designed organic molecules — to use the surface chemistry to enhance desirable properties of the nanocrystals. She aims to create functional, nanostructured inorganic-organic hybrid materials that perform better within alternative energy and sensing applications than do well-passivated quantum dots alone.

Weiss’s research is funded by a Department of Energy Early Career Research Award and an Air Force Office of Scientific Research Young Investigator Award. She recently was awarded the Presidential Early Career Award for Scientists and Engineers and a Packard Foundation Fellowship in Science and Engineering.
Michael Wolf  
**Feinberg School of Medicine**  
**School of Education and Social Policy**

**Health Care That Speaks Your Language**

Michael Wolf, medicine and learning sciences, serves as associate division chief for research in general internal medicine. In 2005, Wolf founded the Health Literacy and Learning Program (HeLP) to engage interdisciplinary research that would seek out ways to simplify the patient experience in health care. HeLP and the general internal medicine division address a range of practical issues, such as enhancing drug labeling, improving access to medical information in one’s own language, standardizing prescribing of medications, and developing plain-language information to promote learning about health across a range of issues.

Wolf’s recent research has mostly focused on medication safety. Working with the Food and Drug Administration, U.S. Pharmacopeia, and the Institute of Medicine, among others, he has proposed to standardize the way physicians prescribe, using a “universal medication schedule.” UMS would get rid of Latin abbreviations that may cause errors and confusion and instead rely on more explicit times (morning, noon, evening, bedtime) to direct patients when to take their medicine. Wolf’s work testing this concept is funded by the National Cancer Institute, the Agency for Healthcare Research and Quality, and the Office of Behavioral and Social Sciences Research within the NIH. Wolf is leveraging electronic health records at points of prescribing and dispensing to ensure patients receive clearer, more understandable, and more explicit information to support the safe use of a medication regimen.

At the beginning of 2010, Wolf’s research on health literacy and medication safety had a prompt policy impact. California’s Board of Pharmacy named Wolf in a bill signed by Governor Schwarzenegger that requires pharmacies to provide their patients with the UMS instructions as applicable. With his colleagues at Emory, Louisiana State, Harvard, and Cornell universities, he is helping to develop and disseminate consumer-directed medication information.

Wolf is now in Britain, having received a Fulbright fellowship to engage in health literacy research throughout the United Kingdom and to build collaborations between Northwestern and various academic institutions there.
Determining Which Genetic Variants Influence HIV Susceptibility

Over 33 million people are infected with human immunodeficiency virus (HIV), the virus that causes AIDS. Because the HIV genome is small and encodes few proteins, it must use machinery inside the cell to multiply. The virus relies on borrowed human proteins to infect immune cells, enter the nucleus, integrate into the host chromosome, and copy itself. HIV can evade the immune response to persist in some cells or continue to infect and kill others, usually the same immune cells that should clear it.

Identification of the borrowed human proteins that carry out essential functions during the HIV life cycle is important to understand the relationship between the virus and its host. Small interfering RNAs, which inhibit transcription and prevent the targeted genes from making their protein products, have been used to disrupt thousands of genes and, in so doing, identified previously unrecognized human proteins and biological pathways involved in HIV infection. High expression of many of these human genes is found in the immune cells targeted by the virus for infection.

Variations in DNA sequence may have a significant impact on how humans respond to HIV. Natural variations in the expression levels of human proteins that can impact HIV replication could contribute to the immune responses to HIV infection, act as cofactors important for replication, or be cellular restriction factors that have the intrinsic (or innate) ability to suppress HIV replication. It is likely that most associations do not involve human proteins already related to HIV disease. HIV/AIDS is a complex condition, and therefore rare alleles with strong phenotypic effects are likely to contribute significantly to HIV/AIDS susceptibility.

To ferret out rare genetic variants that influence HIV/AIDS susceptibility, Steven Wolinsky, medicine, and members of his lab are using a hypothesis-driven approach that involves isolating and sequencing parts of the human genome that code for the catalog of borrowed human proteins. They are analyzing the genomes of hundreds of patients with the extreme phenotypes for HIV/AIDS susceptibility. After filtering out mutations that do not change the amino acids in the protein or are found commonly, they will confirm that these genetic variants link tightly to the risk of disease and actually modulate HIV infection in a population-based cohort study. As a result, they will learn how our genome affects HIV disease and find potential drug targets.
Computational Techniques for Alternative Energy Materials

Christopher Wolverton, materials science, and his research group use computational tools to investigate materials for alternative energies and sustainability. The computational techniques are atomic scale and involve solving, from “first principles,” the fundamental equations of quantum mechanics to determine the electron distributions in materials. These methods are predictive: Materials can be synthesized and studied on a computer in a “virtual laboratory” before they are ever made in a laboratory.

One of the main focuses of Wolverton’s research involves the discovery of novel materials for hydrogen storage. Hydrogen-fueled vehicles are all reliant on an efficient means of storing hydrogen as fuel on board the vehicle. Many experts today consider finding a high-density means for hydrogen storage to be one of the key bottlenecks towards the large-scale introduction of hydrogen-fueled vehicles. Reversible solid-state storage materials represent an approach whereby hydrogen gas (H₂) is liberated from a solid state material by applying heat, and then the spent material can be regenerated on board the vehicle by applying H₂ under pressure. However, current reversible solid-state storage materials suffer from one (or both) of two significant drawbacks: (a) the storage material is very heavy, so while the volumetric density can be high, the density by weight (or gravimetric density) is low, and (b) the storage material binds the hydrogen too strongly and thus requires too much heat or energy to liberate the H₂.

What is required to overcome this hydrogen storage bottleneck is a cost-effective, lightweight material that will store hydrogen at a high (volumetric and gravimetric) density and bind hydrogen strongly enough to be stable, but weakly enough that the H₂ can be easily liberated with minimal heat input. Wolverton’s group has invented new computational techniques that aid in the discovery of novel hydrogen storage materials and reactions. Several new high-capacity reactions have been predicted by his group and are now being experimentally tested in nonvirtual laboratories.

Wolverton’s group also applies these computational tools to a variety of other energy-related materials topics: lithium battery materials, thermoelectric materials, nuclear fuel materials, the discovery of new materials for solar thermochemical production of fuels, and lightweight energy-efficient structural materials.

First principles computation of the atomic-scale structure of the high-capacity hydrogen storage material, Li4BN3H10, which contains more than 10 percent hydrogen by weight.
The more than half a billion dollars of research grant funding awarded to Northwestern University in FY2010 represents both the largest yearly total of funding and the biggest percentage increase in the University’s history. The $556.4 million of funding this year showed an increase of 17 percent, almost doubling last year’s increase of 9 percent (from $438.8 million in 2008 to $476.9 in 2009).

The 2010 increase is due in part, but not completely, to the 279 awards totaling $72 million in funding from the American Recovery and Reinvestment Act (ARRA). In 2010, the overall dollar volume of awards from federal agencies increased by 32 percent to $451.9 million. State of Illinois agency awards more than doubled, with an increase of 107 percent to $11.2 million. Awards from industry and foundations decreased by 44 percent to $39.8 million and 6 percent to $27.7 million, respectively.

When comparing Northwestern’s schools, it is important to understand that research in some disciplines is more costly than others. Significant research may be conducted in sociology, for example, with awards that are much smaller than the funding required to conduct research of comparable import in a field such as medicine or biotechnology. Also, award volume fluctuates from year to year, often due to opportunities in large program activities such as those in cancer research, materials science, and nanotechnology — or, as in this past year, opportunities from government programs such as the ARRA.

Nearly all of the University’s schools and colleges shared in this year’s growth, however. The Feinberg School of Medicine’s awards grew by 17 percent to $346.2 million. The McCormick School of Engineering and Applied Science increased its funding by 27 percent to $70.6 million. Awards to the Weinberg College of Arts and Sciences grew by 6 percent to $61.6 million. The School of Communication increased its awards by 3 percent to $8.3 million. The School of Education and Social Policy’s awards grew by 84 percent to $7.5 million. The Medill School of Journalism’s awards grew by 4 percent to $1.6 million. The Kellogg School of Management increased its funding by 11 percent to $783,096. Awards to both the School of Law and the Bienen School of Music declined — law by 52 percent to $1.2 million and music by 29 percent to $119,396. Funding for University research centers and institutes grew by 35 percent to $47.5 million.

**SPONSORED RESEARCH AWARDS**

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**Awards by Sponsor**

57.2% Department of Health and Human Services
8.9% National Science Foundation
6.4% Department of Defense
5.5% Department of Energy
3.3% Other Federal
7.1% Industry and Trade Organizations
5.0% Foundations
3.3% Voluntary Health Organizations
2.9% Other Nonfederal

**Awards by Administrative Unit**

62.2% Feinberg School of Medicine
12.7% McCormick School of Engineering and Applied Science
11.1% Weinberg College of Arts and Sciences
8.5% University Research Centers and Institutes
4.0% Other Units*
1.5% School of Communication

* Bienen School of Music, Central Administration, School of Continuing Studies, School of Education and Social Policy, Kellogg School of Management, School of Law, and Medill School of Journalism.
Sponsored Research Awards (Dollars in Millions)

Federal/Nonfederal Awards

Awards by Unit
AMERICAN RECOVERY AND REINVESTMENT ACT AWARDS

Northwestern researchers continued to do well in ARRA awards in 2010, winning 279 awards totaling $72 million in funding. While the difference between the two years seems enormous ($46 million or 174 percent), it’s best to remember that in FY2009, the funding was awarded for only 4 months, as compared to 12 months in 2010.

The bulk of the FY2010 ARRA awarded dollars (72 percent) went to principal investigators at Feinberg, while 9 percent was awarded to Weinberg and 8 percent to McCormick. University research centers were awarded 9 percent; and all other units, 2 percent.

ARRA Awards by Unit

<table>
<thead>
<tr>
<th>Unit</th>
<th># of Awards</th>
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<td>Weinberg College of Arts and Sciences</td>
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ARRA Awards

- **Federal** $379,659,431
- **Nonfederal** $104,529,950
- **Federal ARRA** $72,204,993

*Wien School of Music, Central Administration, School of Communication, School of Continuing Studies, School of Education and Social Policy, Kellogg School of Management, School of Law, and Medill School of Journalism.*
SPONSORED RESEARCH PROPOSALS

Both the number and dollar amount of proposals submitted by Northwestern researchers fell in 2010, as compared to 2009. The total dollar volume of proposals submitted in 2010 fell 7 percent to $2.052 billion, down from $2.2 billion in 2009. The difference in the number of proposals was 15 percent or 2,823 proposals down from 3,328 in 2009. The decrease was due largely to the diminishing availability of ARRA funding.

Feinberg School of Medicine research proposal activity decreased by 3 percent ($43.2 million). Proposals from McCormick were down by 38 percent ($161.5 million). Proposals from University research centers and institutes grew by 35 percent ($55 million).

Weinberg College submissions reflected a 3 percent increase ($6.6 million). The dollar volume of School of Education and Social Policy proposals increased by 89 percent ($15.3 million).

In FY2010 the overall dollar volume of proposals submitted to the federal government decreased by 7 percent ($149.9 million). Submissions to industrial sponsors also fell, by 29 percent ($17.6 million). Proposals to state and local government bodies dropped by 29 percent ($4.6 million), while those to State of Illinois agencies more than doubled ($6.12 million).

Proposals by Sponsor

- 66.3% Department of Health and Human Services
- 8.6% National Science Foundation
- 7.7% Department of Energy
- 6.0% Department of Defense
- 2.7% Other Federal
- 2.9% Voluntary Health Organizations
- 2.1% Foundations
- 2.0% Industry and Trade Organizations
- 1.7% Other Nonfederal

Proposals by Administrative Unit

- 60.6% Feinberg School of Medicine
- 12.9% McCormick School of Engineering and Applied Science
- 10.9% Weinberg College of Arts and Sciences
- 10.3% University Research Centers and Institutes
- 1.6% School of Communication
- 1.6% School of Education and Social Policy
- 2.0% Other Units*

*Bienen School of Music, Business and Finance, Central Research- The Graduate School, Kellogg School of Management, School of Law, and Medill School of Journalism, Office of Information and Technology, Office of the President, Office of the Provost, Research Operations, School of Continuing Studies, Student Affairs, The Graduate School, University Library, University Press.

85.3% Federal

8.7% Nonfederal
Sponsored Research Proposals (Dollars in Millions)

Federal/Nonfederal Proposals

Proposals by Unit
AMERICAN RECOVERY AND REINVESTMENT ACT PROPOSALS

The total number of proposals Northwestern submitted to federal agencies for ARRA funding in FY2010 was 90 for a total dollar amount of $124.8 million, compared to 614 for $435.67 million in FY2009. This decrease reflects the diminishing availability of ARRA funds in 2010.

The Feinberg School of Medicine submitted the greatest number of ARRA proposals in 2010: 55 proposals amounting to $80.66 million, or 65 percent of the total. The Weinberg College of Arts and Sciences came second with 15 ARRA proposals, totaling $19.4 million (16 percent). The McCormick School of Engineering and Applied Science came next with 12 ARRA proposals, amounting to $9.1 million (7 percent). Research Operations submitted 1 ARRA proposal for $10 million (8 percent). Research centers and institutes submitted 3 ARRA proposals for $3.8 million (3 percent). The Office of Information Technology submitted 1 ARRA proposal for $1.4 million (1 percent). The School of Communication submitted 2 ARRA proposals for $419,375, and the Kellogg School of Management submitted 1 ARRA proposal for $44,803.

### ARRA Proposals by Unit

<table>
<thead>
<tr>
<th>Unit</th>
<th># of Proposals</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feinberg School of Medicine</td>
<td>55</td>
<td>$80,662,979</td>
</tr>
<tr>
<td>Weinberg College of Arts and Sciences</td>
<td>15</td>
<td>$19,434,836</td>
</tr>
<tr>
<td>Research Operations</td>
<td>1</td>
<td>$10,000,000</td>
</tr>
<tr>
<td>McCormick School of Engineering and Applied Science</td>
<td>12</td>
<td>$9,061,340</td>
</tr>
<tr>
<td>University Research Centers and Institutes</td>
<td>3</td>
<td>$3,804,031</td>
</tr>
<tr>
<td>Office of Information Technology</td>
<td>1</td>
<td>$1,374,132</td>
</tr>
<tr>
<td>School of Communication</td>
<td>2</td>
<td>$419,375</td>
</tr>
<tr>
<td>Kellogg School of Management</td>
<td>1</td>
<td>$44,803</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
<td><strong>$124,801,496</strong></td>
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</tbody>
</table>

*Office of Information Technology, School of Communication, and Kellogg School of Management.
EXPENDITURES

Northwestern is known for its interdisciplinary approach to research and strongly encourages inter- and multidisciplinary research collaboration. To facilitate such collaborations, it is important to remove administrative barriers that might impede research interactions among departments, centers, and schools.

At the same time, ensuring appropriate credit is vital for fostering research collaborations. Tracking investigator expenditure credit is necessary to determine the appropriate distribution of facilities- and administrative-cost recoveries as well as for informing decisions regarding the allocation of space and other resources within the University.

Research expenditures, like award volume, grew in 2010. Total expenditures (direct plus indirect) increased by 17.7 percent over FY2009 to $470.8 million. The amount of expenditures for the Feinberg School of Medicine continues to grow, reaching $270.2 million in FY2010. This increase of 19.7 percent follows an increase of 10.3 percent in 2009. McCormick’s expenditures grew by 2.6 percent to a total of $59.2 million, up from $57.7 million in 2009. Weinberg College expenditures grew to $61.2 million, an increase of 12.7 percent. Expenditures for the University’s research centers grew by 30 percent to $34.9 million.
EXTERNAL METRICS

Northwestern had a mixed year in terms of rankings of federal awards for 2009 (data from federal agencies lag by one year). In volume of awards for universities, Northwestern dropped slightly, from 24th to 25th, in the National Institutes of Health (NIH) rankings and advanced to 30th from 38th in the ranking of National Science Foundation (NSF) awards for 2009. When viewed over a greater length of time, however, the growth in research volume at the University has been extremely positive. Since 2001 Northwestern’s funding from the NIH has increased by 65.8 percent to $184.5 million, while funding from the NSF has increased by 95.7 percent to $60.2 million; however, Northwestern’s ranking has stayed the same.

National Institutes of Health Awards to Domestic Institutions of Higher Education (Dollars in Thousands)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Johns Hopkins University</td>
<td>$457,362</td>
<td>1</td>
<td>$607,223</td>
<td>1</td>
<td>$603,367</td>
<td>1</td>
<td>31.9%</td>
</tr>
<tr>
<td>University of Pennsylvania</td>
<td>376,032</td>
<td>2</td>
<td>471,350</td>
<td>2</td>
<td>454,903</td>
<td>3</td>
<td>21.0%</td>
</tr>
<tr>
<td>Washington University</td>
<td>303,650</td>
<td>5</td>
<td>394,788</td>
<td>5</td>
<td>382,455</td>
<td>8</td>
<td>26.0%</td>
</tr>
<tr>
<td>Duke University</td>
<td>232,180</td>
<td>13</td>
<td>391,196</td>
<td>6</td>
<td>371,408</td>
<td>9</td>
<td>60.0%</td>
</tr>
<tr>
<td>Harvard University</td>
<td>270,226</td>
<td>8</td>
<td>321,224</td>
<td>12</td>
<td>363,470</td>
<td>11</td>
<td>34.5%</td>
</tr>
<tr>
<td>Yale University</td>
<td>256,664</td>
<td>10</td>
<td>336,743</td>
<td>10</td>
<td>357,364</td>
<td>12</td>
<td>39.2%</td>
</tr>
<tr>
<td>Columbia University</td>
<td>248,892</td>
<td>11</td>
<td>330,755</td>
<td>11</td>
<td>325,106</td>
<td>13</td>
<td>30.6%</td>
</tr>
<tr>
<td>Stanford University</td>
<td>224,781</td>
<td>14</td>
<td>305,561</td>
<td>14</td>
<td>306,735</td>
<td>15</td>
<td>36.5%</td>
</tr>
<tr>
<td>University of Chicago</td>
<td>131,241</td>
<td>27</td>
<td>194,717</td>
<td>23</td>
<td>214,138</td>
<td>20</td>
<td>63.2%</td>
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<tr>
<td>University of Rochester</td>
<td>121,954</td>
<td>32</td>
<td>162,312</td>
<td>34</td>
<td>188,205</td>
<td>23</td>
<td>54.3%</td>
</tr>
<tr>
<td>Cornell University</td>
<td>152,197</td>
<td>23</td>
<td>192,563</td>
<td>24</td>
<td>186,657</td>
<td>24</td>
<td>22.6%</td>
</tr>
<tr>
<td><strong>Northwestern University</strong></td>
<td><strong>111,299</strong></td>
<td>37</td>
<td><strong>168,377</strong></td>
<td>32</td>
<td><strong>184,539</strong></td>
<td>25</td>
<td><strong>65.8%</strong></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Massachusetts Institute of Technology</td>
<td>79,513</td>
<td>172,184</td>
<td>143,549</td>
<td>80.5%</td>
</tr>
<tr>
<td>Princeton University</td>
<td>33,262</td>
<td>37,660</td>
<td>48,764</td>
<td>36.6%</td>
</tr>
<tr>
<td>Rice University</td>
<td>5,488</td>
<td>10,088</td>
<td>12,714</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Percent increase of 131.7%.

Source: National Institutes of Health
http://report.nih.gov/award/trends/AggregateData.cfm
*Note: NIH ceased formally ranking institutions in 2005; 2009 rankings calculated from NIH “Aggregate Data 2009”

National Institutes of Health Awards Statistics (Dollars in Millions)

<table>
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<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIH Total Budget</td>
<td>$19,856</td>
<td>$27,532</td>
<td>$29,501</td>
<td>49%</td>
</tr>
<tr>
<td>NIH Published Success Rate*</td>
<td>32%</td>
<td>22%</td>
<td>21%</td>
<td></td>
</tr>
</tbody>
</table>

Source: National Institutes of Health
*Research Project Grants, Competing Applications
### National Science Foundation Award Summary by Top Institutions*

(Dollars in Thousands)

<table>
<thead>
<tr>
<th>University</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2009 Rank</th>
</tr>
</thead>
<tbody>
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<td>Cornell University</td>
<td>$90,192</td>
<td>$88,904</td>
<td>$109,968</td>
<td>$111,548</td>
<td>$155,181</td>
<td>3</td>
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<tr>
<td>Columbia University</td>
<td>69,901</td>
<td>72,084</td>
<td>62,482</td>
<td>74,144</td>
<td>104,788</td>
<td>9</td>
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<tr>
<td>University of Chicago</td>
<td>45,960</td>
<td>40,623</td>
<td>43,593</td>
<td>76,476</td>
<td>80,716</td>
<td>16</td>
</tr>
<tr>
<td>Massachusetts Institute of Technology</td>
<td>62,011</td>
<td>55,766</td>
<td>56,239</td>
<td>57,202</td>
<td>67,488</td>
<td>23</td>
</tr>
<tr>
<td>Stanford University</td>
<td>48,678</td>
<td>53,778</td>
<td>55,978</td>
<td>50,362</td>
<td>63,748</td>
<td>24</td>
</tr>
<tr>
<td>Harvard University</td>
<td>32,394</td>
<td>29,15</td>
<td>35,687</td>
<td>33,683</td>
<td>61,153</td>
<td>29</td>
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<tr>
<td>Northwestern University</td>
<td>29,503</td>
<td>33,234</td>
<td>41,657</td>
<td>32,274</td>
<td>60,247</td>
<td>30</td>
</tr>
<tr>
<td>Princeton University</td>
<td>38,554</td>
<td>44,301</td>
<td>39,554</td>
<td>41,180</td>
<td>55,893</td>
<td>38</td>
</tr>
<tr>
<td>University of Pennsylvania</td>
<td>28,300</td>
<td>27,415</td>
<td>27,643</td>
<td>27,991</td>
<td>48,589</td>
<td>43</td>
</tr>
<tr>
<td>Johns Hopkins University</td>
<td>27,748</td>
<td>28,856</td>
<td>34,494</td>
<td>24,747</td>
<td>45,297</td>
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<tr>
<td>Duke University</td>
<td>33,227</td>
<td>31,884</td>
<td>34,377</td>
<td>35,185</td>
<td>44,949</td>
<td>48</td>
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<tr>
<td>Yale University</td>
<td>27,001</td>
<td>27,791</td>
<td>22,028</td>
<td>27,398</td>
<td>41,736</td>
<td>51</td>
</tr>
<tr>
<td>Rice University</td>
<td>20,481</td>
<td>26,221</td>
<td>24,574</td>
<td>26,091</td>
<td>28,566</td>
<td>64</td>
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<tr>
<td>University of Rochester</td>
<td>7,703</td>
<td>13,297</td>
<td>9,872</td>
<td>11,256</td>
<td>19,885</td>
<td>89</td>
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<tr>
<td>Washington University</td>
<td>15,254</td>
<td>18,565</td>
<td>17,901</td>
<td>18,893</td>
<td>18,874</td>
<td>93</td>
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<tr>
<td>NSF Total Funding</td>
<td>$5,472,800</td>
<td>$5,645,800</td>
<td>$6,020,200</td>
<td>$6,474,000</td>
<td>$6,468,800</td>
<td>1</td>
</tr>
</tbody>
</table>

*Those categorized as “University”

†Includes ARRA funds

INNOVATION AND NEW VENTURES OFFICE AND TECHNOLOGY TRANSFER

Late in 2009, Jay Walsh, vice president for research, assumed responsibility for Northwestern’s Technology Transfer Program, which previously reported to the president. He appointed Alicia Löffler as associate vice president of innovation and new ventures to set up the new Innovation and New Ventures Office, which manages the former Tech Transfer Program. Löffler became executive director of INVO. In 2010, Northwestern executed 23 licenses and was responsible for 4 startup companies. INVO handled 165 invention disclosures; 76 new patents were applied for and 58 patents were received.

Since 2005-2006 the bulk of the monetary returns from technology transfer has come from the patent on pregabalin, a synthesized organic molecule discovered by Richard Silverman, chemistry, which ultimately was marketed as Lyrica, a drug sold by Pfizer and used to combat epilepsy, neuropathic pain, and fibromyalgia. The Lyrica returns in 2008 pushed Northwestern into first place among universities in licensing income.


<table>
<thead>
<tr>
<th>University</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbia University</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>$135,632,417</td>
<td>$134,273,996</td>
</tr>
<tr>
<td>Cornell University</td>
<td>$7,233,500</td>
<td>$5,392,000</td>
<td>$6,125,000</td>
<td>$5,208,000</td>
<td>$6,928,171</td>
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<td>Duke University</td>
<td>3,794,523</td>
<td>3,712,252</td>
<td>4,124,547</td>
<td>14,268,023</td>
<td>15,591,503</td>
</tr>
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<td>Harvard University</td>
<td>16,604,975</td>
<td>27,987,375</td>
<td>20,849,993</td>
<td>12,402,873</td>
<td>99,991,534</td>
</tr>
<tr>
<td>Johns Hopkins University</td>
<td>6,321,110</td>
<td>12,369,870</td>
<td>13,938,457</td>
<td>10,260,830</td>
<td>11,362,574</td>
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<td>25,781,923</td>
<td>39,834,482</td>
<td>43,500,000</td>
<td>61,600,000</td>
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<tr>
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<td>4,019,199</td>
<td>29,990,550</td>
<td>85,298,599</td>
<td>824,426,230</td>
</tr>
<tr>
<td>Princeton University</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Rice University</td>
<td>122,000</td>
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<td>431,003</td>
<td>383,260</td>
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<tr>
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<td>15,069,427</td>
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<td>7,495,118</td>
<td>8,255,096</td>
<td>6,167,230</td>
<td>8,200,086</td>
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<tr>
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<td>38,016,557</td>
<td>53,336,965</td>
<td>72,264,249</td>
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<tr>
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<td>11,655,363</td>
<td>11,382,912</td>
<td>12,099,853</td>
<td>15,715,818</td>
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<td>Yale University</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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</table>


U.S. Licensing Activity Survey: FY2008

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<tbody>
<tr>
<td>Columbia University</td>
<td>36</td>
<td>10</td>
<td>297</td>
<td>59</td>
<td>264</td>
<td>$134,273,996</td>
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<td>46</td>
<td>5</td>
<td>246</td>
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<td>137</td>
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<td>7</td>
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<td>102</td>
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<td>1,055</td>
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<td>12</td>
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<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
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<td>68</td>
<td>34</td>
<td>96</td>
<td>$30,730</td>
</tr>
<tr>
<td>Stanford University</td>
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<td>9</td>
<td>441</td>
<td>132</td>
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<td>62,514,524</td>
</tr>
<tr>
<td>University of Chicago</td>
<td>22</td>
<td>8</td>
<td>144</td>
<td>29</td>
<td>58</td>
<td>8,623,473</td>
</tr>
<tr>
<td>University of Pennsylvania</td>
<td>54</td>
<td>2</td>
<td>332</td>
<td>44</td>
<td>478</td>
<td>8,200,086</td>
</tr>
<tr>
<td>University of Rochester</td>
<td>18</td>
<td>6</td>
<td>147</td>
<td>25</td>
<td>74</td>
<td>72,264,249</td>
</tr>
<tr>
<td>Washington University</td>
<td>52</td>
<td>4</td>
<td>98</td>
<td>14</td>
<td>112</td>
<td>15,715,818</td>
</tr>
<tr>
<td>Yale University</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>


Includes Harvard Hospitals (Beth Israel, Brigham & Women’s, Children’s Hospital Boston, Dana-Farber, Mass. General).

Does not include data from the Applied Physics Lab.
Office for Research

Joseph (Jay) T. Walsh, Vice President for Research
Ann K. Adams, Associate Vice President
Linda Hicke, Associate Vice President for Research
Alicia Löffler, Associate Vice President for Research
Lewis J. Smith, Associate Vice President for Research
Meg A. McDonald, Senior Executive Director for Research
Sheryl A. Sloan, Assistant to the Vice President for Research
Phillip E. Hockberger, Director, Core Facilities
Teng-Leong Chew, Director, University Imaging Resources
Nasir Basit, Research Associate
Dhaikal Nanavati, Research Associate
Erin O’Brien Wallace, Assistant to the AVP Research
Ellen S. Feldman, Director, University Research Center Administration
Joan T. Naper, Director, Research Communications
Mary C. Tobin, Director, Administration and Resource Planning
William C. Higgins, Assistant Director, Finance and Administration
Barbara R. Beeuwsaert, Business Manager
Julie R. Cowan, Marketing-Communications Manager
Kathleen P. Mandell, Senior Editor
Amanda B. Morris, Publications Editor
Aaron J. Rosen, Business Coordinator
John Serafin, Web Administrator

Center for Comparative Medicine

Lisa A. Forman, Interim Executive Director
Steven M. Knable, Director, Business Operations
Stephen I. Levin, Director, EV Animal Care Use Program
Lot S. Bercasio, Business Administrator
Diana M. Berger, Clinical Veterinarian
Charlette M. Cain, Clinical Veterinarian
Mary Ann Carroll, Manager, Husbandry and Facilities
Jeremiah W. Dunlap, Assistant Manager, Quality and Training
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*We are sad to report that Keren Dimah passed away in January 2011. We will miss her.
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E. Patrick Johnson is professor and department chair of the Department of Performance Studies and also professor in the Department of African American Studies. He has published widely in the areas of race, class and gender, and performance. An article about his research may be found on page 32. Photo by Jon Miller.

Xunrong Luo, assistant professor of medicine and surgery at Feinberg School of Medicine, focuses her research on the tolerance mechanisms in autoimmune diabetes and in allogeneic islet cell transplantation, a form of cure for autoimmune diabetes. Read more about her research on page 37. Photo by Andrew Campbell.

Carlos Abril is associate professor of music education at Bienen School of Music and coordinates the Music Education Program. He is a general and elementary music education specialist. His research interests include the sociocultural nature of teaching and learning, music perception, and arts education policy. His Research Excellence article may be found on page 20. Photo by Sally Ryan.

Cristina Lafont is Wender-Lewis Research and Teaching Professor of Philosophy in the Weinberg College of Arts and Sciences. She specializes in German philosophy, particularly hermeneutics and critical theory. One of her current research projects focuses on a defense of an ideal of deliberative democracy that could be implemented beyond national borders. Find out more about her research on page 35. Photo by Andrew Campbell.