Kimberly A. Yuracko is professor of law at Northwestern University School of Law and has a joint appointment in Weinberg College of Arts and Sciences. Her primary research interests are in antidiscrimination law with a focus on sex discrimination in employment and gender equity in education. She teaches courses in employment law, property, and family law. Her book *Perfectionism and Contemporary Feminist Values* was published in 2003 by Indiana University Press. She is also a co-author of the casebook *Feminist Jurisprudence: Cases and Materials* and is the author of numerous articles. An article about Yuracko’s research may be found on page 50.

Joseph R. Leventhal is associate professor of surgery-organ transplantation at Feinberg School of Medicine. He currently directs the kidney and pancreas transplant programs at Feinberg. His clinical interests include kidney/pancreas transplantation, laparoscopic surgery, living donor kidney transplant, vascular access, and desensitization for kidney transplant recipients. Read about his research in developing cell-based therapies to achieve tolerance induction in solid organ transplant recipients on page 32.

Milan Mrksich is professor of biomedical engineering in McCormick School of Engineering and Applied Science. He holds joint appointments in Weinberg College of Arts and Sciences and at Feinberg School of Medicine. Mrksich’s research focuses on engineering materials for applications in the life sciences. His laboratory has developed devices that can perform thousands of tests on a biological sample, with applications in understanding the basic biology of how cells function and in diagnosing disease. Find out more about his research on page 35.

Ravi Allada is professor of neurobiology and chair of that department in the Weinberg College of Arts and Sciences. He holds a joint appointment at Feinberg School of Medicine and is affiliated with the Center for Genetic Medicine, Northwestern University Institute of Neuroscience, and Robert H. Lurie Comprehensive Cancer Center. His principal research is focused on the circadian regulation of sleep behavior using the fruit fly *Drosophila* and incorporates a variety of approaches including biochemistry, molecular biology, genetics, cell culture, electrophysiology, anatomy, and behavior. Find out more about his research on page 22.
December 2012

Dear Colleagues,

Research advances depend ever more on collaboration. Indeed, today’s research with the greatest impact emerges from the convergence of multiple disciplines.

Many years ago, discoveries came identified with the name of a single person—consider Newton’s laws, the Pythagorean theorem, and Keynesian economics. Today, that is most often not the case. Yes, the Higgs boson was named for a single theoretician, but we only have to look at the number of authors on the papers announcing the discovery and characterization of this new subatomic particle to see that things have changed. Twelve Northwestern scientists were among the more than 5,000 researchers from over 200 institutions worldwide who published the news from two experimental collaborations at CERN (the ATLAS and the CMS) this past summer. In particular, Mayda Velasco and Michael Schmitt, both physics and astronomy, co-lead Northwestern’s high-energy research group and have leadership roles at CMS (Compact Muon Solenoid, the general-purpose particle physics detector Northwestern uses at CERN), the focus of one of these seminal articles.

I raise this point because it plays an important part in our vision for the future of Northwestern research and underlies our strategy for building and maintaining our research facilities. This summer and fall Northwestern initiated a campaign to build a medical research facility on the Chicago campus. There are critical reasons to replace the former Prentice Hospital with a new research facility. When the old hospital was built in the 1970s, it was considered a breakthrough in hospital design in the way it suited the hospital’s needs. That is no longer the case, and the new Prentice Women’s Hospital was built on an entirely different plan. The needs of the 21st century greatly differ from those of the mid-20th century, especially in medicine and research.

We plan to build a research building on the Prentice site that will allow us to expand our research facilities using the floor-by-floor connections that help enhance scientific discovery. This plan will allow teams of researchers to collaborate in a close environment spanning several disciplines. This will also provide a hub for a major biomedical research complex in the midst of the hospital facilities on our Chicago campus. Because so many of these hospitals’ clinicians are also researchers, the proximity of research labs will enhance their efficiency and effectiveness.
Since the beginning of the 21st century, in planning scientific research buildings on both campuses, Northwestern has adopted a construction approach that encourages collaboration. On the Evanston campus, Silverman Hall was built to connect on all floors to the Pancoe-ENH Life Sciences Pavilion and Ryan Hall to allow for interaction among all three buildings’ research groups. In Chicago, the Lurie Medical Research Center was designed to provide such connections to both an addition to that building and the new building planned for the Prentice site.

The Evanston campus’s Technological Institute, familiarly known as Tech, has also been renovated with the idea of collaboration in mind. Six-story “infill” additions have been constructed between the B and C wings and between the F and G wings, increasing Tech’s space by more than 90,000 square feet. The FG wing provides both the McCormick School of Engineering and Applied Science and the Weinberg College of Arts and Sciences with lab space, office space, and a new cross-disciplinary biomedical research building. The BC addition now houses the Integrated Molecular Structure Education and Research Center (IMSERC) as well as the Willens Engineering Life Sciences Wing, where world-class scientists and engineers collaborate on projects ranging from fundamental and applied biology and chemistry to robotics and haptics. Plans are already being drawn for another new wing to replace IMSERC’s former space. Each of these wings integrates with the surrounding science and engineering spaces to allow collaboration at the convergence of multiple disciplines—a multidisciplinary convergence that is the hallmark of Northwestern.

Although not on our campuses, another renovation that will enhance our research capabilities is the upgrade of the Advanced Photon Source (APS) at Argonne National Laboratory. Operational for the last 15 years, the APS has had more than 3,500 users. Northwestern faculty and students have been major users since its inception and indeed operate two APS sectors. The APS upgrade is essential to provide the scientific community with improved capabilities in high-energy diffraction, in situ studies of material synthesis, imaging, and ultrafast diffraction and spectroscopy. The $391 million upgrade will bring new capabilities online in phases from 2012 to 2020.

Leading-Edge Science

Such outstanding physical resources help enable our faculty to make extraordinary advances. For example, Amy S. Paller, dermatology, and Chad A. Mirkin, chemistry, and their team are the first to demonstrate the use of commercial moisturizers to deliver gene-regulation technology with great potential as life-saving therapies for skin cancers and perhaps other conditions. The Northwestern approach takes advantage of molecules consisting of novel spherical arrangements of nucleic acids. These structures, each about 1,000 times smaller than the diameter of a human hair, have the unique ability to recruit and bind to natural proteins that allow them to penetrate the skin and enter cells. See more about this amazing topical delivery of gene-regulation technology on page 41.
Another example of collaboration leading to discovery is a Northwestern scientific team's development of a new family of compounds that could slow the progression of Parkinson's disease. The new compounds were developed by Richard B. Silverman, chemistry, inventor of the molecule that became the well-known drug Lyrica, and D. James Surmeier, chair of physiology. The compounds work by slamming the door on an unwelcome and destructive guest—calcium. They target and shut down a relatively rare membrane protein that allows calcium to flood into dopamine neurons. For the next step, the Northwestern team seeks to improve the compounds' pharmacology to make them suitable for human use and move to a phase 1 clinical trial.

Discoveries that take place on campus now regularly spin off to become start-up companies. For example, the Northwestern Global Health Foundation (NWGHF)—a nonprofit organization with the mission of improving access to life-saving medical technologies in resource-limited settings such as rural clinics in sub-Saharan Africa—was founded by two Northwestern faculty members: David Kelso, biomedical engineering, and Kara Palamountain, managerial economics and decision sciences. Daniel Diermeier, managerial economics and decision sciences, chairs the NWGHF board, which includes Matthew Glucksberg, biomedical engineering; Alicia Löffler, INVO executive director and associate vice president for research; and Robert Murphy, medicine–infectious diseases. The team recognized that products developed under Kelso's direction in Northwestern's Center for Innovation in Global Health Technologies (CIGHT) wouldn't reach the target population without the intervention of an organization dedicated to humanitarian objectives.

Another thriving spin-off is Naurex, founded by Joe Moskal, biomedical engineering. The company's lead drug, GLYX-13, is now in a clinical trial. This molecule hits a novel target, the brain's NMDA receptor, which appears to play a key role in regulating learning and memory processes. Moskal's efforts for this drug are focused primarily on treating depression, a high-need area where clinical trials are fairly straightforward and well understood. Phase Ila trials showed significant alleviation of symptoms within hours in patients who previously had failed to respond to other therapies. The next round of clinical trials is in progress.

**Costly Complexity**

The complexity of modern research makes such endeavors extremely expensive. While Northwestern has enjoyed great success in attracting federal funding for scientific research, the NIH and NSF budgets have remained relatively flat, and competition for these funds is fierce; the average national success rate for NIH research project grants (which represent 53 percent of the University's overall funding) has fallen to only 18 percent. As federal research funding grows scarce, faculty must strive harder to garner these funds, and universities increasingly must depend on private philanthropy.

Some of our University research centers have been the recipients of generous gifts this past year. The Querrey Simpson Charitable Foundation has endowed the new Louis A. Simpson and Kimberly K. Querrey Center for Regenerative Nanomedicine as part of the Institute for BioNanotechnology in Medicine (IBNAM). Simpson, a Northwestern University Life Trustee,
and Querrey, president of SQ Advisors, LLC, have been inspired by the work of Samuel Stupp, materials science and engineering, chemistry, and medicine, and they established the endowment to support his efforts in advancing Northwestern’s leadership in regenerative nanomedicine.

A new program in Northwestern’s Buffett Center for International and Comparative Studies will focus on multidisciplinary and comparative research, policy studies, and graduate training related to Asia, Latin America, Africa, and other global regions facing development changes. The Equality Development and Globalization Studies (EDGS) program has been created with a generous gift from the Rajawali Foundation, an Indonesian nonprofit that collaborates with private and public institutions to support education and research, human development, and community advancement. The Buffett Center itself was named to recognize extremely generous gifts from Roberta “Bertie” Buffett Elliott, who again this year made an additional gift to further promote the center’s global engagement programs.

Such philanthropy is responsible as well for funding the aforementioned infill between the B and C wings of Tech. The addition was named the Willens Engineering Life Sciences Wing because it was made possible by a significant gift from Ronald and JoAnne Willens. Ron Willens was a cofounder of Livingston Enterprises (bought by Lucent Technologies in 1997), which made remote-access equipment and software allowing hundreds of users to dial into large corporate networks or Internet service providers simultaneously. JoAnne Willens is a retired technical illustrator.

Other philanthropy helps underwrite the research of individual faculty members.

The MacArthur Foundation awarded Dylan Penningroth, history, a 2012 MacArthur Fellowship, the $500,000 “genius grant” that is bestowed with no conditions on its use. A specialist in African American history, comparative histories of slavery and emancipation, and sociolegal history, Penningroth is affiliated with the University’s Department of African American Studies and holds a joint appointment as research professor at the American Bar Foundation.

The Templeton Foundation awarded Janet Pierrehumbert, linguistics, a three-year grant of $2.74 million to further her work. She and her lab will be working with the New Zealand Institute of Language Brain and Behaviour (NZILBB) at the University of Canterbury to investigate the fundamental mechanisms responsible for the complexity of the human language vocabularies. They will do this by building computer interfaces that look like games and using them to collect language data from people all around the world. Read more about her work on page 43.

Northwestern has now received a total of three Grand Challenges Explorations grants as part of the Bill & Melinda Gates Foundation’s call to “Apply Synthetic Biology to Global Health Challenges.” (Synthetic biology is the design and construction of new types of biological systems.) These global health projects will focus on creating new compounds to combat malaria and on producing biosensors for low-cost in-home diagnoses. Keith Tyo, chemical and biological engineering, is an investigator on all three projects; one of them also involves Joshua Leonard, chemical and biological engineering. Each project receives an 18-month grant of $100,000; successful projects have an opportunity to receive a second grant of up to $1 million.
Building Human Infrastructure

The successful operations of a university research enterprise depend not only on its physical infrastructure but also on its human infrastructure. Retirements and new opportunities resulted in several key Office for Research position openings that were filled this year.

Professors Jian Cao and Rex Chisholm now serve part-time as associate vice presidents for research. Cao is a professor of mechanical engineering and civil and environmental engineering at McCormick. Chisholm is the Adam and Richard T. Lind Professor of Medical Genetics as well as the vice dean for scientific affairs and graduate education at the Feinberg School of Medicine. Their responsibilities as associate vice presidents include overseeing certain University research centers as well as some units within the Office for Research.

Michael B. Blayney is now the executive director for the Office for Research Safety (ORS). Blayney came to us from New Hampshire's Dartmouth College, where he was director of environmental health and safety. He has appointed Andrea Hall as director of the Office for Research Safety-Chicago and Markus Schaufele as director of the Office for Research Safety-Evanston. Hall had served as ORS interim director before Blayney's arrival; Schaufele had served as the assistant director for safety and as the ORS chemical hygiene officer.

Elizabeth Adams rejoined the Office for Sponsored Research (OSR) in Evanston as of 2011 as the executive director. She came back to us from the McCormick School, where she was director of research administration. Adams had worked at OSR as a grant and contract officer until 2005.

David E. Lynch now serves as executive director of the Office for Sponsored Research-Chicago. Previously Lynch was the director of the Office of Sponsored Projects Administration at the Mayo Clinic. James E. Young, associate director, OSR-Chicago, served as interim director for several months before Lynch's arrival and did a great job in that challenging position.

Lane Campbell has been named director of export compliance, a new position in the Office for Research. He comes to us from within our Office for Sponsored Research, where he served as senior contract and grant officer. Campbell has been tasked with establishing an export controls program to support Northwestern's research mission and activities while adhering to federal requirements.

Creativity expert Jonah Lehrer has said, “The most creative spaces are those which hurl us together. It is the human friction that makes the sparks.” Fortunately for us, those sparks are the kind that ignite the imagination and lead to greater advances in solving society's most pressing problems.

All the best,

Vice President for Research
Awards and Recognition

Our faculty are primarily responsible for the University’s intellectual depth. 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 its members produce transformative research as well as graduates who will conduct transformative work themselves throughout their careers.

The distinction of Northwestern’s faculty is 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 financial measures of research excellence—sponsored project awards, expenditures, and proposals—and on more individual faculty accomplishments during the past year. To provide benchmarks for our achievements, the report also considers Northwestern research within the context of our Consortium on Financing Higher Education (COFHE) peer institutions. Our COFHE cohort consists of private schools that attract a national undergraduate applicant pool and that share other characteristics permitting their 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 (NAS), the National Academy of Engineering (NAE), the Institute of Medicine (IOM), and the National Academy of Education (NAEd). The national academies bring together committees of experts in all areas of scientific and technological

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Source: National Academy of Sciences of the United States of America membership online at www.nasonline.org
Note: Total counts as of 8/31/12

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Source: National Academy of Engineering membership online at www.nae.edu
Note: Total counts as of 8/31/12
endeavor. These experts serve pro bono to address critical national issues and give advice to the federal government and the public. Those elected in 2012 are:

- **Tobin Marks**, chemistry, National Academy of Engineering (Marks also received the National Academy of Sciences Award in the Chemical Sciences)
- **Douglas Medin**, education, National Academy of Education
- **Monica Olvera de la Cruz**, materials science and engineering, National Academy of Sciences
- **Samuel Stupp**, materials science and engineering, National Academy of Engineering

**CAREER Awards from the National Science Foundation**

The Faculty Early Career Development (CAREER) Program is the National Science Foundation’s most prestigious award program for new faculty members. The CAREER Award recognizes and supports the early career development activities of those teacher-scholars who are most likely to become the academic leaders of the 21st century. One Northwestern faculty member was a recipient of NSF CAREER Awards in 2012:

- **Bruno Strulovici**, economics

**Citations**

The list of highly cited researchers from the Institute for Scientific Information (ISI) had been used previously as a measure of faculty scholarship contributing to the advancement of science and technology in recent decades. That list is no longer available. The following list of Northwestern faculty whose published work has achieved the greatest impact has been compiled using the Scopus (Elsevier) database. Scopus covers a much broader set of publications than other sources, including the ISI, although it collects

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Source: Institute of Medicine Public Directory online at www.iom.edu

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Source: www.nsf.gov/awardsearch
citations only since 1996. Thus, faculty members who have done their main publishing since 1996 in a wide set of disciplines are well represented. Based on Scopus, these are Northwestern’s 50 most influential researchers.

Anton Anastassov, physics and astronomy
David W. Baker, general medicine
Zdeněk P. Bažant, civil and environmental engineering
Ted B. Belytschko, mechanical engineering
Al B. Benson III, medicine–hematology
Robert O. Bonow, clinical medicine
William J. Catalona, urology
David Cella, medical social sciences
Alan Richard Dyer, preventive medicine
Arthur J. Freeman, physics
Mihai Gheorghiade, cardiology
Robert Goldman, cell and molecular biology
Philip Greenland, preventive medicine
Mary J. C. Hendrix, Lurie Cancer Center
Brian M. Hoffman, chemistry
Yonggang Huang, civil and environmental engineering
Joseph T. Hupp, chemistry
Peter J. Kahrilas, gastroenterology
Mercouri Kanatzidis, chemistry
Robert Lamb, molecular biosciences
Kiang Liu, preventive medicine
Jerilyn A. Logemann, communication sciences and disorders
Tobin Jay Marks, chemistry
Patrick M. McCarthy, surgery
Minesh P. Mehta, radiation oncology
Marek-Marsel Mesulam, neurology
Richard J. Miller, neuroscience and pharmacology

Stephen D. Miller, microbiology-immunology
Chad A. Mirkin, chemistry
Richard I. Morimoto, molecular biosciences
Milan Mrksich, biomedical engineering
Thomas V. O’Halloran, molecular biosciences
William H. Pearce, vascular surgery
Marcus Ernst Peter, medicine–hematology
Alfred W. Rademaker, preventive medicine
Mark A. Ratner, chemistry
Manijeh Razeghi, electrical engineering and computer science
Janardan K. Reddy, pathology
George C. Schatz, chemistry
Heidi M. Schellman, physics and astronomy
Robert P. Schleimer, immunology
Michael H. Schmitt, physics
Jeremiah Stamler, clinical medicine
Sir J. Fraser Stoddart, chemistry
Samuel Stupp, materials science and engineering
Dalton James Surmeier Jr., physiology
Olke C. Uhlenbeck, molecular biosciences
Richard P. Van Duyne, chemistry
Michael R. Wasielewski, chemistry
Steven M. Wolinsky, microbiology
Clyde W. Yancy, cardiology
2012 Faculty Recognition and Honors

Each year President Schapiro and Provost Daniel Linzer 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 with the most prestigious honors for University recognition.

The following faculty members were honored at the faculty recognition dinner in October for bringing distinction to Northwestern by their important recognition from societies and agencies outside the University in 2011–12.

Kenneth Alder, history: Fellow, American Academy of Arts and Sciences

Gad Allon, managerial economics and decision sciences: Skinner Early Career Award, Production and Operations Management Society

Hossein Ardehali, cardiology: Member, American Society for Clinical Investigation

Koray Aydinm, electrical engineering and computer science: Associate Member, Turkish Academy of Sciences

Joseph Bass, endocrinology: Member, Association of American Physicians

Zdeněk Bažant, civil and environmental engineering: Honorary Doctorate, Ohio State University; Honorary Member, American Society of Civil Engineers

Eula Biss, English: Literature Fellowship in Creative Writing, National Endowment for the Arts

Pablo Boczkowski, communication studies: 2011 Best Book Award, American Sociological Association

Timothy Breen, history: Senior Resident Scholar, National Humanities Center

James Brown, anthropology: Fellow, American Academy of Arts and Sciences

Serdar Bulun, obstetrics and gynecology: Member, American Association of Physicians

Héctor Carrillo, sociology: Fellow, Radcliffe Institute for Advanced Study

Lindsay Chase-Lansdale, education and social policy: Ascend Fellow, Aspen Institute

Joan Chiao, psychology: Rising Star, Association for Psychological Science; Early Career International Travel Award, National Institute of Mental Health

Shari Diamond, law: Fellow, American Academy of Arts and Sciences

Vinayak Dravid, materials science and engineering: Distinguished Alumnus Award, IIT Bombay; Lee Hsun Research Fellowship, Chinese Academy of Sciences

James Druckman, political science: Fellow, John Simon Guggenheim Memorial Foundation; Fellow, American Academy of Arts and Sciences

Alice Eagly, psychology: Fellow, American Academy of Arts and Sciences; Honorary Doctorate, University of Bern, Switzerland

David Ebrey, philosophy: Fellowship, Spencer Foundation

Dyan Elliott, history: Fellowship, National Humanities Center

Steven Epstein, sociology: Fellow, John Simon, Guggenheim Memorial Foundation

Charlesnikia Evans, Center for Healthcare Studies: Presidential Early Career Award for Scientists and Engineers, United States Government

Kenneth Forbus, electrical engineering and computer science: Humboldt Research Award, Alexander von Humboldt Foundation

Robert Fourer, industrial engineering and management sciences: Best Paper Award, Computational Management Science

Daniel Galvin, political science: Emerging Scholar Award, American Political Science Association

Dedre Gentner, psychology: Humboldt Research Award, Alexander von Humboldt Foundation

Sandip Ghosal, mechanical engineering: Fellow, American Physical Society

Rebecca Gilman, radio/television/film: Honored Playwright, Great Plains Theatre Conference

Jonathon Glassman, history: Martin A. Klein Prize in African History, American Historical Association

Erwin Goldberg, molecular biosciences: Award of Distinguished Andrologists, American Society of Andrology
Ellen Goldstein, mathematics: Project NExT Fellow, Mathematical Association of America

Matthew Grayson, electrical engineering and computer science: Humboldt Alumni Award, Alexander von Humboldt Foundation

John Hagan, sociology: Harry J. Kalven Junior Prize, Law and Society Association; Fellow, American Academy of Arts and Sciences

Larry Hedges, social policy: Member, National Board for Education Sciences

Christine Helmer, religious studies: Fellowship, European Institute of Advanced Study, Helsinki

Kyle Henry, radio/television/film: Young Critics Jury Prize, Janela International Film Festival; Best Acting Award, MiMi Short Film Festival (Barcelona); Best Short Film, New York Gay and Lesbian Film Festival

Walter Herbst, mechanical engineering: Distinguished Alumni Award, University of Illinois College of Art and Design

Mark Hersam, materials science and engineering: Fellow, Materials Research Society; Fellow, American Vacuum Society

Barton Hirsch, human development and social policy: Social Policy Award for Best Authored Book, Society for Research on Adolescence

Brian Hoffman, chemistry: Alfred Bader Award in Bioinorganic or Bioorganic Chemistry, American Chemical Society; Joseph Chatt Award, Royal Society of Chemistry

Bonnie Honig, political science: David Easton Prize, American Political Science Association

Joseph Hupp, chemistry: Division of Analytical Chemistry Award in Electrochemistry, American Chemical Society

Nicole Immorlica, electrical engineering and computer science: Sloan Research Fellowship, Alfred P. Sloan Foundation

Sarah Jacoby, religious studies: Fellowship, American Council of Learned Societies

Ehud Kalai, managerial economics and decision sciences: Fellow, American Academy of Arts and Sciences

Vicky Kalogera, physics and astronomy: Fellowship in Theoretical Physics, Simons Foundation

Alec Klein, journalism: Sunshine Award, Society of Professional Journalists

Steven Kosak, cell and molecular biology: Presidential Early Career Award for Scientists and Engineers, United States Government

Philip Kotler, marketing: Honorary Doctorate, HHL Leipzig Graduate School of Management

Alex Kotlowitz, journalism: Best Documentary Film, Independent Spirit Awards

Robert Lamb, molecular biosciences: Honorary Doctorate, University of Birmingham

Henri Lauziere, history: Fellowship, Gerda Henkel Foundation

John Lavine, journalism administration: Journalism and Mass Communication Administrator of the Year Award, Scripps Howard Foundation

Carol Lee, learning sciences: Honorary Doctorate, University of Pretoria, South Africa

Paul Leonard, communication studies, industrial engineering and management sciences: Young Scholar Award, International Communication Association; Best Published Paper Award, Organizational Communication and Information Systems Division of the Academy of Management

Jennifer Light, communication studies: Catherine Bauer Wurster Prize, Society for American City and Regional Planning History; Fellow, Center for Advanced Study, Princeton

Wing Kam Liu, mechanical engineering: Gauss-Newton Medal, International Association for Computational Mechanics

Melissa Macauley, history: Fellowship, National Endowment for the Humanities

James Mahoney, political science: Leo Goodman Award, American Sociological Association; Book Award, American Sociological Association

Inigo Manglano-Ovalle, art theory and practice: Fellow, United States Artists

Tobin Marks, chemistry: National Academy of Sciences Award in the Chemical Sciences, National Academy of Sciences; Member, National Academy of Engineering; Theodore W. Richards Medal, American Chemical Society; Honorary Doctorate, Ohio State University; Gabor Samorjai Award for Creative Research in Catalysis, American Chemical Society; Distinguished Alumnus Award, University of Maryland
Dan McAdams, human development and social policy: Jack Block Award, Society of Personality and Social Psychology

Douglas Medin, education: Member, National Academy of Education

Sue Mineka, psychology: Elected Fellow, Society of Experimental Psychologists

Chad Mirkin, chemistry: Award for Creative Invention, American Chemical Society; International Material Science Award, International Centre for Materials Science, Bangalore

Joel Mokyr, economics and history: Elected Fellow, Econometric Society

Hidayatullah Munshi, hematology-oncology: Member, American Society for Clinical Investigation

Christina Normore, art history: Fellow, Medieval Institute at Notre Dame

Gregory Olson, materials science and engineering: Fellow, American Academy of Arts and Sciences

Paula Olszewski-Kubilius, education and social policy: Paper of the Year, Gifted Child Quarterly

Monica Olvera de la Cruz, materials science and engineering: Member, National Academy of Sciences

Robert Orsi, religious studies: Fellowship, Social Science Research Council

Aaron Packman, civil and environmental engineering: Fulbright Distinguished Chair, Politecnico di Torino Institute of International Education

Susan Pearson, history: Merle Curti Award in Intellectual History, Organization of American Historians; Fellowship, National Endowment for the Humanities; Kluge Fellowship, Library of Congress

Lincoln Quillian, sociology: Fellowship, Russell Sage Foundation

Janice Radway, communication studies: Fellows Book Award, International Communication Association

Mark Ratner, chemistry: Willard Gibbs Medalist, American Chemical Society

William Revelle, psychology: Elected Fellow, American Psychological Association

James Sauls, physics and astronomy: John Bardeen Prize, University of Illinois

Karl Scheidt, chemistry: Fellowship, Japanese Society for the Promotion of Science

Joseph Schofer, civil and environmental engineering: National Associate, National Research Council

Billy Siegenfeld, theatre: Choreographer of the Year, Dance Chicago and the Cliff Dwellers Arts Foundation

Mary Silber, engineering sciences and applied mathematics: Fellow, Society for Industrial and Applied Mathematics

Vivasvan Soni, English: Prize for a First Book, Modern Language Association

Pamela Souza, communication sciences and disorders: Fellow, American Speech, Language, and Hearing Association

Walt Spangler, theatre: Joseph Jefferson Award for Scenic Design, Jeff Awards; Michael Merritt Award for Excellence in Design and Collaboration, Michael Merritt Awards and Endowment Fund

Lynn Spigel, radio/television/film: Fellow, John Simon Guggenheim Memorial Foundation

James Spillane, education and social policy: Fellow, American Educational Research Association

Alexander Statsuk, chemistry: Pew Scholar in the Biomedical Sciences, Pew Charitable Trusts

Brian Sternthal, marketing: Fellows Award, Association of Consumer Research

Sir J. Fraser Stoddart, chemistry: Fellow, American Academy of Arts and Sciences; Honorary Fellow, Royal Society of Chemistry

Samuel Stupp, materials science and engineering: Member, National Academy of Engineering; Member, Spanish Royal Academy of Pharmacy; Ronald Breslow Award for Achievement in Biomimetic Chemistry, American Chemical Society; Honorary Doctorate, National University of Costa Rica

John Sullivan, journalism: Pulitzer Prize, Columbia School of Journalism; Casey Medal, Journalism Center on Children & Families; IRE Award, Investigative Reporters and Editors
Igal Szleifer, chemical and biological engineering: Fellow, American Institute of Medical and Biological Engineering

Ajit Tamhane, industrial engineering and management sciences: Distinguished Service Award, IIT Bombay

C. Shad Thaxton, urology: Presidential Early Career Award for Scientists and Engineers, United States Government

Krista Thompson, art history: Fellowship, American Council of Learned Societies

Regan Thomson, chemistry: Research Scholar Award, American Cancer Society, Illinois Division

Debra Tolchinsky, radio/television/film: Best Documentary Award, Iowa Film Festival; Platinum Reel Award, Nevada Film Festival; Best Documentary Award, LA Femme International Film Festival; Award of Excellence, Indie Fest; Award of Merit, Los Angeles Cinema Festival of Hollywood; Award of Merit, Accolade Competition

Valentino Tosatti, mathematics: Research Fellowship, Alfred P. Sloan Foundation

Richard Van Duyne, chemistry: Charles N. Reilley Award, Society for Electroanalytical Chemistry

Jan A. Van Mieghem, managerial economics and decision sciences: Distinguished Fellow, Manufacturing and Service Operations Management

David Van Zanten, art history: Fellow, American Academy of Arts and Sciences

Ellen Wartella, communication studies: Applied/Public Policy Research Award, International Communication Association

Michael Wasielewski, chemistry: Arthur C. Cope Scholar Award, American Chemical Society

James Webster, communication studies: Dennis McQuail Award, University of Amsterdam School of Communication Research

Michelle Weinberger, integrated marketing communications: Sidney J. Levy Award, Schulich School of Business

Eric Weiss, molecular biosciences: Researcher of the Year, American Cancer Society, Illinois Division

Jeffrey Winters, political science: Gregory M. Luebbert Award, American Political Science Association

Teresa Woodruff, obstetrics and gynecology: Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring, United States Government

Harvey Young, theatre: Errol Hill Award, American Society of Theatre Research

Phyllis Zee, neurobiology: Sleep Science Award, Academy of Neurology


Research Fellowships

Northwestern University students and graduates continue to do well in the fiercely competitive national competitions for research sponsorships. In 2012, for the eighth year in a row, Northwestern ranked as one of the top 10 producers of US Fulbright grant recipients among the nation’s research institutions, according to the Chronicle of Higher Education.

Twenty-two Northwestern seniors, graduate students, and recent alumni have accepted the prestigious 2012–13 scholarships from the flagship US government-sponsored program funding international research and exchange. (Five others at the University were selected for the award but declined it for various reasons.) This places Northwestern in a tie for sixth (with Columbia University and the University of Texas at Austin) out of all research institutions nationwide that submit Fulbright applications.

The University’s Fulbright winners represent nearly every Northwestern undergraduate school as well as the School of Law. Studying in Vietnam, Senegal, India, Chile, Italy, Bulgaria, China, and other nations around the world, they represent disciplines ranging from psychology, journalism, and linguistics to law, engineering, and medicine.

Fulbright recipients receive support for an academic year’s study or research in any of more than 100 countries, beginning in fall 2012. The program also includes the English Teaching Assistant awards.
Northwestern graduate and undergraduate students also excel in winning NSF research fellowships. In 2011, among its benchmark cohort of Consortium on Financing Higher Education institutions, Northwestern tied for fifth in graduate NSF research fellowships with 41 and ranked eleventh in undergraduate NSF fellowships with 19.

### NSF Graduate Research Fellowships

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### Northwestern Undergraduate Awards

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Sources: [www.fullbrightonline.org](http://www.fullbrightonline.org), [www.gatesscholar.org](http://www.gatesscholar.org), [www.rhodesscholar.org](http://www.rhodesscholar.org), [www.marshallscholarship.org](http://www.marshallscholarship.org), and [www.winstonchurchillfoundation.org](http://www.winstonchurchillfoundation.org)
Undergraduates Decoding Autism

A picture pops up on a computer screen—a black-and-white landscape of plowed farmland. In the foreground, a young woman in a dress holds a short stack of books in the crook of her arm. In the background, a shirtless, muscled man stands with his horse, their backs to the viewer. An invisible sun positioned somewhere off the upper-right side of the page casts sunlight diagonally across their skin.

A female interviewer asks a young boy to tell a story about the picture using his memory. “It reminds me of the first American settlement,” he says. Then he spends a few moments recounting the plight of the Pilgrims.

“What were the characters thinking?” the interviewer asks. The boy is silent.

Having been diagnosed with autism, the young boy is participating in the Thematic Apperception Test (TAT) administered by members of Northwestern’s Neurodevelopmental Disabilities Lab, directed by Molly Losh, communication sciences and disorders. Developed at Harvard in the 1930s, the TAT consists of a series of provocative yet ambiguous pictures. Though developed originally as a projective test of personality, Losh’s laboratory uses the task to elicit narratives from study participants. The stories that participants tell about the images can offer important information about their language and abilities.

Senior pre-med student Bret Kravis has become deeply involved with TAT-related research since becoming the lab’s first undergraduate member two years ago. His work examines pupillometry data collected through a special computer screen that tracks TAT participants’ eye movements. When the results are reviewed,
red dots move around the screen to show where the eyes looked and for how long. The bigger the dot, the more time spent looking in that area. The evaluator can also see if the eyes dilated—a possible sign of anxiety or excitement—when focused in certain places.

One of seven undergraduate researchers in the lab, Kravis received an Undergraduate Research Grant last summer to analyze these results. “I worked with the TAT and the data we already had,” he says. “I compared individuals with autism to controls, looking at how dilated their pupils were based on where they looked. It was different depending on if they were looking at a face, the body, or the background.”

**LINKING AUTISM**

Established by Losh in 2010, the Neurodevelopmental Disabilities Lab seeks to understand the link between autistic children and their developmentally normal parents. Specifically, Losh is interested in how certain subtle language features may run in families and may relate to the genes associated with autism.

“Part of our assessment involves telling stories and basic conversation,” Losh says. “We’re interested in studying profiles of language use and social perception that might help us target certain features related to the genes causing autism.”

Losh’s lab broadly recruits whole families from the community to participate in the studies. Some families are able to visit campus for interviews and tests; others are visited by researchers in their homes. In all cases, parents and siblings partake in the same activities as their autistic family member. Participants also donate blood samples, which undergo genetic testing by Northwestern collaborators at Rush University Medical Center.

**UNDERGRADUATE CONTRIBUTIONS**

Losh says that the undergraduates such as Kravis play a key role in the lab’s studies. “They contribute to projects at all levels,” she says. “From helping to process language data to really exciting things like generating their own project ideas and adding their own contributions.”
Sophomore Sejal Shah is closely involved in processing the TAT and other data collected in the lab. She exports the videos so they might be transcribed, coded, and analyzed. Shah plays a critical role that allows Losh’s lab to compare the stories along with participants’ eye movement patterns in order to determine whether perceptual processing patterns during stimulus encoding relate to language use in children with language difficulties and their unaffected relatives who are genetic carriers.

Junior psychology major Holly Romaniak received an Undergraduate Research Grant the same summer as Kravis. She studied interviews conducted in the lab, looking for exhibitions of atypical behaviors during social interactions. Her project involved detailed analysis of the relationship between social cognition (or, understanding and reading thoughts and feelings) and language use among individuals with autism.

“I had to submit paperwork to the Institutional Review Board and write grant proposals,” says Romaniak who plans to pursue a career as a researcher. “So now I have that experience that I can apply down the road.”

LOOKING AT LANGUAGE

One of the many challenges of studying autism is that it occurs across a spectrum. Not everyone with autism has the same characteristics and symptoms.

“You’ll see a person with autism who has fluent structural language with no errors, but they have problems using language in social ways,” Losh explains. “Or a person who has no functional language with limited ability to communicate with language. They all fall under the same diagnostic umbrella; they are both considered autistic. Heterogeneity and the complexity of how autism is presented are among the biggest barriers we face in finding causes.”

Despite the heterogeneity, there are characteristics that all autistic patients have in common: impairments in social communication abilities and restricted and repetitive behavior. Seniors Kyle Frost and Cummings Rork are both trained to look for these traits.

Frost, who is writing her honors thesis on autism, watches hour-long videos of children participating in project tasks. In the videos, families perform a series of structured and semistructured tasks that involve social interactions between the examiner and the subject. “I look for 32 different things—from gestures and facial expressions to conversational turns and initiating topics,” she says. “Then I score them and find the sum of total pragmatic language use.”

Rork transcribes recordings of adults’ conversational interactions. During interviews, participants are asked to give autobiographical accounts of their lives. The transcripts are used to code for a range of language features. “We are trying to see if there are patterns in the language use that could relate to the genes that cause autism,” Rork says.

Losh and her collaborators have found very subtle characteristics that recur in some parents of autistic patients. For example, some parents tend to show particular conversational styles, such as being more tangential, or display different patterns of social information processing.

“These characteristics are so subtle that it’s nothing you would ever notice or consider any sort of impairment,” she says. “You don’t see these characteristics in all relatives of people with autism, but you do see them at an elevated rate relative to individuals who are not related to a person with autism. It suggests that the genes causing autism can express as very subtle features and studying those features and their transmission in families can help provide more specific, homogenous targets for genetic and neurobiological studies.”

Once an undergraduate researcher herself, Losh became interested in autism while studying developmental psychology in college. She hopes her students will become hooked on research the same way she did and will continue to contribute to the field.

For more information about Molly Losh and the Neurodevelopmental Disabilities Lab, visit comm.soc.northwestern.edu/ndl.
Exploring the Human Experience

On January 25, 2011, tens of thousands of protestors flooded the streets of Cairo to demand the overthrow of Egyptian President Hosni Mubarak. Citizens were fed up with the government corruption, restrictions on free speech, and manipulated elections that marked Mubarak’s uninterrupted 30-year reign. It would be three long weeks of police clashes, looting, and mass demonstrations before Mubarak finally agreed to step down. This capstone event of the Arab Spring inspired further demonstrations in Libya, Syria, and elsewhere.

Few Americans enjoyed more firsthand insight into this history-making tumult and its 2012 reverberations than the students in the Kaplan Institute for the Humanities. In the fall course, “Global Orients,” offered to students in the Kaplan Scholars Program, students spoke with a group of dissident Egyptian artists through Skype.

Such explorations of human history and culture are cornerstones of the Kaplan Institute curriculum and programming, which give students an organized place for dialogue and exchange. Through its humanities courses, the Institute fosters creative and critical questions about life and society.

“The humanities are not necessarily about learning facts,” says Kaplan Institute founding director S. Hollis Clayson, art history. “The humanities are about discussion, debate, and opinions. The classes serve as a lab where students explore critical thinking and track opinions back to their origins.”

The Institute was established in 1993 as the Alice Berline Kaplan Center by a gift from Morris Kaplan, the CEO of Sealy Posturepedic Mattress Company and a Northwestern life trustee, in memory of his late wife of 60 years. Although Kaplan graduated from Northwestern in 1935 as a business major, his heart belonged to the humanities.
“He always said it was the humanities courses that made his life worthwhile,” Clayson says. “So he gave back to the humanities, and his gift and his ideas became the foundation of our center.” Morris Kaplan passed away in June 2011 at the age of 98.

**INTERDISCIPLINARY FACULTY**

In 2006 the Alice Berline Kaplan Center was upgraded to an institute and in 2009 moved to a modern, newly renovated space on the second floor of Kresge Hall. As an institute, the program was able to hire four full-time faculty members from interdisciplinary fields. The current Kaplan Humanities professors are Steven Epstein, sociology; Ann Gunter, art history and classics; and Rebecca Johnson, English. A scholar specializing in media convergence and circulation will fill the fourth position this year.
represents the Orient and its relationship to the West. This winter a course called “Language and the Human Imagination: On the Nature and Origins of Language,” is being taught by Weinberg professors Sandford Goldberg, philosophy; Susan J. Hespos, psychology; and Franziska Lys, German. The course examines how language has played a central role in human civilization and cultural and social development throughout history. All Kaplan courses explore a topic through a multidisciplinary lens.

“The big questions facing culture and society cannot be answered by one discipline,” Phillips says. “How do we deal with poverty? How do we deal with inequality? These are complicated questions that need to be approached from different angles.”

The institute also includes a faculty fellows program, offering a year of full- or part-time leave for a Northwestern faculty member to work on a research project. Fellows then design and teach a class that incorporates their new research.

The students in the Scholars Program are just as multidisciplinary as the course topics and faculty. This year students represent 20 different majors—from English and history to physics and math. Students also have the option to earn a minor in the humanities, which Clayson calls “aggressively miscellaneous.”

“Having students in the classroom with a range of interests and backgrounds benefits everyone,” Johnson says. “They draw on their diverse backgrounds when looking at texts and have differing opinions in debates and discussions. It shows students they can really learn from each other.”

CULTURAL IMMERSION

Each Kaplan Humanities Scholars Program course includes a field trip, which Phillips says is rare for humanities education at American universities.
Much like the opportunity to Skype with Egyptian activists, the field trips give students the chance to interact with artists, thinkers, and ordinary citizens from around the world. Recent examples include attending a performance by the Malian band Tinariwen at the Old Town School of Folk Music and interviewing a dolphin-language expert at the Shedd Aquarium.

Another rare asset of the Kaplan Institute is its artist in residence program, which brings artists from diverse media to campus for quarter-long residencies. During the residence the artist creates new work and gives the Northwestern community insight into the artistic process. Co-sponsored by Northwestern’s Global Languages Initiative, Residential Colleges, and the Northwestern Library, Marco Nereo Rotelli is the current Kaplan artist in residence. Visiting from Italy, Rotelli explores language and aesthetics. While at Northwestern, he is working with Robert Pinsky’s translation of Dante’s Inferno.

The work of Kaplan faculty members, fellows, artists in residence, and affiliates is shared with the community through regular events, such as the Wednesday lunchtime colloquia series and the Evanston Northwestern Humanities Lecture Series, a collaboration between the Kaplan Institute and the Evanston Public Library.

“It’s easy to get caught up in your own work and not talk to researchers in other areas,” Clayson says. “Having these events is important for our faculty members. It forces specialists to learn how to explain and present their work to non-specialists.”

For more information about the Alice Kaplan Institute for the Humanities, visit www.humanities.northwestern.edu.
Ravi Allada  
Weinberg College of Arts and Sciences

How Time Flies and Why You Sleep

We spend one-third of our lives asleep—unaware of our surroundings and unable to protect ourselves or care for others. Millions of Americans suffer poor quality sleep, which disrupts our ability to learn and remember and can trigger or exacerbate depression and schizophrenia and even diabetes and obesity. Yet it is not known why we sleep.

Sleep is governed by a homeostatic process that sets how much sleep we need (i.e., when deprived of a night of sleep, we sleep more the following day). To understand the molecular basis of sleep, Ravi Allada, neurobiology, and his colleagues have employed a simple model, the fruit fly. Remarkably, flies exhibit around 14 hours of inactivity per day with all of the cardinal features of sleep, including immobility and unresponsiveness. Flies even catch up on sleep after a night of lost slumber. The Allada lab has employed thermogenetic tools to identify the neural circuits important for sleep homeostasis. This work established the mushroom bodies as crucial sleep promoting centers (published in *Nature*).

Sleep is also controlled by a circadian (circa=near, dia=day) process that times sleep and wake to night and day. Circadian clocks anticipate and adapt to our 24-hour environment, trigger bouts of wake and sleep at the appropriate time of day, and even influence everything from the incidence of depression, the timing of heart attacks and cell division to the performance of jet-lagged athletes. Remarkably, these clocks are conserved from flies to humans and are found in all of our organs and tissues.

The Allada lab has identified many of the molecular “gears” that make our clocks tick as well as components that link the clock to the clock’s “hands” that control sleep. This work indicates that at the core of circadian clocks are transcriptional feedback loops whose parts are modified by phosphorylation to set the pace of the clock. Their most recent work has focused on a new pathway involving protein synthesis (or translation) which helps clocks keep time (published in *Nature*). The work has been supported by the National Institutes of Health and a new grant from the Defense Advanced Research Projects Agency.

By studying this mutant and others, they have defined the neurotransmitters and molecular pathways that may reveal why we sleep.

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Sandeep Baliga
Kellogg School of Management

Hawks versus Doves: A Strategy for Peace

Sandeep Baliga, managerial economics and decision sciences, and Tomas Sjöström of Rutgers University have published a study of the ability of extremists’ provocative actions to manipulate international conflicts. Their study shows why those actions have their impact and what circumstances determine the results of their manipulations. It also shows why extremism and terrorism are in no one’s best interests.

As Baliga and Sjöström show, provocateurs obtain their goals by subtlety and stealth. “People often think that extremists want to stimulate the withdrawal of their antagonists directly through their provocative acts,” says Baliga. “But our message is the complete reverse. They want to suck you into a bigger fight, which inflames a key audience. This escalation of conflict then forces you to withdraw.”

These results stem from the application of basic mathematics. “Our paper uses game theory methodically to study a topic in international security and politics,” Baliga explains. “And we hope that, judged purely as a game theory exercise, the analysis is subtle and interesting. It’s basically a new game that introduces an outsider—the provocateur who attempts to influence a game played by other players.”

The key idea is that the target audience the provocateur wants to influence—such as the political leader of the government—may not be as extreme as he is. The extremist acts indirectly by provoking a third player whose aggression forces the hand of their true, targeted audience.

“So, according to our theory, the purpose of attacks by Pakistani extremists on the Indian government is not to make the Indian government back off but to draw them in,” says Baliga. “Once this happens, the Pakistani government will be compelled to turn aggressive which is what the extremist really wants. And ironically the extremist engages in provocation because he knows that without it the chances for peace are good because the government is not on his side.”

The study’s ultimate message is that hawkish extremist behavior increases conflict because of the other players’ response to it. “If you could completely ignore the provocateurs, their ability to strike fear would die. The tricky thing is that both sides have to ignore the provocation.”
Amanda Dehnert  
School of Communication

The Verona Project: A New Way of Telling an Old Story

As a storyteller, Amanda Dehnert, theatre, is dedicated to telling the truth about the human condition as she sees it. Our lives are filled with extraordinary joys and deep sadnesses alike; yet we continue to risk ourselves simply by getting up in the morning.

As a theater artist, she cares most about making theater that is unexpected. Believing that nothing should be assumed about the theater we see, she considers it her job (and privilege) as an artist to make works that take the audience by surprise, create new ways of telling stories, and shock our systems into remembering that theater is a living, breathing art form.

As a musician and composer, she believes in the power of music, which speaks to us in ways that words never can. As a teacher, she is committed to inspiring her students to expand their vision of themselves and their capabilities, both as individuals in the world and as artists.

All this became the foundation for writing a story, told in words and rock songs, inspired by Shakespeare but wholly rooted in the themes of love, loss, survival, growing up, and growing older.

The Verona Project is the result of years Dehnert has spent investigating all these ideas and realizing that something had not yet been said in this particular way. Northwestern and the American Music Theatre Project (a research branch of the School of Communication dedicated to supporting and funding new works for the musical stage) have created an environment where the truly new and authentically human can be realized together in one of the most popular and accessible forms of theater: the American musical.
Understanding Political Gridlock

At a time when many have questioned the US political system’s effectiveness in making tough decisions, an understanding of political constitutions is more important than ever, according to Daniel Diermeier, IBM Professor of Regulation and Competitive Practice. Having studied the inner workings of political institutions throughout his career, Diermeier is one of the pioneers of applying game-theoretic models to the comparative study of legislatures. Such models are well suited to capturing the sometimes subtle consequences of constitutional features.

For example, the United States and the United Kingdom differ dramatically in the rates of legislative success. US presidents are far more likely than parliamentary-system prime ministers to have their bill proposals rejected. According to Diermeier, this is because in a parliamentary system “the legislature can remove the executive at any point through a vote of no confidence”—creating permanent haves (the ruling coalition) and have-nots (the opposition).

This has surprising consequences. Since it is highly valuable for legislators to be part of a permanent ruling coalition, legislators in such a coalition are reluctant to risk bringing down a government by opposing its bills. Since the prime minister is aware of this, the fate of any bill can be linked to the fate of the ruling party. “Because there’s more at stake,” explains Diermeier, “you’re more likely to vote yes.”

This lack of opposition leads to far higher success rates, more policy bias towards the majority, and cohesive voting. These results can have positive and negative consequences. On the one hand, parliamentary systems are more likely to get things done. On the other hand, there is much less protection of minority interests.

These are not the only important differences between constitutions. In related work with 2007 Nobel laureate and former Kellogg colleague Roger Myerson, Diermeier has shown that the bicameral structure of the US Congress can lead to internal veto structures such as the filibuster system or committees with veto powers—so a well-intended separation of powers may lead to unintended gridlock.
Zev Eigen  
School of Law

**Does Workplace Dispute Resolution Improve Procedural Justice?**

Procedural justice is a critical way of measuring organizational success because it is linked to such important measures as employee turnover, counterproductive behaviors (e.g., theft and misconduct), and employee resort to legal redress. According to accepted wisdom and the standard model, implementing a workplace dispute resolution system (DRS) is supposed to improve employees’ perceptions of procedural justice. But until now it has been virtually impossible to empirically measure the impact of DRS implementation on a population of employees for whom a DRS applies. Other empirical work focuses on the tiny fraction of employees who are DRS claimants.

After years of negotiating access with a large national employer—dubbed “Gilda’s” to maintain its anonymity—Zev Eigen, law, and coauthor Adam Seth Litwin (Carey Business School, Johns Hopkins University) have analyzed eight years of survey data spanning hundreds of thousands of employees across thousands of US locations to examine the effect of implementing a typical workplace DRS on private-sector employees’ perceptions of organizational justice. Gilda’s implemented a DRS in the middle of the eight years of survey data, without other corresponding changes to its business or operations, providing a relatively clean natural experimental setting.

Using fixed-effect models to account for time-constant unobservables at the location level, the authors find that implementation of Gilda’s DRS (a typical four-step process that begins with local manager reporting and culminates in final, binding arbitration) is associated with a statistically significant deterioration in perceptions of procedural justice but with a statistically significant augmentation in employee perceptions of interactional justice—a construct measuring the degree to which employees feel respected and treated well by local managers. The DRS was also associated with a statistically significant improvement in the perception that Gilda’s complies with the law. The authors draw on these findings to propose a revised “differential-effects” model linking DRS implementation with organizational justice and legal compliance.
Meeting Your Match

It takes people less than a second to start formulating explanations for why men and women are so different when it comes to romantic relationships. It’s all in the genes! It’s all about socialization!

Eli Finkel, psychology, spends much of his time asking a different question: How much truth is there to the sex-differences assumption? Across a broad program of research, Finkel and his collaborators have shown that supposed sex differences in mating tendencies frequently disappear once scholars employ the most rigorous research methods.

For example, researchers have repeatedly demonstrated that men value physical attractiveness in a mate more than women do, and that women value earning prospects in a mate more than men do. These are widely accepted, and well-publicized, “truths,” but Finkel has systematically debunked them.

To be sure, these sex differences are robust when people report on hypothetical partners or place personal ads. But they disappear once people meet face to face, at which point physical attractiveness and earning prospects inspire romantic attraction equally strongly in both sexes. Indeed, in one of Finkel’s speed-dating studies, men and women exhibited the standard sex differences when reporting their mate preferences 10 days before their speed-dating event, but these sex differences entirely disappeared at the event — once they met flesh-and-blood potential partners.

Another widely publicized sex difference—that women are more romantically selective than men are—has met a similar fate. Based on research exploring the subtle influence of physical movement on thought, Finkel hypothesized that this difference might be attributable not to some basic feature of male-versus-female psychology but rather to dating scripts dictating that men physically approach women in romantic initiation contexts rather than vice versa.

His study randomly determined whether the male or the female speed daters rotated from partner to partner while the opposite-sex dater remained seated. Consistent with the finding that we tend to like things we physically approach, whichever sex rotated (rather than sitting) experienced greater romantic attraction. In addition, the robust tendency for women to be more selective disappeared when they, rather than the men, were the ones who rotated. Given that men are vastly more likely to take the physical-approach role in romantic initiation contexts, perhaps we shouldn’t be surprised that men are more eager.
D.J. Hoek  
University Library  
Bienen School of Music

Dial Up the Music  
D. J. Hoek is the head of the Northwestern University Music Library as well as a lecturer in musicology. His current research concerns Dial Records, a small jazz record label active in the 1940s and early 1950s, and its overlooked role in documenting, promoting, and disseminating 20th-century classical music.

Today Dial is best remembered for the jazz recordings it produced between 1946 and 1948—particularly those by Charlie Parker, whose fiery improvisational style, known as bebop, revolutionized jazz. But after Parker left Dial, the company turned from jazz to focus on modern classical music.

From 1949 through 1951 Dial issued a series of 18 albums, the Dial Library of Contemporary Classics, that featured works by Arnold Schoenberg, Béla Bartók, John Cage, and other innovative composers whose music was then still largely unrecorded. To trace the discographical facts and historical circumstances of the series, Hoek has extensively studied the archives of Dial’s owner and operator, Ross Russell, whose personal papers and business files are held at the University of Texas at Austin.

But he is also pursuing a broader question: While today jazz and classical music typically occupy distinct artistic realms, are there indeed aesthetic connections between bebop and 20th-century classical music that informed, and are embodied in, Dial’s output?

The first phase of his work began in 2010 as part of a fellowship in Northwestern's Alice Kaplan Institute for the Humanities and culminated in the lengthy article “Beyond Bebop: Dial Records and the Library of Contemporary Classics,” soon to be published in the ARSC Journal, the journal of the Association for Recorded Sound Collections. This is an important beginning to understanding how Dial reflects past attitudes about jazz and classical music.

Hoek’s research has uncovered further aspects of Dial’s history that he continues to pursue, including some surprising discoveries in its network of artists and record-industry personnel.
Poverty and Purchasing Power

When giving assistance to the poor, governments often provide goods or services, such as food aid or public housing, rather than cash. One rationale is that in-kind transfers encourage consumption of “the right things,” such as healthy food. On the flip side, cash transfers are typically less expensive to administer, and cash gives recipients greater freedom of choice. Another important but often-overlooked aspect of this policy tradeoff is that transfer programs can affect prices. Cash and in-kind transfers make recipients better off, which can increase their demand for goods and, in turn, prices. In-kind transfers have a different effect: they increase the local supply of goods, which can drive prices down.

Seema Jayachandran, economics, and coauthors Jesse Cunha and Giacomo De Giorgi of the Naval Postgraduate School and Stanford University have studied how Mexico’s food aid program, Programa de Apoyo Alimentario, affected rural food prices. The Mexican government conducted a two-year experiment in 200 villages to compare different policy options. Villages were randomly assigned to one of three groups: those where families received a monthly transfer of beans, powdered milk, canned tuna, and other foods; those where families received the equivalent amount as a cash transfer; and as a comparison group, those where families did not receive any transfers.

Jayachandran and her coauthors find that cash transfers caused price inflation and in-kind transfers caused price deflation, particularly in villages with limited access to outside markets. These price changes created an indirect benefit (or cost) to households that was comparable in size to the direct benefit of receiving the food or cash. Importantly, lower prices are neither universally good or bad for families. While lower prices increase the purchasing power of net consumers of food, they reduce the income of food-producing families. The main lessons are that the format of government transfers has important implications for prices, and these price effects can be large in geographically isolated areas, where many of the world’s poorest people live.
Nina Kraus  
School of Communication  

Listening in on the Brain  

Nina Kraus, communication sciences, investigates the neurobiology underlying speech and music perception and learning-associated brain plasticity. The Auditory Neuroscience Laboratory, which she directs, conducts a wide range of studies in the areas of music, reading, hearing speech in noise, autism spectrum disorders, aging, and bilingualism. Each year findings from her research projects capture the attention of the larger scientific community and the mainstream media. In 2012 these included a battery of studies on the effects of musical experience on the brain as well as a study on listening aids used by children with dyslexia.

Kraus’s research on the effects of musical experience on the nervous system yielded a bounty of findings. By measuring brain activity in response to sound in young adults with varying amounts of past musical training, she and her colleagues were able to show that playing a musical instrument changes the function of the human brain. Test subjects who had received formal music instruction as children encoded information-bearing aspects of sound more robustly than those who had never participated in music lessons—suggesting that benefits of early musical experience in the test subjects’ lives persisted into adulthood.

A flurry of related studies produced findings that gave an even fuller picture: musical experience offsets age-related delays in neural timing, musical experience strengthens the neural representation of sounds important for communication in middle-aged adults, and musical training in early childhood enhances neural encoding of speech in noise.

In yet another well-publicized study from Kraus’s lab this year, she and her colleagues examined the effects of a classroom FM system (an assistive listening device that draws attention to a teacher’s voice through a Bluetooth receiver worn by a child) on a classroom of 38 children with dyslexia. The study was conducted over the course of a year. Kraus and her colleagues showed that children using the device exhibited improvements in reading accompanied by increased stability of neural responses to sounds.
Imagine a Faster and More Powerful Quantum Internet

Prem Kumar, electrical engineering and computer science, and other researchers in his lab have developed a new switching device that takes quantum communication to a new level. The device is a practical step toward creating a network that takes advantage of the mysterious and powerful world of quantum mechanics.

The researchers can route quantum bits, or entangled particles of light, at very high speeds along a shared network of fiber-optic cable without losing the entanglement information embedded in the quantum bits. The switch could help achieve two goals of the information technology world: a quantum Internet, where encrypted information would be highly secure, and superfast networking of quantum computers.

The device would enable a common transport mechanism, such as the ubiquitous fiber-optic infrastructure, to be shared among many users of quantum information. Such a system could route a quantum bit, such as a photon, to its final destination just like an email is routed across the Internet today.

“My goal is to make quantum communication devices very practical,” says Kumar. “We work in fiber optics so that as quantum communication matures it can easily be integrated into the existing telecommunication infrastructure.”

The bits we all know through standard (or classical) communications exist in only one of two states, either one or zero. All classical information is encoded using these ones and zeros. What makes a quantum bit, or qubit, so attractive is that it can be both one and zero simultaneously as well as being one or zero. Additionally, two or more qubits at different locations can be entangled—a mysterious connection that is not possible with ordinary bits.

For quantum communications and computing to succeed, researchers need to build an infrastructure that can transport this “superposition and entanglement” (being one and zero simultaneously). A photonic quantum network will require switches that don’t disturb the physical characteristics (superposition and entanglement properties) of the qubits being transmitted, says Kumar. Working with a qubit that is a particle of light (the photon), he and his team have built an all-optical, fiber-based switch that does just that while operating at very high speeds.

Left: A circuit representation of the photonic switch. Entangled photons entering at fiber inputs A and B would normally exit at outputs C and D, respectively, but when a control pulse is applied (red fiber) the outputs are switched, that is, the A photon goes to D while B goes to C. Right: A laboratory realization of the entanglement preserving fiber-optic photonic switch.
According to Joseph Leventhal, surgery, future organ transplant recipients may not require antirejection medication thanks to the power of stem cells, which—if they can be manipulated in mismatched donor and recipient pairs—may allow for successful transplantation without immunosuppressive drugs. A transplant surgeon at Northwestern Memorial Hospital, Leventhal is also director of kidney and pancreas transplantation at Feinberg. Northwestern Medicine and University of Louisville researchers are collaborating on a clinical trial to study donor stem cell infusions that have been specially engineered to “trick” the recipient’s immune system into treating the donated organ as part of the patient’s natural self, thus gradually eliminating or reducing the need for antirejection medication.

To conduct the research, Leventhal partnered with Suzanne Ildstad, director of the University of Louisville's Institute of Cellular Therapeutics. Theirs is the first study of its kind where the donor and recipient do not have to be related or immunologically matched. Previous studies involving stem cell transplants for organ recipients have focused on donors and recipients who are siblings and are immunologically identical, which only occurs in about 25 percent of sibling pairs.

In a standard kidney transplant, the donor agrees to donate a kidney. In the approach being studied, that individual is asked to donate part of the immune system as well. The process begins about a month before the kidney transplant, when bone marrow stem cells are collected from the kidney donor’s blood using a process called apheresis. The donor cells are then sent to the University of Louisville, where researchers enrich them with “facilitating cells,” believed to help transplants succeed. During the same time period, the recipient undergoes pre-transplant conditioning that includes radiation and chemotherapy to suppress bone marrow so the donor’s stem cells have more space to grow in the recipient’s body.

Once the facilitating cell–enriched stem cell product has been prepared, it is sent back to Northwestern, where the recipient undergoes a kidney transplant. The donor stem cells are transplanted one day later, prompting stem cells to form in the marrow, where immune cells and other specialized blood cells develop. The goal is to create an environment where two bone marrow systems exist and function in one person. Following transplantation, the recipient takes antirejection drugs that are decreased over time, with the goal of stopping a year after the transplant.
Kate Masur
Weinberg College of Arts and Sciences

Racial Equality During and After the Civil War

It’s a good time to be a historian of the Civil War era. As the nation commemorates the 150th anniversary of the war and of the abolition of slavery, Kate Masur, history, is keeping very busy. Contributing scholarly nuggets and perspective to the ongoing popular discussion of the war’s meanings, her writings have recently been featured in the New York Times’s op-ed page and “Disunion” blog as well as in the Chronicle of Higher Education and The Atlantic online.

Her book An Example for All the Land: Emancipation and the Struggle over Equality in Washington, D.C. (University of North Carolina Press, 2010) revealed the capital city as a laboratory for social policy in the Civil War era. Looking at grassroots activism, municipal politics, and the US Congress, she explained how African Americans mobilized for politics and became integral to the local Republican party. She then showed how a cadre of reformers undermined black influence by aggregating power among appointed, not elected, officials. Partially funded by the National Endowment for the Humanities, her project considers both the expansiveness and the limitations of Americans’ ideas about equality. As the Civil War ended, Washington was “an example” of the era’s most democratic tendencies; just 13 years later, it was at the forefront of disfranchisement and elite rule.

Masur is currently pursuing two major research projects. The first, supported by a Ryskamp Fellowship from the American Council of Learned Societies, examines African Americans, federal employment, and the Republican party in the post–Civil War period. Here she is interested in government work as a source of economic stability and upward mobility for African Americans, the 19th-century Republican party’s struggles with race, and the meanings of federal enclaves in the post-Confederate South. In a separate project she is investigating the demise of slavery in the Upper Chesapeake region during the first year of the Civil War, paying special attention to how local and federal fugitive slave laws were enforced during the conflict.

Masur teaches courses on the Civil War and Reconstruction and on Abraham Lincoln in history and memory, and she recently launched a successful class on modern American women’s history.
David Mohr  
Feinberg School of Medicine

Apps for Behavior Change
The work of David Mohr, preventive medicine, focuses on developing and evaluating behavioral intervention technologies (BITs). BITs are applications, commonly delivered by mobile phones or web browsers, that support behavior change aimed at improving physical and mental health. Much of Mohr’s work has focused on clinical problems such as depression and the management of chronic illness.

While BITs have great potential to give patients cost-effective support, many studies have shown that those who are provided with these tools typically do not use them. BITs commonly require ongoing patient effort—for example, logging mood, activities, or treatment-related behaviors. To minimize the burden on patients, Mohr is developing and evaluating Mobilyze, a mobile phone intervention that can identify relevant patient states in real time using sensor data from the phone (GPS, accelerometers, Bluetooth, etc.), which are acquired and analyzed using machine learning. These states will then be used to support just-in-time interventions, such as encouraging depressed patients to adhere to behavioral treatment tasks. Such systems would greatly reduce the effort required by BIT-using patients and allow these interventions to fit more seamlessly into the fabric of their lives.

In a related project Mohr is developing MedLink, a medication management system for antidepressants prescribed in primary care. Primary-care outcomes from antidepressant therapy are generally poor, in part because many patients do not take their medications and in part because physicians often do not optimize medication and dosage. MedLink monitors medication use in real time via an electronic pill dispenser, allowing for targeted reminders only when a missed dose is detected. Both the physician and patient are urged to contact one another when necessary. Two additional projects are testing MedLink to improve adherence among patients with HIV and schizophrenia.

This research has developed a robust infrastructure for creating and deploying BITs that is now available to other researchers through the Center for Behavioral Intervention Technologies (www.cbits.northwestern.edu). Since its inauguration in September 2011, CBITS has developed and supported more than 25 funded projects at Northwestern as well as at other academic institutions throughout the world, targeting a wide range of clinical problems.
Going Deep into the Inner Workings of Cells

The cell is the basic unit of life. It contains a complete copy of an organism’s DNA, it requires an energy flow to maintain its functions, and it can replicate to produce daughter cells. Yet the design rules describing how molecular parts are organized and how they interact with one another to control cellular functions are far from understood. Milan Mrksich, biomedical engineering, chemistry, and cell and molecular biology, is developing tools that can profile the full range of chemical reactions occurring in the cell and that reveal the design principles underlying the complex functions they control.

Characterizing a cell’s biochemical activities is challenging because visualizing each reaction type requires a different method, and the various methods are often incompatible. For example, many enzymes transfer chemical groups to proteins, but the tests used to measure these activities differ according to the type of modification. The Mrksich group has invented SAMDI, a “label-free” technology that can monitor all enzymatic reactions in a cell. The method uses a plate that has an array of thousands of different biological molecules. When the contents of a cell are applied to the array, enzymes in the sample can modify the various biological molecules. The array is then analyzed by mass spectrometry, a powerful technique that can reveal the small mass changes that are evidence of these reactions.

Thousands of reactions are individually performed to reveal the enzymes present in a biological sample. This image of the SAMDI plate was prepared by Adam Eisenberg, research affiliate in the Mrksich lab.

The arrays provide a profile of biochemical activities that underlie specific cell functions. For example, profiles of normal and cancerous cells can reveal new opportunities for treating disease. Similarly, the profiles can add new perspective to understanding how a cell regulates complex functions. The SAMDI technology has also been applied to discovering new enzymatic reactions and to identifying novel intracellular strategies for regulating behaviors.
Character and Blame

The purpose of a criminal trial is to determine whether a person committed a criminal offense, not whether a person is good or bad generally. The logic of criminal blame involves a carefully calculated judgment about the act, the actor’s mental state, and the harmful outcome. Psychological blame, on the other hand, is often intuitive and automatic, driven by a natural impulsive desire to defend social values and expectations.

Research by Janice Nadler, law, shows that people unconsciously impose an extra penalty on an offender who is perceived as a bad person. Her research has demonstrated, for example, that people perceived a skier who accidentally collided with and killed someone as more blameworthy if his moral character was flawed. Specifically, if the skier was perceived as a lazy son and unreliable worker, people imposed a greater punishment than if he was hardworking and reliable off the slopes. The skier’s flawed character not only prompted imposition of extra punishment but also inspired a stronger perception of intent as well as more intense moral emotions like disgust and anger. Surprisingly, this finding only emerged when people judged just one version of the skier—either the bad person or the good person. By contrast, when people were asked to consider both possibilities, they did not impose any extra punishment on the skier with the bad character. This suggests that the process of imposing an extra blame penalty for bad character operates on a level beneath conscious awareness.

The impulse to enhance blame and punishment based on general character flaws poses a problem in criminal trials, where jurors are instructed to make a decision about guilt based solely on the evidence rather than on their impressions of the defendant’s personality or likability. Further research will attempt to determine whether unconscious assessments of moral character can contribute to wrongful convictions. This work was funded by the American Bar Foundation.

Photo courtesy of Janice Nadler.
Hamid Naficy
School of Communication

An In-Depth Look at Iranian Cinema
Hamid Naficy, radio/television/film, and the Sheikh Hamad
bin Khalifa al-Thani Professor in Communication, has
published A Social History of Iranian Cinema, a study covering
Iranian film from around 1897 through the first decade of the
21st century. The history of Iranian society and the cinema
it produced in this period is bookended by two revolutions:
the Constitutional Revolution of 1905–11, which established
a constitutional monarchy, and the Islamic Revolution of
1978–79, which installed a republican theocratic state. As a
work of social history and theory, the study’s four volumes
deal not only with such chronological developments in
history and the film industry but also with synchronic
contexts, formations, dispositions, and maneuvers that
overdetermined modernity in Iran, the nation’s dynamically
evolving film industry, and that industry’s unique products.

Naficy locates the film industry and its mode of
production, narratives, aesthetics, and generic forms in
the interplay of deeply rooted Iranian performative and
visual arts and what was imported, adopted, adapted,
translated, mistranslated, and hybridized from the West.
The interplay between Iranian and Islamic philosophies
and aesthetics complicated and channeled the nation’s
cinema, particularly that involving women, in ways
unique to Iran, as is discussed throughout the volumes.

The study also situates Iranian cinema at the intersection
of state-driven authoritarian modernization, nationalist
and Islamist politics, and geopolitics during its tumultuous
century, charting how local, national, regional, and
international powers competed for ascendancy in
Iran—affecting what Iranians saw on screens, what they
produced, and the technologies they adopted.

The logic of dividing the work into four volumes (The
Artisanal Era, 1897–1941; The Industrializing Years, 1941–1978;
The Islamicate Period, 1978–1984; and The Globalizing Era,
1984–2010) is driven by both sociopolitical developments
and the evolution of the film industry. While these
four volumes are autonomous, each contributes to the
understanding and appreciation of the others, as certain
theoretical, stylistic, industrial, commercial, cultural,
religious, sociopolitical, biographical, authorial, and
governmental elements form lines of inquiry that are
pursued throughout, gathering momentum and weight.
The volumes have recently received two awards: the
Houshang Pourshariati Iranian Studies Book Award in 2012,
and Honorable Mention, Katherine Singer Kovács Book
Award, Society for Cinema and Media Studies, 2012.
Jorge Nocedal
McCormick School of Engineering and Applied Science


Machine learning, a discipline that lies at the heart of Google’s business, creates algorithms and software that perform intelligent searches, recognize speech, or make useful recommendations. Machine learning operates in three steps: it acquires data and selects the relevant features; it chooses a statistical model; and it trains the model using optimization techniques to make optimal predictions for the data provided. Optimization is a discipline where Jorge Nocedal, industrial engineering and management sciences, has become a leading authority.

Having devoted thousands of computers (“the cloud”) and provided millions of training examples to advance machine learning into new realms, Google was already using Nocedal’s optimization algorithms when Google engineer Will Neveitt enlisted Nocedal for a new research collaboration: developing new optimization algorithms to take advantage of the science of big data.

Nocedal realized that training software to perform tasks as complex as intelligent searches, language translation, or product recommendation was dauntingly difficult yet potentially within reach. Google had the resources to maximize the chance of success, providing him with a unique opportunity to do cutting-edge optimization research. Further, Nocedal had several questions he wanted to answer. Could he, in fact, come up with new optimization algorithms for machine learning? And even if he could, what are the limits of machine learning, which is based on statistical models and not artificial intelligence techniques? When will machine learning hit a wall?

The collaboration between Nocedal and Neveitt has proven that there are indeed better optimization algorithms that can operate in the cloud computing environment using big data. Their first algorithmic idea was quickly implemented at Google, and the algorithm was published in 2011. Nocedal presented a second set of ideas last summer in Berlin in a plenary talk at the ISMP Symposium, the world’s largest conference on optimization.

Spurred by new computer science challenges, Nocedal, his research group, and scientists at Google Research plan a more ambitious research agenda for 2013: to study some highly nonlinear neural network models (proposed at the University of Toronto) that have produced tantalizing results.
A Laser the Size of a Virus Particle

Reducing the size of photonic and electronic elements is critical for ultra-fast data processing and ultra-dense information storage. The miniaturization of a key, workhorse instrument such as the laser is no exception. Coherent light sources at the nanometer scale—nanolasers—are important not only for exploring phenomena in small dimensions but also for realizing optical devices with sizes that can beat the diffraction limit of light. The research group of Teri Odom, chemistry, has found a way to manufacture single laser devices that are the size of a virus particle and that can operate at room temperature.

Conventional lasers rely on three ingredients: a cavity, a gain medium, and a means to pump the gain, either optically or electrically. By definition, a nanolaser needs to have a cavity size on the order of 100 nanometers; however, to emit color that the eye can see (400-700 nm), typical cavity sizes need to be at least several times longer than the lasing wavelength. Hence, to create cavities with sizes smaller than that allowed by diffraction, they needed to take advantage of metallic materials that support surface plasmons, collective oscillations of electrons that have no fundamental size limitations for confining light.

Odom’s nanolasers have cavities formed by two gold nanoparticles: structures with a 3D “bowtie” shape. The nanoscale gap between the nanoparticles provides a well-defined, electromagnetic hot spot that can amplify light emission from the organic dye (gain medium) when the molecules are optically pumped—then, lasing can occur. There are numerous applications of nanolasers, including high-resolution nanolithography, increased optical data storage capacity, compact and ultra-fast photonic circuits, and improved biological sensors.

This work was supported by an Initiative for Sustainability and Energy at Northwestern (ISEN) Award and the NSF-MRSEC program at the Materials Research Science and Engineering Center at Northwestern.
Greg Olson
McCormick School of Engineering and Applied Science

Speeding Up Invention of Materials

Greg Olson, materials science and engineering, was inducted into the American Academy of Arts and Sciences in 2012, cited as the “father of materials design.” A pioneer in the field of integrated computational materials engineering (ICME), Olson joined Northwestern in 1988 and created the Materials Technology Laboratory/Steel Research Group as well as a number of classes on computational materials design. ICME design methodologies are a key element of the Materials Genome Initiative, announced by President Obama in 2011.

In 1997 Olson cofounded QuesTek Innovations LLC to rapidly invent new materials and bring them to industry, and he is the company’s chief science officer. A global leader in ICME, QuesTek has received more than 60 Small Business Innovation Research Awards funded by the US Army, Navy, and Department of Energy as well as the National Science Foundation and others to design new alloys to solve specific problems. QuesTek has invented and commercialized four new steels—stronger, tougher, and more corrosion resistant than those on the market today—that are being used in aerospace, racing, oil and gas, and other industries. Products currently in design include improved alloys based on aluminum, titanium, nickel, copper, iron, niobium, molybdenum, and tungsten.

In 2007 QuesTek’s Ferrium S53® became the first commercially produced, computationally designed steel under a project funded by the US Department of Defense in cooperation with the Department of Energy and the Environmental Protection Agency. For 19 months starting in 2010, a T-38 aircraft made more than 500 flights using S53 landing gear—the first field use of a flight-critical part made from a computationally designed alloy.

QuesTek’s Ferrium M54™ (with design funded by the Navy) achieved an SAE Aerospace Material Specification within four years of initial design goals, compared with seven years for S53 and more than 20 years for traditional empirical-design methods. QuesTek’s Navy-funded SBIR project to use M54 in producing new T-45 hookshanks won a prestigious NAVAIR NAWCAD Commander’s Award in 2012.

Olson is currently on a one-year entrepreneurial sabbatical to work full-time at QuesTek.
Moisturizing with Medication

Skin disorders ideally are treated by medication directly applied to skin, thus concentrating the medication at the desired site and avoiding the potential risk to organs of taking the medication by mouth or injection. Few drugs can pass into skin, however, because of the highly impenetrable protective skin barrier.

Spherical nucleic acids (SNAs), in which small RNA strands are densely packed in a unique spherical configuration around a central gold nanoparticle, were recently developed by the Chad Mirkin lab at Northwestern as a novel approach for gene silencing. Amy Paller, dermatology, in collaboration with researchers in her lab, has applied this technology to treat skin disease. Paller was senior author on a recent Proceedings of the National Academy of Sciences publication that showed how SNAs are taken up by skin cells in culture, where they are able to shut down a target gene of choice 100 times more effectively and with greater safety than traditional techniques. Particularly remarkable is the SNA’s ability to penetrate the mouse or human skin barrier when embedded in a common moisturizer, leading to powerful silencing of selected gene targets (as shown for the epidermal growth factor receptor) and showing excellent safety in mouse studies.

New protein-based medications usually take years to discover. In contrast, SNA gene-suppressing technology can be rapidly applied by matching the structure of the target gene. While SNA technology has the potential to treat a wide variety of skin disorders, the Paller lab, with the help of the Skin Disease Research Center and the Mirkin lab, is currently focused on using SNAs for a variety of skin problems caused by faulty or overactive genes. Among these are skin cancer, psoriasis, diabetic ulcers, and rare genetic skin disorders. The NIH and other funding organizations are supporting these studies.
The last century has seen tremendous technological progress that resulted in significant economic changes. The arrival of new technologies has often disrupted traditional business models. Firms need to keep innovating to avoid falling behind in the marketplace. In contrast, workers face fewer difficulties in adapting to new technologies. The current research of Dimitris Papanikolaou, finance, focuses on understanding the effect of technological innovation on the real economy and the stock market.

Papanikolaou argues that a distinguishing feature of innovation is that it does not equally benefit all economic agents. Capital is often tied to a specific technology; improvements in technology render some of the old capital obsolete. In contrast, labor is typically more flexible, since workers have skills that are not necessarily tied to a specific technology.

Technological innovation can lead to substantial reallocation of wealth across generations. Even if investors own shares in innovative companies, they do not necessarily appropriate all the benefits of innovation. For instance, investors buying shares in new technology firms in the 1990s assumed that they would capture a large share of the new value created. As it turned out, this assumption was not necessarily correct; most of the value was captured by the founders of these innovative firms. Thus the Internet led to the creation of a new generation of millionaires who now compete with other high-wealth individuals for scarce economic resources (e.g., prime real estate). Papanikolaou argues that investors’ desire to avoid this process of displacement by investing in innovating firms is a reason behind innovating firms’ high stock market valuations.

Connecting theory and data, Papanikolaou has constructed a new measure of technological innovation, using data on the stock market reaction to news about patent grants, that summarizes the degree of technological progress over the last 80 years.
Janet Pierrehumbert  
Weinberg College of Arts and Sciences

The Wordovators Project
A large and rich lexicon is a hallmark of the intelligence and adaptability of human beings. Words enable people to share complex information, including ideas about the remote past (such as dinosaurs), abstract ideas (such as freedom), and emotions and social judgments (lol, fantabulous). Words are also a vehicle for collective inquiry. By naming things we do not fully understand (such as dark matter), we can collaborate in learning more about them. The shared lexicon of a linguistic community may be the ultimate public good, supporting cooperation and collective intelligence at a scale that is unparalleled in other species.

The lexicon is dynamic. Some words become obsolete, but new words are continually created, and some of these become generally adopted. Drawing on analogies between biodiversity and lexical diversity, the Wordovators project has the goal of discovering the fundamental mechanisms that support the complexity of the lexicon in human languages. It combines mathematical modeling with large-scale experiments in the form of computer word games. Hosted on the web, the games will recruit players from all over the world. Single-player games will explore cognitive factors in the creation and processing of novel words. Multiplayer games using a futuristic space-exploration scenario will investigate the interaction of cognitive and social factors in the development of shared vocabularies.

The leader of the Wordovators project is Janet Pierrehumbert, linguistics, who brings to the research her long-standing interests in statistical learning and language dynamics. The project is a close collaboration between Northwestern and the University of Canterbury’s New Zealand Institute of Language, Brain and Behaviour (NZILBB), which was founded and is directed by Northwestern alumna Jen Hay (PhD linguistics, 2000). The John Templeton Foundation has provided generous funding for this project.
One crucial method for assessing people’s responses to inaccuracies involves examining how they deal with them during reading. Rapp’s lab uses an eye tracker to determine readers’ saccades (eye movements) as they process written materials containing accuracies and inaccuracies. This involves measuring the amount of time participants focus on particular words and sentences, where their eyes go when they encounter difficulties, and their revisits of inaccurate information and the contexts supporting or refuting the information. The eye tracker, coupled with other behavioral measures of reading including memory tests and judgments of the truth of statements, offers a powerful approach for understanding when and how individuals build understandings from text materials. Pictured from the Rapp lab are postdoctoral fellow Matt Jacovina (standing) and undergraduate research assistant Maria Tkacz (seated).

People learn about the world from what they read. They rely on the information in fictional and nonfictional texts, applying the acquired knowledge to solve problems, make decisions, build opinions and arguments, and motivate future activity. This is a good thing when texts provide accurate information as a function of meticulously conducted research, rigorously developed arguments, and carefully constructed prose. Research by David Rapp, learning sciences and psychology, shows that people also routinely rely on texts that contain inaccuracies, both intentional and unintentional, or offer information from wholly unreliable sources. What makes this a particularly perplexing problem is that people use incorrect information not only when they are unaware it is wrong but also when they should already know it is inaccurate.

One line of inquiry in Rapp’s lab attempts to explain why readers fall victim to inaccurate information and to determine how to reduce such occurrences. He argues that one reason people exhibit a liberal reliance on what they read is that effective reading in itself requires substantial mental resources. This places limits on the level of critical evaluation that is likely to be easily enacted during reading. Thankfully, results from his lab have shown that critical evaluation can be encouraged through deliberative activities designed to highlight disconnects between what readers already know and what texts tell them. The challenge for his work is determining how to encourage readers to regularly engage in these deliberative activities, regardless of whether they are reading for fun or for profit.
Derek Rucker
Kellogg School of Management

Power and Status in the Psychology of the Consumer

Derek Rucker, marketing, trained as a social psychologist, which enables him to explore the human mind and how it is influenced by a situation. As a professor of marketing, he focuses on understanding factors that affect consumers’ consumption habits, responses to advertising, and word-of-mouth. His work contributes to understanding both consumer behavior and, more broadly, the psychology of human behavior.

Examining the phenomenon of compensatory consumption, Rucker and his colleagues have begun to advance our understanding of how threats to consumers’ sense of self affect their consumption patterns. For example, in work with Adam Galinsky at Columbia University, Rucker and colleagues have shown that when consumers’ sense of power—their relative control over others or valued resources—is threatened, they seek to offset their loss of power. Because social status is one signal of relative power, consumers experiencing a sense of powerlessness are more likely to desire, and are willing to pay more for, status-related products.

Rucker’s work not only documents the phenomenon of compensatory consumption in response to different types of threats but also explores the different methods by which consumption can be used to compensate for threats. For example, in work with Soo Kim, a doctoral candidate at Kellogg, Rucker distinguishes different consumption strategies for offsetting threat. Specifically, people sometimes seek out consumption that compensates for the specific dimension of threat, as in the example of someone feeling powerless and seeking status. Rucker and Kim also show, however, that in some cases people will engage in consumption merely to distract themselves from thinking about the threat. This research offers a cutting-edge understanding of consumer psychology and the motives underlying consumption.
Could the quality of your kindergarten experience make a difference in your lifetime earnings? Or whether you’re married or own a home? Diane Schanzenbach, education and social policy, and her colleagues have found that the early childhood educational environment produces strong, lingering impacts.

Isolating the causal effects of educational resources isn’t easy. Under normal circumstances, children in better classrooms—classrooms with better teachers, more resources, better-behaved classmates, and so on— are different in many dimensions. As a result, students in better classrooms may do better simply because they had advantages to begin with and not because of the class itself. To solve this problem, Schanzenbach’s team used data from a randomized experiment—Tennessee’s Project STAR (Student-Teacher Achievement Ratio), conducted in the mid-1980s, which randomly assigned nearly 12,000 children and their teachers to specific kindergarten classrooms within 79 schools across the state. Because students were assigned to classes randomly, there were no systematic differences in the background characteristics of students in different classes. As a result, any differences in later outcomes can be traced with considerable confidence to the impact of the original classroom.

Schanzenbach and her colleagues found that kindergarten classroom “quality”—as measured by the gains in test scores experienced by a child’s classmates over the year—has an important long-run effect on adult outcomes. Not only did a high-quality kindergarten classroom increase students’ earnings, but it also improved a wide variety of other outcomes. By age 27, students who were randomly assigned to a higher-quality classroom were more likely to attend college and attended higher-ranked colleges. They were also more likely to own a house, save for retirement, and live in a better neighborhood.

Isolating the portion of this benefit that is driven by teachers, researchers estimated that moving from a classroom taught by a below-average (25th percentile) teacher to an above-average (75th percentile) teacher raises a child’s earnings by about 3.5 percent per year. Having an above-average kindergarten teacher increases the lifetime earning power of a classroom of 20 students by about $320,000.
Complex Systems, Complex Challenges

The research of Mary Silber, engineering sciences and applied mathematics, has taken her in many directions that may initially seem unrelated: from understanding the mechanisms behind exotic surface wave patterns on fluids to modeling biological processes within cells, to searching for tipping points associated with climate change. This wide range of applications for fundamental mathematical concepts is what drew her to a career in applied mathematics, and that career has been sustained by the enriching collaborations required by highly interdisciplinary research.

Mathematical models of complex nonlinear phenomena present inescapable challenges. Typically the models cannot be solved exactly. Even in using a computer to explore such phenomena, scientists often confront insurmountable challenges because of disparities in spatial and temporal scales that prevent a full and appropriate resolution. There is always some uncertainty in their model parameters, and there may be some inherent chaos associated with the process they aim to model. What questions can we meaningfully ask of such a mathematical model? A goal of Silber’s research is to develop mathematics that helps identify robust and universal qualitative phenomena associated with nonlinear dynamical systems.

Earth’s climate is a perfect example of a complex system where these challenges apply. As part of an NSF-funded network of mathematicians and climate scientists, Silber is investigating the mathematical problems posed by climate change. One of her key interests is in identifying tipping-point mechanisms for Earth’s climate and ecosystems. Can we anticipate when this complex system is driven to the brink of an abrupt transition? She is currently focusing on this general question through investigations of the melting of Arctic sea ice and of spatial patterning that accompanies a transition to desertification in models of semi-arid ecosystems. These projects fit well with 2013’s designation as Mathematics of Planet Earth Year.

Exotic surface patterns have been generated on fluid layers subjected to a vertical oscillatory vibration. Experimentalists found that they could change the surface wave patterns by changing the frequency content of the vibration. Silber’s group explained how the spatial pattern characteristics could be controlled by characteristics of the temporal forcing in this complex nonlinear system. To probe the depth of understanding they developed model equations and reproduced the experimental patterns in their numerical simulations. On the right is an example of a 12-fold “quasi pattern”; such patterns have high degrees of symmetry but are not spatially periodic the way that a 6-fold hexagonal tiling would be. On the left is the Fourier spectra associated with the pattern, which has its own beautiful 12-fold structure. (“Design of parametrically forced patterns and quasipatterns,” A.M. Rucklidge and M. Silber, SIAM Journal on Applied Dynamical Systems, 8, p. 298-347, 2009.)
Bonnie Spring  
Feinberg School of Medicine

Building Intervention Systems to Foster Healthier Lifestyles

The chronic diseases that consume 75 percent of all US healthcare dollars are largely caused by several prevalent unhealthy lifestyle behaviors: poor diet, physical inactivity, and cigarette smoking. Bonnie Spring, preventive medicine, has spent the past 20 years learning how to reverse these risk behaviors and substitute healthier habits. To keep health behavior on the radar at Northwestern’s Feinberg School of Medicine, she founded the Department of Preventive Medicine’s behavioral medicine section and, more recently, the Institute for Public Health and Medicine’s Center for Behavior and Health. One obstacle Spring often confronts is a belief that people can’t change their adverse health habits. Her research proves otherwise.

Earlier in her career Spring found many women discouraged by clinical guidelines advising them that trying to prevent weight gain while quitting smoking causes a relapse to tobacco use. Spring’s findings failed to support that pessimistic conclusion and showed that efforts to manage both smoking and weight need not undermine each other. Since then she has moved on to develop mobile tools that help patients manage prevalent diet and activity risk behaviors. These tools provide behavior change feedback, decision support, and a virtual connection to a coach and teammates who supply social support and accountability, incentivizing healthy behavior change. Spring’s findings demonstrate that such connective intervention systems can help patients achieve clinically meaningful improvements in diet and activity and maintain them after treatment ends. Interestingly, she finds that one positive behavior change often leads to another. For example, the patient who reduces television time and increases fruit and vegetable intake automatically reduces saturated fat intake without added effort.

An important challenge now facing healthcare is how to integrate health promotion into clinical practice systems that are already overstretched. Spring’s team was able to improve sustained weight loss outcomes significantly by adding a mobile connective intervention to clinician-directed weight loss treatment. Colleagues from the McCormick School and Penn State University are now helping her take the next steps by applying optimization strategies from engineering to improve the cost-effectiveness of health behavior-change treatments.
Targeted Nanotherapies

Nanotechnology is a far-reaching discipline with potential applications in medicine, electronics, energy, and beyond. This revolutionary new field is based on building new materials with at least one dimension between one and one hundred nanometers in length. (One nanometer is equal to one billionth of one meter.) Synthesis on this scale endows materials with novel properties that can present exciting new opportunities in biomedicine.

The breakthrough research of C. Shad Thaxton, urology, is a powerful example of nano-biomedicine. Thaxton has developed and characterized a unique nanomaterial platform that may provide new therapeutic approaches for cardiovascular disease, prostate cancer, lymphoma, other cancers, and even wound healing.

Initially he and his team developed a synthetic form of high-density lipoprotein (HDL), the carrier of “good cholesterol,” with the ultimate goal of preventing or perhaps reversing the buildup of “bad cholesterol” in arterial walls—often a precursor to heart disease. Working with HDL nanoparticles (HDL NPs), Thaxton’s group and collaborators are focused on gaining a better understanding of cellular cholesterol metabolism and how synthetic agents such as HDL NPs may be used as therapies for heart disease. Further, some cancer cells bind HDLs, utilizing the HDL’s cholesterol payload to support the rapid cell growth characteristic of many tumors.

Because the HDL NPs bind to the same receptors, recent data show that they can starve cancer cells of cholesterol which leads to their demise, or can be used to deliver other therapies to cancer cells.

Accordingly, HDL NP biomimicry is being harnessed to create new biologically active therapies and new drug delivery vehicles that can inhibit, for instance, cancer cell growth or the formation of new blood vessels that support tumors. Further investigations into therapeutic HDL NPs will continue to shed light on how HDLs, HDL NPs, and manipulation of cellular cholesterol metabolism may provide unique approaches and targeted therapies for cardiovascular disease and cancer.
Values at Work
Kim Yuracko, law instruction, seeks to explain the legal and cultural phenomena behind courts’ dramatic expansion of the concept of sex discrimination in employment. When the Civil Rights Act of 1964 banned sex discrimination in employment, its target was clear: to end women’s exclusion from particular jobs and to challenge their relegation to a “pink collar” ghetto. In recent years, courts have interpreted Title VII’s prohibition on sex discrimination in increasingly expansive ways. Not only are workers protected from discrimination based on their biological sex, they are increasingly protected from discrimination based on how they express their gender identity. Men perceived as inappropriately effeminate, women perceived as inappropriately masculine, and transsexuals are winning protection against workplace demands that they conform to the dominant social norms of their sex. Yuracko examines the values, beliefs, and principles that are motivating these changes and explores their implications for antidiscrimination law, workplace equality, and social conceptions of gender more broadly.

Her current research reveals the difficulty in attributing recent coverage expansions to a heightened or renewed commitment to Title VII’s core antidiscrimination values—namely, neutrality and antisubordination. Indeed, courts’ commitment to such values in sex discrimination cases has been and continues to be more limited and constrained than generally recognized. Instead, Yuracko shows that current expansions in sex discrimination protection flow most directly from a new medicalization of gender in the courts. Critical to the victories of gender nonconformists has been the introduction of evidence regarding gender identity disorder. Such evidence serves to medicalize not only a particular gender disorder but masculinity and femininity more generally—and to define both in static, binary, and highly stereotyped terms. The result, paradoxically, is that new protections for individual gender nonconformists may be achieved at the expense of a subtle hardening of gender expectations for everyone else.
SPONSORED RESEARCH AWARDS
Research grant funding awarded to Northwestern University in 2012 totaled more than a half billion dollars for the third year in a row. Northwestern’s research award funding for fiscal year 2012 (FY2012) was $508.3 million, a slight (1 percent) decrease from last year’s $511.7 million.

The difference in funding between the two years is due largely to the decrease in funding from the American Recovery and Reinvestment Act (ARRA), which provided 66 awards totaling $13.5 million funded in FY2012 compared with 116 awards for $34.3 million during FY2011. Excluding ARRA funding from both this year’s and last year’s totals, 2012 funding otherwise increased by close to $6.7 million (4 percent).

In the past year, relative to FY2011, awards to the Weinberg College of Arts and Sciences grew by 3.1 percent to $69.1 million. Funding for the McCormick School of Engineering and Applied Science grew by 1.7 percent to $63.5 million. The School of Education and Social Policy’s awards decreased by 40.6 percent to $5.1 million. The School of Communication awards increased 18.2 percent to $9.5 million. The Feinberg School of Medicine’s awards dipped by a slight 0.8 percent to $314.4 million. The University Research Centers award amounts were flat from $31.1 million in 2011 to $31.3 million in 2012.

In FY2012 the dollar volume of awards from industrial sponsors reflected an increase of 43 percent (up $18.1 million). Awards from federal agencies decreased by 3 percent ($12.9 million), while those from state and local government bodies were down by 89 percent ($4.4 million). Awards from voluntary health organizations also declined, by 20 percent ($3.7 million).
Sponsored Research Awards (Dollars in Millions)

Federal/Nonfederal Awards

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Awards by Unit

- Other
- University Research Centers
- McCormick
- Weinberg
- Feinberg
AMERICAN RECOVERY AND REINVESTMENT ACT AWARDS

The slowdown in ARRA awards is shown in the overall 2012 total of 66 awards totaling $13.5 million compared with 116 awards totaling $34.3 million in 2011. The majority of the 2012 ARRA awarded dollars were divided among Feinberg (29 awards totaling $3.95 million), McCormick (14 awards for $3.6 million), and research centers and institutes (6 awards for $4.2 million). Weinberg garnered 10 awards for $1.1 million.

ARRA Awards by Unit

![ARRA Awards by Unit Chart]

ARRA Awards

<table>
<thead>
<tr>
<th>Unit</th>
<th># of Awards</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Centers and Institutes</td>
<td>6</td>
<td>$4,210,137</td>
</tr>
<tr>
<td>Feinberg School of Medicine</td>
<td>29</td>
<td>$3,949,432</td>
</tr>
<tr>
<td>McCormick School of Engineering and Applied Science</td>
<td>14</td>
<td>$3,615,913</td>
</tr>
<tr>
<td>Weinberg College of Arts and Sciences</td>
<td>10</td>
<td>$1,111,493</td>
</tr>
<tr>
<td>School of Communication</td>
<td>2</td>
<td>$193,014</td>
</tr>
<tr>
<td>Information Technology</td>
<td>1</td>
<td>$160,000</td>
</tr>
<tr>
<td>School of Education and Social Policy</td>
<td>3</td>
<td>$140,494</td>
</tr>
<tr>
<td>Northwestern School of Law</td>
<td>1</td>
<td>$79,678</td>
</tr>
<tr>
<td>Kellogg School of Management</td>
<td>1</td>
<td>$50,439</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>$13,460,161</strong></td>
</tr>
</tbody>
</table>

*Kellogg School of Management, Information Technology, Northwestern School of Law, and School of Education and Social Policy.*
Northwestern stepped up its award proposal activity in 2012 with a cumulative dollar volume of $2.2 billion in submissions, an increase of 17 percent (up $329.9 million) over the total reported in FY2011. This includes a 20 percent increase ($331.8 million) in the dollar volume of proposals submitted to federal agencies and an increase of 58 percent ($25.8 million) in those to industrial sponsors.

Many of the schools and colleges saw increases in the dollar volume of proposals, including Feinberg, 26.6 percent to $1.4 billion; McCormick, 17 percent to $378.5 million; and research institutes and centers, 45.4 percent to $129.1 million. This first year of proposal activity at Northwestern University in Qatar totaled $249,832. Decreases were seen at Weinberg, Communication, and Education and Social Policy.

### Proposals by Sponsor

- **66.0%** Department of Health and Human Services
- **12.3%** National Science Foundation
- **6.9%** Department of Defense
- **3.0%** Department of Energy
- **1.8%** Other Federal
- **3.4%** Voluntary Health Organizations
- **3.2%** Industry and Trade Organizations
- **1.9%** Foundations
- **1.5%** Other Nonfederal

### Proposals by Administrative Unit

- **63.8%** Feinberg School of Medicine **$1.42 billion**
- **17.0%** McCormick School of Engineering and Applied Science **$378 million**
- **9.9%** Weinberg College of Arts and Sciences **$221 million**
- **5.8%** University Research Centers and Institutes **$129 million**
- **2.2%** School of Communication **$49 million**
- **0.9%** School of Education and Social Policy **$19 million**
- **0.5%** Other Units*
Sponsored Research Proposals (Dollars in Millions)

Federal/Nonfederal Proposals

Proposals by Unit
EXPENDITURES

Northwestern’s interdisciplinary approach to research is a strong point in its reputation. The University encourages such collaborations and has worked to remove administrative barriers that might discourage interactions among departments, centers, and schools.

At the same time, ensuring appropriate credit is vital for fostering such 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.

Overall research expenditures largely remained stable in 2012. Total expenditures (direct plus indirect) increased by less than 1 percent over FY2011 to $484.7 million. The expenditure amount for the Feinberg School of Medicine declined by 1.24 percent, to $295.6 million. McCormick’s expenditures dipped by 4.17 percent to a total of $62.0 million, down from $64.7 million in 2011. Weinberg College expenditures increased by 3.02 percent to $64.9 million. Expenditures for the University’s research centers grew, by 8.7 percent, to $37.6 million from $34.6 million in 2011.
EXTERNAL METRICS

Northwestern continues to strengthen its position in biomedical research. In 2011 (data from federal agencies lags by one year) Northwestern moved up from 25th to 20th in volume of awards for universities in the National Institutes of Health (NIH) rankings. The University dropped one slot to 46th from 45th in the National Science Foundation (NSF) rankings.

When viewed over a greater length of time, the trend in research volume at the University has been positive.

---

### 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>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Johns Hopkins University</td>
<td>$437,144</td>
<td>1</td>
<td>$563,308</td>
<td>1</td>
<td>$603,367</td>
<td>1</td>
<td>$610,467</td>
<td>1</td>
<td>$625,135</td>
<td>1</td>
<td>43%</td>
</tr>
<tr>
<td>University of Pennsylvania</td>
<td>369,407</td>
<td>2</td>
<td>452,631</td>
<td>2</td>
<td>454,903</td>
<td>3</td>
<td>482,316</td>
<td>2</td>
<td>462,600</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>Harvard University</td>
<td>269,103</td>
<td>7</td>
<td>325,777</td>
<td>12</td>
<td>363,470</td>
<td>11</td>
<td>396,845</td>
<td>7</td>
<td>386,696</td>
<td>8</td>
<td>44%</td>
</tr>
<tr>
<td>Washington University</td>
<td>295,441</td>
<td>5</td>
<td>372,664</td>
<td>9</td>
<td>382,455</td>
<td>8</td>
<td>386,470</td>
<td>9</td>
<td>371,214</td>
<td>9</td>
<td>26%</td>
</tr>
<tr>
<td>Yale University</td>
<td>255,561</td>
<td>10</td>
<td>336,318</td>
<td>10</td>
<td>357,364</td>
<td>12</td>
<td>378,805</td>
<td>10</td>
<td>366,307</td>
<td>10</td>
<td>43%</td>
</tr>
<tr>
<td>Columbia University</td>
<td>246,405</td>
<td>11</td>
<td>326,361</td>
<td>11</td>
<td>327,311</td>
<td>13</td>
<td>330,030</td>
<td>15</td>
<td>350,532</td>
<td>12</td>
<td>42%</td>
</tr>
<tr>
<td>Duke University</td>
<td>227,067</td>
<td>12</td>
<td>407,538</td>
<td>5</td>
<td>371,408</td>
<td>9</td>
<td>351,617</td>
<td>12</td>
<td>340,621</td>
<td>13</td>
<td>50%</td>
</tr>
<tr>
<td>Stanford University</td>
<td>219,911</td>
<td>13</td>
<td>312,777</td>
<td>13</td>
<td>306,735</td>
<td>15</td>
<td>340,649</td>
<td>14</td>
<td>332,384</td>
<td>15</td>
<td>51%</td>
</tr>
<tr>
<td>Northwestern University</td>
<td>109,664</td>
<td>34</td>
<td>167,506</td>
<td>28</td>
<td>184,539</td>
<td>25</td>
<td>191,208</td>
<td>24</td>
<td>203,282</td>
<td>21</td>
<td>85%</td>
</tr>
<tr>
<td>University of Chicago</td>
<td>128,638</td>
<td>28</td>
<td>188,602</td>
<td>22</td>
<td>214,138</td>
<td>20</td>
<td>198,347</td>
<td>22</td>
<td>196,394</td>
<td>23</td>
<td>53%</td>
</tr>
<tr>
<td>Cornell University</td>
<td>148,348</td>
<td>23</td>
<td>167,810</td>
<td>27</td>
<td>186,656</td>
<td>24</td>
<td>186,162</td>
<td>26</td>
<td>182,837</td>
<td>27</td>
<td>23%</td>
</tr>
<tr>
<td>University of Rochester</td>
<td>119,388</td>
<td>33</td>
<td>151,978</td>
<td>34</td>
<td>188,206</td>
<td>23</td>
<td>186,789</td>
<td>25</td>
<td>158,401</td>
<td>35</td>
<td>33%</td>
</tr>
<tr>
<td>Massachusetts Institute of Technology</td>
<td>79,119</td>
<td>48</td>
<td>181,160</td>
<td>23</td>
<td>143,549</td>
<td>37</td>
<td>119,216</td>
<td>46</td>
<td>106,817</td>
<td>49</td>
<td>35%</td>
</tr>
<tr>
<td>Dartmouth</td>
<td>57,257</td>
<td>64</td>
<td>86,494</td>
<td>54</td>
<td>78,856</td>
<td>59</td>
<td>84,007</td>
<td>57</td>
<td>80,384</td>
<td>57</td>
<td>40%</td>
</tr>
<tr>
<td>Brown University</td>
<td>37,907</td>
<td>79</td>
<td>55,087</td>
<td>73</td>
<td>61,962</td>
<td>64</td>
<td>65,198</td>
<td>64</td>
<td>63,472</td>
<td>66</td>
<td>67%</td>
</tr>
<tr>
<td>Georgetown</td>
<td>58,686</td>
<td>62</td>
<td>61,431</td>
<td>66</td>
<td>62,112</td>
<td>67</td>
<td>65,294</td>
<td>63</td>
<td>56,089</td>
<td>71</td>
<td>-4%</td>
</tr>
<tr>
<td>Princeton University</td>
<td>33,018</td>
<td>85</td>
<td>38,206</td>
<td>96</td>
<td>48,764</td>
<td>82</td>
<td>43,774</td>
<td>92</td>
<td>38,383</td>
<td>97</td>
<td>16%</td>
</tr>
<tr>
<td>Rice University</td>
<td>5,502</td>
<td>181</td>
<td>10,426</td>
<td>166</td>
<td>12,714</td>
<td>155</td>
<td>14,548</td>
<td>148</td>
<td>14,786</td>
<td>145</td>
<td>169%</td>
</tr>
</tbody>
</table>

* It’s possible that these numbers were affected by ARRA payments.
Source: National Institutes of Health
http://report.nih.gov/award/

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### National Institutes of Health Awards Statistics
(Dollars in Millions)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NIH Total Budget</td>
<td>$19,856</td>
<td>$27,318</td>
<td>$29,501</td>
<td>$30,200</td>
<td>$29,944</td>
<td>51%</td>
</tr>
<tr>
<td>NIH Published Success Rate*</td>
<td>32%</td>
<td>20%</td>
<td>21%</td>
<td>21%</td>
<td>18%</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>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009(^a)</th>
<th>2009 Rank</th>
<th>2010(^b)</th>
<th>2010 Rank</th>
<th>2011</th>
<th>2011 Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cornell University</td>
<td>$88,904</td>
<td>$109,968</td>
<td>$111,548</td>
<td>$155,181</td>
<td>3</td>
<td>$102,551</td>
<td>4</td>
<td>$113,742</td>
<td>3</td>
</tr>
<tr>
<td>Columbia University</td>
<td>72,084</td>
<td>62,482</td>
<td>74,144</td>
<td>104,788</td>
<td>9</td>
<td>91,458</td>
<td>6</td>
<td>81,508</td>
<td>9</td>
</tr>
<tr>
<td>Massachusetts Institute of Technology</td>
<td>55,766</td>
<td>56,239</td>
<td>57,202</td>
<td>67,488</td>
<td>23</td>
<td>81,918</td>
<td>10</td>
<td>81,222</td>
<td>10</td>
</tr>
<tr>
<td>Stanford University</td>
<td>53,778</td>
<td>55,978</td>
<td>50,362</td>
<td>63,748</td>
<td>24</td>
<td>77,804</td>
<td>14</td>
<td>56,788</td>
<td>18</td>
</tr>
<tr>
<td>University of Chicago</td>
<td>40,623</td>
<td>39,554</td>
<td>41,180</td>
<td>80,716</td>
<td>16</td>
<td>44,317</td>
<td>33</td>
<td>51,002</td>
<td>28</td>
</tr>
<tr>
<td>Duke University</td>
<td>31,884</td>
<td>35,687</td>
<td>33,683</td>
<td>44,949</td>
<td>47</td>
<td>42,685</td>
<td>36</td>
<td>49,789</td>
<td>29</td>
</tr>
<tr>
<td>Princeton University</td>
<td>44,301</td>
<td>43,593</td>
<td>76,476</td>
<td>55,893</td>
<td>37</td>
<td>59,855</td>
<td>24</td>
<td>49,676</td>
<td>30</td>
</tr>
<tr>
<td>Harvard University</td>
<td>29,150</td>
<td>34,494</td>
<td>24,747</td>
<td>61,153</td>
<td>29</td>
<td>53,561</td>
<td>28</td>
<td>45,875</td>
<td>33</td>
</tr>
<tr>
<td>Johns Hopkins University</td>
<td>28,856</td>
<td>34,377</td>
<td>35,185</td>
<td>45,297</td>
<td>46</td>
<td>42,775</td>
<td>35</td>
<td>37,332</td>
<td>42</td>
</tr>
<tr>
<td>Northwestern University</td>
<td>33,234</td>
<td>41,657</td>
<td>32,274</td>
<td>60,247</td>
<td>30</td>
<td>35,899</td>
<td>45</td>
<td>36,605</td>
<td>46</td>
</tr>
<tr>
<td>University of Pennsylvania</td>
<td>27,415</td>
<td>27,643</td>
<td>27,991</td>
<td>48,589</td>
<td>42</td>
<td>32,608</td>
<td>49</td>
<td>34,842</td>
<td>47</td>
</tr>
<tr>
<td>Yale University</td>
<td>27,791</td>
<td>22,028</td>
<td>27,398</td>
<td>41,736</td>
<td>50</td>
<td>28,652</td>
<td>56</td>
<td>31,748</td>
<td>51</td>
</tr>
<tr>
<td>Rice University</td>
<td>26,221</td>
<td>24,574</td>
<td>26,091</td>
<td>28,566</td>
<td>63</td>
<td>27,581</td>
<td>57</td>
<td>30,338</td>
<td>52</td>
</tr>
<tr>
<td>Brown University</td>
<td>18,432</td>
<td>9,872</td>
<td>11,256</td>
<td>37,104</td>
<td>54</td>
<td>30,069</td>
<td>54</td>
<td>21,944</td>
<td>67</td>
</tr>
<tr>
<td>University of Rochester</td>
<td>13,297</td>
<td>17,901</td>
<td>18,893</td>
<td>19,885</td>
<td>87</td>
<td>16,462</td>
<td>83</td>
<td>14,268</td>
<td>90</td>
</tr>
<tr>
<td>Dartmouth</td>
<td>7,855</td>
<td>8,422</td>
<td>8,157</td>
<td>20,215</td>
<td>86</td>
<td>13,347</td>
<td>97</td>
<td>13,483</td>
<td>93</td>
</tr>
<tr>
<td>Washington University</td>
<td>17,565</td>
<td>17,901</td>
<td>18,893</td>
<td>18,874</td>
<td>91</td>
<td>16,422</td>
<td>84</td>
<td>12,361</td>
<td>100</td>
</tr>
<tr>
<td>Georgetown</td>
<td>4,248</td>
<td>4,589</td>
<td>4,253</td>
<td>7,862</td>
<td>141</td>
<td>4,852</td>
<td>178</td>
<td>4,452</td>
<td>176</td>
</tr>
</tbody>
</table>

**NSF Total Funding**  
$5,645,579 | $588,437 | $608,404 | $887,042 | $757,242 | $691,255

\(^a\)Those categorized as “University”  
\(^b\)Includes ARRA funds  
The leadership and staff of the Innovation and New Ventures Office (INVO) work to create, nurture, and inspire a culture of innovation at the University. The former Tech Transfer program is managed through this office. In 2012 Northwestern executed 76 license agreements with 68 different companies and institutions. Ten startup companies were launched through INVO. That office handled 196 invention disclosures; 269 patents were filed and 73 received. INVO brought Northwestern and Northwestern faculty net licensing revenues of $117.5 million.

Since 2005–06 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. Pregabalin ultimately was marketed as Lyrica, a drug sold by Pfizer and used to combat epilepsy, neuropathic pain, and fibromyalgia. The Lyrica returns in 2010 (the chart below is based on 2010 data) kept Northwestern in first place among universities in licensing income.

### US Licensing Income: FY2002–FY2010

<table>
<thead>
<tr>
<th>University</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown University</td>
<td>$5,142,956</td>
<td>$5,982,272</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<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>
<td>154,257,579</td>
<td>147,237,631</td>
</tr>
<tr>
<td>Cornell University</td>
<td>7,288,500</td>
<td>3,812,500</td>
<td>6,125,000</td>
<td>5,208,000</td>
<td>6,928,171</td>
<td>5,100,407</td>
<td>11,579,965</td>
</tr>
<tr>
<td>Dartmouth</td>
<td>721,029</td>
<td>871,261</td>
<td>3,282,958</td>
<td>2,532,668</td>
<td>4,939,523</td>
<td>1,833,707</td>
<td>2,335,506</td>
</tr>
<tr>
<td>Duke University</td>
<td>3,171,904</td>
<td>3,607,749</td>
<td>4,124,547</td>
<td>6,715,214</td>
<td>15,591,503</td>
<td>19,048,244</td>
<td>25,733,526</td>
</tr>
<tr>
<td>Georgetown</td>
<td>737,597</td>
<td>431,800</td>
<td>8,478,309</td>
<td>3,129,739</td>
<td>6,518,923</td>
<td>9,222,996</td>
<td>8,054,887</td>
</tr>
<tr>
<td>Harvard University¹</td>
<td>16,654,975</td>
<td>19,850,474</td>
<td>20,849,993</td>
<td>12,402,873</td>
<td>20,980,563</td>
<td>12,308,207</td>
<td>10,052,098</td>
</tr>
<tr>
<td>Johns Hopkins University²</td>
<td>6,321,110</td>
<td>12,184,834</td>
<td>13,938,457</td>
<td>10,260,830</td>
<td>11,362,574</td>
<td>12,387,415</td>
<td>12,413,714</td>
</tr>
<tr>
<td>Massachusetts Institute of Technology</td>
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<td>35,060,162</td>
<td>43,500,000</td>
<td>61,600,000</td>
<td>88,924,500</td>
<td>66,450,000</td>
<td>69,200,000</td>
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<tr>
<td>Northwestern University</td>
<td>1,523,391</td>
<td>4,019,199</td>
<td>29,990,550</td>
<td>85,298,599</td>
<td>824,426,230</td>
<td>161,591,544</td>
<td>179,930,000</td>
</tr>
<tr>
<td>Princeton University</td>
<td>N/A</td>
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Note: The comparative figures in these tables come from AUTM U.S. Licensing Activity Survey 2010.

¹Includes Harvard Hospitals (Beth Israel, Brigham & Women’s, Children’s Hospital Boston, Dana-Farber, Mass. General).

²Does not include data from the Applied Physics Lab.
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Zev Eigen is associate professor of law at the School of Law, with a courtesy appointment as an associate professor of management and strategy at the Kellogg School of Management. He is also a Research Fellow with NYU School of Law’s Center for Labor and Employment Law. He studies how individuals interact with organizations in employment settings as well as commercial and social settings online. He has designed experiments testing how people behave with respect to contracts, measuring when they comply, and when they defect. He is working on an experiment now involving an applet that lets people digitally edit live contracts online. Read more about his research on workplace dispute resolution on page 26.

Diane Schanzenbach is associate professor of human development and social policy at the School of Education and Social Policy and a faculty fellow in the Institute for Policy Research. Schanzenbach’s research interests are the economics of education policy, anti-poverty policy, and the intersection of education and health. Recently, PBS featured her opinion piece, “Naming a Child Policy Czar” on its website at www.pbs.org. Her Excellence in Research article may be found on page 46. Photo by Jim Ziv.

Dimitris Papanikolaou is assistant professor of finance at Kellogg School of Management. He is currently working on the effects of technological shocks on the cross-section of risk-premia and firms’ investment decisions. Find out more about his research on page 42.

Hamid Naficy is professor of radio/television/film and the Sheikh Hamad bin Khalifa al-Thani Professor in Communication in the School of Communication. Naficy holds a secondary appointment in Weinberg College of Arts and Sciences (art history) and has affiliations with Northwestern’s Buffett Center for International and Comparative Studies and the Program of Asian and Middle East Studies. His areas of interest are North Africa and the Middle East cultures and cinemas and the cinema and media of the global diaspora. Read more about his work on page 37.

D.J. Hoek is a musicology lecturer in Bienen School of Music and head of the Northwestern University Music Library, one of the nation’s largest music research libraries, known worldwide for its particular commitment to twentieth-century and contemporary music. His research is on twentieth-century music, jazz, and music analysis. His interests also include copyright, licensing, and ownership of digital media. Find out more about his research on page 28.

Kate Masur is associate professor of history at Weinberg College of Arts and Sciences. Her research focus is nineteenth-century US history, with particular emphasis on how Americans confronted the political and social problems posed by the end of slavery. Masur is also a faculty affiliate of the Department of African American Studies. Her Excellence in Research article may be found on page 33.

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