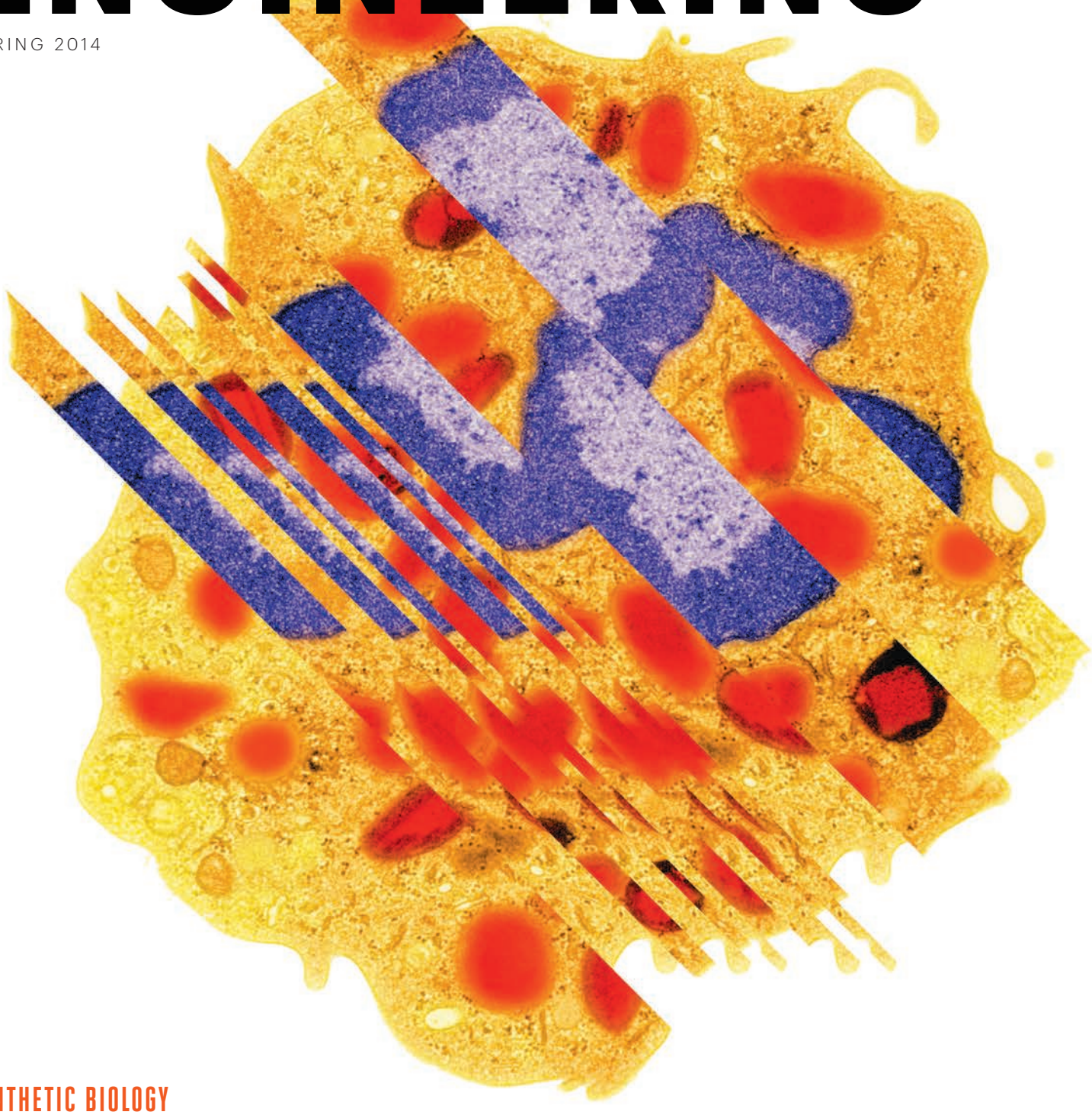
McCormick School of Engineering and Applied Science

NORTHWESTERN ENGINEERING

SPRING 2014



SYNTHETIC BIOLOGY

REPROGRAMMING THE CODE OF LIFE

MCCORMICK STUDENT HITS THE GLOBAL STAGE

When senior David Harris studied abroad in China to perfect his Mandarin, he didn't expect to become a singing, guitar-playing sensation on some of the country's most popular TV competitions. But Harris, a double major in industrial engineering at McCormick and in Mandarin Chinese in the Weinberg College of Arts and Sciences, has tried out for and won spots on several Chinese talent shows, including *Xing Guang Da Dao*, similar to *American Idol*, and *Huang Jin 100 Miao* (pictured). On that show, which is similar to *America's Got Talent*, Harris earned second place. After he returned from studying abroad, Harris continued to fly back to China to perform. "Luckily my teachers have been very understanding, but it's not easy," he says. "The jetlag is the hardest part."

"One of the great things about being part of a university—and particularly a school of engineering—is that you are surrounded by both the ideas and the people that will shape our future."

JULIO M. OTTINO DEAN OF THE MCCORMICK SCHOOL

GREETINGS FROM MCCORMICK

One of the great things about being part of a university—and particularly a school of engineering—is that you are surrounded by both the ideas and the people that will shape our future.

Synthetic biology is a good example. The field has emerged only within the past decade, enabled by breakthroughs that have opened new possibilities. Now we have the tools to rebuild cells to work for us—from solving energy problems to fighting against disease. We have made an investment in synthetic biology, hiring five professors who each connect with different disciplines across campus. It is difficult to know which ideas and technologies will ultimately triumph, but such is the nature of innovation.

The future also belongs to data. Large datasets are now available in nearly every part of our lives, and being able to cull information from them, understand that data, and use it to effect change is an essential skill we teach our undergraduates. When students get to use these skills to help optimize a complex event like the Chicago Marathon, it shows them how to use tools in real, often intense situations. Partnerships like these also provide a way for professors like Karen Smilowitz and Sanjay Mehrotra to continue their work in humanitarian logistics, creating models that will ultimately help make our world safer, and, when disasters do happen, help us to respond better.

You might notice a new look for our magazine. We have long been proud of this publication, but in the spirit of constant improvement we hope our new design better communicates the innovative work of our faculty and students. We are also dedicating more space to highlight some of our excellent alumni. They end up all over the world, in every industry, and we are glad to feature the impactful work that they do and learn how lessons from McCormick apply to their careers.

Lastly, we are excited to announce the launch of **We Will. The Campaign for Northwestern.** This ambitious fundraising campaign will enable Northwestern to achieve its bold vision, and provide the resources for the McCormick School to educate the next generation of whole-brain leaders and conduct path-breaking research that will drive us forward. I thank the many alumni who have already stepped up to support our efforts.

As always, I welcome your feedback.

Julio M. Ottino
Dean, McCormick School of Engineering and Applied Science

On the Cover

With such ambitious goals as helping cure cancer and eradicating pervasive disease, some of the most talented scientists in the country from the emerging field of synthetic biology are breaking new ground at Northwestern University.

Read more on page 14.

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McCormick
Northwestern Engineering

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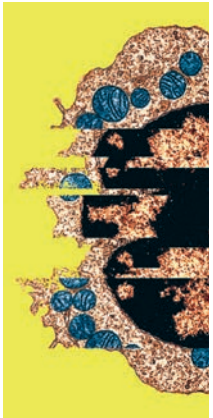

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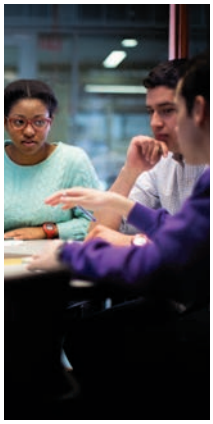

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SPRING 2014

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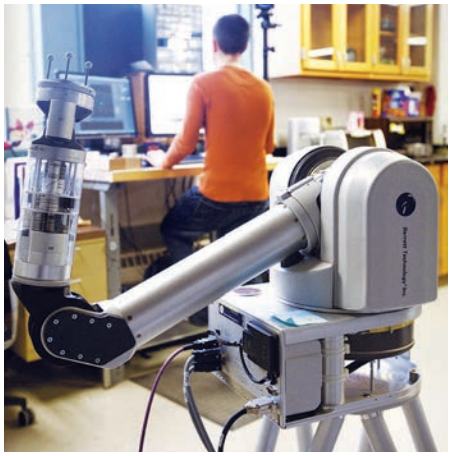


NEW MASTER'S PROGRAM IN ROBOTICS

Beginning fall 2014, McCormick will offer a master of science in robotics degree, an interdisciplinary program designed to prepare college graduates for careers as robotics engineers.

The full-time, one-year program will draw on McCormick's strengths in mechanical engineering, biomedical engineering, mathematics, electrical engineering, and computer science to provide promising graduates the skills they need to succeed in the cutting-edge fields of robotics and artificial intelligence. Course subject areas will include automatic control, kinematics and dynamics, machine learning, path planning, human-machine interfaces, biomedical engineering, neuroscience, robotic rehabilitation, and prosthetics.

Students will have the opportunity to participate in a diverse set of robotics research projects with faculty from all over Northwestern, including the Neuroscience and Robotics Laboratory, a world leader in robotics, haptic interfaces, and biomedical engineering.

"ROBOTICS IS AN INCREDIBLY FAST-GROWING FIELD, AND THE JOB OPPORTUNITIES FOR GRADUATES IN ROBOTICS ARE RAPIDLY EXPANDING."

TODD MURPHEY DIRECTOR OF THE MASTER OF SCIENCE IN ROBOTICS PROGRAM

"I LOVE HAVING ALL TEAMS IN ONE SPACE INSTEAD OF SPREAD OUT ACROSS MULTIPLE SPACES." **MICHAEL MARASCO**

New studio for collaborative design

Northwestern engineering, design, and entrepreneurship students seeking an environment ideal for collaboration now have a new option: the Design Studio in the Ford Motor Company Engineering Design Center.

The 1,700-square-foot, glass-paneled room provides classroom space for Northwestern's Segal Design Institute, Farley Center for Entrepreneurship and Innovation, and the MMM and Master of Product Design and Development Management programs. When not in use for classes, the studio (Ford 1.230) becomes a collaborative workspace for Northwestern students, faculty, and staff. Moveable tables accommodate group work in various configurations, providing an improved learning experience for students in fields that emphasize collaboration.

"All our classes leverage team learning highly, but traditional classrooms don't allow teams to effectively work together," said Michael Marasco, clinical professor of industrial engineering and management sciences and director of the Farley Center. "We can now seamlessly transition from class discussion to team meetings in the same space. Even when we fully pack the studio space, students still prefer it to a tiered classroom. I love having all teams in one space instead of spread out across multiple spaces."

McCormick a Leader in Multimillion-Dollar Lab

A $70 million federal grant awarded to UI LABS, a Chicago-based consortium of researchers that includes Northwestern faculty, will help position Chicago as a national hub for digital manufacturing and bring cutting-edge research and innovation opportunities to the Northwestern University community.

The goal of the five-year, U.S. Department of Defense (DoD) grant is to re-invigorate U.S. manufacturing, create new jobs and economic development, and spur future innovation through the Digital Manufacturing and Design Innovation (DMDI) Institute. Combined with an expected $250 million in additional funding from 40 industry partners and some 30 academic, government and community partners, including 23 universities, the project will fund the DMDI institute with $320 million in all.

The research for this project will be centered at a new space called the Digital Lab, under the direction of UI LABS. The Digital Lab will be the nation's flagship research institute for digital manufacturing and design innovation, applying cutting-edge technologies to reduce the time and cost of manufacturing, strengthen the capabilities of the U.S. supply chain and reduce acquisition costs for DoD.

Kornel Ehmann and Jian Cao, professors in the department of mechanical engineering and globally recognized leaders in manufacturing, will provide technical leadership to the Digital Lab, which has three major technical thrust areas: advanced manufacturing enterprise, intelligent machines, and advanced analysis.

The Digital Lab will establish new projects on applied research with industrial partners and course development and workforce development through a competitive process. This provides opportunities for Northwestern faculty members to become involved in their areas of interest.

Digital manufacturing is the use of an integrated, computer-based system that uses simulation, three-dimensional (3D) visualization, analytics, and various collaboration tools to create product and manufacturing process definitions simultaneously.

© City of Chicago

THE GOAL OF THE FIVE-YEAR, U.S. DEPARTMENT OF DEFENSE GRANT IS TO RE-INVIGORATE U.S. MANUFACTURING, CREATE NEW JOBS AND ECONOMIC DEVELOPMENT, AND SPUR FUTURE INNOVATION THROUGH THE DIGITAL MANUFACTURING AND DESIGN INNOVATION INSTITUTE.

PROGRAM TO WATCH

McCormick's Department of Biomedical Engineering is helping Nigerian universities set up biomedical engineering curricula, invent medical devices, and ultimately grow their medical projects industry.

STUDENTS AUTHOR BOOK

Undergraduate students worked together to write *Remarkable Natural Material Surfaces and Their Engineering Potential*, a 13-chapter book published this spring. Chapters focus on areas like the antibacterial properties of shark skin and the hydrophobic properties of rice leaves.

TEAM ADVANCES TO 2014 WORLD FINALS

A Northwestern undergraduate team captured first place honors in the Association for Computing Machinery (ACM) 2013 International Collegiate Programming Contest (ICPC), advancing to the 2014 ACM–ICPC World Finals in Russia in June 2014. The international competition, which tests students' algorithmic thinking and programming skills, will bring together 80 top teams from around the world.

The November 2013 regional contest at the University of Chicago drew 139 teams from five states. Within a five-hour timeframe, teams of three students were challenged to write programs for eight complex, real-world problems and to produce a correct result within the computing time limit, usually between 1 and 60 seconds. Team Wildcats, comprising students Ed Kim, Zeyu Wang, and Siyuan Cai, was the only team to solve all eight problems.

Photograph courtesy of NASA

108,349

total enrollment in McCormick's first three Coursera courses

102%

increase in applications to McCormick over five years

>300%

increase in computer science course enrollment over five years

Riding the Vomit Comet

Five Northwestern undergraduates got the chance to "experience" space flight and conduct scientific experiments in zero gravity like astronauts without ever leaving Earth's atmosphere. Their spacecraft? NASA's famous "Vomit Comet."

The students, along with a two-person ground crew and an alternate flyer, are part of the Northwestern University Microgravity Team (NUMT), one of 18 teams selected to participate in this year's NASA Reduced Gravity Education Flight Program. The team includes three McCormick students.

The students used the flight to conduct biomedical research on how space travel affects bones. NASA uses a modified Boeing 727–200 aircraft to fly parabolas at high altitudes, creating short periods of zero gravity that simulate the weightlessness of space flight. The team hoped their experiment would provide some insight into why human bones become weaker in space.

"AS A CHEMICAL ENGINEERING MAJOR, WORKING ON THIS PROJECT HAS BEEN A PUSH AND PULL FOR TIME, BUT EVERY MINUTE IS ONE THOUSAND PERCENT WORTH IT."

KAT DHIANTRAVAN A MCCORMICK SOPHOMORE AND MEMBER OF THE NUMT TEAM

"EVERYBODY SAYS THEY HAVE A PATENT-PENDING, CURVE-JUMPING, PARADIGM-SHIFTING, REVOLUTIONARY, ENTERPRISE-CLASS, SCALABLE PRODUCT. EVERYBODY SAYS THAT. TELL A STORY INSTEAD."

SILICON VALLEY AUTHOR AND INVESTOR **GUY KAWASAKI** at the Master of Engineering Management program's 35th anniversary celebration in February.

NUVENTION TEAM WINS, CONSUMERS SAVE

MeterGenius, a start-up that grew out of a NUvention: Energy entrepreneurship course, created an award-winning software platform to help homeowners and residents take control of their electricity bills. The software analyzes data from digital meters, allowing users to understand their electricity usage, learn how to save energy, and earn rewards for saving. The team, which includes three McCormick students, won $25,000 at the 2014 Clean Energy Student Challenge sponsored by the U.S. Department of Energy.

Freshman-year advisers Richard Freeman, Ken Gentry, Emma DeCosta, Janice Mejia

PERSONALIZED WHOLE-BRAIN ADVISING

Over the last year, McCormick has worked to innovate and improve freshman-year advising to help students create the best first draft of themselves.

This year, four new advisers will provide high-quality, consistent advising for all McCormick first-year students. Students will be paired with an adviser who can provide guidance on curriculum, degree requirements, study skills, and campus life. McCormick has also built and implemented a new online auditing system. The system allows staff, faculty, and students to track electronically courses planned, taken, and needed.

"THIS NEW SYSTEM WILL EMPOWER STUDENTS TO HARNESS OPPORTUNITIES AVAILABLE TO THEM, OPPORTUNITIES THAT WILL ULTIMATELY HELP SHAPE THEIR CAREERS AND LIFE TRAJECTORIES."

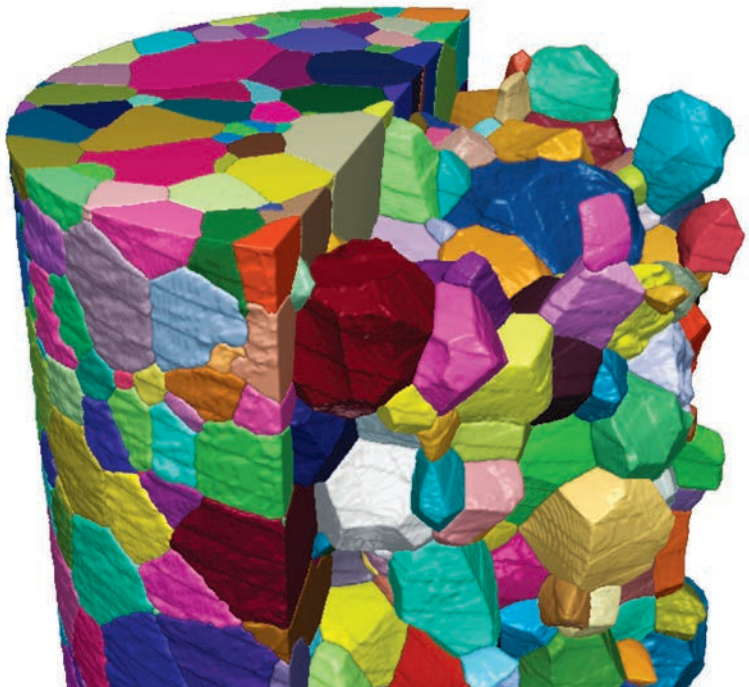
STEPHEN CARR ASSOCIATE DEAN FOR UNDERGRADUATE ENGINEERING

MMM program renews focus

The MMM program, McCormick's joint graduate program with the Kellogg School of Management, has announced it will enhance its rigorous management coursework with new courses in technology and design. The enhanced program will launch in June 2014 with the Class of 2016.

Several design innovation and technology courses will extend the degree curriculum from six quarters to seven and require an additional four credits for graduation, including classes in project management, programming design, service design, applied advanced analytics, innovation frontiers, organizing for innovation, and design of networks. Northwestern's Segal Design Institute will support many of the design-related activities.

Previously, students received an MBA from Kellogg and a Master of Engineering Management from McCormick. Now, students will receive an MBA and a Master of Science in Design Innovation. Students will continue to benefit from hands-on learning experiences inside and outside the classroom, including the capstone integration project, in which students focus on end-to-end solutions at major corporations; a studio and prototyping space; and business and design competitions. Students will also benefit from additional recruiting opportunities targeted to MMM graduates and support from an existing MMM career coach.



GRANT FUNDS NEW MATERIALS DESIGN CENTER

A Chicago-based consortium led by Northwestern University has been awarded $25 million from the National Institute of Standards and Technology (NIST) to establish the Center for Hierarchical Materials Design (CHiMaD). The new center will focus on the next generation of computational tools and experimental techniques to create novel "hierarchical materials." An example in nature of a hierarchical material is bone, a composite of mineral and protein at the molecular level assembled into microscopic fibrils that in turn are assembled into hollow fibers and on up to the highly complex structure that is "bone." Peter Voorhees, the Frank C. Engelhart Professor of Materials Science and Engineering, will codirect the center with Gregory B. Olson, the Walter P. Murphy Professor of Materials Science and Engineering, and Juan de Pablo, the Liew Family Professor in Molecular Engineering at the University of Chicago.

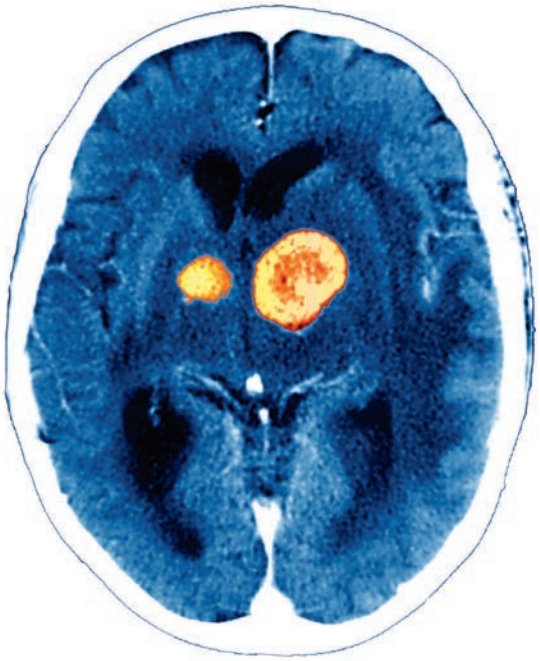
> THIS PROOF-OF-CONCEPT FURTHER ESTABLISHES A BROAD PLATFORM FOR TREATING A WIDE RANGE OF DISEASES, FROM LUNG AND COLON CANCERS TO RHEUMATOID ARTHRITIS AND PSORIASIS.
>
> **CHAD MIRKIN**

Switching off brain cancer

Glioblastoma multiforme (GBM), the brain cancer that kills approximately 13,000 Americans each year, is aggressive and incurable. A Northwestern University research team has for the first time demonstrated delivery of a drug that turns off a critical gene in this complex cancer, increasing survival rates significantly in animals with the deadly disease.

The novel therapeutic, based on nanotechnology, is small and nimble enough to cross the blood-brain barrier and get to where it is needed—the brain tumor. Designed to target a specific cancer-causing gene in cells, the drug simply flips the switch of the troublesome oncogene to "off." This knocks out the proteins that keep cancer cells immortal. The research was led by Chad Mirkin, George B. Rathmann Professor of Chemistry, medicine, chemical and biological engineering, biomedical engineering, and materials science and engineering.

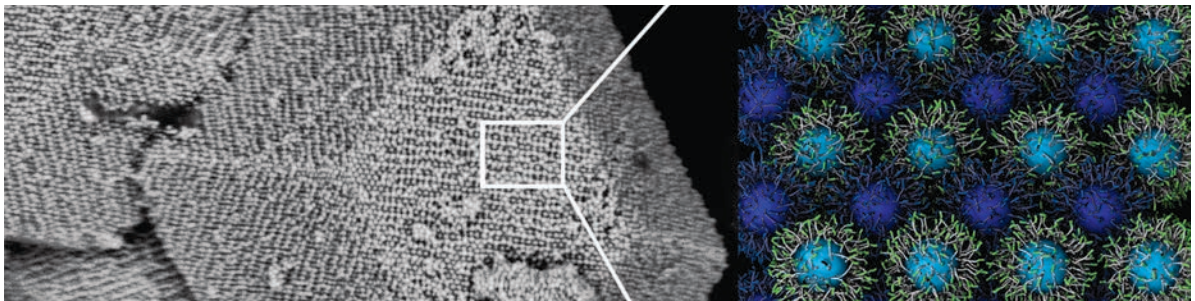
In a study of mice, the survival rate for those with GBM increased nearly 20 percent, and tumor size was reduced three to four fold, as compared to the control group. The next step for the therapeutic will be to test it in clinical trials.



THIS METHOD COULD LEAD TO NOVEL TECHNOLOGIES AND EVEN ENABLE NEW INDUSTRIES, MUCH AS THE ABILITY TO GROW SILICON IN PERFECT CRYSTALLINE ARRANGEMENTS MADE POSSIBLE THE MULTIBILLION-DOLLAR SEMICONDUCTOR INDUSTRY.

Making a gem of a tiny crystal

Nature has been building flawless diamonds, sapphires, and other gemstones for eons. Now, a Northwestern research team has become the first to build near-perfect single crystals out of nanoparticles and DNA, using the same structure favored by nature. In the Northwestern study, led by professors Chad Mirkin and Monica Olvera de la Cruz, strands of complementary DNA act as bonds between disordered gold nanoparticles, transforming them into an orderly crystal. The team worked with gold nanoparticles, but the recipe can be applied to a variety of materials, with potential applications in the fields of materials science, photonics, electronics, and catalysis.



Measuring nanojet flows

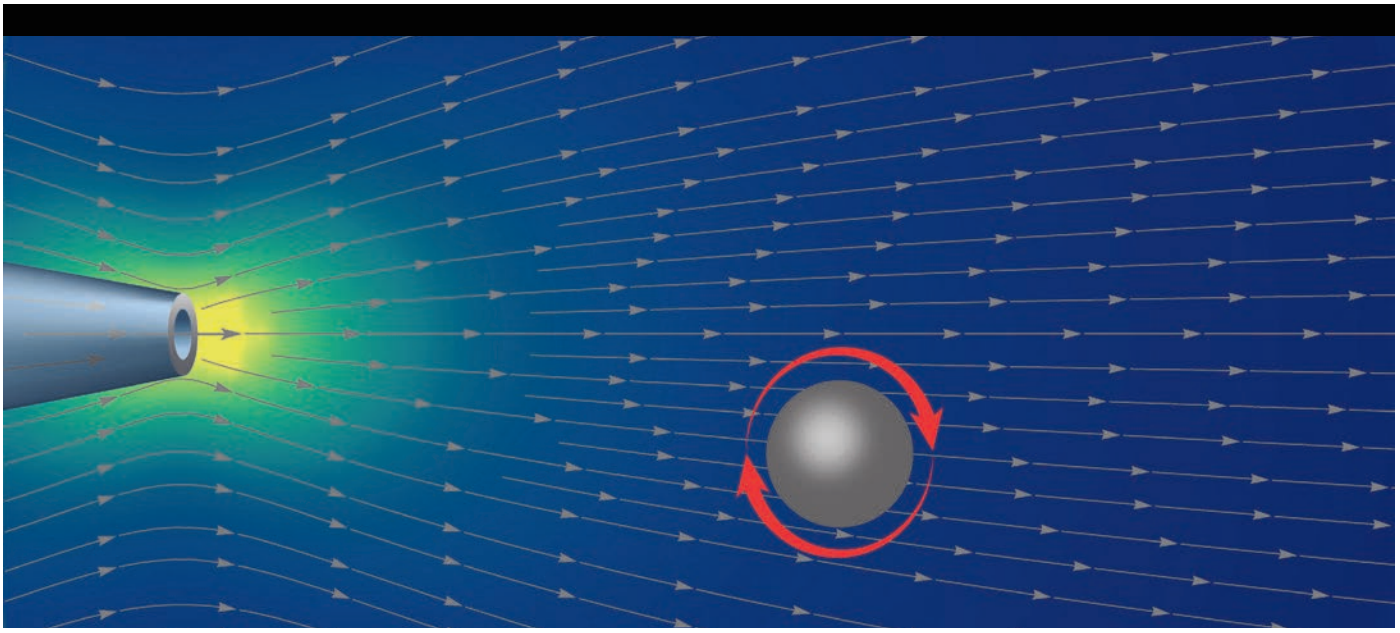
A research team including Sandip Ghosal, associate professor of mechanical engineering, created and measured flow from tiny fluid jets with diameters of 20 to 150 nanometers, the length of just a few hundred water molecules lined up in a row. The team found that the nanojets could be used as ultra-low-volume injectors for transferring biomolecules into cells or vesicles. The process, used in recombinant DNA technologies, is important in the production of human insulin and disease-resistant crops. Other possible applications include use as a "flow rectifier" in microfluidic logic circuits, the functional equivalent of semi-conductor diodes in microelectronics, and in nanoscale patterning and micromanipulation.

INSPIRING THE NEXT GENERATION

What happened when 360 girls visited McCormick labs for the 43rd annual Career Day for Girls? Watch online. bit.ly/swecareerday

RESEARCH TO WATCH

Professor Aaron Packman is working to create tools that can predict how a river's water level, course, and toxicity will change in the future. The project, called Earthcasting, combines observations in the natural environment with the development of new mathematical models.



MANUFACTURING CREATIVE DESIGN

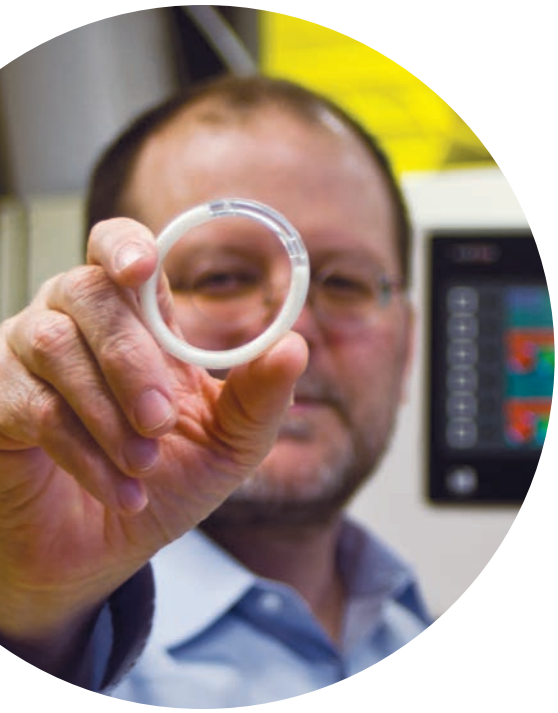
"How can we make it in a way that no others could?" That's the question Jian Cao, professor of mechanical engineering and associate vice president for research, and her group asked as they looked to develop new computer-integrated systems for stamping sheet metal.

The result? A new manufacturing system for small-volume, on-demand production called double-sided incremental forming (DSIF). In the new system, a piece of sheet metal is clamped around its edges and gradually deformed by two strategically aligned stylus-type tools that follow programmed toolpaths. The tools, one on each side of the sheet, can form concave and convex shapes as well as detailed features.

DSIF eliminates the need for geometric-specific tooling, which can cost millions of dollars and requires a special environment for storage. The new process also significantly increases the forming limit, which can lighten sheet weight and reduce scrap material.

With these advantages, DSIF is a promising process for low-volume, flexible, rapid prototyping and production of thin sheet parts. Applications include prototyping and customization in the automotive and appliance industries; providing regular production and on-site repair for civilian and military aircraft components; and possible uses in biomedical and point-of-need products.

DSIF can also reduce the cycle time from a computer-aided-design model to a finished sheet product to several days compared to the 8 to 25 weeks required using current processes. With shorter design-to-fabrication cycles plus increased formability, DSIF is expected to unleash design creativity as it moves the technology closer to consumers and designers.



WOMEN'S REPRODUCTIVE HEALTH MAY CHANGE FOR THE BETTER, THANKS TO BIOMEDICAL ENGINEERING PROFESSOR PATRICK KISER AND HIS FIRST-OF-ITS-KIND INTRAVAGINAL RING THAT RELIABLY DELIVERS AN ANTIRETROVIRAL DRUG AND A CONTRACEPTIVE FOR MONTHS.

Device prevents HIV, pregnancy

Women's reproductive health may change for the better, thanks to biomedical engineering professor Patrick Kiser and his first-of-its-kind intravaginal ring that reliably delivers an antiretroviral drug and a contraceptive for months.

Kiser's one ring delivers two drugs that do three important things: protect against HIV, herpes, and unwanted pregnancy. It will be the first device with this potential protection to be tested in women. The two drugs, delivered in controlled doses, are tenofovir (a common antiretroviral drug) and levonorgestrel (a contraceptive) for 90 days.

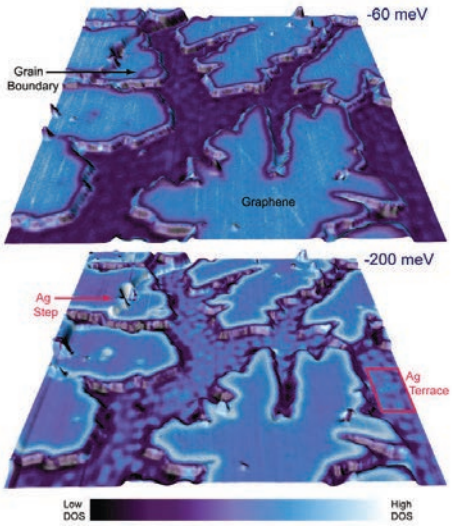
Kiser and his colleagues worked painstakingly for five years, engineering the three materials that make up the ring and optimizing the device to reliably deliver fixed and efficacious doses of two medicines over a long period of time. The ring is easily inserted in the vagina and stays in place for three months. The strength of the device stems from its unique polymer construction: its elastomer swells in the presence of fluid (such as that found in the human body), delivering up to 100 times more of the tenofovir than current intravaginal ring technologies, which have release rates that decline over time.

The antiretroviral drug section of the ring is made of one kind of polyurethane, and the contraceptive section of the ring is made of another polyurethane. Each material needed to be engineered with the correct diffusion rates to ensure the encapsulated drugs are released into the body at the desired rate, providing the correct dose. A third polyurethane material between the two sections keeps the drugs separate. All the parts are welded together to complete the ring.

The rings are currently being manufactured, and the device soon will undergo its first clinical trial.

GROWING GRAPHENE ON SILVER

Working with collaborators at Argonne National Laboratory, professor Mark Hersam has demonstrated the first growth of graphene on silver, which could advance graphene-based optical devices and enable the interfacing of graphene with other two-dimensional materials. This is seen as a vital step toward developing ultrafast graphene-based circuits.



OPTIMIZED KIDNEY DISTRIBUTION

Professor Sanjay Mehrotra's model for kidney transplant distribution was featured on FoxNews.com. Nearly 100,000 people in the United States are waiting for kidney transplants, but only 17,000 kidneys are available annually. Mehrotra's optimized distribution model could save hundreds of lives each year.

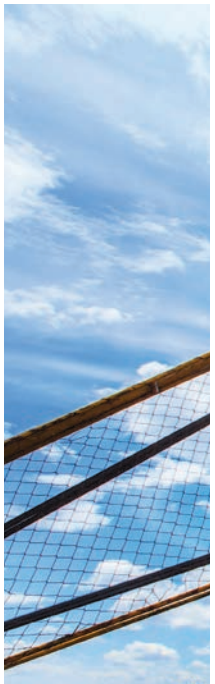
Water in carbon nanotubes moves

10,000

times faster than predicted, according to research by professor Seth Lichter. This discovery could enable carbon nanotube-powered batteries and nanocrystals for electronics.

>2 MILLION

The number of stories written by Narrative Science, a Northwestern start-up that turns data into narratives



Improving Pilots' Visibility

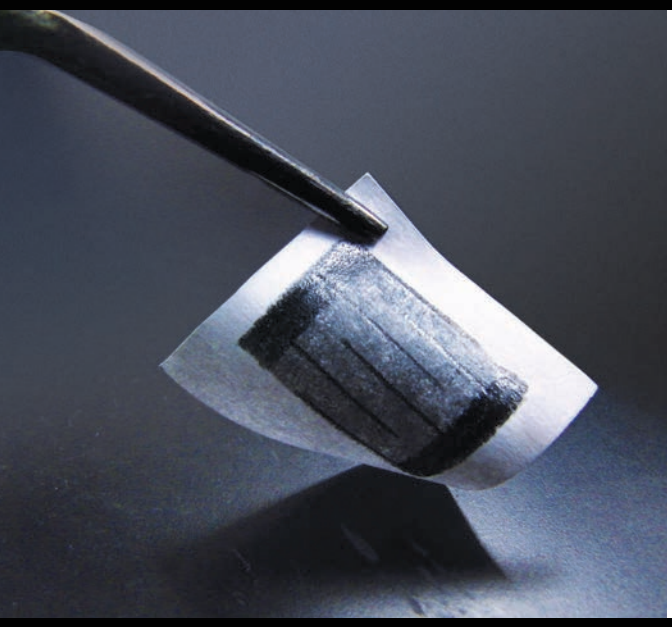
Professor uses passive millimeter-wave technology to see through poor weather conditions.

Bad weather always means problems for air travel. Conditions such as clouds, rain, and fog lessen visibility, making landing and taxiing operations difficult and sometimes extremely dangerous.

A new technology developed in Northwestern's Image and Video Processing Laboratory by AT&T Research Professor Aggelos Katsaggelos and his team has potential to improve pilots' visibility under poor conditions. Such an advance could mean fewer canceled flights and safer, more reliable air travel.

Supported by the Department of Energy and in collaboration with Argonne National Laboratory, Katsaggelos' team has developed cutting-edge technology to produce passive millimeter-wave (PMMW) images with a portable single-pixel camera. The short wavelength of PMMWs can penetrate smoke, blowing dust, fog, and clouds to create better imaging in these conditions. This stands in contrast to traditional optical systems, such as infrared imaging, which require clear atmospheric conditions for reliable operation.

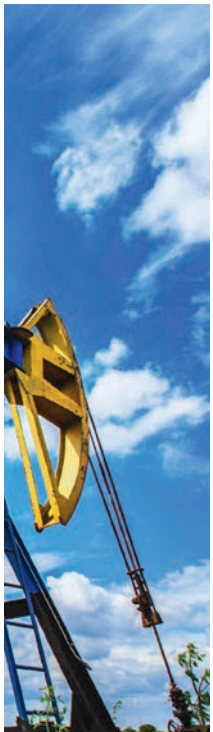
Katsaggelos' technology has potential in many other areas, including medical diagnostics and security-point inspection for concealed weapons. For example, researchers can use the technology to image the human brain to gain a better understanding of its highly complex architecture, which could help in the diagnosis and prognosis of mental conditions and brain disorders.



Undergrads get electrifying results

Sometimes solving a problem requires only a pencil and paper. Students in McCormick's Introduction to Conducting Polymers course (MSE 337) have proven that pencils and regular office paper can be used to create devices that can detect hazardous chemical vapors.

Students knew that a pencil trace on paper could conduct electricity because graphene, a one-atom thick layer of carbon that can be parsed from the graphite in pencil lead, is conductive. But what about the traces of a bendable toy pencil? (These novelty pencils are flexible because the graphite is mixed not with clay, but with a polymer binder.) With the help of Jiaxing Huang, associate professor of materials science and engineering, they found that curling the paper in one direction increased the trace's conductivity by compressing the conductive graphene particles. They also found it was affected by the presence of volatile chemical vapors, such as those from toxic industrial solvents. When the chemical is present, the polymer binder absorbs the vapors and expands, pushing the graphene network apart and decreasing conductivity. The result: the possibility of cheap chemical sensors for detecting toxic chemical vapors.



A SAFER ALTERNATIVE TO FRACKING

Although fracking—a process that uses water pressure to release natural gas from shale—has great economic benefits, it can also contaminate groundwater. Professor Zdeněk P. Bažant proposes exploring the use of the kinetic energy of high-rate shearing generated by an underground explosion to reduce the rock to small fragments and thereby release the gas trapped in rock pores. The mathematics shows it could work without contaminating groundwater.

FISH ROBOTICS

Professor Malcolm MacIver's agile fish robots were featured in February on the BBC. The robots could lead to a vast improvement in underwater vehicles used to study fragile coral reefs, repair damaged deep-sea oil rigs or investigate sunken ships. "Current underwater vehicles are large and lack agility, which means that working close to living or manmade structures is nearly impossible," says MacIver. "We've taken lessons learned from the electric black ghost knifefish about movement and non-visual sensing and developed new technologies that should improve underwater vehicles."

A FASTER SMARTPHONE

What's more frustrating than when your mobile phone connection slows down or stalls right in the middle of an important transaction or search? Fabián Bustamante, associate professor of electrical engineering and computer science, has come up with a solution—a new mobile application called Namehelp Mobile that allows users to measure and compare the performance of each domain name service (DNS) available on their smartphones. His team found that by simply choosing the "right" DNS, users could improve their web performance by up to 150 percent. Android phone users can download the app at the Google Play Store.

$3.7 MILLION

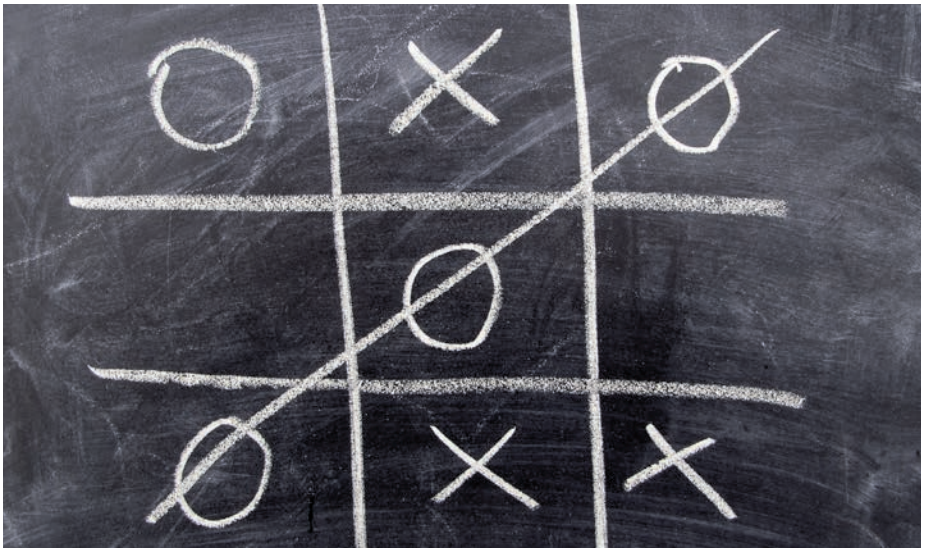
Funds received from UNITAID to support the market entry of an early infant diagnostic test for HIV developed at Northwestern.

Anti-depressant in clinical trials

Naurex Inc., a biopharmaceutical company founded by research professor Joseph Moskal to commercialize his novel molecular therapeutics, has achieved success in clinical studies of two drugs. GLYX-13, an anti-depressant that targets brain receptors responsible for learning and memory, continued in Phase 2 clinical studies to show sustained improvement for patients with difficult-to-treat depression. NRX-1074, the company's second-generation, more potent drug for major depressive disorder, will now enter Phase 2 studies after successfully completing a Phase 1 study.

Body-powered medical implants

Why not use the body's own energy to power medical implants? Yonggang Huang, Joseph Cumming Professor of Civil and Environmental Engineering and Mechanical Engineering, and his longtime collaborator John A. Rogers of the University of Illinois, developed a flexible medical implant that harvests the energy of the beating heart. Such a device could power pacemakers, defibrillators, and heart-rate monitors naturally and reliably and reduce or eliminate the need for batteries.



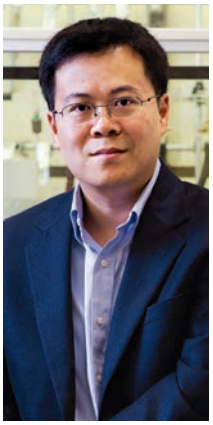
COMPUTER COMPANION

Someday we might be able to build software for our computers simply by talking to them. Ken Forbus, Walter P. Murphy Professor of Electrical Engineering and Computer Science, and his team have developed a program called Companion Cognitive Systems that allows them to teach computers as you would teach a child—through natural language and sketching.

In one line of experiments, Forbus and his team taught the Companion how to play tic-tac-toe. The user started by introducing the game using natural language, letting the Companion know it's a two-player marking game. Next the user sketched the three-by-three game board. The user introduced the idea of players by saying things like "X is a player" and drawing an X.

Game play is also described in natural language, such as "X goes first" and "X and O take turns marking empty squares." Through demonstration, the user showed the Companion how to win.

The end goal is a computer that has a rich understanding of natural language, spatial reasoning, and sketching and can be programmed with natural language rather than code.



Jiaxing Huang

Julia Weertman

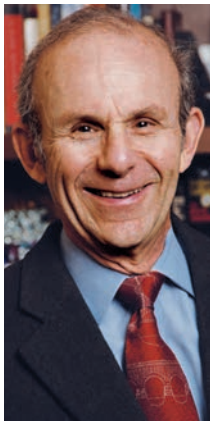
Liz Gerber

Horacio Espinosa

Katherine Faber

David Corr

Todd Murphey



David Seidman

Christopher Wolverton

Neelesh Patankar

Faculty Awards

JIAXING HUANG NAMED GUGGENHEIM FELLOW

Joining a number of global thought leaders, Jiaxing Huang, associate professor of materials science and engineering, was named a 2014 Guggenheim Fellow.

TWO PROFESSORS NAMED AAAS FELLOWS

Horacio Espinosa, the James N. and Nancy J. Farley Professor in Manufacturing and Entrepreneurship and professor of mechanical engineering, and David N. Seidman, the Walter P. Murphy Professor of Materials Science and Engineering, have been elected fellows of the American Association for the Advancement of Science (AAAS), the world's largest general scientific society.

JULIA WEERTMAN RECEIVES JOHN FRITZ MEDAL

Julia Weertman, Walter P. Murphy Professor Emerita of Materials Science and Engineering, has received the 2014 John Fritz Medal from the American Association of Engineering Societies. She was selected for her role in the understanding of failure in materials and for inspiring young women in the science and engineering fields.

KATHERINE FABER ELECTED TO AMERICAN ACADEMY OF ARTS AND SCIENCES

Katherine Faber, Walter P. Murphy Professor of Materials Science and Engineering, has been elected member of the American Academy of Arts and Sciences, one of the nation's oldest and most prestigious honorary societies.

CHRISTOPHER WOLVERTON NAMED WALDER AWARD WINNER

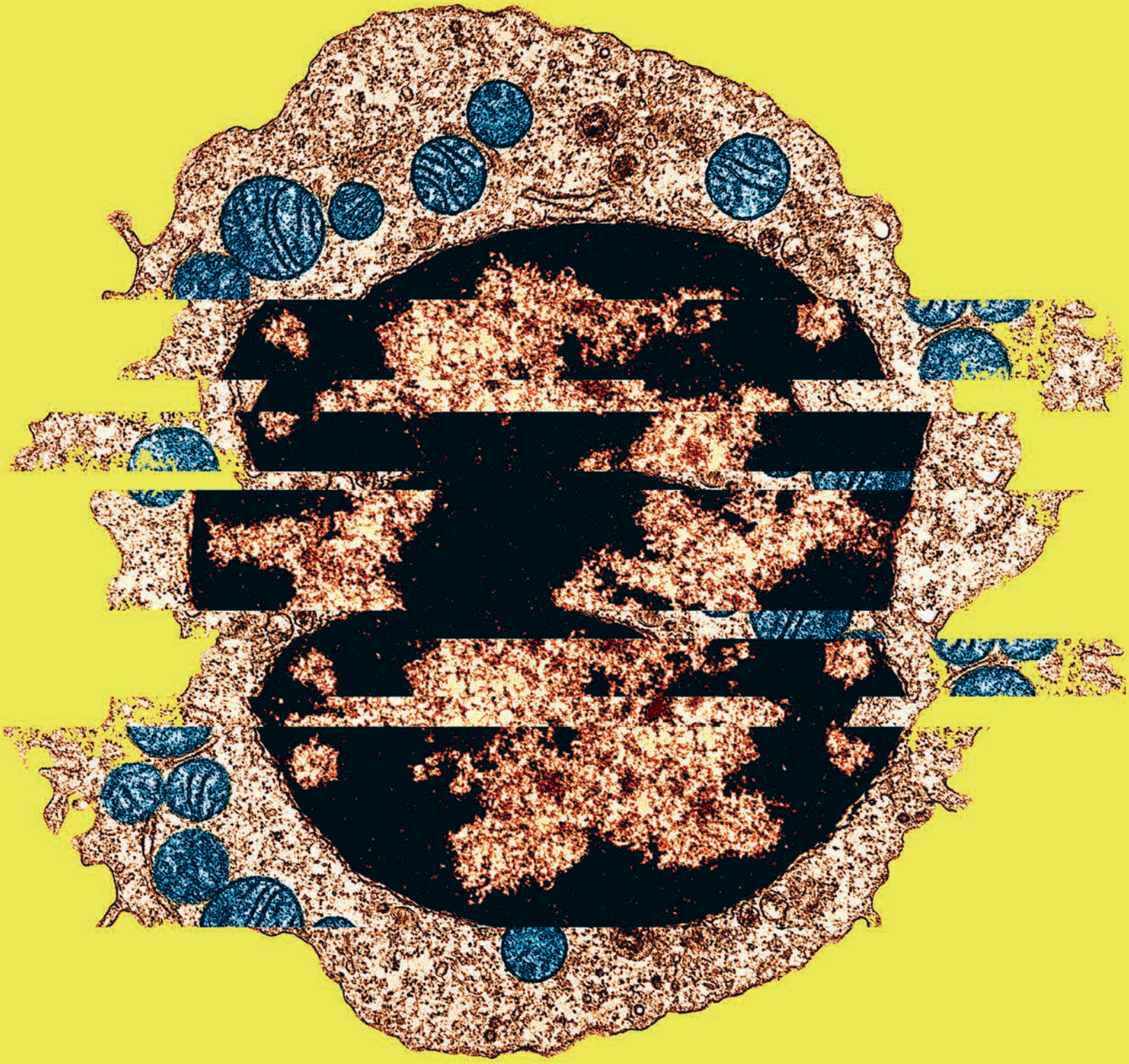
Christopher Wolverton, professor of materials science and engineering, has been named the 12th recipient of the Martin E. and Gertrude G. Walder Award for Research Excellence, an honor established by Joseph A. Walder, M.D., in 2002 and given annually by the provost.

LIZ GERBER NAMED 2014 RECIPIENT OF IEEE UNDERGRADUATE TEACHING AWARD

Liz Gerber, Breed Junior Professor of Design, received the 2014 IEEE Computer Society Computer Science and Engineering Undergraduate Teaching Award for helping create Design for America, a national network of students using design to tackle social challenges.

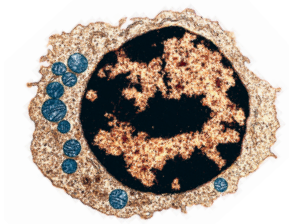
THREE MCCORMICK FACULTY RECEIVE TEACHING AWARDS

Three McCormick faculty members were honored with 2014 University Teaching Awards. David Corr, a clinical associate professor of civil and environmental engineering, was named Charles Deering McCormick Distinguished Clinical Professor. Todd Murphey, an associate professor of mechanical engineering, and Neelesh Patankar, a professor of mechanical engineering, were named Charles Deering McCormick Professors of Teaching Excellence.



REPROGRAMMING BIOLOGICAL SYSTEMS TO SOLVE BIG PROBLEMS

SYNTHETIC BIOLOGY



With such ambitious goals as helping cure cancer and eradicating pervasive disease, some of the most talented scientists in the country from the emerging field of synthetic biology are breaking new ground at Northwestern University.

The hot field of synthetic biology uses tools and concepts from physics, engineering, and computer science to build new biological systems. Newly understood genomic sequencing and advances in molecular biology, as well as the ability to work at much smaller scales, have accelerated the work. A group of five young researchers in this field includes Northwestern scientists from a range of disciplines—chemistry, biology, and engineering—working with an interdisciplinary approach to solve pressing challenges in global public health and environmental stewardship.

The scholars at the McCormick School of Engineering and Applied Science, Weinberg College of Arts and Sciences, and Feinberg School of Medicine put Northwestern on the map as a national leader in this growing area of study. Much of the research focuses on reprogramming cells by changing their DNA. In this way, researchers are working to engineer biology much as they engineer high-tech machines, creating new and environmentally friendly fuels and less expensive and more potent drugs and biological therapies. Such approaches utilize successful solutions found in nature as inspiration for designing artificial systems. These scholars also reflect on the ethical issues of the technology they employ.

"We have a newfound ability to read, write, and edit DNA, the code of life," said Michael Jewett, among the leading synthetic biologists on campus. "What synthetic biology enables us to do is analyze biological systems faster and more cheaply than ever before. In turn, engineering living systems can now benefit society in new and powerful ways. The key idea is to use our newfound abilities to make something useful, such as a new sustainable chemical or fuel, or to fight disease or improve agriculture."

Joshua Leonard, a member of this Northwestern group who focuses on integrating synthetic biology into medicine—for example, by programming immune cells to build customized cancer therapies—argues that synthetic biology will have major economic impacts, too.

"There are many signs that synthetic biology will usher in the next big technological wave, driving innovation and economic activity just as we saw at the dawn of the information age," Leonard said. "The ability to engineer living technology is simply not a capability we have had in the past, and this is a tantalizing prospect with broad-reaching potential impact."

"Synthetic biology will usher in the next big technological wave, driving innovation and economic activity just as we saw at the dawn of the information age." **JOSHUA LEONARD**

EMBRACING SAFEGUARDS, ETHICAL QUESTIONS

Despite its lofty goals and promising advances, synthetic biology has generated controversy, too, prompting President Barack Obama to order investigations into the ethical and global implications of the work. Some researchers have urged caution, fearing that scientists manipulating the DNA of living organisms are essentially "playing God" and have the ability to cause great harm to biological and ecological systems.

Laurie Zoloth, a professor of both religious studies and bioethics at Northwestern, is aware of the potential of synthetic biology for extraordinary medical research that could address terribly intractable problems as well as the potential for the powerful technology to be used in destructive ways. "This is a feature of all powerful new and transformative technologies," she said. "Using synthetic biology is like smelting iron. You can make sewing needles, and you can make spears. There is always the possibility of dual use."

What makes Zoloth interested in synthetic biology is the potential for the field to apply engineering principles to solve so many pressing human problems, such as global environmental concerns and public health crises in impoverished countries with limited access to food and medicine. At the same time, she said many skeptics are concerned that the tools of the technology could get into the wrong hands.

The main fear is rooted in one of the field's most powerful ideas—that science should be available for all. "Synthetic biology is being widely taught," Zoloth said. "And therefore, that makes it doable in very simple conditions. Unlike, for example, nuclear power, it does not need a state apparatus or complex materials, and that makes it harder to regulate. The idea is: What happens if the very thing that makes synthetic biology so exciting gets in the wrong hands, or in the hands of someone who simply makes a mistake?"

Zoloth argues that, so far, the leading synthetic biology researchers—especially those at Northwestern—are already embracing the ethical questions: a recent research grant from the Keck Futures Foundation included funding for ethics research and for a seminar series to debate the ethics of emerging technology in the field.

WORKING TO REALIZE THE PROMISE

The field has gained a lot of attention over the past several years for its potential to be a game changer for scientific breakthroughs in public health and the environment. Julio M. Ottino, dean of the McCormick School, sees great potential for Northwestern to continue building on its worldwide reputation in this field.

"At McCormick, we encourage interdisciplinary thinking, and when we put our resources behind synthetic biology, we saw a team of young researchers who are catapulting us into the highest levels of the field," he said. "Since this field is so young, we do not yet know which ideas will become game changers, but we do know this is a long-term investment, and the possibilities are enormous."

Clearly, the Northwestern scientists already are gaining traction on much of their promising research, attracting investments from such highly regarded philanthropies as the David and Lucile Packard Foundation, which awarded Jewett with its prestigious Packard Fellowship for Science and Engineering, as well as the Bill & Melinda Gates Foundation, which has awarded three separate research grants to Northwestern synthetic biologists.

Another sign of the growing interest in synthetic biology comes from undergraduate participants is the International Genetically Engineered Machine competition, or iGEM, which now attracts more than 200 teams of students worldwide, including a Northwestern team co-mentored by Leonard, Jewett, and fellow scientist Keith Tyo. For the competition, student researchers use a kit of biological parts to conceive, design, and build new biological systems that operate in living cells and may perform useful functions. Students also explore the ethical, legal, and social aspects of their research. In 2012, Northwestern's iGEM team received top honors by winning the Best Model at the Americas competition for its work developing an E. coli-based biosensor that could help detect the presence of a pathogen in hospital settings.

TAKING ON THE CHALLENGES OF HUMAN SUFFERING WORLDWIDE

The goal of the Gates Foundation grants, part of the "Grand Challenges Explorations" program, is for scientists to address some of the world's most immediate health needs, such as HIV, malaria, cancer, and tuberculosis. In fact, research funded by the Gates Foundation has already helped bring about a recent breakthrough—achieving low-cost production of a drug for treating malaria in developing countries. By producing this drug in engineered cells rather than in plants, where crop yields fluctuate dramatically from year to year, this technology is stabilizing both supplies and prices of this drug.

Tyo, among the synthetic biologists recruited to Northwestern, is a researcher on all three of the $100,000 Gates grants, one of which is a collaboration with Leonard to engineer yeast-based biosensors to serve as cost-effective, easily deployed diagnostics. In addition, Tyo is submitting an application for a $1 million Gates grant to further the yeast-based biosensors research.

JOSHUA LEONARD creates programmable therapeutics that could travel the body and selectively target cancer and other sites of disease.

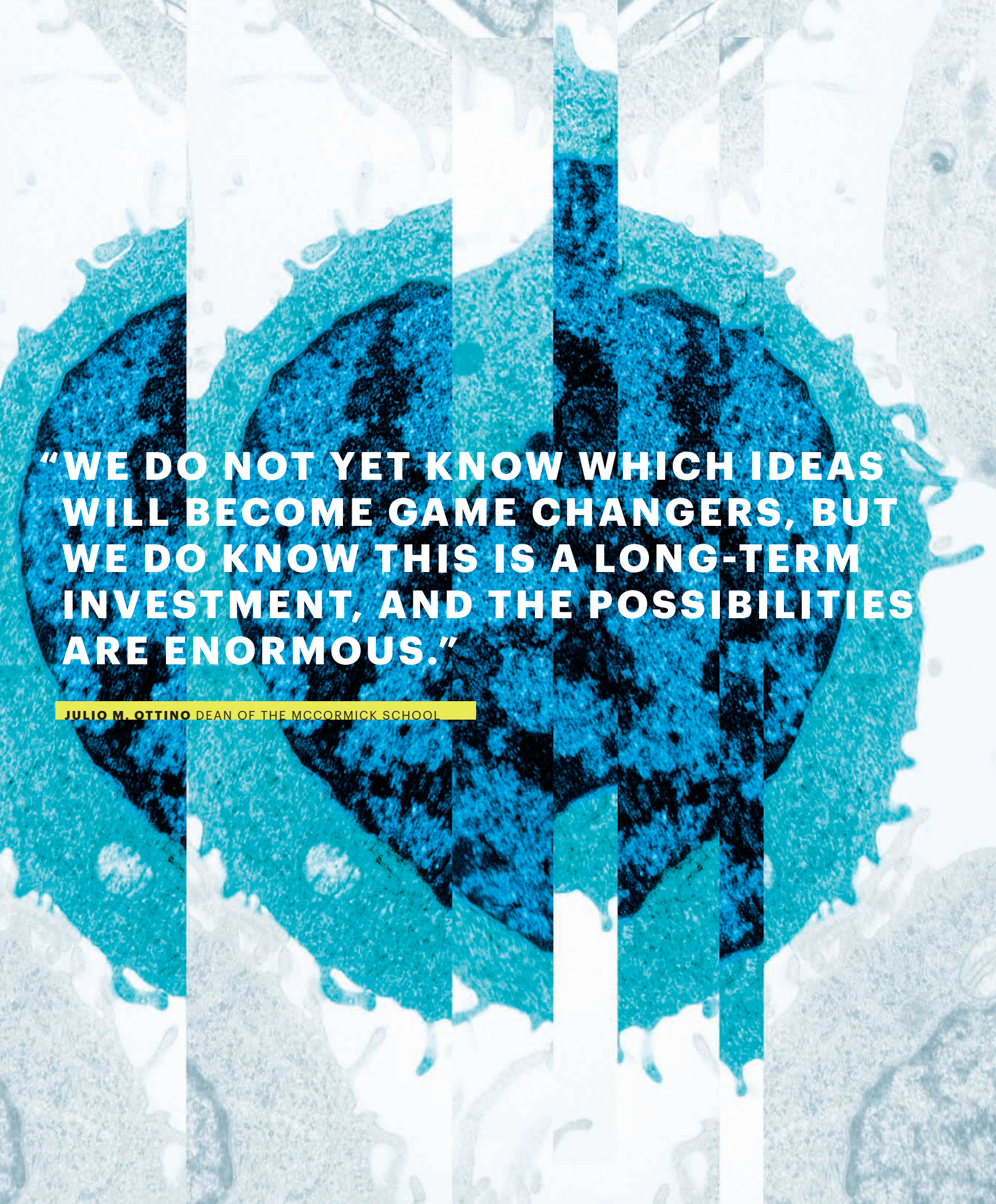
MILAN MRKSICH uses biochips to quickly detect enzyme reactions within cells, speeding up the process for finding effective drug therapies.

KEITH TYO aims to develop novel biomanufacturing processes to lower costs for sustainable fuels and disease treatment in the developing world.

MICHAEL JEWETT uses cell-free systems to create new therapies, chemicals, and novel materials for public health and the environment.

NEDA BAGHERI leads computation research that integrates network and control theory with experimental data to better understand biological function.

WHAT IS SYNTHETIC BIOLOGY? Synthetic biology uses tools and concepts from physics, engineering, and computer science to build new biological systems. Much of synthetic biology research focuses on reprogramming cells by changing their DNA. Once reprogrammed, cells can take on new, specialized purposes, such as creating low-cost biofuels or therapeutics.



"WE DO NOT YET KNOW WHICH IDEAS WILL BECOME GAME CHANGERS, BUT WE DO KNOW THIS IS A LONG-TERM INVESTMENT, AND THE POSSIBILITIES ARE ENORMOUS."

JULIO M. OTTINO DEAN OF THE MCCORMICK SCHOOL

"One of the primary things I care about in the world is alleviating suffering associated with poverty," Tyo said. "I'm specifically interested in solving technical problems, so I chose synthetic biology as a research field because of the unique and profound ways that the field can affect the resource-poor in our world."

Tyo's research tries to resolve the high cost of existing drugs for HIV and tuberculosis by using cells to synthesize these drugs more cheaply to attack those diseases. His work, with that of all the synthetic biology researchers, is generating a lot of interest from undergraduates who see the field as one of the most promising and exciting new areas of scientific research. Early this year, Tyo taught a new project-based class called Global Health and Biotechnology that attracted undergraduate and graduate students from a variety of disciplines, including chemical and civil engineers, biology majors, and computer scientists.

Tyo also is leading an initiative to train synthetic biologists on global health through internships in Nigeria and South Africa. He is challenging students to think about diseases and potential synthetic biology solutions, such as a banana that contains vaccine proteins, therefore allowing people to be vaccinated simply by eating a banana. "We also considered protein engineering and looking at how you would make therapeutic proteins that help with cancer or different blood diseases," Tyo said.

A TECHNOLOGICAL BOOST TO PHARMACEUTICAL RESEARCH

Northwestern's work to advance the synthetic biology field got a big boost after former University of Chicago scientist Milan Mrksich joined the Northwestern researchers in 2011. Mrksich is a nationally renowned biomedical engineer and chemical biologist. He's worked for years to develop a technology that measures biochemical reactions on sophisticatedly engineered metal plates, each the size of a large notecard, in an extremely fast, low-cost way.

The technology, which he dubbed SAMDI, or self-assembled monolayers desorption ionization, has been more than 10 years in the making and is generating a lot of excitement from pharmaceutical companies. Among its applications, it can allow scientists to study how proteins function and how their activities are different in a diseased organ. In that way, scientists might pinpoint whether a person is at risk for certain diseases.

At the same time, SAMDI can help identify drugs that might be effective in fighting disease much more quickly than has ever been possible. Researchers can perform 100,000 tests per day of interactions using just two people to run them. Without SAMDI, researchers would have been lucky to conduct 1,000 tests in a day.

While the drug development process can take years before winning FDA approval, Mrksich expects that his technology will lead to pharmaceutical breakthroughs in the very near future. At the same time, he hopes SAMDI also can help scientists around the world replicate his work.

"IN ORDER TO PUSH SCIENCE FORWARD AND DISCOVER ENDURING SOLUTIONS, WE MUST BE CREATIVE AND THINK OUTSIDE THE BOX. THE EASIEST WAY TO DO THAT IS TO DO WHAT WE'RE DOING HERE—TRANSFORMING OUR APPROACH BY BRINGING PEOPLE WITH DIFFERENT EXPERTISE TOGETHER TO WORK AS A TEAM."

NEDA BAGHERI

"It's really exciting," Mrksich said. "We're producing tens of thousands of protein patterns so you can really look inside a diseased cell and figure out what's gone wrong. ... Every biologist is going to want to use these arrays to see how protein functions vary."

TAILORING THERAPEUTIC STRATEGIES TO THE INDIVIDUAL PATIENT

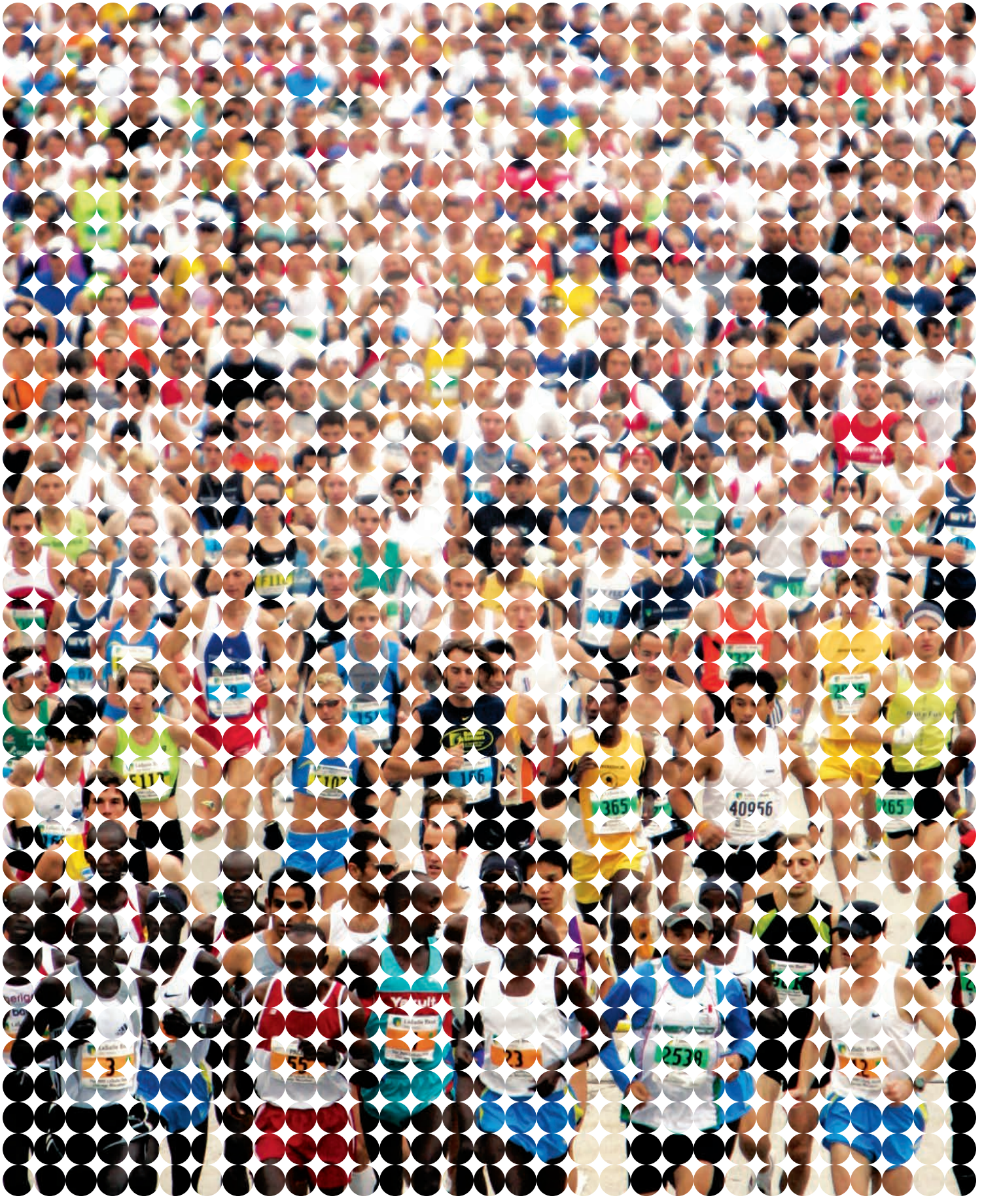
The most recent addition to the synthetic biology effort at Northwestern is Neda Bagheri, an expert in computational biology. She develops algorithms that uncover the dynamic communication blueprints of cellular systems. These algorithms are designed to predict how changes to gene or protein activity manifest into unique cellular function. In this way, her models can identify interventions, for instance, as well as therapeutic strategies to personalize patient care on an individual basis. To her, one of the most exciting aspects of the work is its collaborative and global nature, with scientists reaching out to other like-minded researchers on campus and around the world. Together, they integrate different disciplines and work to address pressing public challenges.

"Current scientific challenges are multifaceted and complex," Bagheri said. "In order to push science forward and discover enduring solutions, we must be creative and think outside the box. The easiest way to do that is to do what we're doing here—transforming our approach by bringing people with different expertise together to work as a team."

Dean Ottino agrees that the group of researchers brought together at Northwestern—and led by the work of Mrksich—clearly have the potential to make powerful contributions to the field.

"The best and most radical ideas often happen at the intersections of disciplines. James Watson and Francis Crick used their training in physics to look at biology in a new way and discover DNA," Ottino said. "Synthetic biologists work at such an intersection of disciplines, using engineering thinking to reframe biology. It is this pursuit that could change the face of medicine and energy."

MEG MCSHERRY BRESLIN



McCormick industrial engineering students learn from—and improve—Chicago's famed marathon

An Optimal Race

Karen Smilowitz, associate professor of industrial engineering and management sciences, working with students at the 2014 Bank of America Shamrock Shuffle 8K in March.

Taut, eager faces at the starting line. Ninety thousand feet pounding the pavement. The exhausted winner breaking the tape at the finish. We've all seen those pictures.

What most of us don't see at the Bank of America Chicago Marathon: the logistics. With 45,000 runners from around the world, an estimated 1.7 million spectators, and dozens of stakeholders with a variety of expectations, running a seamless event becomes a tremendous organizational challenge. Now, the experts who have worked for years to make this event a world leader in emergency preparedness and public safety are partnering with Northwestern University to teach the next generation their tools of the trade. In return, they're getting access to the bright minds of faculty and students who just might provide a few new tools of their own.

ORGANIZATION, COMMUNICATION, AND AN ENGINEER'S EYE FOR DETAIL

As part of a new partnership, faculty and students from the Department of Industrial Engineering and Management Sciences and the Feinberg School of Medicine are working with marathon organizers to observe and analyze the race's logistics plan and propose suggestions to make a great event even greater.

The bar on event management is already high at the Chicago Marathon. Thanks to a unique organizational plan, the race is recognized as global leader within the industry. Implemented in 2008 after 88-degree heat forced the cancellation of the 2007 marathon mid-race, the aptly named Chicago Model brings together dozens of interested parties, including race organizers, the mayor's office, the Office of Emergency Management, police, the fire department, state and federal agencies, medical staff, emergency workers, the Red Cross, and others in a central command center during the race. George Chiampas, assistant professor of emergency medicine at Feinberg and the Chicago Marathon's medical director, has worked with the marathon on this model for the better part of a decade and has published his research on enhancing community disaster resilience during mass sporting events.

"We've done a lot of great work, but we always strive to be better," Chiampas says. "That's what this partnership is all about. It's a great example of a university and an organization working together to share knowledge and ultimately improve a great Chicago event."

The significance of the project is not lost on the researchers involved in the new partnership, whose work began just months after the tragic 2013 Boston Marathon bombings. "People understandably are apprehensive about large public gatherings right now," said Karen Smilowitz, associate professor of industrial engineering and management sciences, who spearheaded the project with Chiampas, Sanjay Mehrotra, professor of industrial engineering and management sciences, and Jennifer Chan, assistant professor of emergency medicine at Feinberg. "Carefully planned logistics not only improve runners' experiences, but also make the marathon safer."

Having this team in close proximity, both physically and online, fosters collaboration and enables quick decision-making and response. For example, during the 2013 Bank of America Shamrock Shuffle, a shorter race at which Northwestern students collected data in April 2013, a man threatened to throw himself off a bridge along the racecourse. The race command center dispatched emergency workers and re-routed the race, and the man was safely removed from the bridge.

"It's exciting for us to work with such a prestigious program and such bright minds and be able to look at new innovations that can enhance this program even further," says Carey Pinkowski, executive race director of the Bank of America Chicago Marathon. "The ability to use this program to think outside the box allows us to continue to be a global leader in this area."

HOPE FOR THE BEST, PLAN FOR THE WORST

In October 2013, Smilowitz attended the marathon with a core group of five undergraduates, one master's student, and a PhD candidate. Their task: to learn everything possible about event operations from how organizers communicated, to the processes in place in first-aid tents, to how supplies were delivered.

"CAREFULLY PLANNED LOGISTICS NOT ONLY IMPROVE RUNNERS' EXPERIENCES, BUT ALSO MAKE THE MARATHON SAFER."

KAREN SMILOWITZ

ASSOCIATE PROFESSOR OF INDUSTRIAL ENGINEERING AND MANAGEMENT SCIENCES

"At first it was really hectic," said Christine Hsiao, a senior industrial engineering major. "But once I started looking closer, it was really interesting to see how things I had learned in class, like forecasting, could be applied, even with little things like replenishing ice and Gatorade."

Hsiao and her teammates focused on the marathon's 20 first-aid stations, particularly their system for tracking patients, which includes equipping each aid tent with a tablet computer to check injured runners in and out and monitor the care provided. The system connects all medical facilities in a shared network and provides critical data that organizers can analyze after the event to better understand what injuries to anticipate and where care is needed most.

KEEPING THEIR EYES ON THE ROAD

Other McCormick students focused on central command, the event's nerve center. Currently, marathon officials use a variety of independent systems to stay alerted to conditions on the course with vital information, such as the current number of runners, weather conditions, and first-aid and police activity being relayed frequently.

What officials lack is a central platform that provides basic, need-to-know information in a consolidated view. McCormick students took the challenge and set out to design a solution: an online portal to provide a visual "home base" for the central command.

"It's really a macro-level view of the race, with weather, live updates, and a map of the course with indicators like the location of the front-runner and the capacity of the aid stations," said Alex Van Atta, a fourth-year co-op student studying industrial engineering.

The portal serves another important purpose: a virtual location for information in case of an emergency. "By creating a central information hub, we are training people to go to a specific place for their information," Van Atta said. "If something bad were to happen, God forbid, people would know where to look."

The project has recently received funding from the National Science Foundation, and researchers hope to use what they learn to create new models that will improve medical preparedness, public safety, and security at mass events worldwide.

PLOTTING A BETTER COURSE

If the race goes smoothly, runners will hardly ever give a thought to most of these logistics—but invariably, they will have thoughts about the race course itself.

Starting in downtown Grant Park, the Chicago Marathon takes runners through 29 neighborhoods: north to Wrigleyville, through a swath of the city's West Side, and south through Chinatown and Bronzeville, before winding back to the park. This route has remained virtually unchanged for years. Graduate student Mehmet Basdere believes it deserves a fresh look.

After interviewing knowledgeable individuals and studying relevant maps, Basdere has begun to build an optimization model for course design that could later be applied to similar events in other cities. One goal is optimizing the Chicago Marathon course to ensure participants have easy access to treatment facilities in case of injury. True to his researcher's mindset, he plans to run the 2014 marathon to experience the race firsthand from the runner's viewpoint.

Satisfying the demands of all the stakeholders won't be easy, though. Race organizers want a course that minimizes turns, which can slow the pace and prevent runners from setting coveted records. The medical community insists the course cannot surround a hospital, which would hinder access to medical care by others. City officials want the course to wind through strategic neighborhoods, and emergency workers demand a safe evacuation route.

"It's a huge task with so many aspects to consider," said Basdere, who worked in airline scheduling before coming to Northwestern to study with Smilowitz and Mehtrotra. "But that's the kind of challenge industrial engineers enjoy, isn't it?"

SARAH OSTMAN

"WE'RE EXPANDING THE RANGE OF WHAT IS POSSIBLE TO EMPOWER MORE PEOPLE TO MAKE BETTER MUSIC."

BRYAN PARDO
ASSOCIATE PROFESSOR OF COMPUTER SCIENCE

MIXING IT UP

PROFESSOR BRYAN PARDO BLENDS MUSIC WITH COMPUTER SCIENCE TO CREATE NEW TOOLS FOR EXPERIENCING SOUND

FOR AS LONG AS HE CAN REMEMBER, MUSIC HAS BEEN PART OF BRYAN PARDO'S LIFE.

"I can't say there has ever been a time I wasn't interested in music," he says. "I first started learning piano at the age of four, the clarinet at 12, and the saxophone at 13. I could read music before I could read English."

Today, as a jazz musician and associate professor of electrical engineering, computer science, and music theory and cognition, he blends his twin passions for music and engineering in his teaching and research at Northwestern. While some may have trouble envisioning the intersection of the two disciplines, for Pardo it's obvious.

"I've always been drawn to the creative disciplines where the output of your effort is a thing in the world—a piece of music, a piece of software, a piece of hardware," he says. "Some people think of engineering as non-creative, but that's as far from the truth as it is possible to be. We live in a world invented, created, and designed by engineers, from the cars we drive and the houses we live in, to our laptop computers and the buttons on our clothing."

This urge to create steered him toward computer science, where Pardo was drawn to the opportunities to invent whole worlds using nothing more than a laptop.

"Building a sound mixing board in the real world requires machine shops, parts, wires, space," he explains. "Building a mixing board in software requires my laptop, my mind, and some spare time."

INSPIRED INVENTION

Pardo applies this creative approach to McCormick's Interactive Audio Lab, which uses machine learning, signal processing, natural language processing and database search techniques to make new auditory tools and interfaces. The goal of the lab's work is to facilitate creativity by looking for places where current tools don't support it, and then building new tools that do.

One of the lab's projects is Tunebot, a music search engine that helps users "name that tune" by singing a melody into the tool, which then returns a list of songs ranked by how similar they are to the one they sang.

The inspiration came from Pardo's own bad memory. "I can just about always remember the melody of a song, but I rarely remember what it's called," he says. "I figured I probably wasn't the only one with this problem, and I wasn't."

Tunebot has been used by hundreds of thousands of people and was Reason #27 on *Rolling Stone's* 2010 list of "40 Reasons to Get Excited About Music."

The Interactive Audio Lab also launched SocialEQ and Social Reverb, online tools that learn the meanings of hundreds of sound adjectives from users. Both have wide applications for hearing aids, music production, and sound design.

"They work by applying changes to sounds and asking the user to rate the changes in terms of some descriptive word, such as, 'How much warmer is the sound now?'" he explains. "So if someone complains of a 'brash' sound, we have a tool that can learn what they mean and understand how we need to change the sound to fix it."

"If people have trouble finding the song they want, we build a music search engine called Tunebot," Pardo explains. "If people have trouble working a music synthesizer, we build an easier interface called Synthassist. If people have a recording of their daughter's flute recital where someone keeps coughing, we write software called REPET that lets them remove just the coughing from the recording."

WHERE TECHNOLOGY AND CULTURE INTERTWINE

"We've just experienced a revolution in how music is disseminated," says Pardo. "Today, anyone with an Internet connection can access millions of pieces of music from across the globe at a moment's notice. But how do you find which one you want?"

The need for consumers and music makers to access the songs and tools they need leaves the door wide open for Pardo's lab.

"The old tools will still be there for those who want them," he says. "We're just expanding the range of what is possible to empower more people to make better music."

For Pardo, that music is jazz. The saxophonist and clarinetist has what *Time Out Chicago* described as a "pure tone and sweetly melodic approach." When not exploring new frontiers in sound technology, he participates in Urbana, a Brooklyn-centered composition collective that writes and records original music, combining modern jazz with influences from pointillism and other improvisatory traditions. He also leads the Balkan-influenced group Balkano and is a member of avant-jazz group Spider Trio.

Like his work in the audio lab, Pardo says music allows him to collaborate with others to create new worlds of sound.

"I like music that encourages thinking compositionally, improvisation, and interplay between musicians," he says. "For me, one of the best parts about playing music is the 'play' aspect of interacting with others in the moment. Jazz lets you explore the relationships between the freely improvised and the deeper structure of a piece."

SARA LANGEN

WANT TO BE A LEADER? FIRST, BE PART OF THE TEAM.

NORTHWESTERN'S CENTER FOR LEADERSHIP SHOWS MCCORMICK FRESHMEN HOW RIGOROUS SELF-ASSESSMENT HELPS BUILD TEAMWORK, COMMUNICATION, AND LEADERSHIP SKILLS.

For many McCormick incoming freshmen, "team" is a dirty word—and for good reason. Says Stephen Lillington, a freshman studying chemical engineering, "In high school, teamwork inevitably meant that I would end up pulling more weight than my teammates or I'd have to re-do their work. It was really frustrating."

Like it or not, even the best engineers in the world constantly find themselves fighting uphill battles if they don't know how to collaborate. People skills matter in school, on the job, with family and friends, and virtually everywhere else one's entire life.

> "We are giving them tools and self-awareness. They leave much more aware of what they don't know."
>
> **ADAM GOODMAN**

Whether they have a take-charge attitude or bristle at the thought of speaking in a group, McCormick freshmen get a new take on teamwork from a program developed by Northwestern's Center for Leadership. Integrated into the two-quarter foundational course, Design Thinking and Communication (DTC), this new program requires students to formally analyze their individual and group strengths and weaknesses in a series of assessment exercises.

"Integrating leadership and teamwork training into existing courses gets students to reflect about work they are already doing," says Adam Goodman, clinical assistant professor and director of the Center for Leadership. "We want them to extract insight from their experiences in context, where it counts."

A 360° VIEW OF LEADERSHIP

Founded nearly 25 years ago, the Center for Leadership began by offering a popular undergraduate certificate program in leadership and subsequently expanded its offerings to graduate students as well. Since the center became part of McCormick in 2010, it has emerged as a trailblazer in the integration of leadership and engineering.

Although housed within McCormick, the center offers services broadly across Northwestern. Each year, approximately 300 students complete the center's "360° Assessment," an evaluation that collects insights from professors, classmates, and others to help determine a student's leadership strengths and weaknesses. In a subsequent coaching session, participants meet with program leaders to discuss the findings and explore pathways for growth. Grounded in principles of "authentic leadership," programs like these teach students to develop their individual leadership style based on their own talents, rather than emulate a maverick CEO who's perceived as today's great leader.

EXTENDING THE CONCEPT TO TEAMS

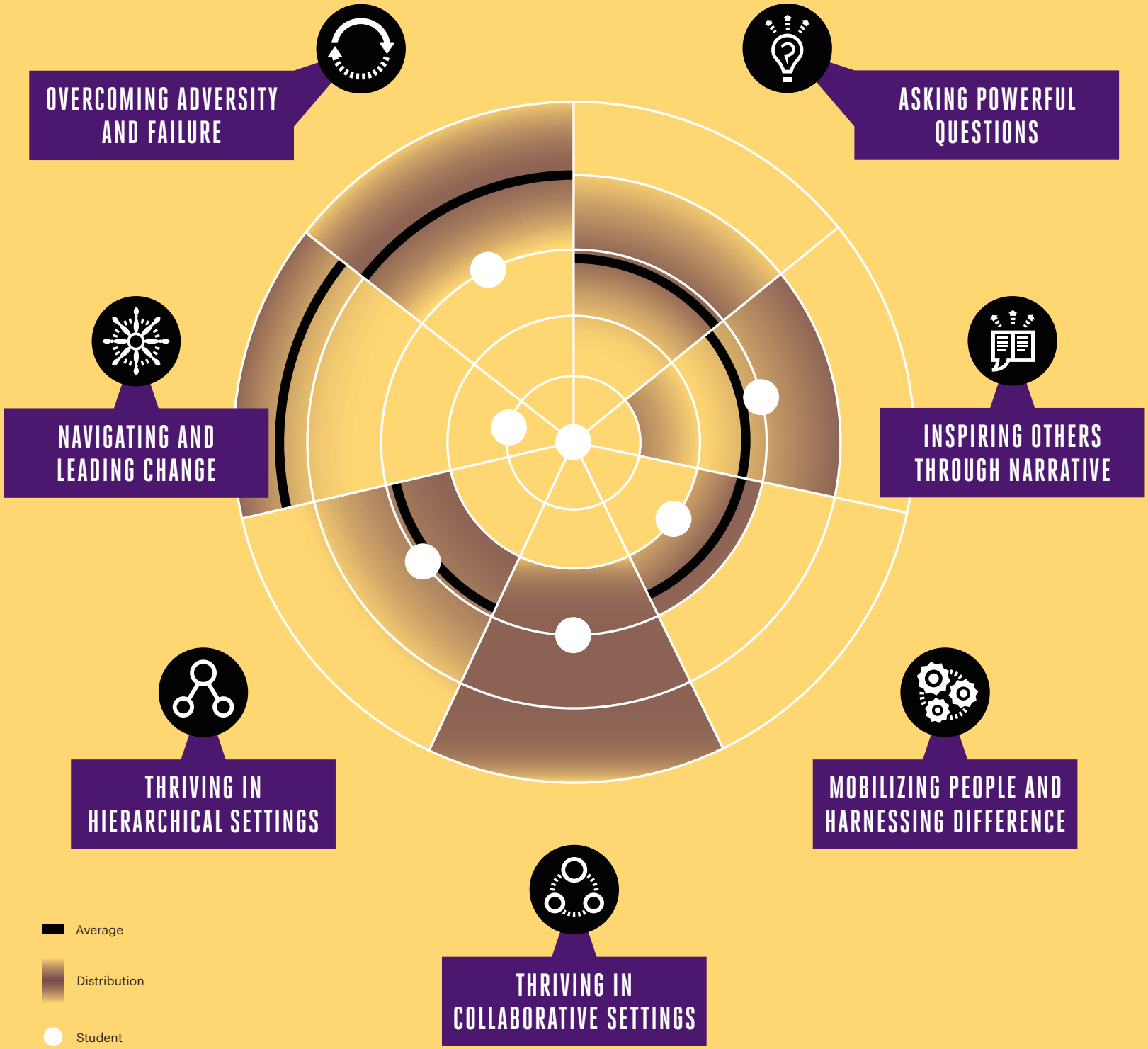
The collaborative program between DTC and the center, now in its fourth year, encourages students not only to look to their individual strengths for personal growth, but also to align them with the goals of the team. Early in the quarter, teams develop charters that lay out the mission, goals, and ground rules for their interactions. At midterms, as a group, they conduct an online survey, assessing their own work and that of their teammates. Through a frank, give-and-take team discussion of the assessments, students determine an area they want to work on in the second half of the course.

What does it take to be a leader?

The Center for Leadership has developed the "360° Assessment," an online evaluation tool that collects insights from professors, classmates, and others to help determine a student's leadership strengths and weaknesses.

Students can see how others rated them on their seven leadership assets (the closer to the outside of the circle, the higher the rating) and how their rating compares to the average rating.

Northwestern is one of the first universities to customize a tool like this for its students. The software, developed by the Center for Leadership and McCormick's Information Technology team, has already been licensed by three universities.



"THEY UNDERSTAND THEY REALLY ARE HERE TO LEARN, AND THIS IS A SAFE ENVIRONMENT IN WHICH TO DO IT." **ADAM GOODMAN**

The brutal honesty that such conversations require could make for a harrowing experience. After all, who wants to be told they monopolize conversations or dominate decision making? The results, however, are rarely devastating. "Students aren't as fearful of this conversation as you might think they'd be," Goodman says. "They understand they really are here to learn, and this is a safe environment in which to do it."

Student Elizabeth McTighe approached her group project with some skepticism, but found creating a charter especially helpful. "It was nice to know that if you broke the rules, no one was going to get mad at you, but you were going to be held accountable," says McTighe, whose group created a special timer to help improve dental hygiene at a residential home for people with developmental disabilities. "It gave us a non-confrontational way to talk to each other." To curb tardiness, her group agreed that anyone who showed up late to a meeting had to bring food for the group next time; the rule was broken only once.

The Center for Leadership program can also give faltering students a second chance, according to Bruce Ankenman, Charles Deering McCormick Professor of Teaching Excellence in Industrial Engineering and Management Sciences and co-director of the DTC program. "For me, that is the greatest outcome," he says. "A student can step back at the mid-term evaluation and say, 'You're right, I do tend to interrupt people. I need to work on that,' and they have time to improve."

CONTINUOUSLY IMPROVING THE PROCESSES

The DTC assessments are conducted on a proprietary online portal, which collects students' data and tracks their progress; instructors can also view the data. The system, developed by McCormick's Information Technology team and based on research conducted at the Center for Leadership, is attracting widespread attention inside and outside the University. Northwestern's Innovation and New Ventures Office is commercializing the software, and three universities—Georgia Tech, Texas Tech, and Claremont McKenna—have already licensed it. That number is expected to double in the next year. Other Northwestern disciplines ranging from entrepreneurship to journalism have begun using the software as well.

In the meantime, Goodman and his team continue to improve the process. Data from previous courses have shown that the ratings that teams and individual students give themselves on their mid-term assessments accurately predict how well the team will fare in its final project. "We can actually tell when a team is likely to fail," Goodman says, "and we can use this data to help faculty intervene and guide them while there is still time for improvement." Later iterations of the portal will feature a dashboard with an indicator that signals yellow and red when a team is at risk for failure.

The next step is a module that pulls together data from each student's teamwork assessments, as well as other leadership assessments from the portal, so students can see the trajectory of their leadership and teamwork development over time and also how it compares to the entire population of students.

Gaining knowledge about oneself is the first step in improvement, but it's not everything. "We are a launching pad, not a factory," Goodman says, referring to the system's role in student development. "We are giving them tools and self-awareness. They leave much more aware of what they don't know."

SARAH OSTMAN

Farley Fellows on the rewards and risks of entrepreneurship


Ed Colgate


Vadim Backman


Joseph Moskal


Greg Olson


Michael Peshkin


Larry Birnbaum


David Mahvi


Chad Mirkin


Milan Mrksich

AN INSPIRING FATHER.
THE INSPIRATION OF FATHERHOOD ITSELF.
A PASSION TO IMPROVE THE LIVES OF OTHERS.

The motivation for making the leap from engineer to entrepreneur takes many forms. Even more numerous are the challenges and pitfalls the engineer-cum-entrepreneur encounters on the road to success.

One thing the Farley Fellows, those entrepreneurially minded Northwestern faculty members who advise McCormick's Farley Center for Entrepreneurship and Innovation, agree on: taking that difficult path has proven worth the effort. All 11 fellows have either founded companies or play key roles in significant entrepreneurial efforts and draw on their insight and experience as they mentor students and lead by example.

While student entrepreneurship has been growing at McCormick for years, more and more faculty are turning their research innovations into commercial success. McCormick faculty founded nine start-up companies in just the past year. In fact, McCormick researchers made up nearly half of the total issued patents and total invention disclosures at Northwestern in 2013.

Recently, a group of Farley Fellows shared their collective wisdom on becoming entrepreneurs, finding investors, and building a business team. They also acknowledge that as hard a bump as failure can be, it is often a necessary detour on the road to success for the entrepreneur.

I came to biomedical engineering because I wanted to make a positive impact on medicine. For that to happen, technologies have to be delivered to patients. Big corporations aren't going to do it; that's not their model. I realized I couldn't sit around waiting for someone else to bring my ideas to life. It had to be me.

VADIM BACKMAN Professor of biomedical engineering and founder of two biomedical device companies: BioOptics LLC, which develops fiber-optic technology to identify patients at high risk for colorectal cancer, and Nanocytomics, which develops nanocytology technology for early cancer detection.

"I REALIZED I COULDN'T SIT AROUND WAITING FOR SOMEONE ELSE TO BRING MY IDEAS TO LIFE. IT HAD TO BE ME." **VADIM BACKMAN**

Why become an entrepreneur?

"Instead of starting directly from curiosity, I look at the world and see a problem that really needs to be solved."

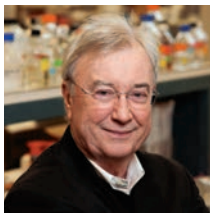
ED COLGATE

With my daughter's birth in 1982, I suddenly felt an urge to contribute to society. I started to think seriously about creating technology. I knew I needed to start a company to market the design technology I developed, but I didn't know how. That's still true. I'm not really interested in business. I'm interested in enterprise. It's a way to get my technology out in the world.

GREG OLSON Professor of materials science and engineering and founder of QuesTek Innovations, a new-materials design company in integrated computational materials engineering. Olson recently sold half of his company to a Silicon Valley electronics company.

My father is a chemistry professor. He took a hiatus from research mostly so he could pursue his entrepreneurial ideas. Along with our neighbor, he developed a sprayer for garden chemicals. His influence, along with my own experience in starting my first company, has strongly colored my approach to research. Instead of starting directly from curiosity, I look at the world and see a problem that really needs to be solved.

ED COLGATE Professor of mechanical engineering and co-founder of Tangible Haptics, a company that brings haptic technology to touchscreens; Kinea Design, a leader in human/robotic collaboration technology for physical therapy; and Cobotics, Inc., which commercializes collaborative robots. Stanley Assembly Technology purchased Cobotics in 2002.



The business team carries the day—not the science. The scientists can be brilliant and build the foundation, but it's the business team that knows how to craft the plan. I've been doing this for 35 years, and the company has only blossomed in the past three. Persistence is an unbelievably important quality. Never give up.

JOSEPH MOSKAL Professor of biomedical engineering and founder of Naurex, a drug discovery company that develops therapies for difficult-to-treat depression and other central nervous system diseases, and now has two rapid-acting antidepressants in clinical development.

Persistence is an unbelievably important quality. Never give up.

JOSEPH MOSKAL

How do you build a business?

"IT'S VERY IMPORTANT TO DO YOUR RESEARCH."

CHAD MIRKIN

It's very important to do your research. That's the biggest challenge a new entrepreneur faces: they talk to an investor, and the investor says, "This is the way we do things. This is the way we always do things." That's baloney. Every deal is different. It depends on the investor, the time, the people, the technology, and how badly they want it.

CHAD MIRKIN Chemistry professor and founder of four start-ups, which include NanoSphere Inc., a manufacturer of diagnostic equipment that uses nanotechnology principles to test for medical conditions, and AuraSense Therapeutics, a biotechnology company that commercializes spherical nucleic acid constructs as gene regulation and modulation agents for diseases.

I'm glad I never asked my friends or family for money. If you make money, they gladly take the profit. But if you lose money, you never hear the end of it. Also, larger investors often don't want to be involved with a whole bunch of small investors. Grants are the best, of course.

MICHAEL PESHKIN Professor of mechanical engineering and co-founder of Tangible Haptics, a company that brings haptic technology to touchscreens; Kinea Design, a leader in human/robotic collaboration technology for physical therapy; and Cobotics, Inc., which commercializes collaborative robots. Peshkin's first company, ZKAT, which later became MAKO Surgical, developed image-guided surgery and was recently bought by Stryker for more than a billion dollars.

How do you deal with failure?

Failure: you have to learn to define it differently. A company closing is not a failure. Most every entrepreneur fails a number of times before hitting it big. Failure prepares you to be successful. It gives you the experience to raise money for the next company.

MILAN MRKSICH Professor of biomedical engineering and chemistry and co-founder of Arsenal Medical, Inc., a medical devices company that has a stent product in medical trials, and SAMDI Tech, an early-stage technology company based on Mrksich's new platform for analyzing biochemical reactions.

"When you fail, it's actually liberating. Once you fail and you see that it's not all that painful, you say, 'Yeah, I can do that again.'"

LARRY BIRNBAUM

When you fail, it's actually liberating. Once you fail, and you see that it's not all that painful, you say, "Yeah, I can do that again." The first failure is the hardest, but you learn so much, it's not a waste of time. The bigger question is: How can we change the culture to be not just "failure forgiving" but more "failure celebrating"?

LARRY BIRNBAUM Professor of electrical engineering and computer science and co-founder of Narrative Science, which extracts insights from pools of data, turning it into stories. Narrative Science recently launched Quill Engage, a free app that interprets Google Analytics into narrative-style reports.

Is it all worth it?

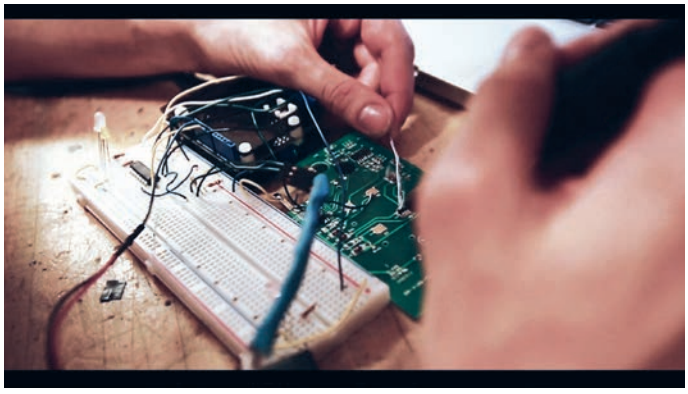
The cool thing, from my standpoint, is to develop something that's actually used in patient care. That's the clinician's ultimate goal and the ultimate prize. If you can develop something that helps someone else, then you've pushed the ball down the road a little bit farther.

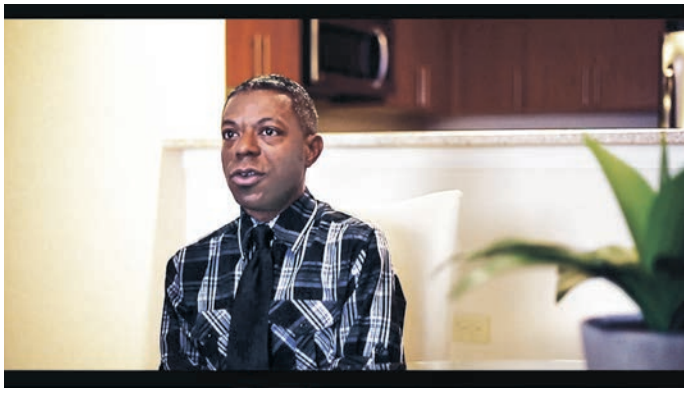
DAVID MAHVI Professor of surgery and co-founder of Medical Engineering Innovations, which commercializes new, more effective technologies to fight liver cancer. Mahvi is also a mentor to BriteSeed, a medical start-up that developed SafeSnips technology for surgical cutting tools.

"IF YOU CAN DEVELOP SOMETHING THAT HELPS SOMEONE ELSE, THEN YOU'VE PUSHED THE BALL DOWN THE ROAD A LITTLE BIT FARTHER."

DAVID MAHVI

ILLUMINATING SOLUTIONS





When student team members learned about the dangers of nighttime falls for older adults, they designed a bright new tool that could potentially save lives.

WATCH THEIR STORY AT BIT.LY/LUNALIGHTS

Matthew Wilcox understands the terrifying nature of falls: He has watched more than one of his grandparents struggle after experiencing one. Not only did they endure long hospital stays and grueling physical therapy sessions, they experienced long-lasting emotional trauma.

"It made them feel like they were getting old," recalls Wilcox, a senior in mechanical engineering. "And that was depressing for them. They lost their confidence."

Wilcox's grandparents' experience is not unusual. According to the Centers for Disease Control, one in every three adults aged 65 or older will fall each year. For that same age group, falls are the number one cause of death and injury. And after an older adult falls, the chances of falling again increase significantly.

While walkers and wheelchairs might be associated with the loss of independence, Luna Lights is unseen by others, eliminating the stigma users might feel for being "old."

"We wanted to create an invisible, seamless solution that people wouldn't have to interact with," Wilcox says. "Luna Lights allows people to be safe without compromising the way they are already living."

With help from students in a mechanical engineering design course, the team created several prototypes to present to The Mather. Residents tested the product and found that at less than a half-millimeter thick, the pressure pad felt undetectable. The soft illumination of the lights was also less harsh and jarring than traditional lamps and overhead lights.

FOR OLDER ADULT SAFETY

"LUNA LIGHTS ALLOWS PEOPLE TO BE SAFE WITHOUT COMPROMISING THE WAY THEY ARE ALREADY LIVING."

MATTHEW WILCOX

So when administrators from The Mather, a retirement community in Evanston, asked a Northwestern Design for America (DFA) team how to reduce falls among older adults two years ago, team member Wilcox was excited to look for solutions to a problem that affected him so personally.

Over the summer, he worked with team members Donovan Morrison, a senior in biomedical engineering, Wesley Youman, a junior in civil engineering, Melissa Sobin (WCAS '13), and Catherine Chung (SESP '15) to find a way that they, a small team, could design a solution to a major public health issue.

"We talked to doctors and professionals and found that nighttime falls were the biggest concern for older adults," Youman says. When getting out of bed to use the washroom or pour a drink of water during the night, older adults often forget to use walkers or canes and are more likely to trip or become disoriented in the darkness.

After brainstorming several different solutions, the team developed Luna Lights, an automated lighting system to reduce nighttime falls. The system requires users to sleep on a thin, pressure-sensing pad. When the user sits up, the system uses radio frequencies to trigger a system of small, portable lights to illuminate a pathway. Unlike a traditional nightlight that glows all night, Luna Lights only turns on when it is needed, saving energy and allowing adults to sleep in complete darkness. The lights are portable and battery-operated, so there are no limitations to where they can be placed.

The product was met with much excitement from residents and their adult children. "We explained the project, and one senior said 'You mean I don't have to do anything? It just works and makes me safer?'" Wilcox says.

Last quarter the team began working with Matthew Patrick, a graduate student in mechanical engineering, to add tracking software. The software senses when a person gets out of bed and for how long. Based on a set time limit, it can send an alert to a caregiver or family member via text message if someone has been out of bed for too long, which could indicate a fall. The software can also tell if a user is sitting up in bed or merely shifting around while sleeping, so it does not trigger the lights unnecessarily.

This summer, the Luna Lights team will embark on a month-long study with six participants from Mather Lifeways. Three men and three women over the age of 65 will test the product every night. During that time, participants will keep a journal to log their experiences. After the study, the team will continue refining the product.

"We've had a lot of positive feedback," Youman says. "People have told us that they wish they could have had Luna Lights to help their parents or grandparents when they struggled with falls. That's a great motivator."

AMANDA MORRIS

WE WILL.

THE CAMPAIGN FOR NORTHWESTERN

left Northwestern donors JoAnne and Ron Willens with Professor Milan Mrksich at the Campaign launch celebration on March 14; *above* the NU Marching Band entertains the audience

NORTHWESTERN UNIVERSITY ANNOUNCES A $3.75 BILLION FUNDRAISING INITIATIVE CALLED "WE WILL. THE CAMPAIGN FOR NORTHWESTERN."

"This monumental Campaign seeks to amplify Northwestern's local and global impact in everything from breakthrough research discoveries to innovations in creative expression to preparing the global leaders of tomorrow," said Northwestern President Morton Schapiro. "We will unite as a University community to build an even better Northwestern and to address society's most critical challenges."

We Will. The Campaign for Northwestern is a University-wide, multiyear effort that will support initiatives across all of Northwestern's schools, as well as Northwestern Medicine and a range of University units and programs. Gifts will fund new and renovated facilities on the Evanston and Chicago campuses; endowed professorships; student scholarships and fellowships; laboratories and research support; new academic centers and institutes; curriculum expansion and academic program support; global initiatives; and other areas that will solidify Northwestern's position among the world's leading research universities.

The Campaign has a second goal to broaden the University's base of annual support among alumni, parents, and friends—as reflected by 141,000 donors making gifts during the campaign. A total of 85,832 donors have made a gift during the early phase of the Campaign.

Learn more about We Will. and the campaign priorities at WEWILL.NORTHWESTERN.EDU.

With **We Will. The Campaign for Northwestern**, the McCormick School is focusing on three areas where we can have the greatest impact:

RESEARCH AT THE INTERSECTION

Cancer detection, energy storage, global health technologies, complex systems, and engineering biology are areas of unique strength where we can achieve global impact. We will invest in the interdisciplinary team science that enables McCormick to produce the next big ideas that will improve lives around the world.

THE POWER OF COMPUTER SCIENCE

We envision a future in which computational expertise enhances disciplines throughout the University. Some of the biggest advances affecting medicine, energy, business, and communication will be made by computer science students and faculty. We will strengthen computer science at McCormick, expand its reach across the University, and bolster the overall research enterprise at Northwestern.

ENHANCING THE WHOLE-BRAIN EXPERIENCE

We do more than educate capable engineers—we empower our students to be whole-brain engineers. Mastery of both analytical left-brain skills and creative right-brain thinking will be essential to lead effectively in the 21st century. We will provide the widest range of rewarding experiences inside and outside the classroom that allow McCormick students to stand out and to succeed.

Professor Monica Olvera de la Cruz addresses the more than 700 alumni, leaders, and friends of Northwestern who attended the event.

Dean Julio M. Ottino, sophomore Rachel Weathered, and McCormick Advisory Council Chair Ken Porrello were among the attendees. Weathered, a biomedical engineering student and cross country athlete, spoke at the event.

McCormick Giving Report

Alumni and friends are essential to McCormick's teaching and research success. We are grateful for the support of the more than 3,800 alumni and friends who contributed in the past year. Thank you.

$25 MILLION FOR REGENERATIVE MEDICINE RESEARCH

Lou Simpson ('58), a member of the University's Board of Trustees, and his wife **Kimberley Querrey**, donated $25 million to name the Louis A. Simpson and Kimberly K. Querrey Institute for BioNanotechnology in Medicine. The Institute is directed by McCormick faculty member and alumnus Sam Stupp (PhD '77), Board of Trustees Professor of Materials Science, Chemistry, and Medicine, and member of the National Academy of Engineering (NAE). Established in 2000, the institute draws clinicians, scientists, and engineers from across the University to work together on the challenges of regenerative nanomedicine: using nanoscale technology or materials to seek ways to repair, replace, or regenerate tissues or organs and to improve human health.

John A. "Mac" McQuown ('57) and his wife **Leslie McQuown** made a significant gift to fund new research at the Northwestern Institute on Complex Systems (NICO). The donation will fund three new research projects within NICO involving complexity in biological systems, markets, and innovation adoption in workplaces. NICO serves as a hub and facilitator for path-breaking research in complexity science that transcends the boundaries of established disciplines.

Richard Padula ('84, P '15) and **Sue Mullen Padula** ('86, P '15) made a significant gift to fund the construction of a new classroom on campus as well as support the new freshman advising program.

An **unnamed McCormick alumnus** gave $1.5 million in expendable support to seed high-risk faculty research grants, including a matching gift from the **Sherman Fairchild Foundation**.

Members of the **McCormick Advisory Council (MAC)** have made contributions exceeding $820,000 towards establishing a new Visiting Professor in Computer Science. Major gifts were donated by MAC Chair **Ken Porrello** ('77), **Greg Merchant** (PhD '90), **Vivek Ragavan** ('74), **David Sachs** ('81), and the **Deloitte Foundation**.

3M donated $100,000 towards the construction of new autobays for the Solar Car, Formula SAE, and Mini Baja competition teams.

Hu-Friedy, the leading dental instrument manufacturer, has made a major gift to support the research of professors Jian Cao and Kornel Ehmann.

A trust from the late **Robert Fierle** ('45) has provided funds towards ongoing improvements to Tech, which will support the renovation of Jerome Cohen Commons, McCormick's faculty dining room.

Bob Peskin (PhD '77) documented his plans to donate a large collection of transportation materials to the Transportation Library, including regional transit plans, vintage posters, and 1,500 books.

A trust from the late **William Krucks** ('40) and **Lorraine Krucks** will establish the William Krucks '40 and Lorraine R. Krucks Laboratory in the Department of Electrical Engineering and Computer Science.

FIRMLY GROUNDED AND FLYING HIGH

Bob Feldmann '76
leads Boeing's newest line of long-haul jets
with lessons learned at McCormick

"OUR JOB AS LEADERS IS TO MAKE A COMPLEX TASK SIMPLE SO THAT PEOPLE CAN STAY UNIFIED IN THEIR EXECUTION AND THEIR DELIVERY TO DESIGN AND BUILD AN AIRPLANE."

Watching a plane he helped design as it lifts and climbs into the air the first time—for Bob Feldmann ('76), it doesn't get any better. The Boeing vice president credits a good measure of that experience to the firm grounding in engineering he received at McCormick.

"I've witnessed the first flights of five or six different airplanes that I've worked on, and they've been the highlights of my career," Feldmann says. "It's the culmination of amazing design-and-build work. When the airplane finally flies, there's no feeling of accomplishment that compares."

It's a feeling he hopes to experience again as general manager of the 777X program, a new version of Boeing's 777 twin-engine jet that takes the main high-efficiency composite wing design from the 787 Dreamliner, combines it with a new engine from General Electric, and puts both on the fuselage of the 777. This blend of new and existing technology creates a larger, more fuel-efficient long-haul aircraft.

"We're lengthening the fuselage so the airplane holds more seats. It will be a 'flagship airplane' for elite airline customers worldwide," Feldmann explains. "The 777 has an outstanding reputation, and we can make it even better; the 777X is 20 percent more efficient."

When Boeing announced plans for the new airplane at the Dubai Airshow in November 2013, the company immediately received 259 commitments from four customers, positioning it to be the most successful launch of a commercial plane in history.

"You're taking a great airplane, improving it, and applying new technology to the wing, engines, and interior cabin," he says. "Airlines of the world will make the 777X the backbone of their long-haul fleets."

Heading up the 777X program requires complex planning and execution that includes developing designs, managing staff across multiple sites, coordinating the supply chain, and building the aircraft. Ensuring everything stays on track to begin production in 2017 and deliver the finished product by 2020 is challenging, but Feldmann keeps his projects running smoothly by applying the most valuable lesson he learned at McCormick: keep it simple.

"We worked in teams in the engineering labs, and we did our best work when we broke the problem down into simple elements. That made it easy to coordinate among the different people trying to get things done," he remembers. "The teams that understand how to work together effectively are the teams that do the best. Those are the airplane programs that do the best, and the companies that do the best. That's what I learned in college and have tried to apply ever since."

Feldmann has employed that approach to every project he's worked on in his more than three decades at Boeing. He began his aerospace career as a software engineer working on the F/A-18 Hornet combat jet with McDonnell Douglas in 1976, prior to the company's merger with Boeing. He later headed up the surveillance and engagement division of Boeing Military Aircraft and led the development of the U.S. Navy's EA-18G Growler and P-8A Poseidon aircraft. His work then shifted to the company's commercial side, where he was general manager of the single-aisle 737 MAX prior to the 777X.

For Feldmann, applying his electrical engineering background to airplanes felt like a natural fit. His time at McCormick coincided with the dawn of the digital age, preparing him for his job at Boeing with knowledge of computer technology and digital electronics.

"Just as computers were growing across nearly every application in science and industry, it was happening with airplanes as well," he remembers. "The amount of software and digital technology going into our airplanes expanded exponentially. The knowledge I had gained put me right in the middle of that growth from the start."

Feldmann's progression from working on a component of an airplane to managing the development and delivery of an entire jet has been gratifying for a man who grew up in a family of engineers. He says his natural affinity for math and science was fostered by his teachers in high school, who made classes fun and sparked a desire to follow in the footsteps of his engineer father, brothers, and sisters. Choosing where to study was easy.

"For me, it was the reputation of Northwestern," he says. "I knew it was an outstanding academic institution. Then I visited and saw the beautiful campus on the lake, so it was really easy to choose."

It's a choice he values each day as he manages the 777X project across the diverse teams involved.

"We have to make sure we're all marching to the same schedule and ensure things interface correctly and flawlessly," he says. "Our job as leaders is to make a complex task simple so that people can stay unified in their execution to design, build, and deliver an airplane."

When the 777X takes its first flight, you can bet Bob Feldmann will be there. SARA LANGEN

Two McCormick Alumni Honored

ACHIEVEMENTS, LEADERSHIP, AND SERVICE RECOGNIZED AT THE ANNUAL NORTHWESTERN ALUMNI ASSOCIATION AWARDS BANQUET IN APRIL.

Dennis Chookaszian ('65) received the Alumni Medal in recognition of his professional success. A lecturer at the University of Chicago School of Law, Chookaszian is the former chairman and CEO of CNA Insurance Companies. Prior to joining CNA, he was a management consultant for Deloitte and chairman and CEO of mPower, an Internet start-up providing financial advice for the management of 401(k) plans. Chookaszian has served as a director on the boards of eleven publicly traded corporations and received the Outstanding Director Award from the *Financial Times* Outstanding Directors Exchange. He is currently a member of the McCormick Advisory Council.

David Porges ('79) received an Alumni Merit Award for high achievement in a profession or field. He is the chairman, president, and CEO of EQT Corporation, one of the largest natural gas producers in the Appalachian Basin. Prior to joining EQT, Porges held management positions at Bankers Trust Corporation and Exxon Corporation. He is a member of the Board of Trustees at Winchester Thurston School and a member of the McCormick Advisory Council.

1960s

Dennis H. Chookaszian ('65) has joined the board of managers of Patriot Investment Holdings, LLC.

Tsu-Wei Chou ('66) received the Nadai Medal from the American Society of Mechanical Engineers.

Ronald Wajer ('66) is president and founder of the management consulting firm, Business Engineering. He co-wrote *Food for Thought: Lessons at Lunchtime for Business Owners* (Sigma Resource Group, 2013), which offers advice to small and mid-sized professional service firms on how to grow their businesses.

James R. Goodman ('67) received the 2013 ACM-IEEE Eckert-Mauchly Award for his contributions to the hardware/software interface of computer architecture.

William Kroll ('67, 'MS 71) relinquished his role as chairman and CEO of Matheson Tri-Gas to become executive chairman of the board of Matheson in January. He will remain a member of the board of Matheson's parent company in Japan, Taiyo Nippon Sanso Corp. (TNSC). Last June, Kroll also became a senior managing director of TNSC.

1970s

Sally Rimkus Marshall ('70, PhD '75) distinguished professor emerita and vice provost emerita at the University of California, San Francisco, received the 2013 American Association for Dental Research Irwin D. Mandel Distinguished Mentoring Award.

Tuncer B. Edil (MS '73) professor emeritus at the University of Wisconsin–Madison, was named a Distinguished Member of the American Society of Civil Engineers (ASCE), its highest accolade. Edil was recognized at ASCE's annual conference in October for his seminal contributions to geotechnical engineering.

Nathan H. Little ('73), former vice president of Rudolph Technologies, retired from the company on December 31, 2013.

Steven Berkowitz ('75) has been named chairman of the board of the Texas Institute of Health Care Quality and Efficiency.

Nick Arvis ('76) wrote *ExpressWay to Growth: A Practical Guide for Business Owners* (Presidents Advisory Committee, 2013). Bob Hahn (GJ81), owner of Dimensions Management in Chicago, was profiled in the book.

John L. Donnelly ('76) received the W. Clement Stone Outstanding Achievement Award from the Boys & Girls Clubs of America for his outstanding service as a volunteer and advocate for Chicago's youth.

Dan Thompson ('77) was recently selected as Manchester, Connecticut's first town troubadour. He will promote the arts through song and perform at town functions. His wife is Nancy Lewandowski Thompson (J79).

Virginia M. Rometty ('79), president, chairman, and CEO of IBM Corporation, was appointed by President Barack Obama to the President's Export Council.

1980s

Dr. Michael Apkon ('82) has been appointed president and CEO of The Hospital for Sick Children in Toronto.

Joseph J. Rencis (MS '82), dean of engineering and the Clay N. Hixson Chair for Engineering Leadership at Tennessee Tech University, has been named the 2014–15 American Society for Engineering Education (ASEE) president-elect.

Howard I. Zauberman (MEM '82), interim CEO at Vision-Sciences, Inc., was promoted to president and CEO and will serve on the company's board of directors.

Michael Roger Walsh (MS '83) is chief security officer and head of research and development for Coupons.com, a provider of digital coupons.

Edward H. Belanger, Jr. ('84) joined the Great American Group as the corporate valuation services practice leader.

Andrew Christopher Hafenscher ('84) is managing director of industry solutions at Junction Solutions.

Brian D. Gordon ('84), former senior professional in the risk specialists division at the Federal Reserve Bank of Chicago, joined the financial services office of Ernst & Young LLP as an executive director.

Jeffery K. Spoerk ('84, L87), a partner in the Milwaukee office of Quarles & Brady, was named in the 2014 edition of *The Best Lawyers in America*.

Gary Kremen ('85), founder of Clean Power Finance, joined the board of directors of Identive Group, Inc., a secure identification solutions provider.

Lowell J. Lindstrom ('85; KSM '98), head of the Oobeya Group, joined the software company VersionOne Inc. as vice president of services.

Steven C. George ('87) was named chair of the department of biomedical engineering at Washington University in St. Louis, effective July 1, 2014. George is currently an engineering professor at the University of California-Irvine.

Eric H. Joost ('87, KSM '98), CEO of Willis North America's speciality practices, was promoted to COO of Willis North America.

1990s

Elizabeth B. Hunsicker ('91), chief operating officer at Rose Medical Center in Denver, Colorado, was appointed CEO at West Valley Medical Center in Caldwell, Idaho.

Sheila K. Gujrathi ('92, MED, MD '96), chief medical officer at Receptos, joined the board of directors of biopharmaceutical company Ambrx Inc.

Hemali Dassani ('93), managing director with Old City Investment Partners, was appointed director of investor relations of Castle Harlan in New York City.

Mark Prein (MS '94) was promoted to vice president at Prein&Newhof, where he is a team leader and serves as project manager on wastewater and water system projects.

David C. Thomsen ('94) became executive vice president of product and design at Wanderful Media in September 2012.

ON A MISSION, GIVING BACK

Cynthia Quarterman '83 puts her McCormick education to work keeping Americans safe and enabling others to follow in her footsteps.

"I like to tell people we're the most important agency you never heard of. That's rewarding to me, to know that we're there on a day-to-day basis fulfilling our mission without anybody ever knowing it."

Cynthia Quarterman ('83) looks out for your safety every day without you even knowing—and that's just the way she likes it.

As administrator of the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA), Quarterman oversees the safe transport of hazardous materials throughout the country by air, land, and sea. Thanks to her agency's work, Americans can routinely cross over underground gas and oil pipelines and drive past trucks and trains hauling hazardous materials without a concern for their personal safety.

"I like to tell people we're the most important agency you never heard of," she laughs. "That's rewarding to me, to know that we're there on a day-to-day basis fulfilling our mission without anybody ever knowing it."

With 2.6 million miles of pipeline and about 1 million shipments of hazardous materials each day under its purview, the PHMSA fulfills a huge mission with a relatively small amount of resources. "We have less than 500 people and a budget of around $200 million," she explains. "But I'm always interested in a challenge."

With her education in industrial engineering and law, Quarterman has blended her technical expertise with legal acumen throughout her career. Prior to her service at PHMSA, she was partner in the Washington law office of Steptoe & Johnson, specializing in regulatory and industry affairs related to transportation and energy. She also served on the Obama administration's transition team at the Department of Energy and as director of the Department of the Interior's Minerals Management Service.

Drawn to engineering by her love of math and science, Quarterman remembers how welcoming Northwestern was to a young woman very far from her Savannah, Georgia home.

"The support of the University community is like nothing I've ever seen—it's just a great place to go to school," she remembers. "I've used the skills that I learned there every day, not only here at a federal agency, but also when I practiced law. Because I've tended to be involved in very technical areas, it helps a great deal to have an understanding of the underlying concepts of engineering."

Quarterman says she's very grateful for the scholarships and grants that made her dream of a McCormick industrial engineering education possible. She's also dedicated to ensuring that other deserving students realize their dreams as well, regardless of their financial circumstances.

"Having had the great blessing of the opportunity to attend Northwestern, I've become a continuing contributor and supporter of the school," she says. "I want to make sure others have the opportunities to do what I've done."

SARA LANGEN

Sandeep Dave (MS '95, KSM '99, '00, GFSM '01), associate professor and director of the molecular genetics and genomics program in the Duke Cancer Institute at Duke University, was elected to the Lymphoma Research Foundation's scientific advisory board.

Sujal A. Shah ('95, MS '97) was named chief financial officer of CymaBay Therapeutics.

Chelsea R. Stoner ('96), partner at Battery Ventures, was promoted to general partner at the company.

Brian Johnson ('97) of Portland, Oregon, celebrated 15 years of building interesting projects as a project manager at Walsh Construction Co. He recently worked on a 978-bed College Station student housing project at Portland State University.

Dinesh D. Moorjani ('98), founder and CEO of Hatch Labs, joined the global private equity firm, Warburg Pincus, as an executive-in-residence (EIR).

Sandor Weisz ('98) of Chicago became the lead design instructor at the Starter League, a Chicago school for teaching people how to code, design, and ship web apps. Former Associated Student Government presidents Mike McGee (C10) and Neal Sales-Griffin (SESP '09) co-founded the Starter League (formerly Code Academy) in 2011.

2000s

Uttam Dubal ('02) of Palo Alto, California, joined the intellectual property litigation group Kasowitz, Benson, Torres & Friedman.

Michael M. Blake (MSIT '03), CIO at Commune Hotels + Resorts, joined the StayNTouch board of directors.

Jerome L. Budzik (PhD '03) was appointed chief technology officer at Twelvefold.

Gregory J. Leighton ('03), patent attorney at Neal, Gerber & Eisenberg LLP, was promoted to partner of the firm.

Alan L. Schultz ('03) was appointed vice president of enterprise growth and portfolio strategy at Telephone and Data Systems, Inc.

Jasper Chen ('04) works with J.P. Morgan as equity sales business manager covering the Asia-Pacific region.

Donald Fong ('04) worked on the film *Monsters University* as a character tailor. Fong also worked on the Pixar films *Toy Story 3* (2010) and *Hawaiian Vacation* (2011).

Lewis C. Lin (MEM '04) recently published two books. The first, *Decode and Conquer*, is focused on product management professionals who are looking to prepare for a job interview at their dream company. The second, *Rise Above the Noise*, is focused on marketing professionals who want to stand out at the interview.

Chris Hayes ('05), a professional baseball player, and his wife, Tracy Tanguay Hayes (WCAS '02), launched flik, a free social media platform and consumer-focused mobile app that combines video sharing, content discovery, and personal recommendations into a single, streamlined experience.

Cody Hansen ('07), an interaction designer for General Motors, developed the new Cadillac User Experience (CUE) infotainment system, which operates more like an iPad than a traditional dashboard. CUE won an Editors' Choice Award from *Popular Mechanics* for the Top Gadgets of the 2012 International Consumer Electronics Show. He also serves as a liaison between GM and Northwestern's NUsolar and Formula Racing teams.

Jorgen Hesselberg (MSIT '07) is director of agile enterprise transformation at McAfee, an Intel company. Hesselberg and his family relocated from Chicago to Portland.

Nicholas Hayes ('08) is co-owner of Enquire Solutions, a call center and customer relationship management provider in the senior living industry.

Michael Parrott ('09) of New York City was promoted to senior associate consultant at Mars & Co., a global management consulting firm. Parrott joined the company's Greenwich, Connecticut office in 2012.

Jennifer Wei ('09) started her career at Schlumberger, an oil and gas services company, where she supervised all-male crews on oilrigs in the Gulf Coast. She transitioned to Motorola Solutions in New York, where she led product sustaining for one of the most ruggedized product lines as a senior mechanical engineer. She is currently studying engineering management at Northwestern.

2010s

Eric DeFeo ('11) is now a consultant at IHS Chemical.

Kristin Landry ('11) began her first full-time position with Navigant Consulting.

Steve WaiChing Sun (PhD '11) recently joined Columbia University as an assistant professor of civil engineering and engineering mechanics. His research paper, written with McCormick professor John Rudnicki and collaborator Matthew Kuhn, won the 2013 Caterpillar Best Paper Prize, as selected by the editorial boards of the international geoengineering journal, *Acta Geotechnica*.

Benjamin Shorofsky ('12, MS '13) received a Fulbright to test the effectiveness of subsurface contrasted wetlands as a solution in treating textile effluents in Rajasthan, India.

Matthew Doerfler ('13) of Naperville, Illinois, received a Fulbright to teach English in Malaysia.

Cindy Solomon ('13) of Chesterfield, Missouri is studying for a master's degree in bioengineering at the University of Nottingham as a Whitaker International Fellow.

Alumni Update

Dan Cornew ('11) was featured in the spring 2013 issue of this magazine as the lead mechanical engineer of Titan Aerospace, a start-up that designs and builds solar-powered unmanned aerial vehicles. In April, the company was purchased by Google. In buying the company, Google also acquired the talent of five McCormick alumni, who make up nearly half of Titan Aerospace's engineers: Matthew Nubbe ('11), Kyle Liske ('10), Stephen Benson ('13), and Nick Renold ('11). All are also alumni of McCormick's automotive design teams. Last year, Cornew credited this experience with helping him get his job. "Get on a project team like the Northwestern University Solar Car and Formula SAE Teams," he said. "Be as involved as you can be. The skills you use there are really what you'll use on the job."

"Be as involved as you can be. The skills you use there are really what you'll use on the job." **DAN CORNEW**

IN MEMORIAM

Louis E. Fazen Jr. '37
J. Armin Bierbaum '45
Laverne S. Brown '45
Robert J. Fierle '45
Marvin Cherner '47
George W. Randall '47
Robert D. Reilly '47
Lawrence W. Zonsius, Jr. '47
George E. Bailie '48
Robert L. Berg '48
John R. Boyd '49
Bruce C. Brown '49
Berthold J. Notheisen '49
David J. Theobald '49
Eugene D. Johnson '50
Donald E. Dahlberg '51
Arthur R. Gallup '51
Harold M. Butzloff '53
Jacques Denavit '53
James L. Lundy '53
John L. Larney '54
Bruce Broker '55
Richard C. Gern '56
Joseph J. Perona '56
Edward R. Vrablik '56
Robert C. White '56
Joann Temple Dennett '61
John M. Rademacher '61
John E. Dickinson '65
Anthony V. Fiacco '67
John Francis Rourke '67
James A. Currie '69
James M. Garnett III '69
Maria Vaughan Frey '73
Clinton D. Gibler '81
Peter Lawrence Mente '87
David K. Mueller '88
Martin Shenk '91
Michael John Mills '94
Victor B. Tsirline '99

A MIND FOR BUSINESS AND AN EYE FOR ART

Technology entrepreneur Dieter Marlovics '98 transforms compelling technology into meaningful businesses.

With brightly colored markers in hand, four-year-old Nadia Marlovics scampered to the wall of her family's suburban Chicago home, paused momentarily, turned and grinned slyly at her father.

Dieter Marlovics quickly recognized what was about to become an indelible mural by a budding artist and offered his daughter an intriguing alternative.

"I'll take a photo of the wall, and you can color that instead," Marlovics said. That fast fatherly thinking inspired Marlovics' most recent entrepreneurial adventure, ReallyColor, an online company with a patent-pending technology that allows customers to convert real-world photographs into printable coloring book pages.

ReallyColor is not the first start-up venture for Marlovics, a self-described serial entrepreneur. In 1997, while studying electrical engineering, he and fellow McCormick student Paul Silevitch ('99) founded Hypermeals, a forerunner to the now ubiquitous online restaurant ordering sites.

"I love to observe the world around me and create something others will use," Marlovics says.

Inspired by Sandra Bullock ordering pizza online in the 1995 film, *The Net*, Hypermeals' founders enlisted restaurateurs and then promoted their brainchild by roaming around campus in purple sweaters, knocking on doors, and handing a $50 bill to everyone who had Hypermeals as their Internet home page.

"When you're trying to grow a business, you have to be willing to abandon your own insecurities," Marlovics says, adding that his McCormick education compelled him to approach challenges with discipline and confidence.

While customers proved eager to try the new platform, operational issues on the food service end plagued Hypermeals. "The restaurants just weren't ready for this," Marlovics confides.

In 1999, Marlovics joined Gelber Group, a proprietary trading firm, where he conceived of and built the firm's electronic trading division. His subsequent work helped establish Gelber as one of the premier technology-enabled trading groups.

Around 2011, Marlovics again felt his entrepreneurial spirit stirring. Inspired by daughter Nadia's artistic intentions, the idea for ReallyColor sprang to life. Marlovics contacted an image-processing scientist, created sample coloring pages, and tested the idea on the market.

"I knew nothing mattered unless the technology worked, and kids wanted to color," Marlovics says.

Motivated by promising early results, Marlovics officially launched ReallyColor in October 2013 and just recently unveiled an online tool for editing during the photo-to-coloring page conversion process. The company also plans to launch a mobile app in the near future.

"I love taking technology and turning it into a business," Marlovics says. "That's the work that inspires me."

DANIEL P. SMITH

> "I LOVE TAKING TECHNOLOGY AND TURNING IT INTO A BUSINESS. THAT'S THE WORK THAT INSPIRES ME."

McCormick Connects with Alumni in Taiwan

DEAN JULIO M. OTTINO VISITS ASIA UNIVERSITY AND MEETS WITH ALUMNI IN THE THRIVING HIGH-TECH SECTOR

You can find McCormick alumni almost anywhere you travel worldwide. Go to Taiwan, and you'll find the highest concentration of McCormick alumni outside the United States.

In December, Dean Julio M. Ottino and members of the McCormick community did just that. They traveled to Taiwan to meet with alumni at "Innovation at Northwestern," a presentation and reception hosted by McCormick and the NU Club of Taiwan. Ottino delivered a talk at Asia University, where he was hosted by the university's president Jeffrey Tsai (PhD '86).

Ottino also met with leaders of Taiwan's high-tech sector, a global powerhouse that produces 94 percent of the world's motherboards and notebook PCs. Not surprising, those high-tech leaders included three McCormick graduates from the 1980s: Shih-Wei Sun (PhD '86), Pei-Jih Wang (PhD '87), and Kuo-Hsin Huang (PhD '88). All three had studied materials science and engineering under McCormick's Bruce Wessels, the Walter P. Murphy Professor of Materials Science and Engineering and highly regarded for his expertise in the area of integrated circuitry.

SUN RISES THROUGH THE RANKS

After working for Motorola for 10 years, Shih-Wei Sun joined United Microelectronics Corp., a global semiconductor foundry that provides advanced technology and manufacturing for applications spanning every major sector of the integrated circuit industry. Sun quickly moved up through the ranks, serving as chief operations officer, then director and chief executive officer, and now vice chairman.

In recounting the impact Wessels had on his education, Sun notes, he "gave us well-balanced graduate training—from the hands-on setup of lab equipment and design of experiments to theoretical interpretation. He also painstakingly helped international students write scientific papers and dissertations. He didn't just help with the English, he also provided guidance on flow, logic, and structure, which was proven to be invaluable throughout my career and life."

TWO TOP LED LEADERS

Pei-Jih Wang founded Trend Lighting Corporation (TLC) in 2008 to provide environmentally friendly light emitting diodes (LEDs) for streetlights and indoor solid-state lighting. TLC now ranks as one of the Taiwan's largest companies. In 2009, Wang created Hexalux Optoelectronics Corp. to manufacture LED epitaxial layers and chips.

"Before joining Northwestern, I was in the field of metallurgy," Wang said. "I knew nothing about semiconductors besides knowledge from textbooks. Professor Wessels helped me build a solid foundation in the field and the basis for my lifelong career."

Nicknamed the "godfather of Taiwan's LED industry," Kuo-Hsin Huang started two companies to manufacture LED chips and wafers. He is the chairman and chief executive officer of High Power Optoelectronics, a company he founded that produces electronic components, lighting equipment, and computers and peripherals. Earlier, in 1993, he also cofounded United Epitaxy. Within two years, it became one of the three global companies (with Hewlett-Packard and Toshiba) capable of manufacturing high brightness LEDs.

"My PhD thesis focused on metal-organic vapor phase epitaxy," Huang said. "It became the most important work in my career."

The well-connected money man

Houston Frost (PhD '07), co-founder of Akimbo Financial, believes the future of banking is now.

After surviving the financial crisis of 2008 as an associate at J.P. Morgan, Houston Frost concluded that Wall Street wasn't for him. He moved back home to Texas and began looking for ideas for a new business.

It didn't take him long.

"I came across the prepaid card banking product and thought it would be neat to design a new checking alternative and debit card from the ground up," he remembers. "We began thinking about how to create an online and mobile consumer banking product that had a social focus—a debit card that connected people."

That sense of connection makes the Akimbo Card different from other pre-paid cards, says Frost, who co-founded Akimbo Financial in 2010 and now serves as president and CEO. Described as "a next generation debit card," it allows people to put money in the pocket of a friend or loved one instantly by using a mobile phone.

Using the Visa-branded card, Akimbo members can access funds almost everywhere, including ATMs. The "sub-card" feature, which allows members to manage up to five additional cards, offers a handy way for families to pay allowances or small businesses to manage corporate expenses.

So far, the company has raised approximately $2.4 million from angel investors and mailed nearly 30,000 Akimbo Cards loaded with more than $14 million. With a goal of $1 million in revenue this year, Frost hopes to expand to a $50 million-a-year business within four to five years.

Not easily discouraged by the challenges of a start-up, Frost says he owes his persistence and determination to the lessons he learned while working on his PhD in chemical engineering at Northwestern.

"My time at McCormick instilled the belief that I could learn anything and gave me the ability and confidence to take on any problem," he says. "It's the kind of confidence you gain through the complex problem solving you practice as an engineer. If you can learn statistical mechanics and quantum chemistry, why can't you start a financial services company?"

SARA LANGEN

FINDING HIS SENSE OF PLACE

Tony Vasquez '13 draws on his McCormick experience to meet tough challenges at a premier Chicago architectural firm

As a Chicago area native, Tony Vasquez gained an early appreciation for the city's architectural splendor, admiring its skyscrapers and bridges during school field trips and family outings.

Today, Vasquez, who majored in civil engineering and earned an Architectural Engineering & Design Certificate, helps sustain the city's dynamic architectural tradition as an associate at Chicago's award-winning architectural firm, Booth Hansen.

"Chicago is the epicenter of architecture, and I'm thrilled to be part of this world," Vasquez says.

At Booth Hansen, where he interned prior to his senior year, Vasquez builds physical and computer generated 3D models, produces energy studies, and draws buildings, occasionally working alongside the company's founder and principal, Larry Booth, who also serves as the Richard C. Halpern/Rise International Distinguished Architect in Residence at Northwestern.

Vasquez has quickly made his mark.

In the fall of 2013, Vasquez and a trio of colleagues captured the Professional Merit Award at Architecture at Zero 2013. The international design competition, sponsored by the American Institute of Architects' San Francisco chapter, challenged participants to develop a zero-net-energy, 150-unit, mixed-use residential building in San Francisco's Tenderloin neighborhood.

With only a basic understanding of zero-net construction prior to the competition, Vasquez approached the challenge the way McCormick teaches, by defining the problem, uncovering solutions, and collaborating with others. Over the course of four months, he studied zero-net projects and developed the theoretical relationship of systems that would allow the building to reach its ambitious energy target.

For Vasquez, the project provided a valuable opportunity to better understand the environment's role in design. His team's 14-story project, CatalystSF, married architectural integrity with energy performance and boasts energy-efficient features such as rooftop, façade, and brise soleil (sunshade) integrated photovoltaic arrays; rain and gray water harvesting; hydrogen catalytic converters and co-heat and power fuel cell generators that work in unison to create a hybridized power generation matrix; and natural cross-ventilation and geothermal radiant heat in lieu of forced air systems.

DANIEL P. SMITH

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For the truly whole-brained, graduation often marks only the official beginning of a lifetime of advanced learning.

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EXECUTIVE EDUCATION: DESIGN FOR NON-DESIGNERS

In collaboration with designer Bruce Mau's Massive Change Network, the Segal Design Institute will offer a three-day executive education workshop, Design for Non-Designers. Mau and a team of design associates will introduce non-design professionals to the process of systematic design thinking to enhance how they tackle problems, develop solutions, and create innovative ways of moving forward. An immersive, hands-on learning experience designed for business executives, social entrepreneurs, and other decision makers, this course introduces participants to design thinking as a powerful strategic tool they can use to lead their organizations toward more innovative projects, services, and processes.

Two sessions in 2014:
June 15–17 or September 14–16

For more information, visit
segal.northwestern.edu/programs/executive-education

EXECUTIVE EDUCATION: INNOVATION AND MANAGEMENT

In fall 2014, the Master of Product Design and Development Management program will offer a three-day certificate course in innovation and management. This intensive course addresses skills and issues related to managing creativity and design, customer-focused innovation, gap analysis in the design process, strategy in design, industrial design essentials, human factors, and intellectual property. Leading faculty from McCormick and the Kellogg School of Management and industry experts will use case studies and group workshops to illustrate and illuminate the concepts. The program is designed for product design and development professionals with either technical or marketing backgrounds.

Next session: October 26–29, 2014

For more information, visit
segal.northwestern.edu/programs/graduate/mpd2/executive-education/

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MCCORMICK MASSIVE ONLINE OPEN COURSES (MOOC)

Not a Chicago resident? Can't travel to attend courses? Study remotely by enrolling in a MOOC. Upcoming MOOCs taught by McCormick faculty members include:

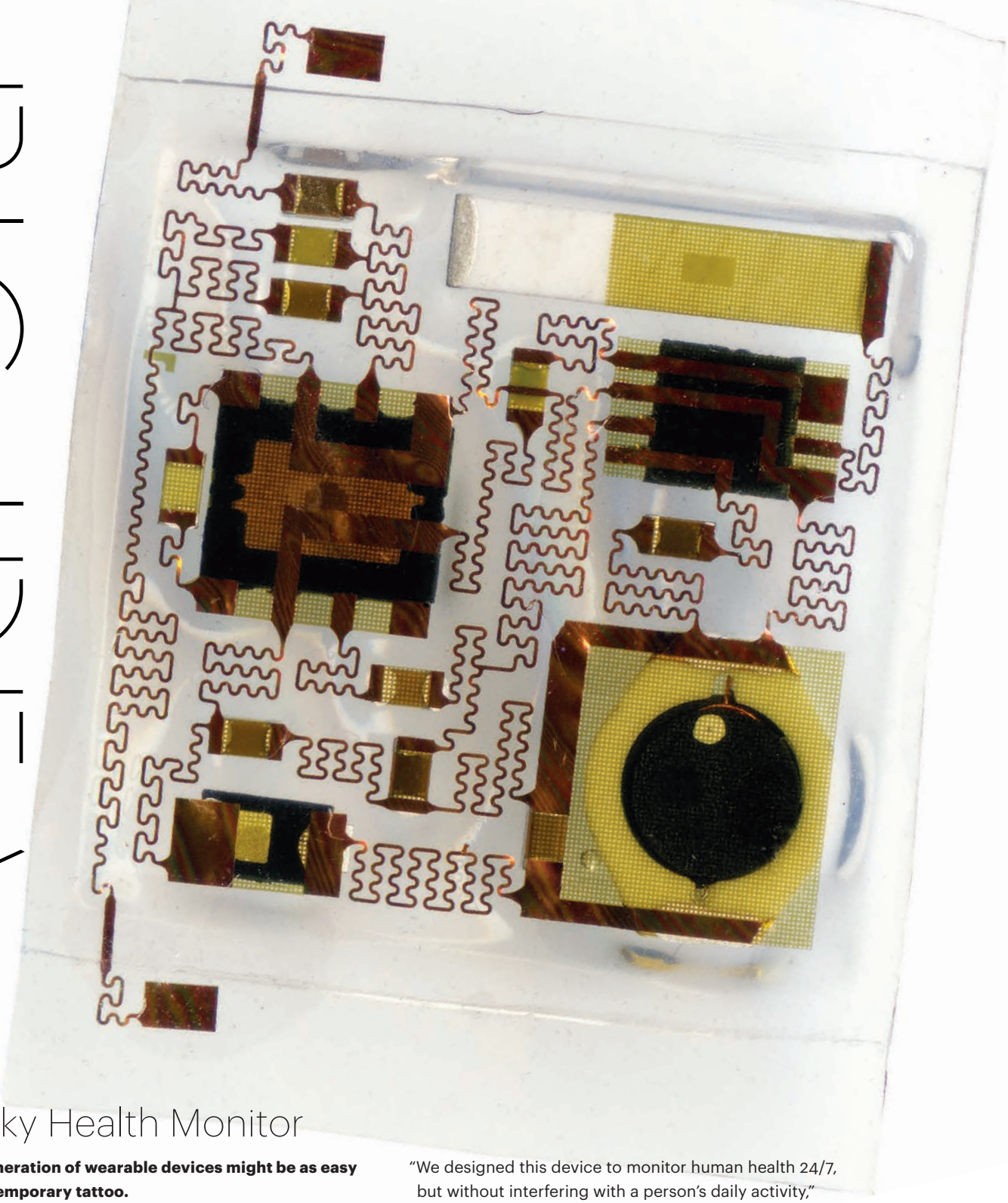
Fundamentals of Digital Image and Video Processing, taught by Aggelos Katsaggelos, AT&T Professor of Electrical Engineering and Computer Science

Everything is the Same: Modeling Engineered Systems, taught by Todd Murphey, associate professor of mechanical engineering and physical therapy and human movement sciences

How Green is that Product? An Introduction to Life Cycle Environmental Assessment, taught by Eric Masanet, associate professor of mechanical engineering and chemical and biological engineering

To discover more MOOCs, visit
coursera.org

BIG IDEA



A Sticky Health Monitor

The next generation of wearable devices might be as easy to use as a temporary tattoo.

McCormick engineers are part of a team that has demonstrated thin, soft, stick-on patches that stretch and move with the skin and incorporate electronics for sophisticated wireless health monitoring.

The patches stick to the skin and use a unique microfluidic construction with folded wires to allow the patch to bend and flex without being constrained by the rigid electronics components. The patches could be used for everyday health tracking and could revolutionize clinical monitoring, such as EKG and EEG testing.

"We designed this device to monitor human health 24/7, but without interfering with a person's daily activity," said Yonggang Huang, the Joseph Cumming Professor of Civil and Environmental Engineering and Mechanical Engineering. "This device is wirelessly powered and can send high quality data about the human body to a computer in real time."

Huang, along with longtime collaborator John A. Rogers of the University of Illinois, compared the device to traditional EKG and EEG monitors and found the wireless patch performed equally to conventional sensors, but was significantly more comfortable for patients.

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NEW RESIDENT ROBOT

Meet RJ, a new resident of the Willens Engineering Life Sciences Wing in Tech. RJ is programmed to interact with visitors using the popular Baxter robot from Rethink Robotics. RJ provides a visible presence for the robotics group at McCormick while allowing students to continue to develop new capabilities for human-robot interaction.