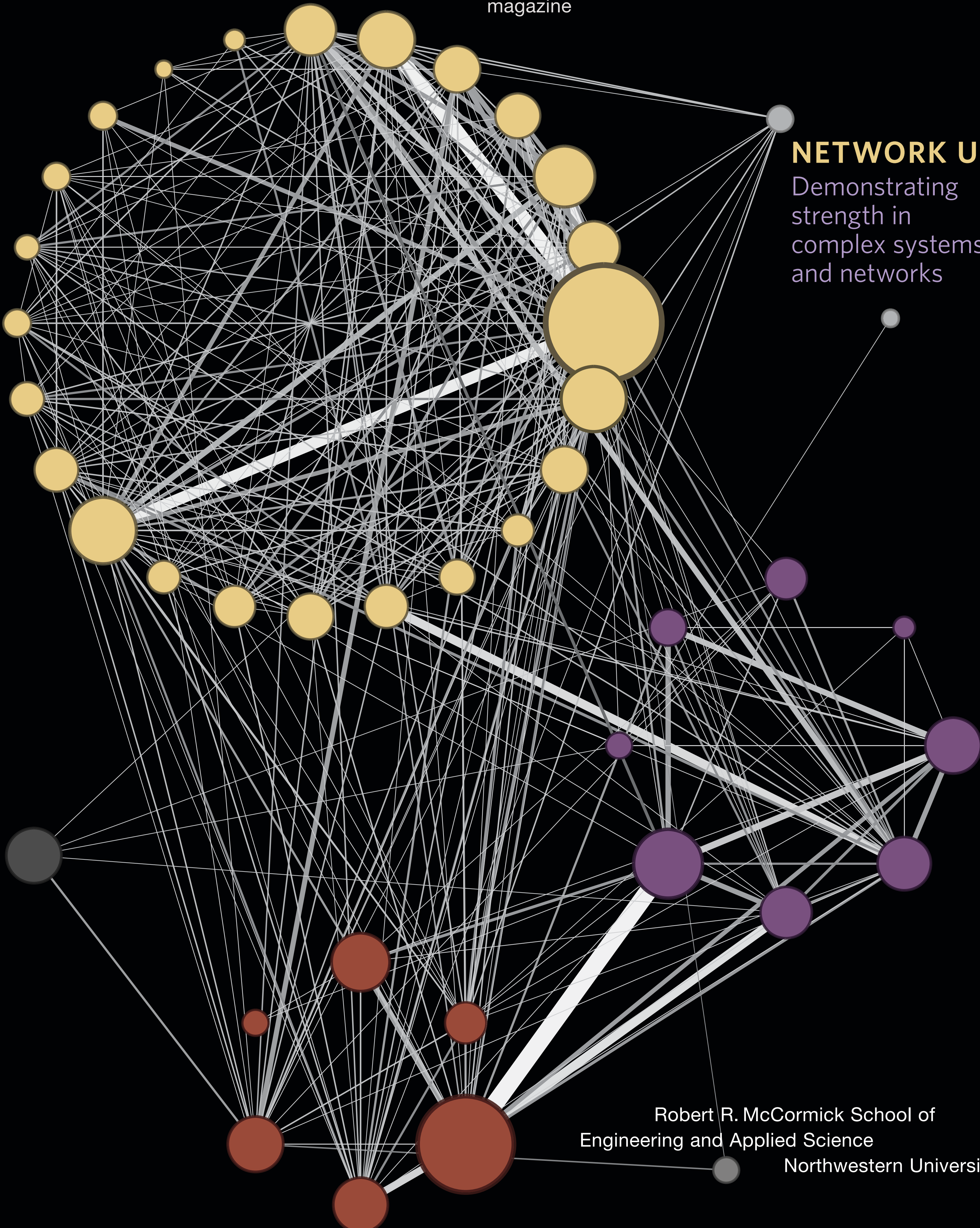
McCormick
magazine



NETWORK U
Demonstrating strength in complex systems and networks

Robert R. McCormick School of Engineering and Applied Science
Northwestern University

FROM THE DEAN

Welcome to the newly redesigned *McCormick* magazine. We received such positive feedback regarding our Centennial issue last fall that we decided to give the magazine a new look that better showcases the exciting research and educational initiatives at McCormick.

One research area that I'm particularly pleased to share with you is complex systems and networks. Six years ago I cofounded the Northwestern Institute on Complex Systems, and today more than three dozen faculty members across several schools are involved in complex systems research that ranges from networks of neurons to social networks.

Network analysis is also an effective way of measuring our collaboration with other schools and departments at Northwestern and is something that has been part of our DNA for the last five years. On the cover and on pages 10 and 11 you'll find graphics that show quantitatively the increased level of collaboration at Northwestern, which is a priority for our school and for the University. We are small, but a place of highly concentrated quality. Continued success will require leveraging resources throughout campus.

In this issue we also highlight a student group, Design for America, that has worked to find new solutions to an old problem: hand hygiene in hospitals. Design for America is a new organization, born in McCormick, but open to all of Northwestern. Within its first year participants have won a national design prize, completed several local projects, and launched chapters on other campuses. Design for America continues to address new projects that strive for social impact, which is an invaluable lesson for the students as well as an important contribution to the community.

Throughout this academic year we have been celebrating McCormick's Centennial. We've held several successful events around the country that brought together McCormick alumni with graduates of other schools at Northwestern; you'll find several pages of photos in this magazine that highlight these events. We look forward to our final two events, in Washington, D.C., on April 28 and in New York City on May 13. I hope that you will join us.

As always, I welcome your feedback.

Julio M. Ottino, Dean | April 2010

McCormick magazine is published by the Robert R. McCormick School of Engineering and Applied Science, Northwestern University, for its alumni and friends.

On the cover: Graphics showing the level of collaboration between McCormick departments and other areas of the University. See story on pages 10–11.

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McCormick magazine

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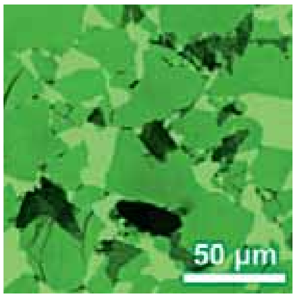

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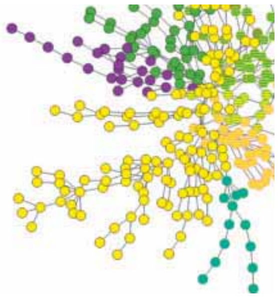

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McCormick news

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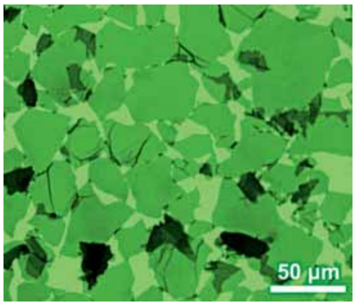
AN EASY WAY TO SEE THE WORLD'S THINNEST MATERIAL



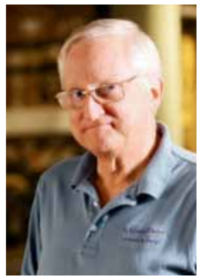
It's been used to dye the Chicago River green on St. Patrick's Day and to find latent blood stains at crime scenes. Now researchers at Northwestern have used it to examine the thinnest material in the world.

It is the dye fluorescein, which **Jiaxing Huang,** assistant professor of materials science and engineering, has used to create a new imaging technique to view sheets of graphene, a material one atom thick that could help produce low-cost carbon-based transparent and flexible electronics. The results were published in the *Journal of the American Chemical Society*.

The world's thinnest material, graphene is difficult to see. Current imaging typically involves expensive and time-consuming methods. When Huang and his research group coated a graphene sample with fluorescein and put it under a fluorescence microscope — a relatively cheap and readily available instrument — they obtained remarkably clear images. The team named its new technique fluorescence quenching microscopy (FQM).

The group also found that FQM can visualize graphene materials in solution —"No one has been able to demonstrate this before," Huang says — and the dye can be easily washed off without disrupting the sheets themselves. "It's a simple and dirt-cheap method that works surprisingly well in many situations," Huang says.

GREG OLSON ELECTED TO NAE



Greg Olson, Walter P. Murphy Professor of Materials Science and Engineering, has been elected a member of the National Academy of Engineering. He is cited for his contribution to research, development, implementation, and teaching of science-based materials by design.

Olson is considered one of the founders of computational materials design. He developed a systematic science-based approach for designing alloys that takes the desired properties and calculates the optimum composition and processing route.

He directs the Materials Technology Laboratory/Steel Research Group at McCormick. In 1997 he founded QuesTek Innovations LLC, a materials design company that was selected one of *Fortune* magazine's 25 breakthrough companies of 2005. QuesTek's first creation was a high-performance gear steel that was designed at Northwestern and licensed to the company. The company recently developed a stainless steel alloy for aircraft landing gear that replaces cadmium-plated steel, which poses an environmental hazard.

McCORMICK STUDENT NAMED TO BOARD OF ANITA BORG INSTITUTE

Eugenia Gabrielova (computer science '10) is one of the first student members on the board of the Anita Borg Institute. Based in Palo Alto, California, the Anita Borg Institute helps industry, academia, and government recruit, retain, and develop women leaders in high-tech fields. Gabrielova will assist with the organization's strategy and outreach to students and its efforts to make computer science a sustainable field for women. "It's really exciting to be able to get involved and try to involve more women in science and technology," she says.

Gabrielova was nominated by **Seda Memik,** assistant professor of electrical engineering and computer science, and has worked on distributed systems research with **Fabián Bustamante,** associate professor of electrical engineering and computer science. Last summer she performed research at the Databases Lab at the University of Washington.

Gabrielova is applying for graduate school and hopes to get her PhD in computer science with an emphasis on distributed systems.

SWE EARNS NATIONAL AWARD AT CONFERENCE

Northwestern's chapter of the Society of Women Engineers (SWE) was named Outstanding Collegiate Section — Silver Level at the organization's national conference in Long Beach, California. The honor recognized the chapter's ability to meet the society's strategic priorities, including outreach, education, and personal and professional growth. The Northwestern SWE chapter, founded in 1976, includes graduate and undergraduate female and male engineers who, through various events, build relationships and networks with other engineers and scientists and develop their skills in leadership, problem solving, and interpersonal relationships.

BUILDERS OF NEW MINNEAPOLIS BRIDGE HONORED AT LIPINSKI SYMPOSIUM

The team that built the Minneapolis I-35W bridge — replacing the one that collapsed into the Mississippi River two years ago — received the David F. Schulz Award for Outstanding Public Service in Transportation and Infrastructure Policy from Northwestern in November 2009. The honor was presented as part of the third annual William O. Lipinski Symposium on Transportation Policy.

The I-35W St. Anthony Falls Bridge team included the Minnesota Department of Transportation, the City of Minneapolis, the Federal Highway Administration, Figg Engineering, and Flatiron Manson, A Joint Venture.

"The bridge opened only 437 days after design work began — a near miracle," said **Joseph Schofer,** professor of civil and environmental engineering and director of Northwestern's Infrastructure Technology Institute (ITI), which sponsored the symposium. "This team showed what could be accomplished in response to the unexpected loss of a critical piece of transportation infrastructure."

The award is named for the late Dave Schulz, a McCormick professor and the founding director of ITI.

This year's Lipinski Symposium, titled "Moving the Goods: Chicago and the Nation's Freight," was held on Northwestern's Evanston campus. Transportation leaders and policy makers — including U.S. Transportation Secretary Ray LaHood and former Congressman William O. Lipinski, for whom the symposium is named — addressed issues and opportunities in freight transportation for the Chicago region, the nation's leading freight hub.

TWO NAMED BOEING ENGINEERING STUDENTS OF THE YEAR

Two McCormick graduate students received first- and second-place awards in the 2009 Engineering Student of the Year competition sponsored by the Boeing Company and presented by the aerospace publisher Flightglobal.

Can Bayram (second from left) as one of two first-place winners and **Pierre-Yves Delaunay** (second from right) won second place. Both are PhD candidates in electrical engineering and computer science.

Bayram, a native of Turkey, focuses his research on energy-efficient III-Nitride semiconductor devices, including high-sensitivity ultraviolet detectors, high-performance light-emitting diodes, and compact terahertz emitters, that could advance reliability, duration, and performance in many areas of aeronautics and astronautics.

Delaunay, a native of France, uses a novel quantum material called Type-II superlattices to fabricate infrared cameras. Atomic engineering of this semiconductor opens the door to novel photon detectors that are more sensitive and faster than previous technologies. The infrared cameras based on superlattices can detect temperature differences of a few millidegrees Celsius in a fraction of a millisecond.

Bayram and Delaunay are members of the Center for Quantum Devices, led by **Manijeh Razeghi,** Walter P. Murphy Professor in electrical engineering and computer science.

Julio M. Ottino, dean of the McCormick School, hosted the awards ceremony at McCormick last December. John Tracy, Boeing's chief technology officer and senior vice president of engineering, operations, and technology (above, far right), presented the awards with Warren McEwan, Flightglobal's North American sales director (far left).

HERSAM NAMED OUTSTANDING YOUNG INVESTIGATOR

Mark Hersam, professor of materials science and engineering and chemistry, will receive the Outstanding Young Investigator Award from the Materials Research Society. The award recognizes outstanding interdisciplinary scientific work in materials research by a young scientist or engineer. Hersam is cited for "pioneering research on the physics, chemistry, and engineering of nanoelectronic materials and devices, including solution phase techniques for sorting carbon nanotubes and graphene and for organic functionalization and nanopatterning of semiconductor surfaces."

INFOLAB'S STATSMONKEY MAKES SOME JOURNALISTS NERVOUS

Sportwriters have competition, thanks to new software being developed by the Intelligent Information Laboratory directed by **Kris Hammond,** professor of electrical engineering and computer science, and **Larry Birnbaum,** associate professor of electrical engineering and computer science. StatsMonkey takes the box score from a baseball game and generates a short news story that identifies key players and plays.

But as Hammond explained on NPR's *All Things Considered,* sports journalists shouldn't start job hunting just yet. "We're really aiming this at a genuinely local audience," he says. "We're trying to write the stories no one else is writing. We could literally write a story for every single Little League game played in this country. That means every kid, every dad, every family, every grandma would see the story of what the kid is doing."

StatsMonkey was developed as part of a unique course that paired undergraduate computer science students with graduate students from the Medill School of Journalism. Other projects included new iPhone apps and better ways to integrate Twitter into online news.

McCormick IN THE MEDIA

BROCKMANN'S RESEARCH FEATURED ON CBS SHOW *NUMB3RS*

The crime: A group of thieves has been stealing lottery tickets from locations around town. The question: Where will they strike next? The solution: **Dirk Brockmann**'s research.

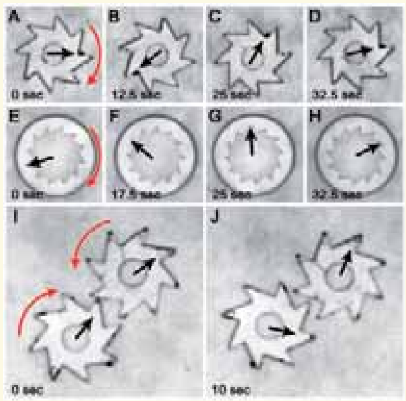
At least that's how things work in the CBS show *NUMB3RS,* which follows an FBI agent and his math genius brother as they solve crimes using, as the name suggests, numbers. In the episode that aired on January 8, investigators used fractional diffusion equations from "Dirk Brockmann's work with human mobility networks" to determine the area where the thieves will strike next.

Brockmann, associate professor of engineering sciences and applied mathematics at the McCormick School, has employed data from WheresGeorge.com, a site where users enter the serial numbers from dollar bills to track their travels, to find the patterns and regularities that govern human mobility. From that information Brockmann was able to reconstruct a comprehensive multiscale human mobility network for the United States that includes small-scale daily commuting traffic, intermediate traffic, and long-distance travel by air.

Brockmann has used this network to model how diseases spread and to create a map of large-scale community boundaries in the United States, different from those defined by administrative state-line boundaries. He hasn't applied it to fighting crime — yet.

Read more about Brockmann's research on pages 6–9.

SCIENTISTS USE BACTERIA TO POWER MICROGEARS



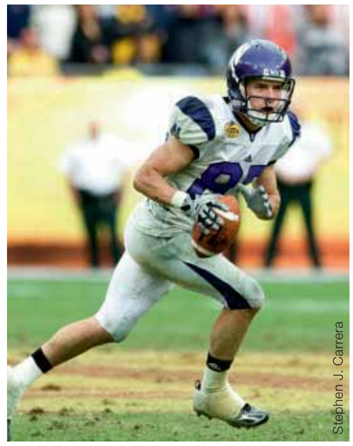
Scientists at Northwestern and Argonne National Laboratory have discovered that common bacteria can turn microgears when suspended in a solution.

Researchers placed microgears with slanted spokes in a solution along with a common aerobic bacteria, *Bacillus subtilis.* They discovered that the bacteria (a million times smaller than the gears) appear to swim around the solution randomly but occasionally will collide with the spokes of the gears and begin turning them in a definite direction.

The work was first published in the *Proceedings of the National Academy of Sciences* and then featured in publications such as the *New York Times* and *Popular Science.*

"This provides the first demonstration that useful energy can be harnessed from random and otherwise wasteful motions of bacteria," said **Bartosz Grzybowski,** a senior coauthor of the paper and the Kenneth Burgess Professor of Physical Chemistry and Chemical Systems Engineering as well as director of the Non-equilibrium Energy Research Center at Northwestern. "If this technology is further optimized, one could envision generating some useful power from bugs swimming in contaminated waters."

—Megan Fellman



Stephen J. Carrera

McCORMICK STUDENT NAMED ACADEMIC ALL-AMERICAN

Zeke Markshausen (mechanical engineering '09), a wide receiver on Northwestern's football team, was named an Academic All-American first-team selection by *ESPN The Magazine*. The honorees are chosen by the College Sports Information Directors of America.

Markshausen led the Wildcats with 79 receptions in 2009, second among Big Ten players. He also had 774 receiving yards and three touchdowns and was named a second-team All–Big Ten selection by the media. Markshausen is now enrolled in McCormick's Master of Science in Engineering Design and Innovation Program.

He is the second McCormick student in as many years to be chosen. Wildcat long snapper Phil Brunner was named a first-team selection last year; he is now at work on a PhD in materials science and engineering at Northwestern.

DEAN'S GRAND CHALLENGE LECTURES IN MEDICINE AND ENGINEERING

McCormick and the Feinberg School of Medicine have announced the Dean's Grand Challenge Lecture Series in Medicine and Engineering. The six-lecture series brings together engineering and medical faculty members to catalyze interdisciplinary collaboration.

"Research at the boundaries of disciplines is critical to addressing the problems facing our society," says **Julio M. Ottino,** dean of the McCormick School. "Northwestern is a very collaborative institution, and these lectures are designed to bring our collaborations to an even higher level."

The series addresses topics ranging from neurobiology and nanomechanics to cell-based therapies for heart disease and oncofertility. It is free and open to all members of the Northwestern community. The lectures will take place on the Chicago and Evanston campuses throughout the academic year.

"By aligning researchers and practitioners from the fields of medicine and engineering, we can find fertile new research areas that may have greater impact than either of these groups working alone," says J. Larry Jameson, dean of Feinberg.

For more information and to view past lectures, visit www.mccormick.northwestern.edu/grandchallenges.

SILVERMAN HALL OPENS, ENCOURAGES MEDICAL DISCOVERIES

The Richard and Barbara Silverman Hall for Molecular Therapeutics and Diagnostics was dedicated on Northwestern's Evanston campus in November 2009. It is home to the Chemistry of Life Processes Institute and approximately 245 researchers and staff in 17 research groups; seven McCormick faculty members have space in the building. The facility brings together faculty, graduate students, postdoctoral fellows, staff, and undergraduates from the physical sciences, engineering, and life sciences to address fundamental questions in biomedical research and to develop new medicines and diagnostics.

Designed to support interactions and collaborations among colleagues, the 147,000-square-foot building has state-of-the-art research laboratories and student offices on each of its five floors.

The building is named for Richard B. Silverman, the John Evans Professor of Chemistry in the Judd A. and Marjorie Weinberg College, and his wife, Barbara. Silverman donated to the University a portion of the royalties that he receives from sales of the drug Lyrica to help fund construction of the building. In 1989 Silverman and his Northwestern research group first synthesized an organic molecule that was ultimately marketed as Lyrica. The drug, sold by Pfizer, is used to combat epilepsy, neuropathic pain, and fibromyalgia.

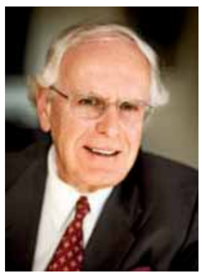
INTERNATIONAL MATERIALS INSTITUTE ESTABLISHED AT McCORMICK

The International Materials Institute for Solar Energy Conversion, funded by a $4 million grant from the National Science Foundation, is being established at Northwestern. The institute, led by **Bob Chang,** professor of materials science and engineering and director of the Materials Research Institute, will develop a network of global materials researchers and train young U.S. researchers for positions of leadership in the field.

"This program will build U.S. capacity in solar energy research," says Chang, "by linking U.S. expertise with international best practices, building collaborative partnerships abroad, and preparing the next generation of U.S. researchers to enter the global workforce as leaders."

Key to the institute is a partnership with Tsinghua University in China in organic/inorganic photovoltaic cells. The institute also features collaborations with researchers from Louisiana State University and Argonne National Laboratory. In addition to research, participating organizations will develop educational content for college and precollege students and the public, including undergraduate courses on energy topics and modules for K–12 math and science classes.

BAŽANT RECEIVES TIMOSHENKO MEDAL

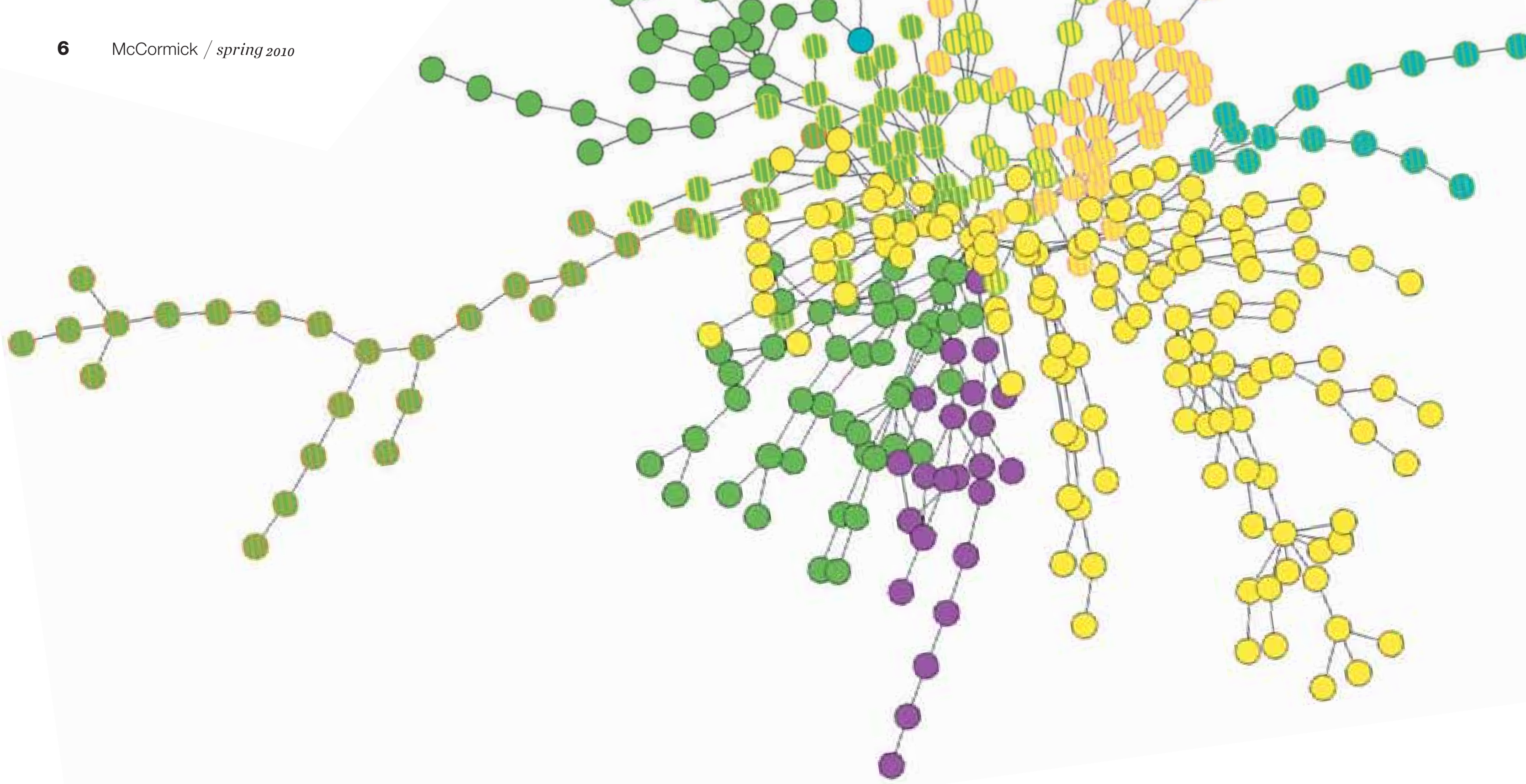


Zdeněk P. Bažant, McCormick School Professor and Walter P. Murphy Professor in civil and environmental engineering and in materials science and engineering, was awarded the prestigious Timoshenko Medal in 2009 by the American Society of Mechanical Engineers.

Bažant received the medal in November. Previous recipients of the medal include **Ted Belytschko,** Walter P. Murphy Professor and McCormick Professor in civil and environmental engineering and in mechanical engineering, in 2001 and **Jan Achenbach,** professor emeritus in service of mechanical engineering and civil and environmental engineering, in 1992.

ACHENBACH RECEIVES VON KARMAN MEDAL

Jan Achenbach, professor emeritus in service of mechanical engineering and civil and environmental engineering, will receive the 2010 Theodore von Karman Medal from the American Society of Civil Engineers. The award, established in 1960, recognizes distinguished achievement in engineering mechanics applicable to any branch of civil engineering.



Network U

Connections enable research on complex systems

IN MANY WAYS much of the progress in science has involved taking something complicated — a cell, a machine, an organization — and breaking it down to understand its basic building blocks and how they work together.

But what if an understanding of the parts (neurons in the brain, for example) does not lead to an understanding of the whole (human consciousness)? What if knowledge of an object didn't come from an understanding of its parts but from an understanding of the connections among its parts? What if the object at hand is not just **COMPLICATED** but **COMPLEX?**

Over the past 10 to 15 years engineers and scientists have begun to view complex systems — such as traffic, power grids, social networks, and cells — as a series of connections rather than a collection of parts. Understanding these vastly intricate systems requires a new way of thinking and new types of collaboration. Northwestern has positioned itself at the forefront of this kind of research.

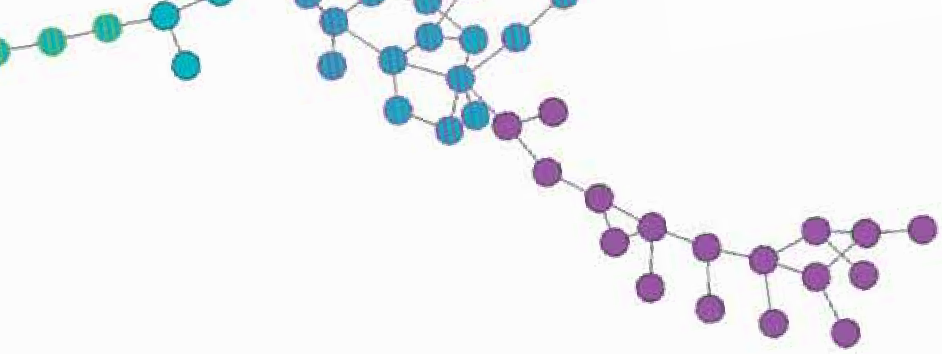
Nearly three dozen faculty members are now deeply involved in complex systems research at Northwestern. Working in research areas ranging from networks of neurons to social networks, faculty from McCormick are learning that the connections that they develop with each other are nearly as important as the dizzying networks they study.

Recognizing a need, starting an institute

Six years ago Julio M. Ottino, then a professor of chemical and biological engineering and now dean of McCormick, saw the growing interest in complex systems. His research on chaos and self-organization and the modeling of complex systems had earned wide attention, and a meeting with Daniel Diermeier, the IBM Distinguished Professor of Regulation and Competitive Practice at the Kellogg School of Management, sparked a cross-disciplinary collaboration. Although their work addressed different areas — Diermeier's research focuses on social and political phenomena — both professors realized that the theories and principles behind complex systems could be applied across disciplines.

"Complex systems were gaining more attention as an emerging research area, and we knew we were in a position to place Northwestern at the forefront of it," Ottino says. "Investigating how complex systems operate — looking at them as a whole and not just as the sum of their individual parts — is the only way to get an understanding and to make sensible decisions about them."

Ottino and Diermeier started pulling together faculty from across the University who were interested in the topic. What started as group meetings over lunch quickly expanded into a network of interdisciplinary teams, conferences, and a corporate outreach program



Left: Cartographic representation of the metabolic network of *E. coli.* Graphic by Luis A. N. Amaral and Roger Guimera. Below: NICO codirectors Brian Uzzi and Bill Kath

that paired faculty research with the business community. The Northwestern Institute on Complex Systems (NICO) was born.

"It was the budding of a brand-new science," says Brian Uzzi, the Richard L. Thomas Distinguished Professor in Leadership at Kellogg, an expert in complex networks and now codirector of NICO. "Northwestern really got on at the bottom of the escalator."

At the heart of the center are weekly meetings where faculty members present their research and connect with each other. "People are just now figuring out the basic rules and tools by which you try to understand complex systems," says Bill Kath, professor of engineering sciences and applied mathematics and codirector of NICO. "We try to get people from across all kinds of disciplines to see if what you learn in one field can be translated into others. If you can get a little bit of insight into how a network works in one case, perhaps you can apply that to some other field."

Part of his research involves looking at the complex systems in biology. Kath works with Nelson Spruston, professor of neurobiology and physiology in Weinberg College, to understand how networks of neurons process information. Kath and Spruston's models have shown how neurons receive and integrate signals and how biological processes cause a neuron to fire. Studying how neurons behave in certain situations gives them a better idea of how the brain processes and stores information.

"We may never fully understand how the brain works," Kath says, "but we look for these key insights that help us understand what's happening. I wouldn't have thought to use a lot of the tools in our research if I hadn't learned about them from other faculty members in NICO."

Studying networks, from cells to students

The networks inside the body provide rich opportunities for research in what is called systems biology. Luis Amaral, professor of chemical and biological engineering, is primarily focused on building an equivalent to Google Maps for human cellular organization. (Amaral was named a Howard Hughes Medical Institute Early Career Scientist in 2009.) But he has also expanded his network research into other disciplines. Amaral has collaborated with Daniel Diermeier to study political prediction markets and consensus building and with Brian Uzzi on a project that will look at every scientific paper published since 1945 to come up with a more efficient way to rank academic departments.

Amaral is also collaborating with Uri Wilensky, associate professor of electrical engineering and computer science and of education and social policy, to look at networks among students in Chicago and Evanston. Amaral and Wilensky used surveys to find networks among the students, then used that data to determine the effects of school closings. Preliminary findings show that belonging to a group had a positive effect on how students performed at new schools. "We have been using network analysis and database modeling," Amaral says. "This was made possible by NICO. If you are like me and you like to work on many different things, you need to find people who can tell you what is known, what is not known, what could be challenging, and what is possible."

Changes in social network research

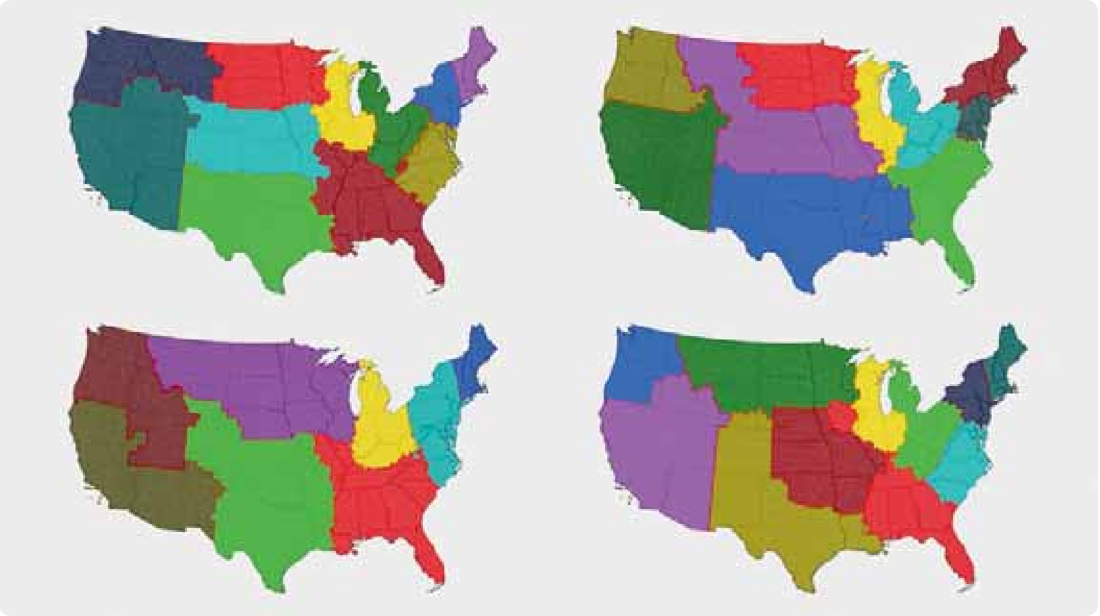
Social network analysis, an area once traversed only by sociologists, is undergoing a dramatic change. Previously, underfunded faculty members would hand out small-scale surveys, but in the digital age researchers use electronic information to understand human networks. "In the last five years we've gotten an unprecedented amount of electronic footstep data from e-mail, blogs, and Twitter," Uzzi says. "We now have an unbelievable amount of information on how people actually behave."

Uzzi, a sociologist by training, had always studied social networks. In one well-publicized paper Uzzi studied Broadway playbills from more than 2,200 productions to pinpoint how networks were involved in successful shows. In the NICO era, however, he has started studying large-scale networks.

"Sociologists have theories and models, but they don't really have methods to deal with large databases," Uzzi says. "NICO provided me with an opportunity to form collaborations with people who are trained in these methods."

Uzzi's collaborations with Amaral have led to new research on team science and science policy. "We are in a tremendously good position to take advantage of this new era in the social sciences," Amaral says.

Based on a human mobility network created with data from WheresGeorge.com, Dirk Brockmann and his research group have created maps of large-scale community boundaries in the United States. Graduate students Christian Thiemann and Daniel Grady created a video about the research called "Follow the Money," which won first place in the 2009 International Science and Engineering Visualization Challenge. Visit http://video.mccormick.northwestern.edu to see the video.



The impact of connecting

Using vast databases to get new perspectives on human behavior is also within the purview of Noshir Contractor, the Jane S. and William J. White Professor in Behavioral Sciences at McCormick and professor of communication studies. Contractor and his collaborators, who include scientists and engineers from around the country, are studying nearly 60 terabytes of data from EverQuest II, a massive multiplayer online role-playing fantasy game in which players complete quests and socialize with one other. The researchers analyzed this data along with a survey of 7,000 players, making it one of the largest social science projects ever to investigate virtual worlds.

Contractor is now looking at how players develop trust in virtual worlds. For example, in the online world of Second Life, players can assign other players different levels of trust, allowing them to see when they are logged on, for example, or allowing them to come into their online homes. By studying levels of trust, Contractor can create models of how people develop trust that can be used in real-life situations, as in emergency response situations where people have to work together but don't yet trust one other. Contractor is also working on a National Science Foundation project to analyze these large-scale networks using petascale computing.

"We have certain techniques to discern and understand the structural signatures of networks," Contractor says. "The techniques to accomplish these goals are very computationally intensive. We're exploring new algorithms that take advantage of high-performance computing, such as the recently launched petascale environments, to concurrently investigate disparate parts of these very large networks."

Contractor says that talking with faculty from across the University through NICO has given him theoretical and methodological insights into how networks can be understood and enabled across different disciplines. "It's incredibly valuable to me to find someone who is studying networks in one discipline and who has developed mathematical, computational, or statistical techniques that have not been discovered by those studying networks in other contexts," he says.

Human networks and new state boundaries

It was through NICO that Contractor met Dirk Brockmann, associate professor of engineering sciences and applied mathematics, who has used data from WheresGeorge.com — a site where users enter the serial numbers from their dollar bills in order to track the currency's travels — to discover the patterns that govern human mobility. That information has allowed Brockmann to reconstruct a comprehensive multiscale human mobility network for the United States that includes small-scale daily commuting traffic, intermediate traffic, and long-distance travel by air.

Using a framework based on this mobility network, Brockmann has modeled how diseases spread throughout the country and has created a map of large-scale community boundaries within the United States that differ from those defined by political boundaries. He is trying to understand the underlying rules of human mobility and the complex patterns hidden within multiscale human mobility networks.

Brockmann, whose collaborations with linguists and epidemiologists allow him to study everything from infectious disease to language, says NICO was one of the reasons he came to Northwestern a year and a half ago. "The critical mass of people at NICO who share the same philosophy about networks generates this interdisciplinary spirit," he says.

Optimizing the workplace

Social networks can be used to make businesses more efficient as well. That was a revelation for Seyed Iravani, associate professor of industrial engineering and management sciences, who, after learning about other faculty members' research through NICO, decided to apply their social network theories to his own work in operations management.

Iravani uses operations research methods and applied mathematics to determine how manufacturing and supply-chain companies




Among the network scientists at the McCormick School are (from left) Luis Amaral, Dirk Brockmann, Noshir Contractor, and Seyed Iravani. Their work with colleagues at the Northwestern Institute on Complex Systems (NICO) covers myriad disciplines, collaborations, and problems. It places the University at the forefront of this developing and highly influential field.

can be more efficient and productive. When he read Brian Uzzi's paper on Broadway musicals, he realized he could use Uzzi's social network ideas in his own research.

His first project was to test social network theories in call center workforce management. A major issue for call centers is employee turnover. The high rate of turnover frequently forces call-center managers to decide whom to train or cross-train to answer different types of calls. Using concepts from social network theories, Iravani developed a model that helped managers quickly determine which employees to cross-train so that customers spend less time on hold.

"If science is about great new discoveries, this area of network science is where those new discoveries are coming from. Northwestern is making that happen." BRIAN UZZI

"I was very excited because I was able to steal a concept from one discipline and bring it to another," he says. "I'm bringing the concept of complex systems and social networks to operations management, which hasn't been done enough."

Iravani also worked with a major auto manufacturer to examine the product development process. In a business where more than 10,000 engineers design more than 100,000 parts for a new car, engineers keep a paper trail of documents (called "engineering change orders") that can be used to track who talked to whom and when; when two or more engineers discuss something that affects parts they are designing, they all sign a document.

Iravani studied the more than 100,000 documents compiled during one vehicle's three-year design period. From that data he first created a complex network of the parts (how the parts of the vehicle are physically connected) and then a network of people (who talked to whom and how often). He then compared the two networks and asked, Did the connected engineers talk as often as their connected parts would have decreed?

"We could see where there was a lack of coordination," Iravani says. "If there was no connection, we could tell there would be a warranty problem later." And sure enough, Iravani was able to predict 7 of the top 10 warranty problems on the vehicle.

Iravani is no stranger to cross-disciplinary research: several years ago he conducted a study to show the collaborations of McCormick faculty members. "We showed that if you wrote a paper with someone from a different department, you got more citations and had more impact in the field," he says.

The future of NICO

Researchers who study networks are cognizant of their own networks, and NICO's are strong and growing. Its corporate arm provides executive education on complex systems and matches faculty members with businesses to collaborate on research. New links form among faculty members each week, and excitement about complex systems is growing on campus and beyond. The first-ever "Science of Team Science" conference, cochaired by Contractor and organized by several NICO faculty members, will be held in Chicago in April; participants will discuss what makes scientific teams succeed or fail.

"Northwestern is a leading institution in the study of team science," Uzzi says. "We continue to do some of the best work in the area of social networks. If science is about great new discoveries, this area of network science is where those new discoveries are coming from. Northwestern is making that happen."

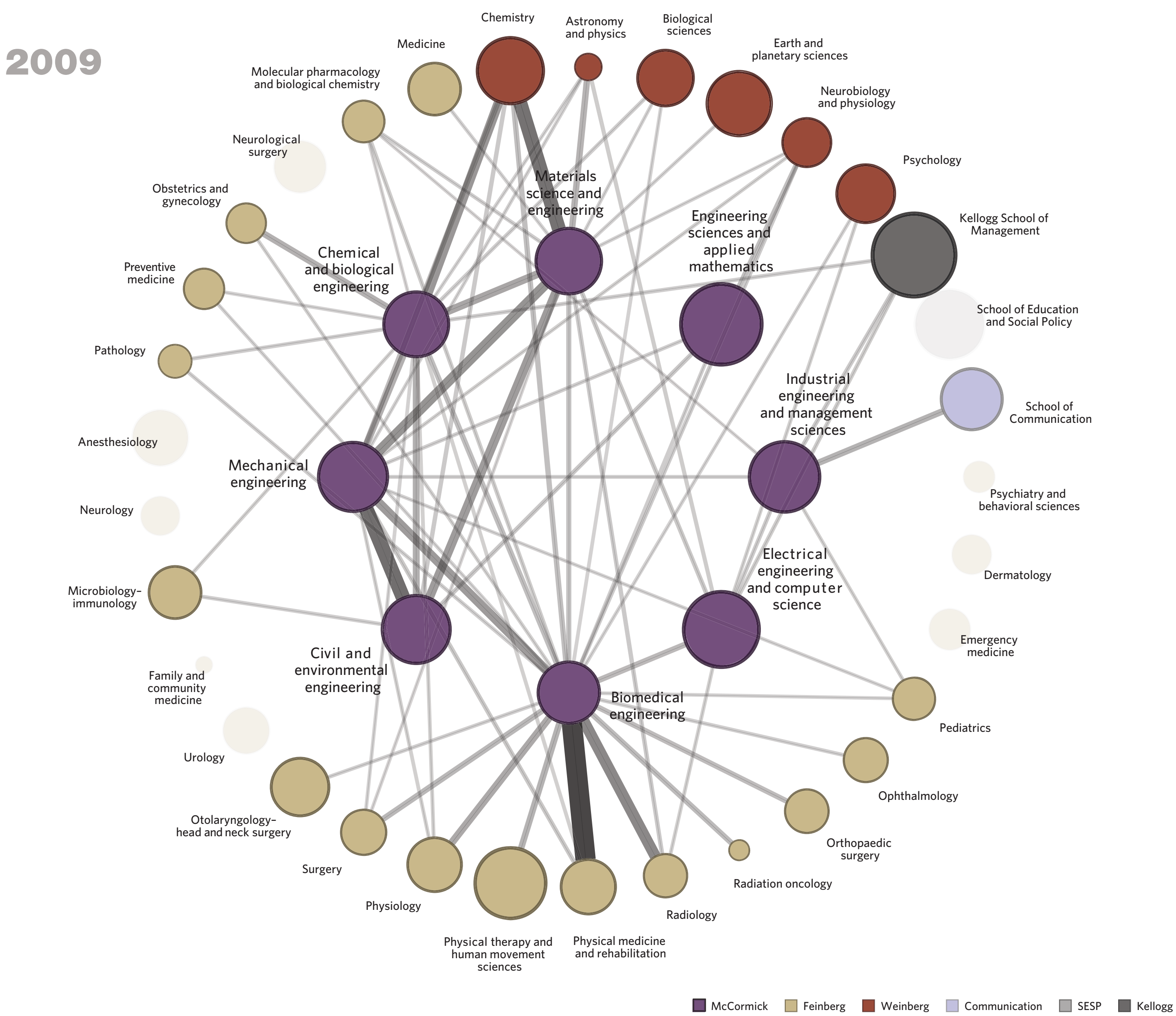
The study of complex systems is daunting, but even small advances are changing our knowledge about previously inexplicable networks. "We may not fully understand everything," Kath says, "but every new insight enables you to make the system a little better." —*Emily Ayshford* M

BUILDING NETWORKS WITHIN NORTHWESTERN

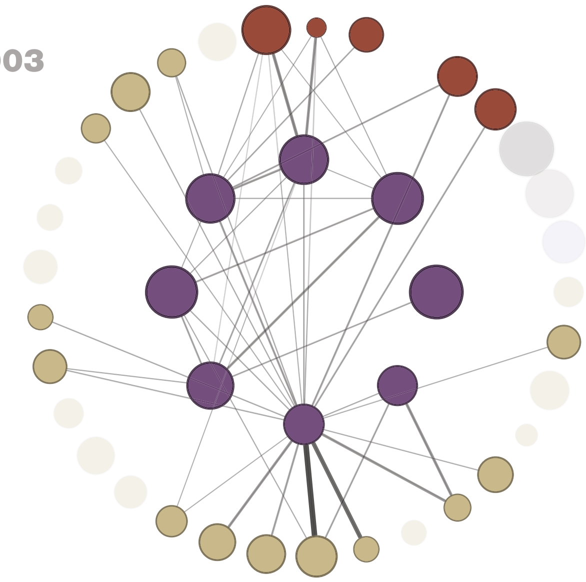
The study of networks is a thriving area of research at Northwestern, and it also provides an excellent means to analyze collaborations among researchers throughout the University. Increasing interdisciplinary collaboration is a goal of McCormick and Northwestern, as many of the most challenging issues facing society will need solutions drawn from many different fields.

Using data from the Thomson-Reuters ISI Web of Science, it is possible to visualize collaborations at Northwestern based on research publications. Analysis of the graphics shows trends in the types of research at Northwestern. For example, the increasingly active connections between the Department of Materials Science and Engineering and the Department of Chemistry is partially due to Northwestern's strength in nanotechnology. Growth in the connections between McCormick departments and the Feinberg School of Medicine indicates increasing collaborations in the life sciences.

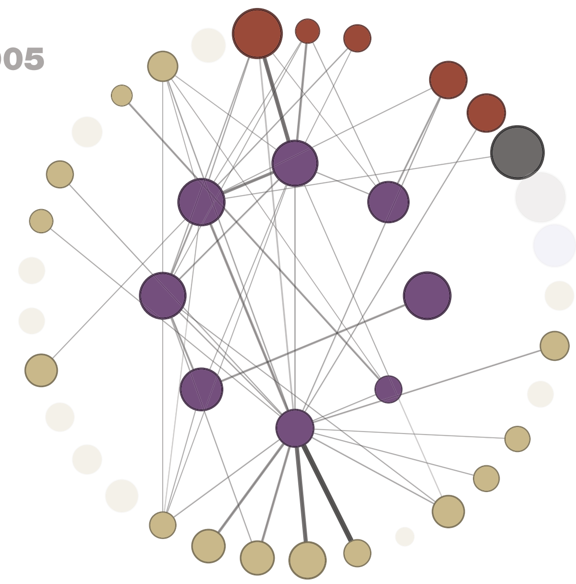
While research is one aspect of collaboration, the McCormick School has also built strong connections with other schools through innovative teaching initiatives. The Medill School of Journalism and McCormick teach joint classes on innovation in media, and NUvention courses bring together faculty from across campus to teach entrepreneurship and innovation.



2003



2005



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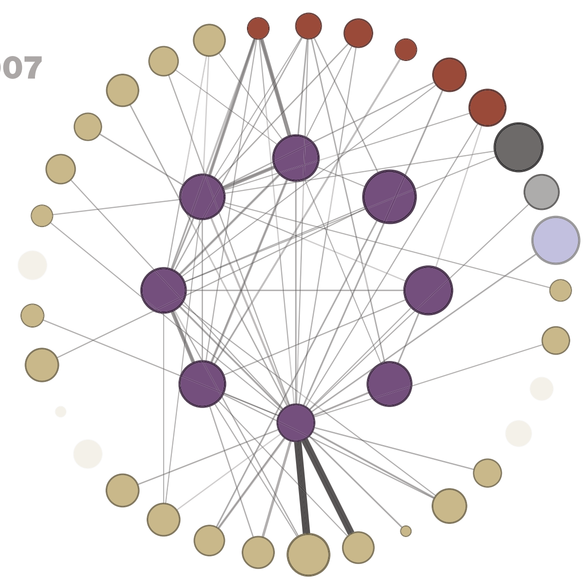


UNDERSTANDING THE GRAPHICS

The graphics at left show the level of collaboration between McCormick departments and other areas of the University. Circles represent departments, and the lines connecting two circles indicate that authors from those two departments have collaborated on a paper. The size of each circle is proportional to the number of annual publications per coauthor within the department; the thickness of each line is proportional to the number of papers involving authors from both departments. Faded circles represent departments with no coauthors from McCormick in a given year.

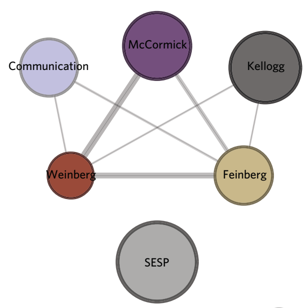
The data is not cumulative, so repeating connections show consistency of collaboration between departments and schools. The data show that over time the degree of collaboration is clearly increasing.

To view this data in an interactive format see **http://collaboration.mccormick.northwestern.edu.**

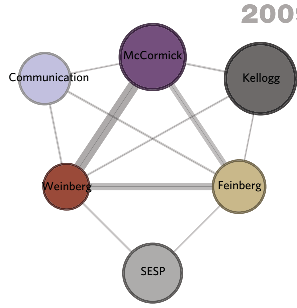
COLLABORATION AMONG SCHOOLS

When viewed from a higher level, collaboration among all units at Northwestern is on the rise.

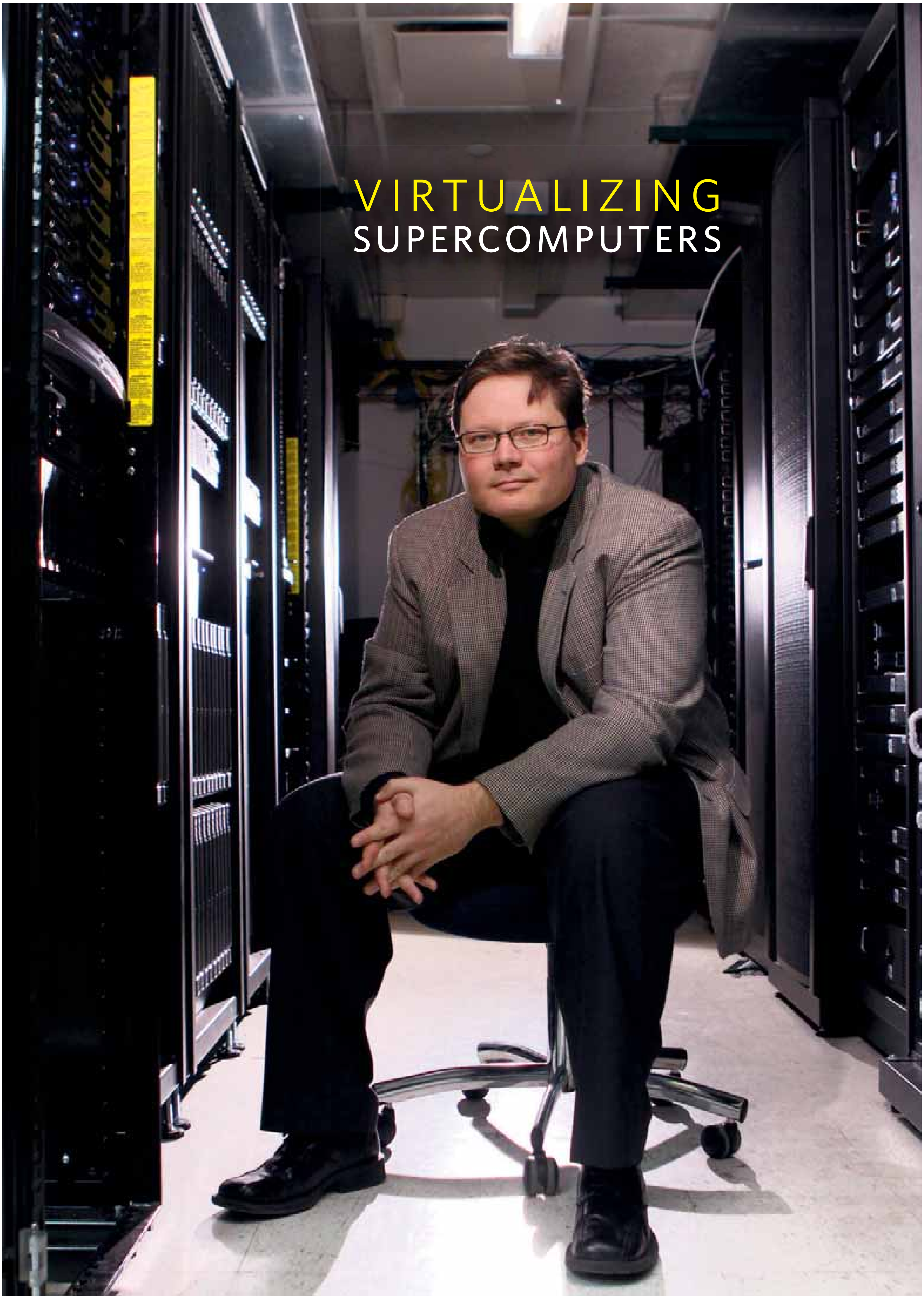
2002



2009



VIRTUALIZING SUPERCOMPUTERS



IN A SANDIA NATIONAL LABORATORIES FACILITY PROTECTED BY ARMED GUARDS IN NEW MEXICO SITS A 3,500-SQUARE-FOOT MASS OF BLACK CABINETS THAT HOLD THE 38,000 PROCESSORS OF THE OMINOUSLY NAMED RED STORM, THE 13TH FASTEST COMPUTER IN THE WORLD.

Over the past several years Red Storm has modeled and simulated complex problems in nuclear weapons stockpile stewardship, determined how much explosive power it would take to destroy an asteroid headed for Earth, and gauged how changes in the composition of the atmosphere affect our planet. It's a formidable tool with computing power that could provide solutions to complex problems in a wide range of scientific areas. But it's a tool that isn't used as often as it could be because Red Storm's highly specialized hardware doesn't mesh with most scientific software.

That's where Peter Dinda comes in.

Dinda, associate professor of electrical engineering and computer science, and graduate student Jack Lange have created a virtual machine monitor (VMM) called Palacios that acts as a translator between a user's software and the specialized hardware of the Red Storm system and other supercomputers. While Palacios was made specifically for supercomputers like Red Storm, researchers say that, thanks to the changing nature of computers, VMMs could solve problems that will eventually show up in desktop computers. (Palacios can also run on standard PCs, and Dinda uses it for teaching on such platforms.)

A VMM works by separating a computer's operating system from its hardware — by "virtualizing" it so an operating system from one machine can run on another, or by allowing one machine to run multiple operating systems simultaneously. In essence, a VMM is software that behaves as if it is hardware.

Dinda and his group created Palacios as part of a National Science Foundation and Department of Energy–funded project to build an open-source, publicly available VMM. The need for VMMs stems from the changing world of computers. For about the last 20 years, the dominant processing language (instruction set) for computer processors has been Intel x86, and most programs have been created using that language. But now computer hardware is changing. Researchers are finding it difficult to make individual processing cores faster, so instead they are increasing the number of processing cores per chip and supporting different kinds of cores. Typical operating systems and applications built for Intel x86 assume that only one or a very small number of processing cores are available, however. VMMs can act as mediators between the new hardware that employs an exponentially increasing number of homogeneous or heterogeneous cores and the old operating systems and applications designed for a few homogeneous cores. "Because of this disconnect between the language and the architecture, the problems that happen now in high-performance computers will eventually show up on desktop computers," Dinda says.

"One way computer architects can use VMMs is by exploring different extensions of the Intel x86 language and different ways of implementing that language," Lange says. "We're taking a step back and asking, Given that we have VMMs, how can we move beyond the constrictions of that language? How can we redesign everything?"

Dinda's group has been developing Palacios since 2007. Lange wrote most of the program, and an undergraduate student, Andy Gocke (computer science, '12), spent last summer importing it into the Intel VT architecture. This, Dinda says, "is impressive for anybody, but it's especially impressive for a freshman." Gocke spent his childhood learning how to program computers and was up to the challenge. "As an undergrad you get exposed to a lot of problems that have basically been solved for 30 or 40 years," says Gocke. "It was really fun to work on something that didn't really have a solution."

Researchers hope that Palacios can run on Red Storm all the time. That would allow more people to use the system without rebooting, a process that can take an hour on such a large machine. Dinda's collaborators at Sandia National Labs recently tested Palacios on Red Storm — a task that required the tester to sit in a guarded room for several hours as the program ran. The results were successful: the VMM had minimal impact on performance and was tested across thousands of "nodes" on the supercomputer's network. The test indicated that it is possible to bring the benefits of virtualization to even the largest computers in the world without performance compromises.

"If we can virtualize supercomputers without performance compromises, we can make them easier to use, easier to manage, and generally increase the utility of these very large national infrastructure investments," Dinda says.

The Palacios VMM developed by Dinda's group and his collaborators at the University of New Mexico and Sandia National Labs is available for anyone to use and can be found at http://v3vee.org. —*Emily Ayshford* **M**


1.
GO FOR:
QUANTITY
2.
Defer Judgment
3.
ONE CONVERSATION AT A TIME!
4.
Reel it IN
5.
ENCOURAGE WILD IDEAS
1.342

The walls of the Design for America office in the Ford Motor Company Engineering Design Center are covered with thoughts, ideas, and these five tenets, which students try to remember throughout every design project. The student group, formed last year, has already taken on several design projects aimed at social change, including improving hand hygiene in hospital settings.

Designing change

Student group uses design to create social impact

It happened at 2 A.M. one morning last summer on North Beach on Northwestern's Evanston campus. Yuri Malina was sitting in the lifeguard chair. Mert Iseri was building a sand castle. They didn't talk; they stared at the lake. The two young men were discouraged: For the past several weeks, as part of a project for the new student group Design for America, they had observed hand-hygiene practices at Evanston Hospital (part of the NorthShore University HealthSystem).

They were trying to figure out solutions to a universal health-care problem: design a way to make hand washing more consistent among health-care personnel. Studies show that less than half of health-care professionals in the United States wash or sanitize their hands as often as they should, and previous efforts at hospitals across the country hadn't worked.

The Design for America group had observed doctors, nurses, and hospital staff in the ICU for hours on end in order to develop insights about hand-hygiene practices; they took notes, went home, and considered the possibilities. The entire project team had vowed not to share any insights with each other until the observation period was over, but Iseri (industrial engineering '11) and Malina (integrated science '12) — who met last year in their residence hall and lived together over the summer — would often turn to each other on the couch at night, interrupting the TV show they were watching, to share ideas that could not be contained.

But none of their ideas seemed right. It was an unusual setback for members of Design for America, which had won a top prize in a nationwide design competition shortly after it was formed. It was an unusual setback for the two young men who, over the past several months, had become so passionate about design that they would interrupt each other with escalating excitement when talking about process and possibilities.

So late one night they walked to the beach and sat, looking at the lake. Finally Iseri stood up and rubbed his hands together. With this single motion, the fleeting spark of an idea struck.

The two young men rushed to their design space in the Ford Motor Company Engineering Design Center and went to work. They wouldn't share the idea with their teammates for a while. "You have to take a good idea and park it away so you're not locked into it," Malina explains. Ultimately the idea — a personal hand-hygiene device — would become the cornerstone of a suite of solutions the team presented to hospital administrators. At the time, it was the motivation they needed to keep going.

Creating a new kind of organization

The idea for Design for America came to Liz Gerber shortly after she came to McCormick as an assistant professor of mechanical engineering in fall 2008. She realized there was an opportunity to direct students' excitement for design into local and social change. In a meeting with Dean Julio M. Ottino, she brought up the idea of the group. "What is that?" Gerber recalls the dean asking.

Gerber quickly laid out plans for a service-based design program similar to Teach for America and sent it to a few friends for their feedback. "My colleagues thought it was great," she says. "I got such an enthusiastic response — with offers to do whatever they could to help launch the program — that I thought, yes, there is something here."

Within just a few months dozens of students were on board and the group had won an award in the DiabetesMine.com design challenge, which asked teams to create tools for improving the lives of people with diabetes. The Design for America team created Jerry, "Design for America offers students an opportunity to build strong belief in their capability to use design to impact the world in a positive way." LIZ GERBER

the Bear with Diabetes, an interactive stuffed toy and web site for children with diabetes. From there, the opportunities were abundant. Where to start? Which projects should they do? Which projects shouldn't they do?

"We have an agreement," Gerber says. "As long as the project satisfies the DFA mission, which is one of social and local impact through design, they can do it. Students were considering helping a theater find ways to improve ticket sales, but then they thought although the impact was local, it lacked social impact."

Last summer Design for America started a summer fellowship program called the Design for America Summer Fellows Studio, in which students were hired to work on one of three projects: improving hand hygiene in hospitals, improving retention for an urban youth development program, and improving methods to engage at-risk teens for a community center. Iseri and Malina, along with Hannah Chung (mechanical engineering '12) and K. C. Porter (psychology and global health '11), chose to work on the hand-hygiene project.

Focusing on hand hygiene

According to the Centers for Disease Control (CDC), no single intervention has effectively improved hand-hygiene practices. As early as the 1820s, scientists and doctors realized that hand hygiene could help prevent the spread of diseases and infections. More than 25 years ago the CDC created formal guidelines on hand-washing practices for hospitals that recommended hand washing with nonantimicrobial soap between the majority of patient contacts and washing with antimicrobial soap before and after performing invasive procedures or caring for high-risk patients. While compliance with these guidelines varies from ward to ward and hospital to hospital, CDC studies show that today, less than 50 percent of workers are compliant with hand-hygiene standards — even though research shows that improved hand hygiene can lower the risk for health-care associated infections and outbreaks of resistant bacteria.

Given this background, the students vowed to look at the problem with fresh eyes. Over the next six weeks they were charged with observing hospital practices and creating solutions to the centuries-old problem.

"Whenever you work in engineering and design, you're handed a set of constraints," says Jeanne Olson, a lecturer in the School of Education and Social Policy, a design consultant, and team coach for the project. "You can view them as crippling or you can view them as helping to fuel creativity. Time was one of our biggest project constraints; OSHA-issues and hospital workflow provided another set of problem constraints. All of these forced us to get really creative."

After a series of boot camps with design professionals, the students spent three weeks observing doctors, nurses, and hospital staff. That meant three weeks of long shifts, late nights, and, most important, no discussion about possible solutions within the team. This self-imposed silence was also critical to thoughtful observation of the work of hospital staff. "You don't talk," Malina says of his experience as an observer. "You act like wallpaper."

Sara Levinson, infection control practitioner at NorthShore University HealthSystem, was instrumental in championing the project and acted as a liaison between the team and the staff, addressing logistical concerns and helping to facilitate work with hospital stakeholders. "Their minds never stopped," she says. "They carried these little notebooks with them, and they were always jotting down different ideas."

"In observations, nothing should be too boring or miniscule," Olson says. "I would ask, 'What did you notice about the patient's room? Where do people's eyes go? Where do their bodies gravitate? What do you notice about the hand-sanitizer dispensers?' To that someone replied, 'They are the same color as the wall.' So, how does that affect the hospital staff's interaction with a dispenser? I'm there to ask questions and give advice if the students need it, but they are conducting the research. They are developing and testing their ideas."

In addition to observing, the team talked about why people might not wash their hands: they get busy, they forget, the hand sanitizer makes their skin dry. The team also talked about identifying what are referred to in the design world as "positive deviants": people who *do* wash their hands without fail. Who were these people, and why did they do it? Was there something to leverage there?

Eventually the group came up with a dozen ideas. How about a timed device that squirted sanitizer on people's hands every three minutes? What about latex gloves filled with hand sanitizer? "What if we don't give them a choice about sanitizing their hands?" Malina wondered. "For 150 years we gave them the choice."

With the observation stage completed, the group met in its small office in the Ford Motor Company Engineering Design Center, where drawings and notes cover the walls and pens, markers, and an endless supply of candy and cookies cover the center table. They argued over what to do next. Chung wanted to create prototypes. Iseri wanted to go back and do more observations. Things got heated. Malina was silent, in thought.

"Yuri has a quiet, scientific mind," Olson says. "He was really terrific at observing the team and taking care of all of the things in the group in terms of relationships, what needed to get done with project management."

At that moment Malina got things done. While Iseri and Chung argued, Malina left the room and came back with a crude prototype of their main idea — the personal hand-sanitizing system Malina and Iseri had come up with that night on the beach. He put it on the table. Both Iseri and Chung — to whom Olson had given a Playmobil hospital room for her birthday because, as Olson says, "I could tell she really wanted to build something, because being able to touch something was

Mert Iseri (middle) and Hannah Chung (right) with other Design for America students in the group's workspace. Iseri and Chung have worked together on several projects, including improving hand hygiene in hospital settings.

important to her creative process"— were quiet. Malina had figured out how to move the group past its impasse: They could get busy building quick, imperfect prototypes and still collect observation data.

A bundle of hygiene solutions

The group ended up with a "bundle" of hand-hygiene ideas for the hospital: trays to place above sinks and sanitizer dispensers so doctors and nurses had somewhere to set their things while they wash their hands; a curtain rod that can easily be cleaned so doctors and nurses don't have to use their hands while opening a patient's curtain (that can't so easily be cleaned); hand-hygiene screen savers for hospital computers as constant reminders for staff; and new stickers for foam sanitizer dispensers designed to catch the eyes of people walking by. The bundle also included the personal hand-hygiene device that was the object of the revelation on the beach; students are still working out the details of the device, however, so the particulars will remain a secret for now.

Hospital administrators were impressed by the bevy of ideas that ranged from easy-to-implement solutions to those requiring more research and prototyping. "They really listened to the stakeholders' concerns," says Levinson. "Everybody was really excited about the different ideas, and the students' energy was infectious — in a good way."

NorthShore is considering and discussing a number of the ideas: They decided against placing shelves over hand-sanitizer dispensers — "They tended to decapitate the nurses who were shorter," Levinson says — but are considering the screen saver and the new curtains and curtain rods. "We really enjoyed having the students here," Levinson says. "We foster innovation, we foster learning, and we address problems, and those are common values that the Design for America students have as well."

These values also provide a space for interdisciplinary collaboration at Northwestern, Olson says. "For many reasons, it is often difficult for higher education institutions, especially research institutions, to foster this type of work across areas of study and schools. For this project, an industrial engineer, a mechanical engineer, a global health student, and an integrated sciences major had to combine their different interests in order to tackle a problem. Liz Gerber's enthusiasm for involving professionals from the design community and from different programs at Northwestern created a rewarding experience for the team as well."

Organizing for the future

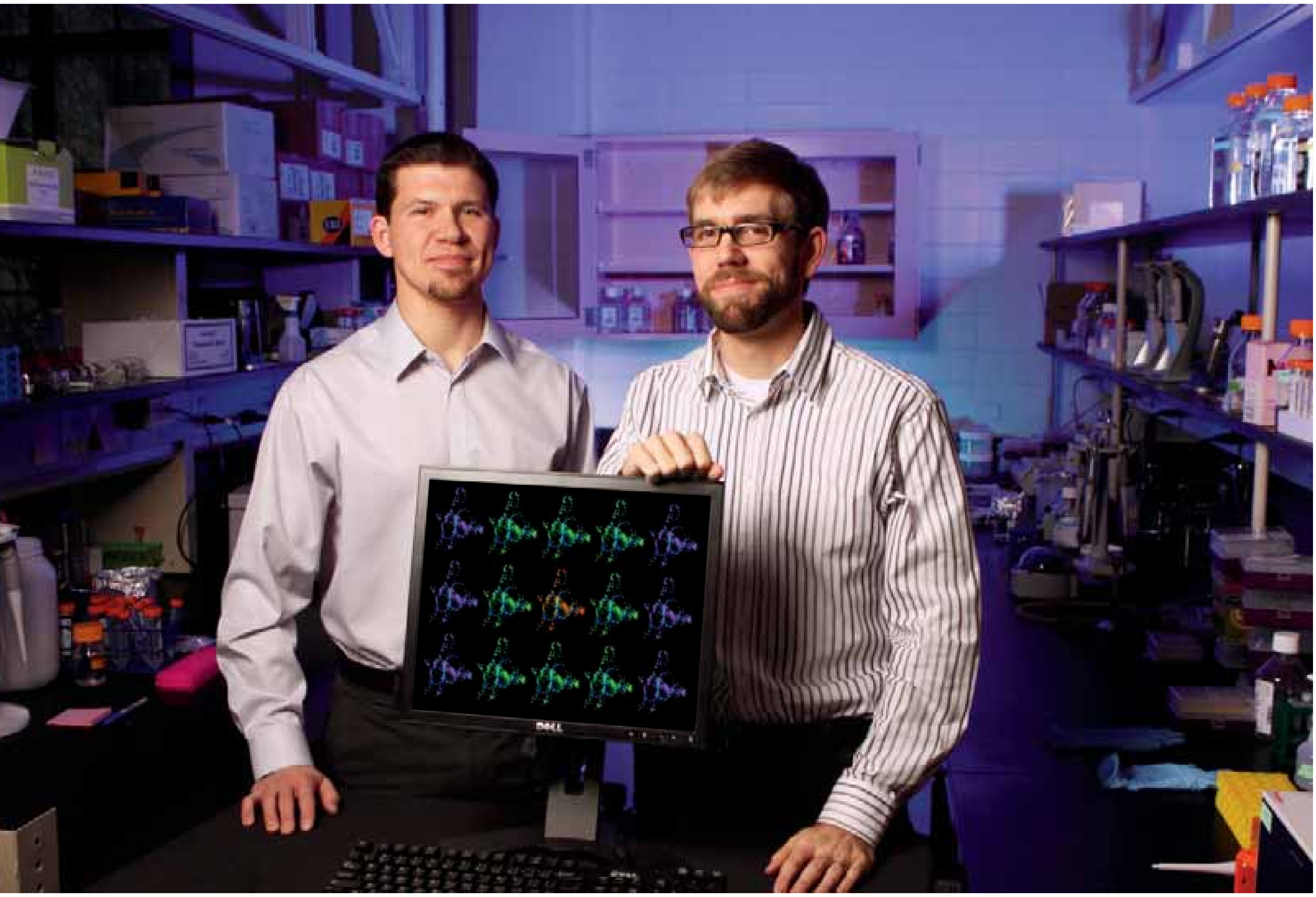
A year into its existence, Design for America has had its share of ups and downs. It recently won a Social Designer competition with a coloring book based on basic human emotions, but it failed to win an entrepreneurship competition due to lack of a sound business plan. "If you only succeed, you don't learn," Gerber says. "A failed experience is okay as long as there is reflection. The thing I am most proud of is that [the students in the entrepreneurship competition] took time to reflect about what they would do next time. The ability to reflect and learn is critical to their success."

The next challenge for students in Design for America is designing their own organization. They need to organize their processes: At meetings students can sometimes still try to talk over each other — or yell, "Reel it in!" (an adage posted on the wall of their office). And there's been interest from other schools that want to start chapters. Students are beginning to decide who will lead and how. "This will only succeed if it is student led," Gerber says. "Design for America offers students an opportunity to build strong belief in their capability to use design to impact the world in a positive way. The less involved I am, the more they develop that capability in themselves."

The students are doing exactly that. Three members of the hand-hygiene team spent all or part of their childhoods in other countries (Iseri in Turkey, Chung in Korea, and Malina in France), and they take their mission to design for social impact as a serious responsibility. "America is a country where people are welcome to do something for the greater good," says Iseri. "America enables us to do this." —*Emily Ayshford* M

Synthetic biology

Redesigning nature to build a better world



For years scientists strived to understand the body at a small scale

TO UNDERSTAND THE FOUNDATION FOR LIFE: CELLS, PROTEINS, THEN DNA.

When engineers look at these building blocks, they see them in a new way: Now that we know how they work, how can we make them work for us? One answer is to reengineer cells and organisms into little factories that perform new duties or to build biological systems that provide new kinds of therapeutics.

It's a new way of looking at the building blocks that make up our bodies and refashioning them for the greater good. This emerging field is called synthetic biology, and its implications are far-reaching. For instance, in one of the field's first successes, researchers at the University of California, Berkeley, recently created a cell factory that converts sugar (a cheap commodity) into artemisinic acid, an antimalarial drug that was previously too expensive to provide to the areas of the world that need it most. This

Now that we know how cells work, how can they work for us?

synthetic biology approach reduced the cost of the treatment to less than a dollar per person, making it possible to widely distribute this medicine and save millions of lives each year.

Now two new McCormick faculty members — Josh Leonard (opposite, left) and Mike Jewett (opposite, right), both assistant professors of chemical and biological engineering — are building their labs at McCormick in hopes of creating synthetic biology successes of their own.

PROGRAMMING CELLS TO TARGET TUMORS

A major challenge in the treatment of cancer is that tumors evade and co-opt the body's immune response to further their own survival. But what if scientists and engineers could reprogram immune cells to go directly to the site of the tumor and repair the immune dysfunction that the tumor causes? "This could allow the natural immune response, which would otherwise be impaired, to take over and clear the cancer," says Leonard.

That is what his research group is trying to do. Arriving from a postdoctoral fellowship in the immunology branch of the National Cancer Institute, Leonard is building a research program that applies his expertise in immunology, gene therapy, and protein engineering to pressing medical needs. "We're using genetic engineering to custom design immune responses," he says. As a graduate student at Berkeley, Leonard developed a way to genetically engineer T cells to suppress HIV infections. Now Leonard is working to modify dendritic cells and macrophages — cells that can regulate a body's overall immune response. By introducing new genetic "programs" into these cells, researchers can change the way cells gather information and respond to their environment.

For example, Leonard can engineer protein-based sensors that allow a cell to detect molecules produced by tumors. These sensors can be coupled through signaling networks to genes encoding immune-stimulating proteins called cytokines. Thus, when the engineered cell encounters a tumor, it responds by producing cytokines that recruit and activate the body's immune defenses against the tumor.

This example shows how Leonard sees cells as devices that can process information and perform useful functions and that eventually can be programmed and designed. By changing the way a cell interprets inputs and regulates outputs, Leonard hopes to build synthetic cells that function in ways that natural cells do not.

"Each immune response consists of the coordinated actions of a network of many different cells exchanging many different types of information," he says. "In the case of cancer, these networks become dysfunctional. We need to better understand not only how individual cells function in these environments, but also how all these pieces fit together in order to initiate and maintain these pathological states. Then we will better understand how to alter or repair the network, which should be useful for treating a wide variety of diseases."

REMOVING THE "OVERHEAD" OF A CELL

Jewett takes a different approach to synthetic biology, using cell-free systems to create protein therapeutics and unnatural polymers for materials, medicine, and nanotechnology. To do this, Jewett removes both the wall and the DNA of a cell — in his case, an *E. coli* cell — to get at the systems inside. In doing this, he removes the "overhead" of a cell and is more easily able to manipulate it.

"A cell has its own operating system," he says. "Its objective is to live, replicate, and multiply. We're trying to get it to carry out a new user-defined function that's often at odds with the cell's main function. By removing the cell wall, we're able to directly activate and control the catalysts we're most interested in."

Jewett takes a bottom-up approach to the biology-by-design problem by trying to create new, more reliable biological systems rather than reengineer existing ones. At Stanford University, Jewett invented a cost-effective crude cell lysate system that is now being used for the production of personalized medicines to fight cancer.

Coming to Northwestern after receiving a National Institutes of Health Pathway to Independence Award while at Harvard Medical School, Jewett is now focused on building and evolving ribosomes, the cell's factory for protein synthesis. He is making synthetic ribosomes to better understand life and to make custom-designed biological machines that can discover and produce new drugs. Collaborating with scientists at universities across the country, Jewett hopes that learning to build ribosomes will contribute toward our ability to construct a biological system that can self-replicate in vitro.

Both Jewett and Leonard are working with Laurie Zoloth, professor of medical humanities and bioethics and of religion and director of the Center for Bioethics, Science, and Society at Northwestern, to explore the ethical implications of synthetic biology. For example, Jewett's self-replicating system would require compounds that aren't found in nature (i.e., they couldn't survive outside of a test tube), and Leonard's customized immune system approach pushes the boundaries of how we engineer our own biology while creating therapeutic options that are both safer and more effective than current alternatives.

"There are certainly important questions that we as scientists need to be asking ethically," Jewett says. "We have some very good practices in place, and at the end of the day, the research that's coming out of synthetic biology will help people. I think that's important." —*Emily Ayshford* M

BusinessWeek recognizes McCormick programs as world-class

Every week Luke Nogales ends his work week like this:
He leaves his job as a researcher for Procter and Gamble in Cincinnati, drives five hours to a friend's house in Joliet, Illinois, does some last-minute reading before going to sleep, wakes up early to drive to Evanston, spends the day in classes in McCormick's Master of Product Design and Development (MPD²) Program, meets with a group of team members, and finally makes the five-hour drive back home.

It's a demanding way to spend his weekend, but Nogales is not complaining. "The program is energizing," he says. "I really enjoy it. It motivates me to make that long drive."

Nogales is not alone in his cross-state pursuit of professional education. Many of the midcareer students who make up the Master of Product Design and Development Program fly or drive from far-flung locales — including California, Texas and, Tennessee — to get what Northwestern offers: a specialized MS that provides an education in product design and development.

While product development may seem like a highly specialized niche, people — and businesses — tuned into the increasingly influential world of design are paying attention. The MPD² Program, along with Northwestern's MMM Program, was named one of the 30 best design programs in the world by *BusinessWeek* magazine. Northwestern was the only university to have two programs listed.

"Industry is still learning what a product design and development program really is," says Rich Lueptow, one of the codirectors of the MPD² Program. (Greg Holderfield, a highly respected designer, joined the program as the other codirector early this year.) "The field has been active for a number of years, but many businesses are just beginning to understand that there is value in design."

The MPD² Program began more than eight years ago in response to industry's demand for a program that trained managers in product design and development. At that time an MBA was the only available business degree, and when it came to product design, MBA programs just weren't cutting it. Walter Herbst, clinical professor of mechanical engineering and director of the MPD² Program, knew firsthand of the mismatch between product designers and traditional business school programs: Years earlier he had sent two of the top engineers at Herbst Lazar Bell, his design firm, to an MBA program — only to lose them to another industry. "They both went into banking," he said. "It was a horrible wake-up call."

McCormick designed the MPD² Program specifically for midcareer product developers, fashioning a curriculum that balances business-oriented courses like management, finance, and marketing with engineering-oriented courses including design, statistics, and innovation. Each course was created specifically for MPD² students. "On the surface we might look like other programs, but we're not," Herbst says. "In other programs students have to find courses — in the engineering school, the business school, the fine arts school — to customize their degree. Here, every course is specific to the program."

The MPD² Program admits 38 students a year and offers classes on alternate Fridays and Saturdays. Since students are at their jobs one fewer day than usual over two weeks, the program requires a commitment from both students and the companies they work for. The curriculum consists of 23 five-week courses taught by both Northwestern faculty and practicing design professionals that give students range and depth in everything from materials selection to accounting. "We don't get students who are just in it because they want another degree," Lueptow says. "They

> "It's a field that is in its infancy, but it's becoming more global. Businesses are beginning to understand that there is value-added in design."
> RICH LUEPTOW

Luke Nogales (above in the blue shirt) talks to his group in the Master of Product Design and Development Program. The group includes students who fly in from as far away as California and Texas to take part in the program each weekend. "The program is energizing," he says. "It motivates me."

love product development, and their employers want them to be more productive."

For Nogales the program provides a way to learn the business side of industry without overlooking its design aspect. "I initially wanted to do an MBA," he says, "but there wasn't a program that focused on creating products. This program is a great balance of engineering and business, and it emphasizes the process of creating products. It helps me see the big picture, how the whole system works."

MPD² students range from medical doctors to jewelry designers, all with years of technical and business experience. Faculty and the program board tweak courses and subjects to keep up with real-world demand. "The business world is getting flatter," Herbst says. "Whether you are talking about a company in Milwaukee or a company in Beijing, the main question is, How do you compete? We think we're the answer."

MMM Program: from manufacturing to design

The MMM Program began as a partnership between the Kellogg School of Management and McCormick more than two decades ago.

At the time the three M's stood for "Master of Management and Manufacturing." As time passed, however, it became clear that the program was much more than the name indicated. It evolved to include services, supply chain, and operations management as well.

Five years ago the program underwent another major change when it began to include courses on product design and development. The shift was complete when Don Norman, a well-known figure in the design field, joined as codirector two years ago. Norman's design expertise melded with the systems expertise of codirector Sudhakar Deshmukh. The "manufacturing" part of the name no longer seemed relevant. The program was refocused on design and operations and rebranded as an MBA plus a master of engineering management degree, keeping the MMM acronym.

"We teach our students how to manage products and services from concept through execution," says Deshmukh, the Charles E. Morrison Professor of Decision Sciences in Kellogg."That's what makes this program unique," says Norman, the Breed Professor of Design in McCormick's Department of Electrical Engineering and Computer Science. "There are many programs that focus on design. We cover the entire system."

Today the full-time program is attracting a new kind of student — one who is looking for a new way of thinking. Christie Shan, a consultant in real estate operations, arrived at Kellogg last fall aiming to do an MBA but decided that it might not deliver the creative curriculum she hoped for. "Recognition of the human factor doesn't happen enough in consulting," she says. "In the MMM Program I learn about focusing on the human-centered aspects of the process. That really excites me."

"In the MMM program I learn about focusing on the human-centered aspects of the process. That really excites me."

CHRISTIE SHAN

The first year of the MMM Program features a full-year, three-quarter course sequence that covers both design and operations. In this case, design doesn't necessarily mean designing a product; it could be designing a structure or an organization. Either way, the program stresses "design thinking."

"Design thinking means that you don't simply solve the problems that you are given," Norman says. "You have to back up and see what the fundamental issues are. Engineers know how to solve problems. MBAs know how to solve problems. I teach my students how to figure out what the problem is in the first place."

Last fall Norman challenged MMM students to redesign the interior of the car — no rules, just find the right problem before you begin solving it. It was Shan's first experience of the design process. "We were challenged with being comfortable with uncertainty and ambiguity," she says. "The creative process — brainstorming — wasn't structured, and I haven't been trained to think that way. But then everyone began throwing out ideas and trying to break through these barriers. It helped me grow into a totally different business leader and to see things in a way that most businesspeople don't."

When the program first began focusing on design, only one or two students out of

40 enrolled said they applied to learn about design. Now 70 percent apply with design in mind, and nearly half say they want to learn both operations and design. This is the result of the program's effort to meld operations and design into a new curriculum that produces the kind of managers businesses want.

"We don't produce designers. We produce businesspeople," Norman says. "When our students graduate, they are not designers, nor are they operations specialists. They are managers who understand operations *and* design. That makes them more valuable."

A community of design graduate students

McCormick's focus on design grew exponentially after the Segal Design Institute was founded here in 2007. Since then faculty and administration have beefed up the design aspects of graduate programs. While the MPD^2 and MMM Programs provide professional degrees to students several years removed from their undergraduate experience, McCormick also wanted to provide a graduate program for the newly minted engineer who wished to learn more about the design process. As a result the school began the Master of Science in Engineering Design and Innovation (MS-EDI) Program, which admits engineers early in their career as well as recently graduated undergraduate students for an extra year of design education.

"We wanted to have a cadre of students who were here full-time, who would be a presence, and who would be very focused on design," says Ed Colgate, professor of mechanical engineering and director of the MS-EDI Program.

At the core of the MS-EDI Program are studio design courses in which students learn human-centered design through group projects. Students also take courses in sustainability and business as well as a series of courses common to both the MMM and MS-EDI Programs. The program aims to enroll 20 students a year, which keeps it small enough for students to get plenty of one-on-one time with faculty and allows students to come together in a tight-knit design community.

"There is great power in that community," Colgate says. "When you get a critical mass of people who share an interest in design, a lot of things begin to happen that wouldn't happen otherwise." MS-EDI students organize field trips, volunteer their design skills in projects for the developing world, and create extra-curricular design projects for competitions. "These students are still engineers, but we see them approaching their jobs differently and bringing a greater awareness of people and innovation," says Colgate.

The MS-EDI Program, now in its third year, is still evolving: faculty recently added a second-year option for students who want to create a thesis project. "There is a real value in taking someone with a traditional engineering education and layering on this understanding of design and innovation," Colgate says. "I expect there will be more and more programs like this, and that's a good thing." —*Emily Ayshford*

"This program is a great balance of engineering and business, and it emphasizes the process of creating products. It helps me see the big picture, how the whole system works."

LUKE NOGALES

GETTING **RID** OF THE **STENT**

Late one night several years ago in a shared office on the top floor of the Robert H. Lurie Medical Research Center on the Chicago campus, Guillermo Ameer and Melina Kibbe came up with a new idea for their research. Kibbe, associate professor of vascular surgery at the Feinberg School of Medicine, had spread out the different kinds of stents she uses in surgery; Ameer, associate professor of biomedical engineering at McCormick and of surgery at Feinberg, wanted to know why certain aspects of one or another are good or bad, what causes devices to fail, and how biomaterials could be more successful. After a long discussion the two came up with a radical idea: What if you got rid of the stent altogether?

That idea came after years of successful collaboration. Kibbe and Ameer began working together five years ago, when one of Ameer's postdoctoral fellows was searching for a researcher who could provide some much-needed assistance with animal models of vascular grafting and found Kibbe, who was just beginning her research program at Northwestern to improve upon current vascular grafts. "My lab was working on citric acid polymer materials and needed a partner to help test these materials in vivo," says Ameer. "Melina and I share a strong interest in cardiovascular work, so it just made sense to work together."

Their partnership developed quickly, and when Kibbe outgrew her research space downtown, an opportunity to share facilities at the Institute for Bionanotechnology in Medicine (IBNAM) on Northwestern's Chicago campus allowed the collaboration to go to the next level. (This opportunity was provided by Sam Stupp, director of IBNAM and Board of Trustees Professor of Materials Science and Engineering, Chemistry, and Medicine.) Kibbe's entire lab is based in IBNAM, and several members of Ameer's team are now there as well. Ameer and Kibbe share an office, facilitating close collaboration and the easy exchange of ideas.

"It can be challenging to work across two campuses, but it's important to have those connections," Ameer says. "The IBNAM space is great because it creates an ideal working environment for this type of collaborative research."

Working together in that space Ameer and Kibbe developed the unorthodox idea that they are pursuing today. They theorized that a liquid polymer could form to the contours of an artery to provide a custom-made stent. "Why couldn't we inject a polymer into an artery and cast it into the shape of a cylinder, like designer medicine?" Kibbe explains. And if that polymer were loaded with drugs that promoted healing, the stent could disperse them in a targeted area before degrading, leaving behind a healthy artery. After some discussion, the two decided that the idea had merit.

> "Some people will shoot down a creative idea because it is so different from current techniques. It's important to develop some of these ideas enough to see the merit in them."
> GUILLERMO AMEER

Ameer and Kibbe hope to develop nitric oxide–eluting materials for use in a biodegradable stent. Nitric oxide is naturally produced by the thin layer of endothelial cells that line arteries and provides a host of benefits key to cardiovascular health. For example, it inhibits the proliferation of the white blood cells, vascular smooth muscle cells, and platelets that can hinder the artery as it heals. In addition, nitric oxide promotes the survival and growth of more endothelial cells in the region. These all-important endothelial cells and the nitric oxide they produce are put at risk by the trauma of surgery. "Whenever you insert a balloon into an artery for angioplasty, the act of blowing it up and the trauma from surgery kill off the fragile single layer of endothelial cells," Kibbe says. "When you lose those cells, you lose your normal nitric oxide supply."

After working on several small projects to make the case for further study, Ameer and Kibbe received a highly competitive challenge grant from the National Institutes of Health. The two-year grant provides them with the resources to develop their idea into a concept that could find its way to clinical trials. "It's my hope that I can eventually use techniques and devices that we've developed in the operating room," says Kibbe.

Ameer and Kibbe's partnership also includes a company they formed in 2008 to commercialize some of the work they were doing with citric acid–based biomaterials (see *McCormick* magazine, spring 2007) and nitric oxide. Since the launch of the company, Vesseltek, Ameer and Kibbe have won a Chicago Biomedical Consortium Business Plan competition and received small-business funding from both the National Science Foundation and the National Institutes of Health.

Even with the benefits of shared space, shared business, and innovative ideas, collaborations are only as strong as the participants. That match is where Ameer and Kibbe thrive. "It can be difficult to find collaborators outside your field who will approach a project with an open mind," Ameer explains. "Some people will shoot down a creative idea because it is so different from current techniques. It's important to develop some of these ideas enough to see the merit in them." —*Kyle Delaney* M

Guillermo Ameer and Melina Kibbe share lab space in the Institute for Bionanotechnology in Medicine on Northwestern's Chicago campus. With support from the National Institutes of Health, the two are developing a biodegradable stent that forms inside the body to the contours of an artery. They hope the technology will elute drugs that promote healing during recovery, improving upon current options.


ALUMNI
AWARDS

Hail to thee, Northwestern

Last September the Northwestern Alumni Association honored 18 accomplished graduates at the 77th annual Northwestern Alumni Association Alumni Awards. Among those honored were three McCormick alumni: **DAVID ECKERT** *('77) and* **AVA YOUNGBLOOD** *('79) both received Alumni Service Awards, given in recognition of loyal service voluntarily rendered to the University; and* **DANIEL LIPINSKI** *('88) received the Merit Award, which recognizes those who have distinguished themselves in their particular professions or fields of endeavor.*

From the top: David Eckert, Ava Youngblood, and Daniel Lipinski shown with University President Morton Schapiro at the Northwestern Alumni Association Alumni Awards Presentation last September

DAVID ECKERT arrived at Northwestern as a freshman in 1973 ready to study engineering — but not ready to become an engineer. "I always thought I would go into business, and I thought engineering would help discipline my thinking and teach me how to analyze and understand the challenges I would face in my career," he says.

Eckert's two older brothers paved the way for him (both had received materials science and engineering degrees from Northwestern in the early 1970s), and Eckert knew that "Northwestern was, far and away, the best school anywhere close to where I was in Wauwatosa, Wisconsin." Four years later Eckert would leave Northwestern with degrees in mechanical engineering and economics.

Now, more than 30 years later, Eckert can safely say that the skills he gained at McCormick did help him along the way. His successful career in improving performance and value in businesses ranging from manufacturing to waste management has garnered him a reputation as a CEO who can parachute in, figure out how to create value, and "get it done."

"The analytical part of it draws heavily on an engineer's approach," he says. "In a business situation, that type of thinking is far more disciplined and effective than the approach nonengineers take. Compared with thermodynamics or Fourier series, understanding finance or marketing or how a business works is pretty simple."

In between business ventures Eckert found himself looking for a way to give back to Northwestern. "You get to a point where you have the perspective to see how important your Northwestern education has turned out to be," he says. "You have a desire to give back and get a little closer to the University."

Eckert is chair of the McCormick Advisory Board and has served in many different alumni roles: acting as a member of the Northwestern Alumni Association Reunion Committee, the board of the NU Club of Boston, and the Leadership Circle Regional Council. "They all build on each other," he says. "It kind of feels like family." Indeed, Eckert has passed the Northwestern tradition down to his own family: Both of his sons are Northwestern alumni.

Eckert recently took a new position as CEO of Safety-Kleen, a leading North American used-oil recycling and re-refining, parts cleaning, and environmental solutions company. He says he's still committed to serving the Northwestern community. "There's no downside to serving," he says. "It's fun, and it's meaningful. You get to meet a lot of good people, have good times, and form lifelong friendships that you wouldn't get any other way."

AVA YOUNGBLOOD always had a talent for math and science when she was growing up in Chicago. But she wasn't set on engineering until she participated in the National High School Institute Cherubs program, in which she spent five weeks one summer taking engineering classes in Tech. "From that experience I chose Northwestern," she says, "and I never looked back."

Youngblood (shown above with McCormick Dean Julio M. Ottino and his wife, Alicia Löffler) studied chemical engineering, but when she helped create the Northwestern chapter of the National Society of Black Engineers, she realized her forte was in running organizations. "I liked the idea of developing and running organizations, and I loved solving problems," she says. Though she started out in a technical position, she quickly moved into business operations at Amoco.

"Engineering is one of the best disciplines that a person can engage in if they are going to be involved in solving problems," she says. "It allows you to take concepts and ideas and apply them. You don't just learn the information, you see how it works. That's real learning."

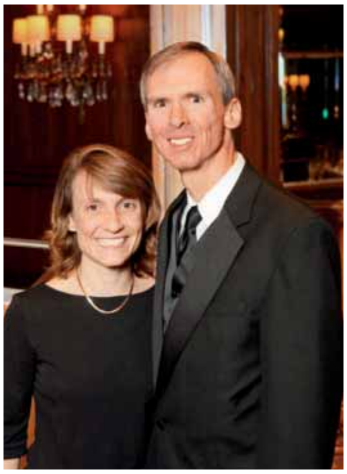
After spending 19 years at Amoco, Youngblood became a senior vice president with the executive search firm Deborah Snow Walsh. In 2002 she broke out on her own and started Youngblood Executive Search. "I use my ability to solve problems every day," she says. "Finding the best talent to fill a particular position requires that you analyze the opportunity, identify people who can meet the requirements, and go about recruiting them. It's a very processed way of thinking."

Nearly 20 years ago then-dean Jerry Cohen invited several black alumni, including Youngblood, to analyze the school's high rate of attrition for black students. After talking to faculty, administrators, and students, Youngblood and her fellow alums made recommendations. Consequently, about five years later, McCormick was recognized as one of the top schools in the United States for graduating black engineers.

"That experience showed me how alums could have an impact on the University," she says. "Northwestern played a very critical role in my life. The faculty and administrators in Tech took an interest in me and made sure I could be successful. It was a very positive experience, and I realized I could help give back."

Since then Youngblood has remained active in alumni endeavors: She has been president of the Northwestern Alumni Association, a member of the Chemical and Biological Engineering Advisory Council, a member of the Women's Board, and a University trustee. Most recently she was on the search committee for the new University president, and she continues to serve on the McCormick Advisory Council.

"It has been great," she says. "To those whom much is given, much is required. It's allowed me to give back, and it has allowed me to be a part of how Northwestern changes and grows. It's exciting to stay close and see what's happening."



DANIEL LIPINSKI has many memories from his time as a mechanical engineering undergraduate in the 1980s: long evenings in the sub-basement of Tech, camaraderie with fellow students, and a teacher so memorable — Analytical Dynamics instructor John Walker — that Lipinski and his friends named their intramural floor hockey team after him: the Johnny Walker Fan Club (which, they assured everyone, had no relation to the whiskey). More than 20 years later, Lipinski, now a congressman for the third district of Illinois, can reflect on how his engineering degree has helped him over the years.

"My education at McCormick proved to be very valuable in that I was well trained in logical thinking and analysis," he says. "I try to gather as much reliable information as possible and work through various solutions. But I understand that legislating is not just a science; it is also the art of figuring out what is possible and how to make it happen."

Lipinski (shown above with his wife, Judy) never practiced as a traditional engineer. After graduating from Northwestern he went on to get his master's in engineering economic systems from Stanford University before getting a PhD in political science from Duke University. As an assistant professor of political science at the University of Notre Dame and the University of Tennessee from 2001 to 2004, he found his engineering background prepared him for the numerical analysis and problem solving required in his research.

As a member of Congress, Lipinski uses his science background (something very few members of Congress can claim) to bring a new approach to two of the committees on which he serves: Transportation and Infrastructure and Science and Technology. Lipinski says his engineering degree helps him bring a logical approach to studying issues and examining the effects of legislation. On the Transportation and Infrastructure Committee, where Lipinski has been working for more than a year to pass a six-year, $500 billion surface transportation bill, he is able to "understand what goes into building roads, bridges, runways, locks, and dams and the technology involved in air, land, and water transport." At a time when the nation's infrastructure needs major funding for overdue work (more than $2 trillion by some estimates), Lipinski says the innovation of engineers is necessary.

"Our ability to succeed as a nation depends on our ability to ensure the fast, safe, and efficient transportation of people and goods," he says. "That is why it is essential that engineers continue to strive to make breakthroughs in developing new innovative technologies and solutions to address the challenges and deficiencies we face in our transportation systems."

As chair of the Science and Technology Committee's subcommittee on research and science education, Lipinski draws on his firsthand experience of science education in crafting bills such as the America Competes Act and initiatives that improve collaboration between universities and the federal government.

"We desperately need new engineers to take the places that will be left as a generation of highly skilled and experienced aerospace, electrical, automotive, and mechanical engineers leaves our economy," he says. "America must continue to lead the world in the basic scientific research required to spur innovation and new economic growth. But we need more than new ideas. We need to turn our discoveries into new products, processes, and jobs."

Lipinski still finds time to stay in touch with Northwestern. He keeps up with McCormick's latest nanotechnology research and participates each year in the William O. Lipinski Transportation Symposium (named for his father, a former Illinois congressman; see page 3 for more on this year's symposium).

"I also make sure that I attend at least one football game and usually one basketball game a year," he says. "I am a die-hard Wildcat fan and wish I could be there more often, but I also watch and listen to as many games as I can." —*Emily Ayshford* M

Pictures from our celebrations

McCormick marked its Centennial during 2009–10 with a series of special events that brought together alumni, faculty, staff, students, administrators, and friends of the school within Northwestern and around the country.

Campus Centennial Celebration

Nearly 1,500 people attended the Campus Centennial Celebration on October 2. The inaugural Centennial event on the Garrett Lawn featured remarks from Dean Julio M. Ottino and Northwestern President Morton Schapiro, as well as food, ice cream, a jazz band, and the McCormick Student Activities Fair. McCormick also hosted a special exhibit at the Dittmar Memorial Gallery in Norris University Center in September, featuring McCormick photos from throughout the past century, a time line of the school's history, research photos that illustrate the art of engineering, and videos about the Centennial and faculty research.

Explore
Create
Transform
100 Years


McCormick School of Engineerin
Centennial Campus Celebration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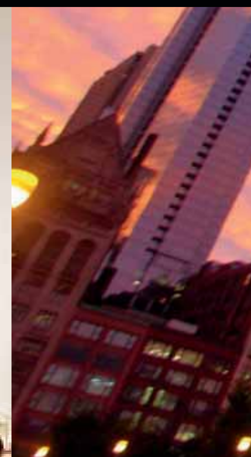

Centennial Gala

More than 340 McCormick faculty, alumni, and friends gathered on October 30 at the Modern Wing of the Art Institute of Chicago for the McCormick Centennial Gala. After a cocktail reception in Griffin Court and a viewing of museum exhibits, attendees dined at the Terzo Piano restaurant. Dean Ottino, Northwestern President Morton Schapiro, and former Northwestern Board of Trustees chairman Pat Ryan made remarks.

San Francisco

McCormick cohosted a Centennial cocktail reception at the de Young Museum in San Francisco on October 14 with the Kellogg School of Management. Attendees enjoyed a private viewing of the Tutankhamun and the Golden Age of the Pharaohs exhibition and heard remarks from Dean Ottino and Kellogg Interim Dean Sunil Chopra.

Los Angeles

For its Centennial celebration on January 20, McCormick partnered with the Feinberg School of Medicine to host a cocktail reception at the Los Angeles County Museum of Art. The 180 attendees, representing nearly every school at Northwestern, enjoyed a private viewing of the museum's modern galleries and remarks from Dean Ottino and Feinberg Dean J. Larry Jameson (left).

MURPHY SOCIETY DONORS

The Walter P. Murphy Society honors individuals for their annual gifts of $1,000 or more to the McCormick School. Members have a unique opportunity to assist the dean in making decisions to fund faculty and student initiatives through Murphy Society grants. The society honors the legacy of Walter P. Murphy, the benefactor whose gifts supported the construction of the Technological Institute.

Life Fellows

Life Fellows are recognized for their extraordinary support of the mission and goals of the school through their gifts of $500,000 or more.

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Johnnie Cordell Breed, H ’97
Stanton R. Cook ’49, H ’85
Lester Crown ’46
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Madeline Halpern ’77, MSJ ’86 and Richard C. Halpern
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Estate of George H. Martin, PhD ’55
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Estate of William H. Richardson Jr. ’59
Patrick G. Ryan ’59 and Shirley Welsh Ryan ’61
Gordon I. Segal ’60 and Carole Browe Segal ’60
Benjamin W. Slivka, BSAM ’82, BSCS ’82, MS ’85 and Lisa Wissner-Slivka ’85
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Harold B. Smith, MBA ’57 and Denise Smith
Chu Tull
Robert P. Wayman ’67, MBA ’69 and Susan H. Wayman
William J. White ’61 and Jane Schulte White

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$10,000 or more

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Donn R. Armstrong ’62
Laverne S. Brown ’45
Lee A. Dayton Sr. ’65 and Mrs. Lee A. Dayton
Rhonda Love Dibachi ’83 and Farzad Dibachi
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Scott H. Filstrup ’65, MBA ’67 and Margaret M. Filstrup
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Bill Gibbons ’73, MS ’74 and Eileen Goode Gibbons ’74
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Jan E. Leestma, MBA ’85 and Louise M. Leestma
Michael P. Lidrich ’72, MS ’79
Estate of Armon Lund ’41, MBA ’46
Estate of Lydia Hoffman Lund ’50
Stella Mah
Roy F. McCampbell ’76
Ethan Meister and Mary Meister ’98
Gregory John Merchant, PhD ’90
D. Eugene Nugent ’51 and Bonnie L. Nugent ’49
David L. Porges ’79
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James N. White ’85 and Patricia White
Howard B. Witt ’63 and Marilyn A. Witt

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$2,500 to $4,999

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Scott F. Clugston, MS ’82
Dana M. Comolli ’81 and Cori S. Staley ’80
Elizabeth K. Dean
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Robert B. Fairley ’69 and Paula Housh Fairley ’68
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Scott David Roberts ’01 and Jill Lewandowski Roberts ’03
Thomas F. Rosenbaum and Katherine T. Faber
Paul H. Schipper, MS ’75, PhD ’77
Stephen L. Schwartz ’74, MMgt ’76
Edward G. Sheppard Jr. ’63
Ronald J. Tabar ’73
Antti P. Talvitie, MS ’68, PhD ’71
Gary F. Teletzke ’78
Sheldon M. Wecker, MS ’70, PhD ’73 and Gail E. Wecker
Howard J. Weiss, MS ’73, PhD ’75 and Lucia Beck Weiss
Molly Wells Williams ’63 and Roger G. Williams

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Donna L. Gilbert ’82
Marilyn Otto Goll ’46
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Jeffrey T. Gotro, PhD ’83 and Elaine M. Grossman-Gotro ’79
Eric P. Granberg ’82
Sandra Shaner Grogan ’79
Kevin John Gross ’77 and Susan Luerssen Gross ’79
Steven Abraham Gross ’76 and Julia L. Winston
Paul R. Gudonis ’76
Amit Gupta, PhD ’01
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Estate of Joseph R. Hahn
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James T. Hoeck ’83
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Jon S. Holmgren ’62, MS ’66
Roy Y. Hori, MS ’73, PhD ’81
Rei Fong Hsu and Pei Mei Hsu
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Robert A. Iehl ’47
Hitoshi Ishii, PhD ’71
Hina T. Jaffery ’96, MEM ’01
John R. Jagela ’80
Josetta I. Jones ’92
Wendee W. Kanarek
Jeffrey P. Kao ’97
W. Donald Kingsley ’57 and Barbara Palicke Kingsley ’58
Kenneth C. Kirsch ’75, MS ’78, PhD ’80
Janet E. Klein ’81
Jack A. Koefoot ’46
Edward F. Kondis, PhD ’69
Tom C. Krejcie ’74 and Valerie Krejcie
Gary Kremen ’85
Herbert P. Krog ’56
William J. Kroll Jr. ’67, MS ’71
Harvey Y. Lee ’88
Michael T. Lee ’84 and Denise Skelton Lee ’84, MS ’86
Jeffrey Richard Lefebvre, MS ’86, PhD ’92 and Julie A. Lefebvre ’87
Robert E. Leigh ’54, MS ’59 and Elaine Leigh
Sek-Hon A. Leung ’80 and Jenny Leung
Steve Liao ’92
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Alan L. Scharff ’46 and Sandra Evelyn Scharff
Logan H. Schlipf ’51
Arnold L. Schmidt ’54 and Ann Atkins Schmidt
Joseph L. Schofer, MS ’65, PhD ’68 and Nancy L. Schofer
Deborah Lee Schuh ’82
Lyle H. Schwartz ’59, MS ’64
Stephen B. Schwartz ’57 and Nancy Astrof Schwartz
Terry Schwartz
Robert W. Semmler ’50
Andrew T. Seputis ’03
Verneta Simon, MS ’93
Narinder Singh ’95
Michael H. Sitko, MS ’89
Alice Zajakala Sloma
Mariel Spalter ’89
Jeffrey Staab ’83 and Sara Hippe Staab ’84
Gregory M. Stanley, MS ’74, PhD ’77 and Linda Wang Stanley, MMgt ’76
Todd Eugene Steyer, PhD ’93
David H. Stieber ’49
Burton L. Streicher ’72
Margaret Tabar
Keiko Takahashi
Kunio Tamura, PhD ’71
John M. Torkelson
William C. Trotter ’58
Paul D. Ulland ’66 and Judy Ulland
Robert W. Waldele ’72
Samuel A. Walker III, MS ’71 and Joanne Walker
Samuel Chih-Hung Wang, MS ’75, PhD ’79 and Sujane Chang Wang, MS ’78, PhD ’81
Nina Joag Waranica ’85 and Gregory P. Waranica
Sharon Sue Warsaski ’84, MS ’90
Jeffrey S. Waterman ’95, MSED ’06 and Paula Chambers Waterman ’97
Bruce W. Wessels
Richard V. Westerman ’63 and Carla Westerman
Arthur R. Whale ’45 and Roberta Donaldson Whale
Charles S. Williams, MS ’80
Frank T. Wimmer ’60, MS ’63
Adam E. Winter ’97 and Jessica Lutkenhaus Winter ’97
Alan Wolfson ’80
Ying-Hon Wong ’79
Dean A. Worrell ’77
Marla L. Wright ’93
Susan Wright ’73
Teck Soon Yap and Yen Yue Yap
James L. Zydiak, PhD ’89 and Katrina L. Helmkamp ’87, MMgt ’92

CLASS NOTES

McCormick alumnus elected to NAE

Sang Yup Lee (MS '87, PhD '91) was elected to the National Academy of Engineering as a foreign member. Lee, dean of the College of Life Sciences and Bioengineering at the Korea Advanced Institute of Science and Technology, was cited for leadership in bacterial biotechnology and metabolic engineering, including development of fermentation processes for biodegradable polymers and organic acids.

1940s

Lester Crown ('46), chairman of Henry Crown and Company, became a life trustee of the Aspen Institute, where he has been a trustee since 1988.

1960s

John F. Carney III (MS '64), chancellor at the Missouri University of Science and Technology, received the Chief Executive Leadership Award from the Council for the Advancement and Support of Education.

Edward F. Voboril ('65), chairman of the board of Analogic Corporation, was appointed the independent lead director of the IRIS International board of directors.

Tsu-Wei Chou (MS '66) is the Pierre S. du Pont Chair of Engineering at the University of Delaware. He received the 2009 Medal of Excellence in Composite Materials from the University of Delaware Center for Composite Materials.

Dwight A. Beranek ('68), a senior vice president and market service manager for Michael Baker Corporation's Department of Defense programs, was inducted into the U.S. Army Corps of Engineers' Gallery of Distinguished Civilian Employees.

1970s

Ashok V. Joshi (MS '70), president of Ceramatec in Salt Lake City, received the 2009 Achievement Award from the Industrial Research Institute.

Warren F. Miller Jr. (MS '70), a part-time professor at Texas A&M University, was confirmed in August 2009 as assistant secretary of nuclear energy and director of the Office of Civilian Radioactive Waste Management in the U.S. Department of Energy.

Michael E. Kassner ('72), formerly a professor and chair of aerospace and mechanical engineering at the University of Southern California, was appointed director of research in the Office of Naval Research in 2009.

Andrew Charles Fox ('75) is president of Pacific Harbor Line, which was named the short-line railroad of the year and the "greenest railroad in America" by *Railway Age* magazine in March 2009.

In October 2009 **James R. Shappell** ('75) was promoted to the newly created position of group executive for development and strategy of Parsons Corporation, an engineering, construction, and technical and management services firm. He was previously president of Parsons Transportation Group.

Paul George Andersen (PhD '76), director of process technology at plastics company Coperion, is president of the Society of Plastics Engineers.

Arden B. Sigl (PhD '78) retired in 2009 after 41 years as an engineering professor at South Dakota State University.

John C. Ziegert (MS '78), professor of mechanical engineering at Clemson University, was elected to the Society of Manufacturing Engineers' College of Fellows in 2009.

1980s

Priscilla Marilyn Lu (PhD '80), a managing partner and founder of Cathaya Funds, was elected to the board of directors of ZAP, a manufacturer of electric vehicles, in 2009.

Jeffrey S. Miller ('81), a hematologist and oncologist at the University of Minnesota Medical Center, Fairview, was recognized for excellence in clinical care, innovation, and scholar/research at the hospital's 5th Annual Medical Staff Recognition Awards in October 2009.

William H. Cork ('82), former chief technology officer and vice president of research and development at Nanosphere Inc., was named senior vice president and chief technology officer of Fenwal Inc., a medical technology company in Lake Zurich, Illinois, in 2009.

Roger H. Gerson ('82) joined Brammo, a start-up manufacturer of electric vehicles, as its electrical engineering manager in May 2009. He was previously employed by Vectrix Electrics.

James T. Hoeck ('83), president of the board of trustees and CEO of Cotuit Center for the Arts in Cotuit, Massachusetts, was elected to the board of directors of the Cape Cod Foundation in 2009.

Cynthia L. Quarterman ('83), a partner in the Washington, D.C., law office of Steptoe & Johnson, was confirmed by the Senate as administrator of the Pipeline and Hazardous Materials Safety Administration at the Department of Transportation in November 2009.

Randolph L. Romenesko (MS '83) is an engineering consultant in Nome, Alaska. He was reappointed to the Denali Access System Advisory Committee in December 2009.

In May 2009 **Jeffrey G. Butler** ('84) was named a senior associate at Gannett Fleming, a planning, design, and construction management firm. He is based in Gannett's Locust Valley, New York, office.

Wilbur W. Mok ('84) was promoted to vice president of the North America tonnage gases division of Air Products in September 2009. He was previously the firm's Asia region president.

Jeffrey M. Scheib ('84) was named vice president of biofuels at Chromatin Inc. in 2009. He was formerly president of the am/pm international division of ARCO.

Ajay Bansal (MS '85) was named executive vice president of corporate development and chief financial officer of Lexicon Pharmaceuticals in June 2009. He was previously chief financial officer and executive vice president of corporate and business development for Tercica.

Helen S. Kim ('85), director and chief executive officer of TRF Pharma Inc., was elected to the board of directors of Sunesis Pharmaceuticals Inc. in July 2009.

Seaphes R. Miller ('85), managing member of HiTech Integrated Solutions in Milwaukee, received the Outstanding Minority Business Award, small company division, in October 2009. The award was given by the Wisconsin Department of Commerce.

Thomas Steven Buchanan (PhD '86), deputy dean in the College of Engineering at the University of Delaware, was named George W. Laird Professor of Mechanical Engineering in June 2009.

Joseph E. Girardi ('86), manager of the New York Yankees, led the team to its 27th World Series championship in October 2009.

Michael K. Huff ('87), former outfielder for the Chicago White Sox, was named vice president of sports at the Chicago Bulls/Chicago White Sox Training Academy in Lisle, Illinois, in July 2009.

Steven Robert Kramer (MEM '87) was named senior vice president of client development in the infrastructure division of ARCADIS, a consulting and engineering company, in May 2009. He was formerly vice president of business development at Parsons Corporation.

Sharmila Shahani Mulligan ('88) was named executive vice president of worldwide marketing at Aster Data in September 2009. She was previously chief marketing officer at HP Software.

Eun Kyo Park (PhD '88) was appointed dean of research and graduate studies at the College of Staten Island in New York in August 2009. He was previously a program director at the National Science Foundation (NSF) and professor at the University of Missouri.

Arup Kanti Maji (PhD '89), chair of the Department of Civil Engineering at the University of New Mexico, was appointed interim dean of the university's School of Engineering in May 2009.

William F. Stanczak Jr. ('89) was named director of commercial sales in the newly launched commercial division of Inspired Electronics Inc. in March 2009.

1990s

Barzin Mobasher (PhD '90), a professor of civil and environmental engineering at Arizona State University, was named a fellow of the American Concrete Institute at its 2009 spring convention.

Alicia S. Boler-Davis ('91) is plant manager for General Motors' Lansing Region, which includes the Grand River and Lansing Delta Township assembly plants.

Michael Jeffrey Pfeifer (PhD '91) is president of Industrial Metallurgists in Northbrook, Illinois. His book *Materials-Enabled Designs: The Materials Engineering Perspective to Product Design and Manufacturing* grew out of his experiences teaching a course at Northwestern.

Ghia E. Griarte (MEM '93), managing director at Saints Capital in San Francisco, was appointed a director of Actelis Networks in 2009.

Jeanne M. VanBriesen (MS '93), a professor of civil and environmental engineering at Carnegie Mellon University, was named the 2008 Professor of the Year by the Pittsburgh Chapter of the American Society of Civil Engineers.

Paul J. Brown (MEM '94), president of global brands and commercial services for Hilton Hotels Corporation, was elected to the board of directors of Borders Group Inc. in August 2009.

Dawn Alisha Lott-Crumpler (PhD '94), associate professor of applied mathematics at Delaware State University, was appointed director of the university's honors program in 2009.

Daaron Dohler ('96) was promoted to general manager and president of Takeda Pharmaceuticals' new operation, Takeda Canada Inc., in March 2009.

Doreen D. Edwards (PhD '97) was appointed dean of the Kazuo Inamori School of Engineering at Alfred University in Alfred, New York, in July 2009.

Lars Pantzlaff (MS '97) was appointed to the management board and named general director of Ventspils Nafta Terminals, a crude-oil and petroleum products transshipment company in the Baltics.

Julien P. Rosso ('97) was named vice president at Haywood Dorland Energy Capital in September 2009. He was formerly with Glitnir Capital.

Matthew J. Cole (MEM '98) was named vice president and general manager of the advanced measurement technology division at AMETEK Inc., a manufacturer of electronic instruments and electromechanical devices.

Frank T. Fisher (MS '98), assistant professor of nanomechanics and nanomaterials at the Stevens Institute of Technology in Hoboken, New Jersey, received $430,000 in funding from the NSF for a study on crystalline morphologies.

Calvin Vernard Johnson (MEM '98) has been appointed president of the hospitals division at Sodexo.

Alan D. Anderson (MS '99), an executive director at the Chicago Public Schools, was appointed acting deputy CEO for human capital on a newly established executive team that is part of a larger restructuring at the organization.

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2000s

Sudhanshu Chhabra (MEM ’00) was named managing director of Gilbarco Veeder-Root India, a new division created from Gilbarco’s acquisition of Larsen & Toubro’s petroleum dispensing pump business.

Alexis Patricia Dunne (’00) joined the Department of Internal Medicine at Dreyer Medical Clinic in Oswego and Plainfield, Illinois, in August 2009.

Penny P. Chen (PhD ’01), principal systems architect for Yokogawa Corporation of America, represents the firm on the board of directors of the Wireless Industrial Networking Alliance.

Jeri Beth Ward (MEM ’01), general manager of marketing and strategy at Audi of America, was profiled as one of *Advertising Age* magazine’s “Women to Watch” in June 2009.

Robert C. Wolcott (MS ’01), a lecturer in entrepreneurship and innovation at Northwestern’s Kellogg School of Management and executive director of the Kellogg Innovation Network, is coauthor of the book *Grow from Within: Mastering Corporate Entrepreneurship and Innovation,* published in 2009.

Charles Goodall (MIT ’02) was named vice president of DailyMed Pharmacy operations at Arcadia Resources, a provider of home care, medical staffing, and pharmacy services.

Frank Edward Curtis (MS ’05) joined the industrial and systems engineering department at Lehigh University in Bethlehem, Pennsylvania, in 2009.

Ying Zhu Chin (’07) won third place in *Northwestern* magazine’s spring 2010 short fiction contest for her story “When Starbucks Came.”

Eric Peterman (’09) has been signed by the Chicago Bears as a wide receiver.

In memoriam

Howard E. Irwin, ’21
Howard F. Brady, ’34
Otto E. Fenske Jr., ’38
John H. Fowler Jr., ’40
Lucien G. Osborne, ’42
John E. Brickwood, ’44
Howard H. Loos, ’44
William S. Jones, ’45
George Pasti Jr., ’45
John F. Whedon Jr., ’45
Arthur B. Dayton Jr., ’46
Paul R. Gouwens, ’46
Frank Loehnert Jr., ’46
William Repenning, ’46
Donald S. Banks, ’47
Paul B. Hiemenz, ’47
Richard W. Bogan, ’48
James C. Carroll, ’48
Richard P. Fye, ’48
Donald H. Hageman, ’48
Dwight A. Nesmith, ’48
Alden Thayer Wulff, ’48
Elaine D. Anderson, ’49
James A. Cudney, ’49
William T. Jensen III, ’49
Robert T. Olson, ’49
Hugh B. Orr Jr., ’49
William S. Postl, ’49
William R. Steitz, ’49
Oliver A. Williams Jr., ’49
Vere L. Hageman, ’50
Hans G. Person, ’50
Kenneth E. Glover, ’51
Guy E. Reynolds, ’54
Norman E. Sondak, ’54
Orval A. Volkening, ’54
M. Richard Tennerstedt, ’55
Robert S. Bowen, ’58
Robert C. Potter, ’59
John R. Powell, ’59
Jay W. Feldmann, ’60
John O. Mingle, ’60
Allen G. Gibbs, ’61
Robert J. Mayschak, ’62
Edward M. Cikanek, ’64
Jack L. Isaacs, ’64
Scott W. Ryburn, ’64
Richard E. Saeks, ’64
Edward F. Kobek, ’65
Charles Wilson Brown, ’67
John E. Matz, ’71
William F. Eckstein, ’72
Emmett R. Kronauer III, ’73
Yung Chuan Chen, ’75
John Hodge Layer, ’76
Craig S. Goren, ’92
Howard H. C. Ma, ’93

Allan Gilman Thompson Jr. (’48) passed away on May 1, 2009. He is survived by his wife of 57 years, Corinne A. (Sir) Thompson (Communication ’51); children John and William Thompson and Sue Thompson Meehan; and grandchildren Mary Kate, Jack, and Mike Meehan; Emily and Robby Thompson; and Dan and Dave Thompson.

Thompson was born in Brooklyn and moved to Wilmette, Illinois, where he graduated from New Trier High School. During World War II he served in the U.S. Army Air Corps. After his honorable discharge, he attended Northwestern, graduating with a BS in mechanical engineering. His entire career was spent at Babcock & Wilcox Co., specializing in power generation for the steel and pulp and paper industries. He mostly worked in the Pittsburgh office before retiring as sales manager of the firm’s Atlanta office.

Thomspon’s estate has established a testamentary charitable gift annuity, the remainder of which will benefit the McCormick School of Engineering and Applied Science. The school is grateful for this gift.

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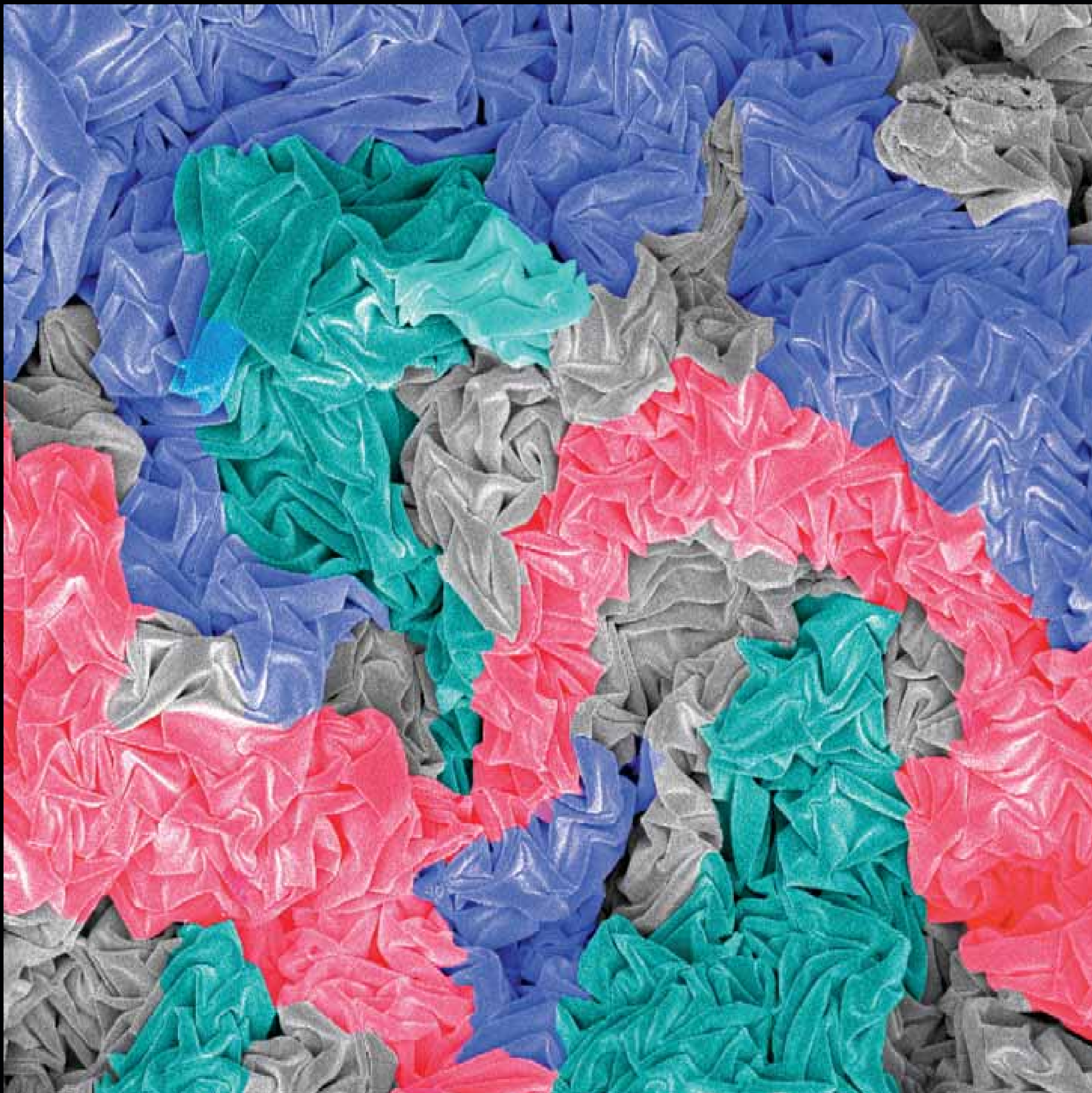

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This image shows nanoporous biodegradable elastomers that were developed using citric acid–based copolymers. The nanopores in these materials facilitate the entrapment and slow release of macromolecular therapeutics. This image from a scanning electron microscope depicts the nano- and microarchitecture of the elastomer prior to pore collapse. Image courtesy of Guillermo Ameer, associate professor of biomedical engineering, and Ryan Hoshi, PhD student in biomedical engineering.

To learn more about Ameer's research, see the story on page 24.

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