

McCormick School of Engineering and Applied Science

NORTHWESTERN ENGINEERING

SPRING 2023



Whole-Brain Legacy

How Dean
Julio M. Ottino
transformed
the philosophy
and culture at
Northwestern
Engineering



At the Intersection of Art and Engineering

Artist Dario Robleto, Dean Julio M. Ottino, and Block Museum of Art executive director Lisa Graziose Corrin observe *American Seabed* (Robleto, 2014), a series of sculptures composed partially of fossilized prehistoric whale ear bones and various butterflies. The installation is part of Robleto's exhibition, *The Heart's Knowledge*, on display at the Block Museum, which urges visitors to remember the human meaning hidden within scientific discoveries. The exhibition culminates Robleto's five-year engagement as Northwestern Engineering's inaugural artist-at-large, where he explored conversations and collaborations with scientists and engineers around ethics and empathy in scientific fields. See more from "The Heart's Knowledge" on page 28.

Photography by Jason Brown





“We are now arguably the most connected school in Northwestern...We went from isolated to connected. We changed the hardest thing to change in an organization: *its culture*.”

GREETINGS FROM NORTHWESTERN ENGINEERING

This issue of *Northwestern Engineering* magazine will be my last as dean. I will step down in August to focus on research, writing, and public speaking. It is bittersweet, but as I look back, I can see how much we have accomplished.

When I took the job, the McCormick School of Engineering was largely siloed, both within the University and from outside institutions. Connectedness, networks, and emergence became centerpieces of my leadership strategy. We are now arguably the most connected school in Northwestern; we have formal and informal initiatives not only with every school at Northwestern, but also with the Block Museum, Argonne National Laboratory, Art Institute of Chicago, and countless other institutions. We went from isolated to connected. We changed the hardest thing to change in an organization: *its culture*.

It took a group effort to change McCormick’s culture at all levels. We created university-wide initiatives that spread design (via the Segal Design Institute) and entrepreneurship (via the Farley Center for Entrepreneurship and Innovation) throughout Northwestern. We recruited new faculty, with a dramatic increase in joint appointments. Research funding doubled, and Northwestern Engineering now ranks consistently at the top in Northwestern’s inventions, disclosures, and number of startups.

We transformed the student experience, hiring first-year advisers, establishing programming that encouraged well-being, and encouraging new student groups. We created new master’s programs, relaunched old ones with new curricula, and developed courses that brought together undergraduate and graduate students from across disciplines.

Central to this was our whole-brain philosophy, the compass that continually guided us toward success. Of course, my tenure was not without its challenges. We weathered economic crises and COVID-19, and we are still living with residual effects of the pandemic—many initiatives remain unrealized. That was likely inevitable, but it also leaves the door open for the next leader.

It has been an honor and a privilege to have been entrusted to serve in this role. I am not retiring; I will still be a part of Northwestern Engineering and the University as a whole, as I navigate this new phase of my career. I am more than eager to help in any way I can to help my successor lead us toward greater success. I leave this job even more convinced of the great possibilities ahead for our school.

JULIO M. OTTINO
Dean, McCormick School of Engineering and Applied Science

On the Cover

Dean Julio M. Ottino’s whole-brain philosophy has transformed Northwestern Engineering’s culture, education, and research. Read more on page 12.

Photography by Justin Barbin, Jason Brown, Rob Hart, and Joel Wintermantle

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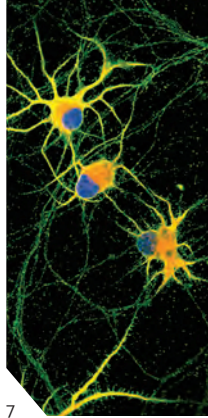
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How Dean Julio M. Ottino developed the whole-brain philosophy and culture at Northwestern Engineering.



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A WHOLE-BRAIN EDUCATION

Ottino transformed the student experience by expanding curricula, promoting well-being, and championing new student groups.



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As dean, Ottino encouraged a research culture that worked to solve problems at the intersection of disciplines.

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THE HEART'S KNOWLEDGE

An exhibition at the Block Museum marks the culmination of Dario Robleto's five-year engagement as Northwestern Engineering's artist-at-large.



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Andrew Reiter ('10) reflects on his success in autonomous systems design and looks to tackle challenges in climate change.



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COMING FULL CIRCLE

Impressed by how much his Northwestern mentors helped him, chemical engineering professor Rodney Priestley (PhD '08) strives to give his students the same level of attention.



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ACCELERATING ACCESSIBILITY AND UTILITY OF POWER WHEELCHAIRS

A multidisciplinary partnership of academic, industry, and nonprofit members, including Northwestern Engineering's Brenna Argall and John Rogers, was among 16 teams selected for the National Science Foundation's Convergence Accelerator Phase 1 funding to enhance opportunities for persons with disabilities.

Titled "Mobility Independence through Accelerated Wheelchair Intelligence," the project aims to accelerate the accessibility and utility of power wheelchairs by radically changing how control inputs are interpreted from movements of the human body and communicated to the wheelchair control system. Practical machine intelligence will also enhance safety and facilitate independent wheelchair operation.



Army Funds New Synthetic Biology Research

Northwestern received a significant grant from the US Army to fund the Center for Predictive Materials Design (PreMaDe), which will include faculty members Nathan Gianneschi, Neha Kamat, Julius Lucks, and Danielle Tullman-Ercek as well as researchers from Johns Hopkins University, Massachusetts Institute of Technology, the University of Illinois Urbana-Champaign, and the University of Texas at Austin.

The research team will combine synthetic biology and materials expertise with engineering and computational modeling strengths to create new biomaterials with precise control over their functional properties. Potential applications include electronic circuitry for wearable electronics, optical materials that dynamically sense and respond to their environment, and rugged cell-free materials with embedded sensing and actuation functions for molecular diagnostics.



Faculty-Led Teams Win Chicago Innovation Awards

Two innovations rooted in Northwestern Engineering were honored at the 21st annual Chicago Innovation Awards in November. The Illinois Wastewater Surveillance System, a creative solution to COVID-19 monitoring, emerged from a cross-institutional research effort led by Northwestern University, the University of Illinois Chicago, and Argonne National Laboratory. Epicore Biosystems, a spinout company from Northwestern's Querrey Simpson Institute for Bioelectronics and Professor John Rogers's research group, created the first sweat-sensing wearable platform to deliver personalized hydration, stress, and metabolic insights.



Sculptures and prints on display at the Mary and Leigh Block Museum in an exhibition of the work of Dario Robleto, Northwestern Engineering's artist-at-large



New full-time and adjunct faculty members who joined the Farley Center for Entrepreneurship and Innovation in the fall



New Rapid Tuberculosis Test Could Save Lives

Tuberculosis (TB) takes more than 1 million lives annually, with 95 percent of fatalities in developing nations. Eradicating TB in these countries is especially difficult because of the lack of cost-effective, high-throughput diagnostic tools.

An award-winning project from Northwestern Engineering could help solve this crucial problem. Three McCormick students developed an automated staining system using 3D printing technology that enables high-throughput sputum smear diagnostics for TB at the patient's point of care. The system, named POCAS: TB and developed during a biomedical engineering capstone course, BME 390-1-20: Biomedical Engineering Design, won the National Institutes of Health Office of AIDS Research Prize during the 2022 Design by Biomedical Undergraduate Teams Challenge.



Kimberly Querrey, Louis Simpson Trust Give \$121 Million to Northwestern

Northwestern University Trustee Kimberly K. Querrey ('22, '23 P) and the Louis Simpson Trust made a \$121 million gift to Northwestern, which includes \$11 million to support the Querrey Simpson Institute for Bioelectronics directed by Professor John Rogers.

The gift will help push biomedical discovery at the Feinberg School of Medicine, reinforce the University's position as a global research leader, and expand executive education at the Kellogg School of Management. A significant portion of the new gift—\$100 million—will go to support biomedical research at Feinberg.

Querrey and her late husband, Louis A. Simpson ('58, '96 P), have built an inspiring philanthropic legacy at Northwestern. Simpson was a University trustee, alumnus, parent, and adjunct professor. This gift

brings their contributions to the University to more than \$379 million.

"Lou and I often discussed the importance of improving the quality of life, particularly for those facing medical challenges. The physicians, scientists, and engineers at Northwestern do groundbreaking, innovative work, realizing our vision of positively affecting people's lives," Querrey says.

"I am so grateful to Kimberly Querrey and Lou Simpson, two of Northwestern's greatest champions," says Northwestern University President Michael H. Schill. "Northwestern's rapid progress over the last decade simply would not have been possible without them. This new gift continues their legacy of visionary support, and the impact will be far reaching."

"THIS INCREDIBLE INVESTMENT WILL ACCELERATE OUR WORK, GEARED FUNDAMENTALLY AROUND UNMET NEEDS IN PATIENT CARE, TO IMPROVE HEALTH OUTCOMES AT REDUCED COSTS, FOR DEVELOPED AND DEVELOPING COUNTRIES ALIKE."

JOHN ROGERS Louis Simpson and Kimberly Querrey Professor of Materials Science and Engineering, Biomedical Engineering and Neurological Surgery



STUDENTS FEATURED IN CHICAGO INNO'S "25 UNDER 25"

Northwestern had a strong showing in the 2022 *Chicago Inno* "25 Under 25" list, which included several Northwestern Engineering students and alumni who passed through the Farley Center for Entrepreneurship and Innovation and the Segal Design Institute. The annual list recognizes Chicago-area innovators under 25 who are shaping the city's technology and startup industries.

ANA CORNELL is on a leave of absence from her engineering studies after receiving a Thiel Fellowship to pursue her biotech startup, Acorn Genetics, which produces at-home DNA testing kits that make genetic analysis more accessible while preserving privacy.

SHANE DOLAN ('22) received a bachelor's degree in mechanical engineering and founded OptiAg, an Internet of Things-enabled intelligent sprinkler controller for large agricultural operations.

YASMEENA FAYCURRY ('22) received a bachelor's degree in economics and a minor in entrepreneurship at the Farley Center. She is the founder of Unfound, an app that helps people discover and share unique places they love.

KEVIN KASPAR ('24) is pursuing a bachelor's degree in manufacturing and design engineering at the Segal Design Institute and a minor in entrepreneurship at the Farley Center. He is the CEO and

cofounder of InfernoGuard, a startup wildfire detection and notification platform that aims to eliminate reliance on word-of-mouth detection.

IZZY MOKOTOFF ('24) is pursuing a bachelor's degree in journalism, a minor in entrepreneurship at the Farley Center, and a certificate at Segal Design Institute. ALEXIS CHAN ('24) is studying toward a bachelor's degree in biomedical engineering. Both are cofounders of SteadyScrib, a startup that produces a self-stabilizing pen for people with Parkinson's disease.

WILL XENAKIS ('23) and NIRAJ SHAH ('23) are pursuing bachelor's degrees in computer science and are cofounders of Xenah Developers, a startup that provides technical consulting and assists businesses in building their apps and websites.



SHARMILA MULLIGAN STRESSES CURIOSITY IN HER COMMENCEMENT REMARKS

In her address to Northwestern Engineering’s graduating master’s and PhD degree students, Sharmila Mulligan (’88, WCAS ’88, KSM ’94) emphasized a simple but profound point: Stay curious. “Keep moving forward, opening new doors, and exploring new things because curiosity will lead you to the right place,” Mulligan said. “Curiosity is, after all, the very basis of education. It is the fuel for discovery. It is what makes us innovate. It is what drove you to achieve what you’ve just achieved.” Mulligan spoke during the McCormick School of Engineering’s PhD Hooding and Master’s Recognition Ceremony in December, which honored 302 master’s and 10 PhD graduates. In total, 480 master’s students and 96 PhD candidates graduated during summer and fall 2022.



MORTON A PART OF NEW CENTER FOR PANDEMIC DECISION SCIENCE

The new, multi-institutional UT Center for Pandemic Decision Science, led by the University of Texas at Austin, counts Northwestern Professor David Morton as a member. Supported by a National Science Foundation pilot grant, the interdisciplinary center will bring together scientists, engineers, clinicians, and policy makers to tackle three fundamental challenges that plagued the global response to COVID-19 and are critical to the future resilience of our planet:

- Anticipating novel pathogen threats and detecting them at their source
- Forecasting and positively influencing individual, collective, and governmental responses to pathogens
- Integrating science into every stage of pandemic decision-making, including prevention, detection, containment, and mitigation

“This grant is an opportunity to advance the science of data-driven decision-making in public health.”

DAVID MORTON David A. and Karen Richards Sachs Professor of Industrial Engineering and Management Sciences

“WE WILL DETERMINE HOW NATURE-BASED SOLUTIONS SUCH AS COMMUNITY GREEN SPACES AND GREEN INFRASTRUCTURE CAN IMPROVE RESILIENCE TO CLIMATE CHANGE AND REDUCE VULNERABILITY TO EXTREME WEATHER.” **AARON PACKMAN** Professor of Civil and Environmental Engineering

NEW COLLABORATION TO STUDY CLIMATE AND URBAN SCIENCE IN CHICAGO

A multi-institution collaboration that includes Northwestern has received \$25 million from the US Department of Energy to study urban climate change, climate resilience, and environmental justice at a street, neighborhood, and regional scale over five years.

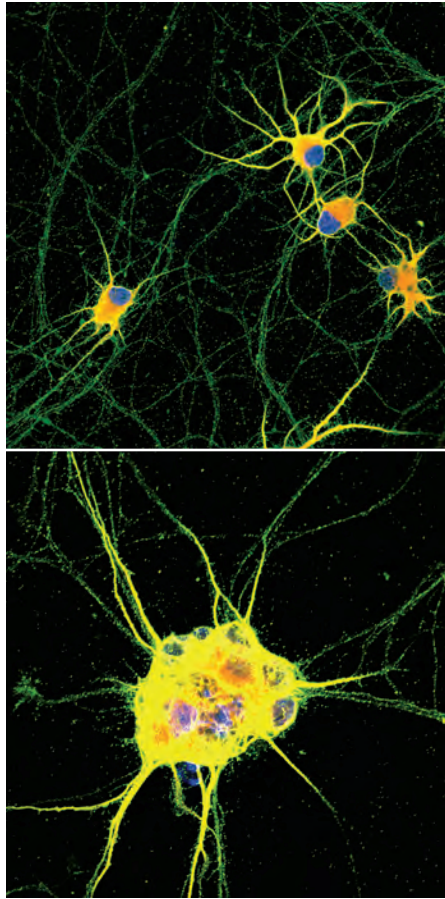
With the new funding, the team will establish Community Research on Climate and Urban Science, a Chicago-based Urban Integrated Field Laboratory. By better understanding urban climate impacts, the team will help communities become more resilient to the effects of climate change. As the lead for urban water research, Northwestern researchers will monitor the environment with artificial intelligence-enabled sensors that provide real-time data and respond to extreme weather events.



Conference Highlights Applying AI Techniques in Security

A newly launched lab will help in developing and deploying artificial intelligence (AI) technologies that serve as solutions to global threats. Led by Professor V.S. Subrahmanian, the Northwestern Security & AI Lab is conducting fundamental research in AI relevant to issues of cybersecurity, counterterrorism, and international security.

In October 2022, the Buffett Institute for Global Affairs and Northwestern Engineering hosted the Conference on AI and National Security to mark the lab’s launch. During the daylong event, Subrahmanian and his collaborators presented several research projects, including a terror early warning system, a model that predicts the number of attacks a terrorist network will carry out, and a system that generates fake versions of sensitive documents to impose costs on an attacker.



Mature, Lab-Grown Neurons Hold Promise for New Therapies

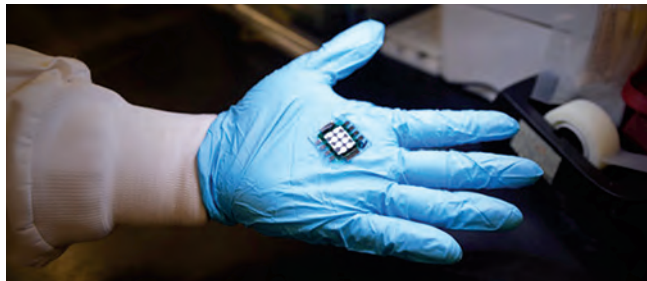
Northwestern-led researchers created the first highly mature neurons from human-induced pluripotent stem cells (iPSCs), a feat that opens new opportunities for medical research and potential transplantation therapies for neurodegenerative diseases and traumatic injuries.

Although researchers have previously differentiated stem cells to become neurons, those neurons were functionally immature—resembling neurons from embryonic or early postnatal stages. To create the mature neurons, the team used “dancing molecules,” a breakthrough technique introduced in 2021 by Northwestern Engineering professor Samuel Stupp. The team first differentiated human iPSCs into motor and cortical neurons and then placed them onto coatings of synthetic nanofibers containing the rapidly moving dancing molecules.

With further development, these mature neurons could be a promising therapy for spinal cord injuries.

“We have confirmed that neurons coated with our nanofibers achieve more maturity than other methods, and mature neurons are better able to establish the synaptic connections that are fundamental to neuronal function.”

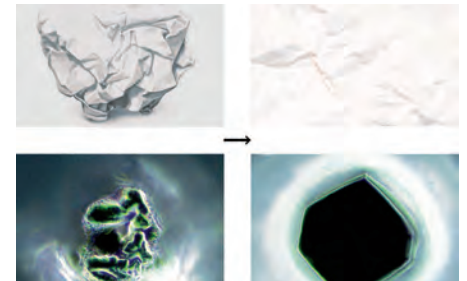
SAMUEL STUPP Board of Trustees Professor of Materials Science and Engineering, Chemistry, Medicine and Biomedical Engineering



Solar Cell Breaks Records for Efficiency and Voltage

In the race to make solar energy more practical amidst soaring gas prices and threats of climate catastrophe, a team of researchers is taking steps toward a more efficient, higher voltage solar cell.

A collaborative Northwestern University, University of Toronto, and University of Toledo team developed a new type of solar cell produced without silicon. Not only does the new cell have extremely high efficiency and record-setting voltage, it also bypasses the need for silicon, which is energetically costly to produce and purify. Instead, the team, which includes Professor Ted Sargent, employed two different layers of perovskites—a type of nanocrystal dispersed in a liquid and coated onto a surface—using low-cost, well-established techniques.



DNA GIVES COLLOIDAL CRYSTALS SHAPE-SHIFTING AND MEMORY ABILITIES

Northwestern researchers led by Professor Chad Mirkin uncovered a previously unknown property of colloidal crystals, highly ordered three-dimensional arrays of nanoparticles. The team engineered colloidal crystals with complementary strands of DNA and found dehydration crumpled the crystals, breaking down the DNA hydrogen bonds. But when researchers added water, all the crystals bounced back to their original state within seconds, which could make them useful in chemical and biological sensing, optics, and soft robotics.



Simple Color-Change Test Detects Fluoride in Water

While researchers have simple ways to measure concentrations of contaminants like fluoride, lead, and pesticides in lab environments, field testing requires more costly specialized equipment. Cellular biosensors can detect and report environmental contaminants in the field cost-effectively, but these sensors must be protected from substances found naturally in the extracted samples.

A cross-disciplinary team of Northwestern synthetic biologists is developing a sensor platform that will be able to detect a range of environmental and biological targets in samples. Using an established riboswitch to build a biosensor for fluoride, the team found they could protect the sensor by encapsulating the sensor inside a fatty membrane. Recently, researchers demonstrated that by modifying the makeup and penetrability of the lipid bilayer membrane, they could further tune and control the performance of their sensor.

“We can sense our heartbeat, our temperature, but if you think about it, we really have no way to sense chemical things. We’re living in an information age, but the information we have is so miniscule—chemical sensing opens enormous dimensions of information that you can tap into.”

JULIUS LUCKS Professor of Chemical and Biological Engineering

CHEMISTRY FLEXES ROBOTIC ARM WITHOUT ELECTRONICS

Organisms have autonomy in large part because of locomotion—the conversion of stored energy into slowly repeating electrical and mechanical signals that allow organisms to move. But these types of relatively slow movements, called low-frequency oscillations, are difficult to recreate in electronic devices.

A team of Northwestern University and Massachusetts Institute of Technology researchers, including Professor Todd Murphey, discovered a way to create slow movements using chemistry only and applied it to microrobotics. The engineers first created an oscillator formed by the interactions of a pair of active microparticles that rested atop a drop of hydrogen peroxide. To the team’s surprise, the more particles they introduced, the more stable the movement became—but only when the particles had very different levels of chemical reactivity.

The team put their knowledge to the test using a tiny robotic arm. By introducing a more reactive particle and adding more standard particles, the researchers found they could create consistent, cyclical movement in a microrobotic arm.



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Students who participated in McCormick’s Global Engineering Trek to Germany last September



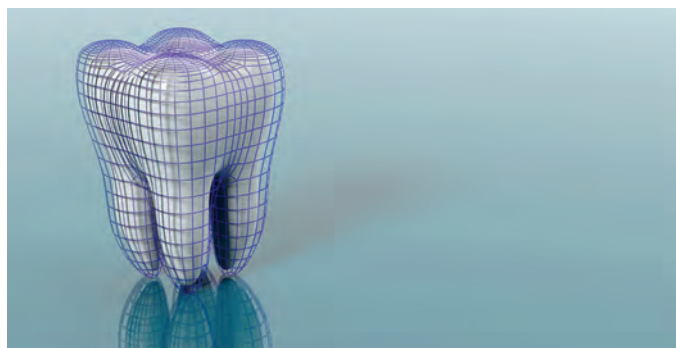
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Startups launched out of the Center for Synthetic Biology within the past two years



1

Minute of use after which most laryngoscope batteries are discarded, according to a study by undergraduate students



VARIETY IN ENAMEL COMPOSITION MAY PREDICT TOOTH HEALTH

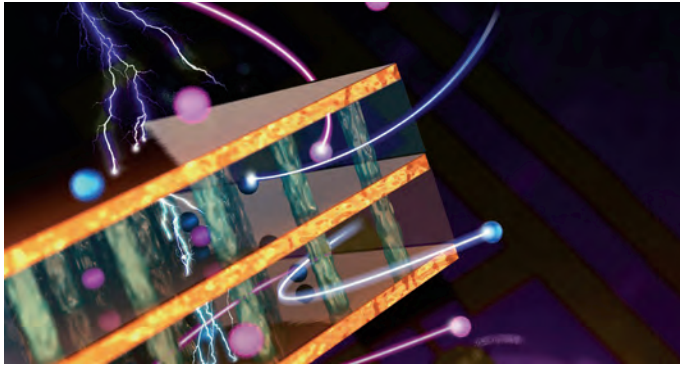
More than 90 percent of adults have had at least one cavity, yet not much is known about how or why some people are more likely than others to experience enamel decay or congenital conditions.

An interdisciplinary team of Northwestern researchers led by Professor Derk Joester has mapped ions within human teeth and found structural differences among samples that may enhance understanding of enamel’s life cycle and impact on health. Using x-ray diffraction technology, the team was able to observe tiny differences—on the order of picometers, a fraction of the size of a single atom—in the crystallographic parameters of enamel crystallites, which they linked to the presence of ions like magnesium and sodium or carbonate.

“Looking at different ions and seeing where they’re localized in the enamel tells us what cells are doing during formation and what they’re contributing.”

VICTORIA COOLEY

PhD Student in the Department of Materials Science and Engineering



VERTICAL ELECTROCHEMICAL TRANSISTOR ADVANCES WEARABLES TECHNOLOGY

A multidisciplinary Northwestern team, including Professors Tobin Marks and Jonathan Rivnay, developed a revolutionary transistor they expect to be ideal for lightweight, flexible, high-performance bioelectronics. The electrochemical transistor is based on a new kind of electronic polymer and has a vertical, instead of planar, architecture. It is compatible with blood and water and can amplify important signals, making it useful for biomedical sensing.

Such a transistor could enable wearable devices for signal processing, directly at the biology-device interface. Potential applications include measuring heartbeat and levels of sodium and potassium in blood as well as eye motion for studying sleep disorders.



“This exciting new type of transistor allows us to speak the language of both biological systems, which often communicate via ionic signaling, and electronic systems, which communicate with electrons.”

JONATHAN RIVNAY Professor of Biomedical Engineering



DEEPPAKE CHALLENGES PRESENT GROWING THREAT

Although public attention surrounding deepfakes has focused mostly on expansive propaganda campaigns, the problematic new technology is much more insidious, according to a report by artificial intelligence (AI) and foreign policy experts at Northwestern Engineering and the Brookings Institution.

In the report, the authors, including Professor V.S. Subrahmanian, discuss deepfake videos, images, and audio and their related security challenges. The researchers predict the technology is on the brink of being used much more widely, including in targeted military and intelligence operations.

 100

Academic and venture leaders who attended the inaugural event for Northwestern's new Querrey InQbation Lab

 6

Person space crew that Noshir Contractor studies with his computational models, which aim to predict crew performance for a potential mission to Mars

NEW APPROACH OPTIMIZES BATTERY-FREE PACEMAKER IMPLANTATION

Clinical pacemakers implanted in patients' hearts to keep them beating regularly are an important part of the treatment of potentially fatal arrhythmias. But current battery technology means these devices can be large and unwieldy.

Recent work by a team that includes Northwestern Engineering professors Igor Efimov and John Rogers could potentially shrink the size of these crucial implants. In 2021, the researchers introduced the first-ever transient pacemaker—a wireless, battery-free, fully implantable pacing device that disappears once it's no longer needed. Now, using bioadhesive materials, investigators working with cardiac surgeons produced a microsurgery procedure for implanting a battery-free pacemaker in a rodent. The work indicates several advances, including implanting novel pacemakers in restricted surgical spaces. The research could eventually pave the way for smaller pacemakers.



IMPROVING MRAM BY LESSENING RELIANCE ON ELECTRIC CURRENTS

During the semiconductor chip shortage that recently disrupted global supply chains, everything from cars to video game consoles became costlier and more difficult to acquire. Magnetic random-access memory (MRAM), an emerging memory technology that could address this need, combines speed, endurance, and nonvolatile operation, making it an attractive alternative.

Professor Pedram Khalili's group has been active in developing materials and devices for MRAM, but is also aware of its limitations. Controlled by electric currents, the existing MRAM technology is limited in how small its energy-per-operation can be and how closely bits can be placed together. Khalili and his team have developed a voltage-controlled MRAM technology that does not rely on electric currents to switch the magnetic memory bits. This can allow MRAM to scale to much higher densities for use in artificial intelligence accelerator chips, graphics processing units, and other types of computing hardware.

ADVANCES IN EXPERIMENTS AND MODELING LEAD TO BETTER UNDERSTANDING OF 2D MATERIALS

With applications for 2D materials ranging from energy to optics and electronics, the annual global market for these newly synthesized materials—already estimated at several billion dollars—is growing at a rate of 4 percent. Advancing models and experiments can enable the design of 2D materials that more reliably support devices and systems.

Led by Professor Horacio Espinosa, Northwestern Engineering researchers took another step toward better evaluating 2D materials. Espinosa and his colleagues performed in situ high-resolution transmission electron microscopy atomistic measurements, directly comparing the atomic structures and material toughness of 2D materials with those same qualities predicted by molecular dynamics simulations. Using this method, the simulations can accurately capture energy levels and atomic deformations, which helps researchers achieve more precise results.

“THE INTEGRATED FRAMEWORK PROVIDES A ROBUST APPROACH TO OBTAINING INTRINSIC MECHANICAL PROPERTIES OF 2D MATERIALS—IN THEIR PRISTINE AND DEFECTIVE STATES—AND INFORMS THE ANALYSIS OF DEVICE RELIABILITY WITH UNPRECEDENTED ACCURACY.”

HORACIO ESPINOSA

James N. and Nancy J. Farley Professor of Manufacturing and Entrepreneurship



Investing in New Water Filtration Membranes Is Worth the Price

High-performing water filtration systems can reduce cost and energy consumption, a Northwestern Engineering-led study found. In the study, headed by Professor Jennifer Dunn, researchers performed a high-level analysis of membrane filtration systems to evaluate cost, energy consumption, and greenhouse gas emissions associated with desalination and wastewater treatment. The researchers examined antifouling membranes, a high-performance filtration system, and found that municipal wastewater facilities could spend 43 percent more on antifouling membranes and up to three times more on antifouling membranes for desalination—and still maintain their baseline operating costs.

 130

Number of attendees at the Lambert Conference on the Future of Human-Computer Interaction + Design in October

 57

Teams that have received pilot project funding through the Northwestern Institute on Complex Systems over the past nine years



WHY FISH LOOK DOWN WHEN THEY SWIM

Just as one might look down at the sidewalk while walking, fish look downward when they swim, a study by a Northwestern-led international collaboration has confirmed.

The study is the first to combine simulations of the zebrafish's brain, native environment, and spatially varying swimming behavior into one computational model. By analyzing this model, researchers, including Professor Emma Alexander, concluded that this quirk—looking down while swimming forward—is an adaptive behavior that evolved to help fish self-stabilize when swimming against a current.

As water moves, fish constantly try to self-stabilize in place rather than get swept away in a moving stream. Focusing on other fish, plants, or debris might give a fish a false sensation that it's moving. The stable riverbed below them, however, gives fish more reliable information about their direction and speed.



Julio M. Ottino



Samir Khuller



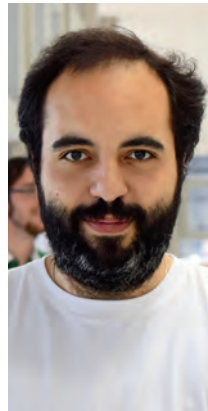
Arthur Prindle



Q. Jane Wang



Roozbeh Ghaffari



Christos Dimoulas



Chad Mirkin



Barry Nelson



Guillermo Ameer



Samuel Stupp



Kristian Hammond



Jian Cao

Faculty Awards

Julio M. Ottino Selected for 2023 G. I. Taylor Medal

Ottino was recognized by the Society of Engineering Science for “pioneering theoretical and experimental contributions to the fluid mechanics of mixing.”

Q. Jane Wang Elected to National Academy of Engineering

Wang is a leader in tribology and the study of surface science whose research has led to better-performing engines, batteries, and lubricants.

Chad Mirkin Receives King Faisal Prize for Work in Chemistry

Mirkin is the first Northwestern professor to win the award widely considered to be the most prestigious in the Muslim world.

Samuel Stupp Selected for Von Hippel Award

Stupp received the Materials Research Society’s highest honor for pioneering contributions to the development of molecularly designed supramolecular soft materials.

Samir Khuller Named ACM Fellow

The Association for Computing Machinery Fellows program recognizes outstanding accomplishments in computing.

Roozbeh Ghaffari Elected to National Academy of Inventors

His contributions in soft bioelectronics and wearable biosensors have been recognized with multiple awards and more than 60 patents.

Barry Nelson Receives INFORMS Lifetime Professional Achievement Award

Given by the Institute for Operations Research and the Management Sciences, the award recognizes Nelson’s major contributions to the field of simulation.

Kristian Hammond Elected 2023 AAAI Fellow

The Association for the Advancement of Artificial Intelligence recognized Hammond for significant contributions to case-based reasoning, practical natural language generation linking data to meaning, and methods for safe AI.

Arthur Prindle and Christos Dimoulas Earn NSF CAREER Awards

The Faculty Early Career Development Program offers the National Science Foundation’s most prestigious awards in support of early-career faculty.

Guillermo Ameer, Jian Cao Named 2022 Researchers to Know

The annual list compiled by the Illinois Science & Technology Coalition spotlights researchers who are driving innovation in the state.



"I wanted to **change the culture of the place**. But to do so, I didn't create a map that tells you how to get from A to B to C. Instead, I worked to create a compass that could guide us."

● **JULIO M. OTTINO** Dean

All Together Now

Developing a whole-brain philosophy and culture

In 2004, **JULIO M. OTTINO** had what he thought was his dream job—and it wasn't dean of Northwestern Engineering.

After decades of success as a chemical engineering professor known for his work in complexity and fluid dynamics, Ottino had cofounded and become the director of the new Northwestern Institute on Complex Systems. Ottino aimed to create a hub of research that would cross academic boundaries to uncover the fundamental principles that govern complex systems and to connect the researchers who were developing concepts and tools with the users of those advances.

At this same time, Ottino was also serving on the second search committee to find the next dean of the McCormick School of Engineering after the first failed to produce a candidate. When—despite his own efforts—the committee failed to find the right candidate, it became clear that the search needed to turn inward. Ottino was offered the job.

"I did not want it," he says. Ultimately, he accepted. With his mind still tuned toward complexity research, the idea of a different kind of educational leadership began forming in his mind.

“If I had to encapsulate my philosophy, it may be ‘**seeing and exploiting connections.**’ I thought, ‘Shouldn’t we do something for the faculty and students here to be enriched by the network and, in the process, enrich the network as well?’”

● **JULIO M. OTTINO** Dean

Ottino envisioned himself leading a school that thrived on interconnectivity and new ways of thinking. But in 2005, that kind of school was still a dream. The McCormick School of Engineering was well regarded but siloed within itself and from other schools at Northwestern.

As a leader, Ottino hoped to take what he learned in his study of complex systems—namely, the importance of networks and emergence—and apply it to the engineering school. Northwestern itself had a broad, rich array of distinguished faculty and whip-smart students, but the disciplines didn’t talk to each other.

As quoted by the *Daily Northwestern* months before starting the job in 2005, Ottino said, “If McCormick were like an orchestra... we have very gifted individual players, but we have to produce great music by producing a more unified sound. We don’t have the togetherness kind of aspect (yet).”

The time was right to grow the network.

“If I had to encapsulate my philosophy, it may be ‘seeing and exploiting connections,’” Ottino says. “I thought, ‘Shouldn’t we do something for the faculty and students here to be enriched by the network and, in the process, enrich the network as well?’”

The network grew swiftly. Two important nodes at the school were established early in his tenure: the Segal Design Institute, which educates design thinkers through immersive, interdisciplinary programs, and the Farley Center for Entrepreneurship and Innovation, which brings together disciplines to teach the entire innovation life-cycle. Both were springboards to connect faculty and students to other schools at Northwestern—a consistent priority during Ottino’s tenure—and their success laid the foundation for new courses, programs, and initiatives that reach almost every discipline.

“I wanted to change the culture of the place,” he says. “But to do so, I didn’t create a map that tells you how to get from A to B to C. Instead, I worked to create a compass that could guide us.”

The compass encouraged networks to form naturally, by supporting faculty to pursue multidisciplinary research projects, giving students the resources they needed to form new student groups, and laying the foundation for new kinds of experiential courses and degrees that brought together students from different fields and taught them to think in new ways.

That sort of thinking has resonated across the University, where Ottino has found many partners in his vision.

“At Kellogg, we encourage our students to experiment and learn multiple skills,” says Francesca Cornelli, dean of the Kellogg School of Management. “The world is complex and nonlinear, and to be successful they need to transcend specialization and be able to use multiple skills simultaneously.”

“Dean Ottino is a leader who embodies this cross-disciplinary skill: his ability to master the complexity of his discipline and then to transcend it and bring insights in the world of art is not common. That ability to go beyond a single discipline is what made him such a trusted partner in finding a common mission for Kellogg and McCormick.”

■ A GUIDING PHILOSOPHY: WHOLE-BRAIN ENGINEERING ●

Exploiting these new networks led to the refinement of what would become Northwestern Engineering’s defining philosophy: whole-brain engineering.

Whole-brain engineering integrates the elements of left-brain thinking—analysis, logic, synthesis, and math—with the kind of right-brain thinking that fosters intuition, metaphorical thought, and creative problem-solving. To lead effectively, Ottino believed, engineering students and faculty needed to master both.

For Ottino personally, whole-brain thinking came naturally. In addition to his successful research career, Ottino was also a painter. He used his skill to understand and illustrate the patterns that emerge in chaotic flows, including creating all of the hand-drawn images in his first book. Thinking creatively was in his DNA. But he found that engineering often attracted analytical thinkers who often had a tough time considering different possibilities, who often converged too quickly onto an idea. Creative thinking—questions or ideas that didn’t fit neatly into boxes—did not jibe with their mental libraries.

When he became dean in 2005, Ottino set out to change that. Again, Segal and Farley proved to be leading indicators of the possibility of a whole-brain engineering vision. Design thinking, especially in the first-year course Design Thinking and Communication, taught undergraduate students the hallmarks of brainstorming, iterating, and testing ideas. It also taught them the importance of working in teams, an essential element in Farley’s NUvention courses, which brought together students from several schools to commercialize ideas and technologies.



▶ **Whole-Brain Legacy**

Watch a video celebrating the legacy of whole-brain engineering.



1



2

“At Kellogg, we encourage our students to experiment and learn multiple skills. The world is complex and nonlinear, and to be successful they need to transcend specialization and be able to use multiple skills simultaneously. Dean Ottino is a leader who embodies this cross-disciplinary skill: his ability to **master the complexity of his discipline and then to transcend it** and bring insights in the world of art is not common. That ability to go beyond a single discipline is what made him such a trusted partner in finding a common mission for Kellogg and McCormick.”

● **FRANCESCA CORNELLI** Dean, Kellogg School of Management

1
Dean Julio M. Ottino (left), Northwestern president Henry S. Bienen (right), and Ford Motor Company officials at the dedication of the Ford Motor Company Engineering Design Center in 2005.

2
The Northwestern Engineering community comes together to view the Northwestern car teams' latest vehicles in 2017.

3
Whole-brain engineering encourages students to master both left-brain analytical thinking skills and right-brain creative problem-solving.



3

“During Dean Ottino’s tenure, the Block Museum and McCormick have developed a collaboration of unprecedented depth, founded on the value of **embracing the unknown as part of the journey that leads to innovation and opens pathways within the imagination.**

Through the cultivation of partnerships like ours, Julio has reinforced for the entirety of the Northwestern community that transformative innovation can happen at the intersections of usually distinct academic disciplines and modes of creativity and inquiry.”

LISA GRAZIOSE CORRIN

Ellen Philips Katz Executive Director of the Block Museum of Art



“Connectivity is essential.”

JULIO M. OTTINO Dean



1 Julio M. Ottino, Dario Robleto, and Lisa Graziose Corrin tour *The Heart's Knowledge* exhibition at the Block Museum.

2 Students work together during a Design Thinking and Communication class.

3 Students present their startup pitch in the Farley Center's NUvention: Web + Media course in 2017.

4 Ottino addresses attendees at the 2019 exhibition opening for *Data as Art*, a collaborative class between Northwestern Engineering and the School of the Art Institute of Chicago.

5 Northwestern Engineering has strengthened research collaborations with external organizations such as Shirley Ryan AbilityLab.



Julio M. Ottino accepts the Bernard M. Gordon Prize in 2017. From left: Northwestern president Morton Schapiro, NAE president Dan Mote, Ottino, BMG Charitable Trust officer Ross Brown, Northwestern provost Dan Linzer.

Exemplifying the philosophy were courses, assessments, and resources designed to encourage leadership, personal development, and collaboration. “I found that if you want to change the culture of the place, you start with the undergraduate students, who are the group open to change, since it changes every four years,” Ottino says.

“Through these efforts, our students emerge as whole-brain thinkers who are successful at working in teams. They understand the augmentation of thinking that happens when different domains are connected.”

● A CONNECTED CULTURE ■

Throughout Ottino’s tenure as dean, this whole-brain engineering vision, along with a collaborative mindset, has made Northwestern Engineering one of the most connected schools at Northwestern. Not only does McCormick have research or educational connections with almost every other school at the University, it also collaborates with Argonne National Laboratory, Shirley Ryan AbilityLab, and the Art Institute of Chicago. Beyond the United States, McCormick has expanded its global footprint, creating many new international partnerships, including most recently with institutions in Israel.

One particularly fruitful whole-brain collaboration has been with Northwestern’s Block Museum of Art. What began as a series of talks by artists to the Northwestern Engineering community evolved into the Artist-at-Large program. Since 2018, artist Dario Robleto has visited campus regularly, meeting with faculty and students to give presentations on his work and finding

intersections that could benefit both art and engineering. Robleto’s time at McCormick culminated this spring with an exhibition of his work at the Block Museum.

“During Dean Ottino’s tenure, the Block Museum and McCormick have developed a collaboration of unprecedented depth, founded on the value of embracing the unknown as part of the journey that leads to innovation and opens pathways within the imagination,” says Lisa Graziouse Corrin, Ellen Philips Katz Executive Director of the Block Museum. “Through the cultivation of partnerships like ours, Julio has reinforced for the entirety of the Northwestern community that transformative innovation can happen at the intersections of usually distinct academic disciplines and modes of creativity and inquiry.”

Ottino has received many research accolades throughout his tenure, culminating in his election to the National Academy of Sciences in 2022. In 2017, Ottino received the Bernard M. Gordon Prize for Innovation in Engineering and Technology Education from the National Academy of Engineering. The nation’s highest prize for engineering, the Gordon Prize recognizes leaders in academia who have developed new educational approaches to engineering. The award capped off Ottino’s original vision, which now sets the stage for the next dean.

As Ottino steps down to focus on research and the wealth of possibilities and ramifications opened by his new book, *The Nexus*, he hopes the school retains at least one piece of his legacy. “Connectivity is essential,” he says.

EMILY AYSHFORD

“I found that if you want to **change the culture of the place**, you start with the undergraduate students, who are the group open to change, since it changes every four years. Through these efforts, our students emerge as whole-brain thinkers who are successful at working in teams. They **understand the augmentation of thinking that happens when different domains are connected.**”

● **JULIO M. OTTINO** Dean

A Whole-Brain Education

The classroom alone isn't enough to create whole-brain thinkers. It's why Dean Julio M. Ottino sought to transform the student experience by expanding the curriculum in design and entrepreneurship, supporting interactive courses that promote well-being and mental health, and championing new student groups borne out of the school's growing leadership in areas like design and computer science.

"We appreciate the importance of encouraging students to follow their interests," Ottino says. "By participating in numerous activities, they are exposed to different viewpoints and ideas, and ways to use their engineering skills."

The effect of these changes has been notable. Northwestern Engineering's undergraduate admittance rate dropped from nearly 45 percent in 2006 to just 7 percent in 2022, while yield—the number of students accepting an offer of admission—increased from less than 30 percent to more than 55 percent during that same period of time.

Demographics have also shifted: 36 percent of the school's Class of 2026 are women, while nearly 27 percent are underrepresented minorities.

We spoke with students and alumni to learn how their experiences at Northwestern Engineering supported and guided their journey to become whole-brain engineers.

AS TOLD TO BRIAN SANDALOW



Segal Design Institute

Endowed by Gordon and Carole Segal in 2007, the Segal Design Institute significantly expanded Northwestern Engineering's undergraduate design curriculum and supported design research.



SHANE DOLAN

Mechanical Engineering ('22)

Program Manager

Tesla



Like all first-year engineering students, I enrolled in the Design Thinking and Communication course sequence offered by the Segal Design Institute. DTC provided me with invaluable exposure to some of the most fundamental concepts in engineering. The distinguished faculty instructed us on the essential phases of the engineering design process, emphasizing the significance of communicating our ideas proficiently to stakeholders, teammates, classmates, and other invested parties. DTC fortified my understanding of the primary stages of observation, ideation, and validation, laying the groundwork for acquiring critical skills, such as conceptual sketching, efficient user testing, and iterative design.

These skills proved foundational in my subsequent coursework at Northwestern. Through Segal courses, I communicated effectively with clients and users, which facilitated the development of user-centric solutions. My early exposure to the advanced manufacturing tools and equipment in the Segal prototyping shop was crucial in designing a prototype intelligent sprinkler device to help farmers more efficiently use water. These experiences taught me lessons I use today to address design problems and coordinate with team members at Tesla.

"DTC FORTIFIED MY UNDERSTANDING OF THE PRIMARY STAGES OF OBSERVATION, IDEATION, AND VALIDATION, LAYING THE GROUNDWORK FOR ACQUIRING CRITICAL SKILLS, SUCH AS CONCEPTUAL SKETCHING, EFFICIENT USER TESTING, AND ITERATIVE DESIGN."

● SHANE DOLAN Mechanical Engineering ('22)

“FOUNDERS WEAR MANY HATS, SO THESE BROAD EXPERIENCES HAVE ESTABLISHED A ROBUST FOUNDATION TO TACKLE CHALLENGES I MIGHT FACE INSIDE OR OUTSIDE THE CLASSROOM IN THE FUTURE.”

• **KEVIN KASPAR** Manufacturing and Design Engineering ('24)

Farley Center for Entrepreneurship and Innovation

Supported by a gift from the late James Farley ('50) and his late wife Nancy, the Farley Center was established in 2008 to foster entrepreneurship across the university. Today, Farley serves more than 1,000 students annually and offers more than 30 courses.

Computer Science

To meet the growing demand for computer science at Northwestern, the McCormick School of Engineering launched the CS+X initiative in 2016. With plans to hire 20 faculty—including 10 appointments structured as collaborative joint appointments with other disciplines such as education, journalism, and robotics—the initiative also led to significant reimagining and expansion of teaching efforts and the development of dedicated teams of teaching faculty and peer mentors.



PETER ZHONG

Computer Science ('22)

Incoming PhD Student, Computer Science

Carnegie Mellon University

A Northwestern computer science education is not just about teaching students how to code, write a database, or write a compiler. There is an institutional focus on treating CS as a discipline of engineering and applying an engineering mindset to it. Professors emphasize the importance of writing clean code and that development should be test-driven. I have carried this mindset with me to both my research and industry jobs.

The community fostered by the faculty is welcoming and impactful. As a first-year student, I was amazed by the wealth of research opportunities. Faculty were genuinely interested in mentoring students like me who had limited experience in CS research.

Similarly, there is a wealth of teaching opportunities—even for its undergraduates. The professors I peer-mentored for didn't just ask me to manage office hours, they helped develop my teaching skills. I ran discussion sections, and professors gave me constructive feedback on how to best communicate course materials. As someone who aspires to potentially become a college professor, I found it invaluable to get such experience so early in my academic career.



KEVIN KASPAR

Manufacturing and Design Engineering ('24)

Studying entrepreneurship through the Farley Center has taught me how to think critically about how the product development cycles of hardware and software technologies occur alongside the business model and scalability of a startup. The center has been especially supportive in helping me launch InfernoGuard, a startup wildfire detection and notification platform. I created the pitch deck for my company in Farley's Principles of Entrepreneurship course, which gave me unique insight into building the foundations of pitch decks. InfernoGuard has since won multiple collegiate startup competitions, including Northwestern's 2022 VentureCat pitch competition.

Through the Farley Center, I have also gained experience in areas such as team building, managing coworkers, sales, marketing/branding, and many more. Founders wear many hats, so these broad experiences have established a robust foundation to tackle challenges I might face inside or outside the classroom in the future.

“As someone who aspires to potentially become a college professor, I found it invaluable to get such experience so early in my academic career.”

• **PETER ZHONG** Computer Science ('22)

Student Groups

Northwestern Engineering student groups foster community and allow students to apply skills learned in the classroom to innovate, advocate for causes, and hone leadership and teamwork skills used in their careers.

Women in Computing



HELEN ZHU

Computer Science ('25)

Historian

Women in Computing

Women in Computing has been an invaluable resource throughout my career at Northwestern. I have fostered a network of peers, mentors, and friends who provided advice and encouragement when I needed it. I also developed leadership skills by serving on WiC's executive board, organizing events, maintaining its website and external communications, and mentoring students. I gained so much from mentors and friends older than me, and I strive to pass on that experience and knowledge to the next generation of women in computing.

Through WiC, I have also attended conferences, hackathons, speaker events, and workshops. These opportunities connected me with industry professionals and peers who have helped guide my academic and professional journey. These experiences have paid off—I've gained the technical and soft skills that have been essential to my growth as an engineer and professional in any field. I am grateful to Dean Ottino and the computer science department for supporting WiC at Northwestern.

"These experiences have paid off—I've gained the technical and soft skills that have been essential to my growth as an engineer and professional in any field."

HELEN ZHU Computer Science ('25)

"DEAN OTTINO WAS THE FIRST PERSON WHO BELIEVED IN ME AS AN ENGINEER AND ENCOURAGED ME TO FLOURISH INTO A LEADER IN THE UNITED STATES."

MERT ISERI Entrepreneurial Design ('11)

Design for America

Founded at Northwestern in 2009, Design for America teaches human-centered design to young adults and community partners through student-led design studios. During the next decade, DFA became a national network comprising 38 programs. The organization was transitioned to the Watson Foundation in 2020.



MERT ISERI

Entrepreneurial Design ('11)

Cofounder, Fellow

Design for America

"Do the things that cannot be done." I remember staring at that sentence after Dean Ottino spoke to me and a room full of young engineers during my first year at Northwestern Engineering.

Fast-forward two years later, I had just cofounded a new student group on campus with my friends called Design for America. I had no idea what we were going to do, but I knew how it made me feel in my gut. This is what I left Turkey for. This feeling was the gift that I was chasing. The exhilarating feeling of discovery. Above any technical skills I picked up during my time at Northwestern, I learned the ability to fan the flame of starting something new.

In the decade that followed, DFA thrived, expanding to dozens of chapters across the country supported by more than 1,000 student members, all focused on tackling social challenges using design thinking.

DFA also spurred my own startup adventures. I failed, failed again, and succeeded with SwipeSense, a company whose hand hygiene improvement tool for hospital settings was borne out of a DFA project. The experience made me appreciate my journey as an entrepreneur as much as the destination many times over.

Dean Ottino was the first person who believed in me as an engineer and encouraged me to flourish into a leader in the United States. Without his support, there is no DFA. Without DFA, there is no SwipeSense. Without SwipeSense, there is no Mert Hilmi Iseri.



1 Northwestern's Women in Computing chapter at the Grace Hopper Celebration in 2019.

2 Three Northwestern Baja cars at the Winter Baja race in Houghton, Michigan, in 2023.

3 Students from Design for America chapters from across the country attend the DFA Leadership Studio at Northwestern in 2016.

Northwestern Baja Racing



LAURA FERRUCCI

Mechanical Engineering ('23)

Project Manager

Baja Racing 2022-23



"BAJA TAUGHT ME COUNTLESS LESSONS AND SKILLS, INCLUDING HOW TO BE A RELENTLESS, ASSERTIVE, BUT EFFECTIVE LEADER. I ALSO LEARNED ABOUT THE IMPORTANCE OF TEAMWORK."

Building a car is a huge undertaking and requires knowledge of unexpectedly vast breadth and depth. Engineers on Baja are both designers and manufacturers, enjoying the full scope of the engineering experience. Each member in charge of a project must understand not only the theory of how a component should function, but also how it should be modeled such that other team members can interpret and integrate it into their designs. We also must understand manufacturing and assembly processes so we can make components with the level of precision necessary for a safe, drivable, competitive car.

Baja taught me countless lessons and skills, including how to be a relentless, assertive, but effective leader. I also learned about the importance of teamwork. At minimum, we must communicate with one another well enough to assemble our car, but strong teamwork is essential to organize a project across time. These are skills that I will use long after graduation.



Student Development

To foster student success inside and outside the classroom, Northwestern Engineering has launched flexible study programs and academic programming designed to promote well-being and mindfulness.

Personal Development StudioLab

Launched in 2007 as the Office of Personal Development, the Personal Development StudioLab offers students unique courses and programming in areas such as emotional intelligence, improv, and swing dancing as a way to support student well-being, mental health, and curiosity.



VICTOR AGABA

Industrial Engineering ('25)

"I'M A MORE MINDFUL ENGINEER BECAUSE OF THE COURSES I'VE TAKEN IN STUDIO LAB. I HAVE LEARNED TO USE MY CONNECTION WITH THE ENVIRONMENT AROUND ME TO ADD VALUE TO WHAT I ALREADY KNOW."

Through courses like Engineering Improv and PATH (Personal Academic Tactical Help), the Personal Development StudioLab has taught me to appreciate what is in my control and the joy of not taking myself too seriously.

StudioLab has also helped me communicate more effectively. I don't hold myself to unnecessarily high standards of articulation—I can get the point across. Sometimes that means using hands more than words. Sometimes that means speaking a different language. What matters is that I focus more on communication than speech.

I'm a more mindful engineer because of the courses I've taken in StudioLab. I have learned to use my connection with the environment around me to add value to what I already know. However, how much I know as an engineer doesn't matter if I can't meaningfully communicate it to others. That's how impact is made. And that's what mindfulness is helping me achieve every day.

McCormick Integrated Engineering Studies Major

While the interests and aspirations of most undergraduate students in McCormick are well-supported by its departmental degree programs, Northwestern Engineering launched the McCormick Integrated Engineering Studies program so undergraduates could develop an individualized engineering degree program to explore new, emerging connections between existing academic fields.



SOPHIE FURLOW

Biomedical Computation ('23)

My MIES degree has prepared me to pursue a career in computational bioengineering. I've always been drawn to interdisciplinary work, where I can use my love for math and computing to advance biotechnology. My background covering the integration of several fields has helped make me a competitive candidate for positions at the front lines of computational innovation in biology.

The MIES program has also let me take advanced courses in a variety of different departments. I've found that each department has a unique style of teaching, and pursuing a MIES degree has taught me how to think like different types of engineers. When I'm solving a problem, I have the tools to attack it as a computer scientist, industrial engineer, applied mathematician, or biological engineer.

Every classroom is a setting to work my brain in a new way and put on a different engineering hat. I've become a better engineer by weaving these modes of thinking together and forming unlikely bridges between fields.

"I've become a better engineer by weaving these modes of thinking together and forming unlikely bridges between fields."

• **SOPHIE FURLOW** Biomedical Computation ('23)

Expanding the Footprint of Master's Programs

During Dean Julio M. Ottino's tenure, professional master's degree programs at Northwestern Engineering have surged. The school has launched or reimagined eight master's programs—some in collaboration with other schools or institutes at Northwestern—that respond to burgeoning industry opportunities and challenges in analytics, artificial intelligence (AI), energy, robotics, and more.

MASTER OF SCIENCE IN ENGINEERING DESIGN INNOVATION LAUNCHED: 2007

Students learn a human-centered approach to address design challenges. This deeply immersive program in design thinking—an innovative process of user observation, visualization, rapid prototyping, and iteration—prepares graduates to lead cross-functional teams and design groundbreaking new products and services.

MASTER OF SCIENCE IN ANALYTICS LAUNCHED: 2011

Students learn the skills that drive business success in a data-driven world through a unique curriculum that explores three areas of analytics: predictive (forecasting), descriptive (business intelligence and data mining), and prescriptive (optimization and simulation).

MASTER OF SCIENCE IN EXECUTIVE MANAGEMENT FOR DESIGN AND CONSTRUCTION LAUNCHED: 2012

Designed for emerging leaders with eight or more years of experience in architecture, engineering, and construction, this program emphasizes the enhanced skills, strategies, and insights needed to become successful senior leaders in the design and construction industries.

MMM PROGRAM REDEFINED: 2014

The first dual-degree program for innovation, the program's 2014 overhaul added a new MS in Design Innovation degree conferred by Northwestern Engineering that focuses on design research, problem framing, and concept development. Graduates also earn an MBA from the Kellogg School of Management.

MASTER OF SCIENCE IN ROBOTICS

LAUNCHED: 2014

This program prepares the next generation of roboticists by bridging the knowledge and experience gap between undergraduate robotics curriculum and industry needs through hands-on learning that develops expertise in computer science, mechanical engineering, electrical engineering, biomedical engineering, and mathematics.

MASTER OF SCIENCE IN ARTIFICIAL INTELLIGENCE

LAUNCHED: 2018

Created to meet the demand from industry for computer scientists who understand AI systems and the problems they can solve, the program equips students with the skills to create powerful AI systems that integrate with workflows, business applications, and human interactions.

MASTER OF SCIENCE IN ENERGY AND SUSTAINABILITY LAUNCHED: 2020

Developed with the Institute for Energy and Sustainability at Northwestern, this program expands the University's internationally recognized strengths in energy sciences research. Students navigate the complex intersection of technology, economics, and regulation in the growing industries associated with sustainability and energy innovation and leadership.

MBAi PROGRAM LAUNCHED: 2021

This joint-degree program with the Kellogg School of Management responds to the growing and global need for leaders who can spearhead strategic, business-driving innovation while understanding the complexities and nuances of the technologies—such as artificial intelligence and machine learning, robotics, and computational thinking—that enable it.



Alumni: Where Are They Now?

Read about Northwestern Engineering alumni who are applying their whole-brain education to guide their success.

From Disparate to Interdisciplinary

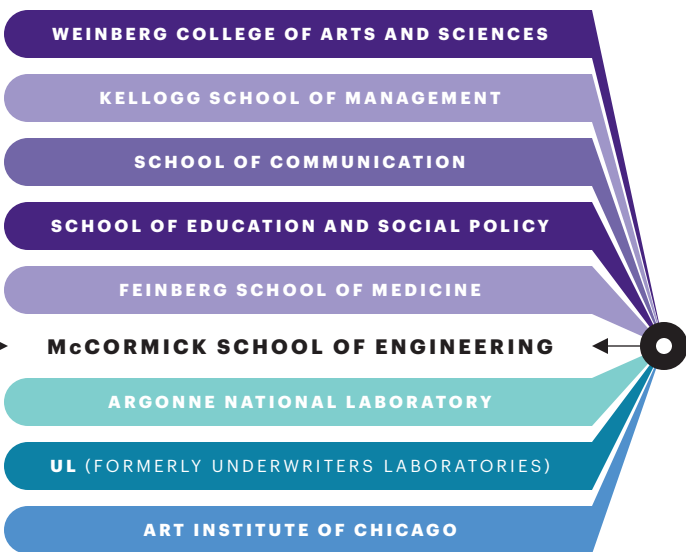
Transforming the Research Enterprise

In a rapidly changing **GLOBAL SOCIETY**, we are confronted with challenges both old and new . ◉ **Pandemics** now spread more quickly. **Climate change** and **environmental degradation** resulting from **human behavior** ▶ threaten our well-being ◀ and that of millions of species. And while **artificial intelligence** has made humans more efficient, it has also presented new challenges in **technological safety and equity** .

HOW DO WE SOLVE THESE PROBLEMS? Even that question raises a new challenge as the traditional boundaries between the academic disciplines we'd usually turn to for answers have become increasingly blurred. ◉ **Fortunately**, says **Dean Julio M. Ottino**, the best ideas to solve complex problems lie at the intersection of disciplines . **Engineers researching solutions to these multilayered problems**, he contends, must **collaborate with others from different backgrounds** .

It's **A RESEARCH CULTURE** Ottino has championed throughout his career at Northwestern Engineering. Faculty are encouraged to **be curious** , to **take risks** , and to **build and embrace** the dynamic network both **within Northwestern University** and **with partners throughout Chicagoland** .

It's one of the reasons the **MCCORMICK SCHOOL OF ENGINEERING** now counts ▶ **NEARLY EVERY SCHOOL** ◀ at the University among its **RESEARCH COLLABORATORS** and has forged **PARTNERSHIPS** with **notable external organizations** .



“When you surround yourself with others from different perspectives, you are more likely to uncover the true problem behind the perceived problem. Our work has focused on **rethinking how research itself is fostered**, believing if you promote a more collaborative culture, you lay the groundwork for transformative research.”

◉ **JULIO M. OTTINO** Dean

An embodiment of this vision , the Northwestern Engineering faculty has been transformed during Ottino's tenure. **HE HAS HIRED:**

30 TENURED PROFESSORS
102 TENURE-TRACK PROFESSORS

▶ **THAT'S TWO-THIRDS OF THE SCHOOL'S CURRENT FACULTY.** ◀

In addition, nearly **20 percent of all faculty hold joint appointments** with other Northwestern schools in education, medicine, journalism, communication, business, and more.



“I’m deeply grateful to Julio for facilitating my transition to Northwestern, and for **defining and clearly articulating a distinctive, exciting identity** for our community—one that values both the boldly creative and the highly technical aspects of research in engineering science, in a collaborative style that resonates strongly with students and faculty alike.”

◉ **JOHN ROGERS** Louis Simpson and Kimberly Querrey Professor of Materials Science and Engineering, Biomedical Engineering, and Neurological Surgery. Joined Northwestern Engineering in 2016.



DANIELLE TULLMAN-ERCEK
Professor of Chemical and Biological Engineering.
Joined Northwestern Engineering in 2016.

“When I arrived at Northwestern from UC Berkeley, I was excited to see that **support for collaboration is fostered every step of the way**. My own research group went from being funded primarily by single-investigator grants to being entirely funded by collaborative grants. More importantly, the impact of our work went up exponentially—we are now able to work on the most challenging problems in synthetic biology and come up with real solutions that can be implemented in industry.”



V.S. SUBRAHMANIAN
Walter P. Murphy Professor of Computer Science and Faculty Fellow at Northwestern’s Buffett Institute for Global Affairs.
Joined Northwestern Engineering in 2021.

“Many university administrators talk about interdisciplinary research, but few **put their words into practice**. It was clear to me that Dean Ottino was a rare exception to this rule. As I started building the Northwestern Security and AI Lab after my arrival, it was clear that the strong partnership he forged between McCormick and the Buffett Institute for Global Affairs was a force multiplier for my own efforts to shape such an interdisciplinary effort.”

Paying Dividends

▶ **THIS COLLABORATIVE APPROACH TO RESEARCH** has resulted in Northwestern cementing its leadership status in existing fields like

- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
- BIOELECTRONICS
- SUSTAINABILITY
- ROBOTICS
- DATA SCIENCE AND OPTIMIZATION

AT THE SAME TIME, it has inspired the creation of new fields of research, such as

- SYNTHETIC BIOLOGY
- PHYSICAL GENOMICS

▶ **FACULTY RECOGNITION HAS ALSO FLOURISHED.** ◀

\$140 MILLION

AWARDED IN FUNDING FOR FACULTY RESEARCH IN 2022,
MORE THAN DOUBLE THE SCHOOL'S FUNDING TOTAL IN 2005.

- 10** Faculty named to the National Academy of Engineering since 2013, a **100 PERCENT INCREASE OVER THE PREVIOUS DECADE.**
- 42** National Science Foundation CAREER AWARDS EARNED by junior faculty since 2005.

▶ **Accolades and funding** alone don't tell the entire story. Ottino would rather look at the school's continued translational success.

Northwestern Engineering **ranks first** out of all Northwestern schools in total inventions, disclosures, and number of startups.

“While research funding is often the typical metric to measure success, it is a means to the end,” Ottino says. ◉ “Connecting researchers across disciplines has played a central role in the quality of research output. ▶ **THE IMPACT OF THE WORK IS THE ULTIMATE GOAL.**” ◀

At the Center of It All

RESEARCH CENTERS have played a vital role in realizing Dean Ottino's vision to promote interdisciplinary faculty collaboration, catalyze innovation, and support translation. Since 2005, Northwestern Engineering has launched **20 RESEARCH CENTERS**, including several jointly with other Northwestern schools or industry leaders. These centers have supported faculty in advancing new fields of study while reinforcing strengths in existing areas of research.

• The **Center for Advanced Regenerative Engineering** (2018) supports research and technology development at the convergence of engineering, medicine, and biological sciences to improve the repair and regeneration of blood vessels, skin, nerves, bones, and other tissues and organs. Central to the center's work is forging an ecosystem to help bring reliable and scalable technologies from the research bench to operating rooms.

▣ Launched as a joint venture with Northwestern's School of Communication, the **Center for Human-Computer Interaction + Design** (2020) brings together researchers and practitioners from across the University to study, design, and develop the future of human-computer interaction at home, work, and play, in the interest of creating a more collaborative, sustainable, and equitable society.

• The **Center for Physical Genomics and Engineering** (2019) uses breakthrough optical imaging and computational genomics to reprogram the genome's chromatin, which regulates gene expression, to treat disease and engineer living systems to overcome environmental challenges. The center's 14 core faculty members come from 11 University departments representing Northwestern Engineering, Weinberg College of Arts and Sciences, and Feinberg School of Medicine.

▣ In partnership with the Digital Intelligence Safety Research Institute at UL, the **Center for Advancing Safety of Machine Intelligence** (2022) fosters a wide-ranging research network to evaluate the human impacts of intelligent technologies and develop best practices for the design, development, and evaluation of AI systems that are safe, equitable, and beneficial to all.

• The **Center for Robotics and Biosystems** (2019) strengthens Northwestern Engineering's leadership in collaborative robotics, envisioning a future where humans and robots work together; where robots augment human abilities, not replace them. Through partnerships with the Feinberg School of Medicine and Shirley Ryan AbilityLab, faculty explore new opportunities at the intersection of robotics and biological systems.

• A collaboration between Northwestern Engineering and the Art Institute of Chicago, the **Center for Scientific Studies in the Arts** (2013) provides opportunities for engineers and artists to uncover new insights into longstanding artistic mysteries, including the formation of soap protrusions on Georgia O'Keeffe paintings and the methods used by Roman-Egyptian artists to paint lifelike mummy portraits more than 2,000 years ago.

▣ From its beginnings within engineering, the **Center for Synthetic Biology** (2016) has grown to include more than 20 researchers from across Northwestern. The center's focus, to build new biological systems for specialized purposes, has led to new classes of sustainable chemicals, next-generation materials and devices, and targeted therapeutics. Its work has led to notable entrepreneurship and translational impact: synthetic biology researchers have produced seven startups in the past two years alone.

• Launched as part of a university-wide commitment to advance global energy and sustainability, the **Institute for Sustainability and Energy at Northwestern** (2008) fosters transformational, interdisciplinary research leading to new solar technologies, sustainable materials, and carbon management.

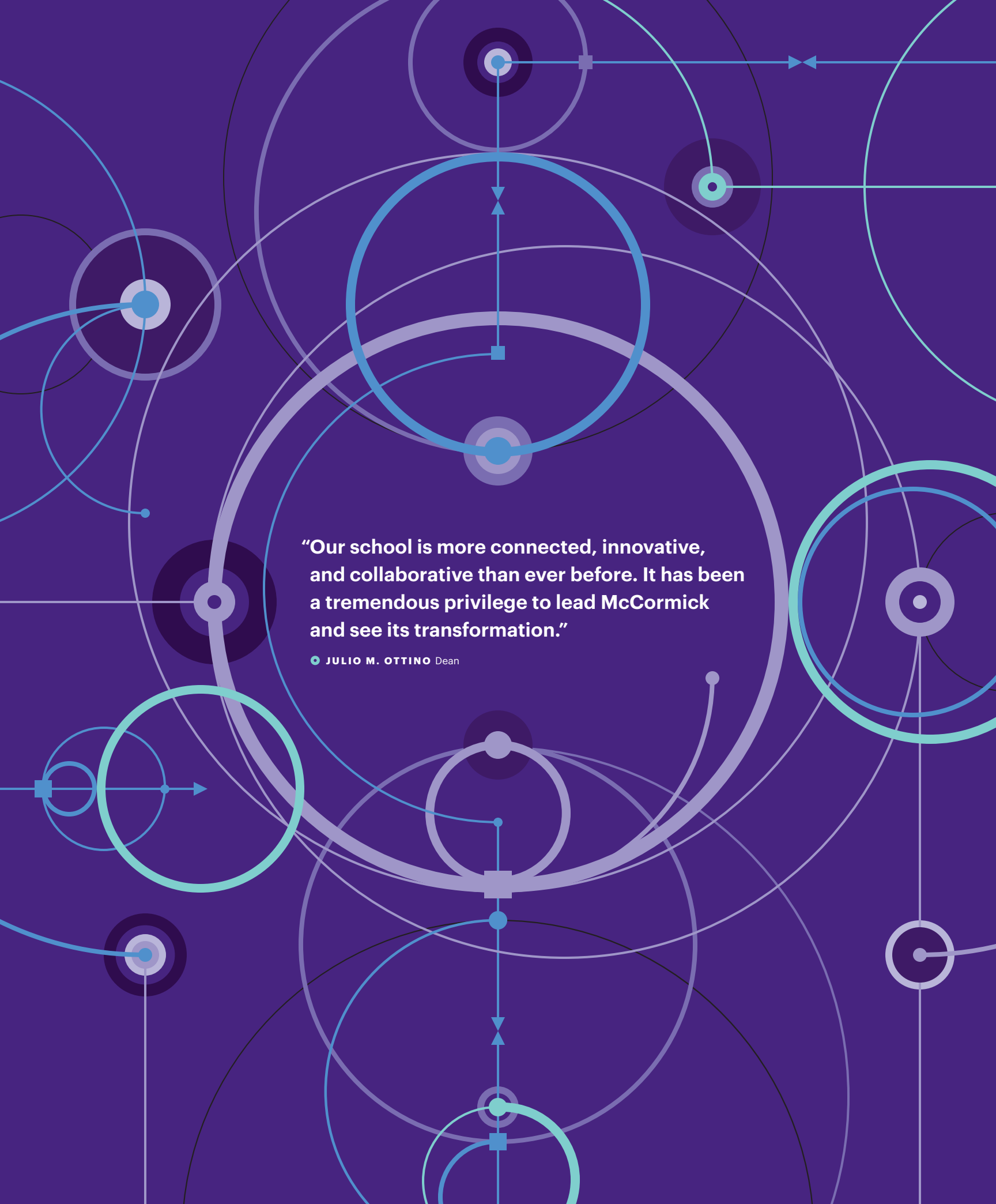
• The **Northwestern Argonne Institute of Science and Engineering** (2011) brings together researchers from Northwestern and Argonne National Laboratory to create powerful collaborations in fields such as energy, biological and environmental systems, data science and computation, materials, and national security.

▣ With broad applications across medicine, rehabilitation, and sports, the **Querrey Simpson Institute for Bioelectronics** (2019) supports the entire ecosystem of translational science—from fundamental materials development to device and component engineering to system prototyping to commercialization—all under one roof.

Other research centers launched under Ottino's leadership:

- Center for Computation and Theory of Soft Materials
- Center for Computer Science and Learning Sciences
- ▣ Center for Deep Learning
- Center for Engineering and Health
- ▣ Center for Engineering Sustainability and Resilience
- Center for Innovation in Global Health Technologies
- Center for Optimization and Statistical Learning
- Falk Center for Molecular Therapeutics
- ▣ Northwestern Center for Engineering Education Research
- Northwestern Initiative for Manufacturing Science and Innovation

ALEX GERAGE



**"Our school is more connected, innovative,
and collaborative than ever before. It has been
a tremendous privilege to lead McCormick
and see its transformation."**

JULIO M. OTTINO Dean

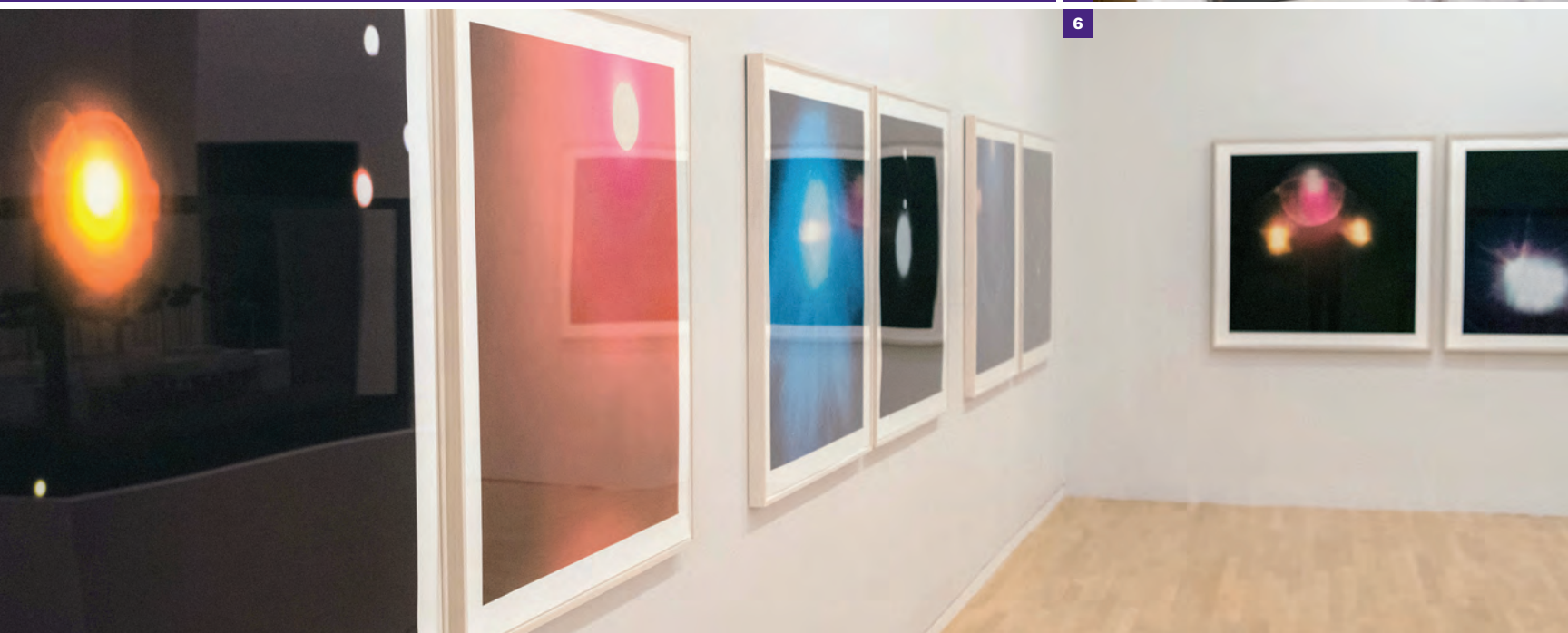


The Heart's Knowledge

■ **THE HEART'S KNOWLEDGE:**
SCIENCE AND EMPATHY IN
THE ART OF DARIO ROBLETO, A
2023 EXHIBITION AT THE BLOCK
MUSEUM OF ART, MARKED THE
CULMINATION OF ROBLETO'S
FIVE-YEAR ENGAGEMENT AS
NORTHWESTERN ENGINEERING'S
ARTIST-AT-LARGE. ○

This partnership between the Block Museum and the McCormick School of Engineering gave the artist an open "hall pass" to learn from, collaborate with, and question scientists, engineers, and experts from across the University.

For Robleto, artists and scientists share a common aspiration: to increase the sensitivity of their observations. Throughout the history of scientific invention, instruments like the cardiograph and telescope have extended the reach of perception from the tiniest stirrings of the human body to the farthest reaches of space. In his prints, sculptures, and video and sound installations, Robleto contemplates the emotional significance of these technologies, bringing us closer to the latent traces of life buried in the scientific record.



1
Survival Does Not Lie in the Heavens, 2012. Digital inkjet print mounted on Sintra, a collection of stage lights taken from the album covers of live performances of now-deceased gospel, blues, and jazz musicians.

2
Small Crafts on Sisyphian Seas, 2018. Intricate sculptures made from polished nautilus shells and other sea life give shape to the speculative search for intelligent life in the universe.

3
Dario Robleto, right, and Dean Julio M. Ottino view *Sparrows Sing to an Indifferent Sea*, 2019. Earliest waveform recordings of inhalation and blood flowing from the heart during various auditory experiences (1876–96), rendered and 3D printed in brass-plated stainless steel.

4
American Seabed, 2014. Made from fossilized prehistoric whale ear bones salvaged from the sea, various butterflies, and butterfly antennae made from stretched and pulled audiotape recordings of Bob Dylan's "Desolation Row," among other materials.

5
The Pulse Armed with a Pen (An Unknown History of the Human Heartbeat), 2014. Robleto collaborated with sound historian Patrick Feaster to digitally resurrect heartbeats in audio form, allowing visitors to listen to pulses of life recorded before the invention of sound playback.

6
The Sky, Once Choked with Stars, Will Slowly Darken, 2011. Suite of eight archival digital prints.

7
Sisyphus' Archivists, 2018.

8
The Computer of Jupiter, 2019.

9
The Boundary of Life Is Quietly Crossed, 2019. Two-channel 4K video.

10
The First Time, the Heart (A Portrait of Life 1854–1913), portfolio 2017. Robleto transformed early measurements of heartbeats made by 19th-century pioneers of cardiography into exquisite photolithographs on paper hand-sooted with candle flames.



7



8



9



10



“The climate emergency waits for no one and needs all the help it can get.”

Mission Next

Having cofounded and guided Shield AI to global leadership in intelligent autonomous systems design, entrepreneur **Andrew Reiter** eagerly anticipates his next new challenge—climate change.

In the military world, danger—an unseen combatant, a threatening counterassault—may lurk behind every door, every corner. But what if military personnel could gather more information in advance of a potential threat?

Andrew Reiter ('10) cofounded Shield AI to help tackle that very question.

“If you can put eyes and ears into a situation to know who and what is where, then you can change your tactics accordingly,” Reiter says.

Over the past eight years, Shield AI has grown from “three guys in a garage” into a 500-person global enterprise working, in Reiter’s words, “on technology at the forefront of what is possible.”

Beginning with the launch of its first product—a compact autonomous quadcopter that can fly inside buildings and stream real-time maps and videos—Shield AI has been on an upward trajectory to become a leader in the field of autonomous systems. The company’s artificial intelligence (AI) architecture has been integrated into larger aircraft, including F-16 planes, and it has recently introduced an AI pilot that enables swarms of drones and aircraft to operate autonomously without GPS, communications, or human intervention.

Forbes has called Shield AI one of America’s most promising AI companies. *Fast Company* hailed it as one of the world’s most innovative.

As a chemical engineering major at Northwestern Engineering in 2006, Reiter could not have foreseen the career turn that would lead him to cofound Shield AI. His intrinsic interest in robotics, however, exploded when he won the 2009 McCormick Autonomous Robot Design Competition alongside Andrew Dai ('10) and Eric West ('11).

“I loved the short feedback loop in robotics and making changes that were immediately manifested,” Reiter says.

After earning a master’s degree in robotics from Harvard University in 2012, Reiter worked on GPS-denied navigation at Draper, a Boston-based engineering lab focused on national defense. There, he led a team developing a handheld system for 3D scanning and reconstruction and another that created a quadrotor for fully autonomous exploration.

Those innovations spurred former Navy SEAL Brandon Tseng and his entrepreneur brother, Ryan, to fly from San Diego to Boston for a face-to-face meeting with Reiter. The Tsengs envisioned creating an autonomous quadrotor for wartime situations but needed technical expertise to transform their idea into a tangible reality.

“It was the perfect meetup of cofounders,” Reiter says. “After eight hours, we had the loose strings of Shield AI in place.”

As the United States and its allies have increasingly embraced the potential of AI in national security, Shield AI has become a prominent early mover. It has deepened relationships with military partners in the United States and abroad, earned investments from heralded firms like Andreessen Horowitz and Homebrew, and continued advancing its technology for military reconnaissance.

Though Reiter left Shield AI in the fall of 2022 and returned to Boston, he remains a company adviser. He is now plotting his next professional steps with a target on decarbonization, perhaps through efforts in nuclear energy or energy storage.

“That’s my next adventure,” Reiter says. “The climate emergency waits for no one and needs all the help it can get.”

DANIEL P. SMITH



COMING FULL CIRCLE

As dean of Princeton University Graduate School and a nationally recognized researcher, **Rodney Priestley** is living life lessons learned at Northwestern.

Rodney Priestley (PhD '08) knows how challenging it can be for busy faculty members to stay fully present for the students they mentor. The Princeton University Graduate School dean is still impressed by the amount of time and effort John Torkelson and Linda Broadbelt, his Northwestern chemical and biological engineering professors, devoted to him as his PhD advisers.

"I felt a lot of engagement and support from them," Priestley says. "Their tremendous dedication stands out in my memory."

Priestley remembers traveling to Italy with Torkelson to attend an international conference, where they had dinner with polymer scientists in a restaurant with a view of the Leaning Tower of Pisa. It was an impactful opportunity that showed him how academics collaborate and engage with colleagues all over the world.

As part of that trip, Broadbelt invited Priestley to visit her in England, where she was on sabbatical at Imperial College London. "I spent time with her and her family," he says. "I would meet with her during the day at the university, and we would talk about research. It was an amazing experience."

On the flight back, the idea that a career in academia could be exciting began to crystallize for Priestley. "Fast forward to 2017, and I also went on sabbatical at Imperial College London, so it all came full circle," he says.

A DISRUPTOR WITH IMPACT

Priestley joined the Princeton faculty in 2009. As Pomeroy and Betty Perry Smith Professor of Chemical and Biological Engineering, he gives his students the same care and attention he received at Northwestern, sharing lessons learned about the importance of communication skills and building a respectful culture where everyone feels valued.

A love of creativity and discovery fuels Priestley's research, which applies principles of physics, chemistry, and engineering to nano-scale processing and characterization of polymers and soft matter, with a particular emphasis on thin films, colloids, and nanocomposites. His contributions to the field of polymer physics and chemistry earned him the 2023 Carl S. Marvel Award for Creative Polymer Chemistry, one of many awards he's received.

Priestley has also cofounded three companies to translate his research into real-world applications, which include AquaPao, a solar water purification technique developed with postdoctoral research associate Xiaohui Xu. That innovation earned the duo a spot on *Newsweek's* America's Greatest Disruptors list.

Excited by the intersection of research, innovation, and entrepreneurship, Priestley expanded Princeton's ties with industry, venture capitalists, entrepreneurs, and alumni when he was the school's inaugural vice dean for innovation. "We endeavor to uncover new fundamental science and then try to push that science to have some type of impact on society," he says.

Serving on the Northwestern Alumni Association Board of Directors allows him to impact the university that gave him so much. He will speak at Northwestern Engineering's PhD Hooding and Master's Degree Recognition Ceremony in June. He also presents seminars on campus, including one planned for October 2023.

"A lot of the success I've had stems from my time at Northwestern," he says. "It's hard for me to imagine being where I am now without my Northwestern experience."

SARA LANGEN

"IT'S HARD FOR ME TO IMAGINE BEING WHERE I AM NOW WITHOUT MY NORTHWESTERN EXPERIENCE."

IN MEMORIAM



**PROFESSOR
EMERITUS
HERBERT
CHENG**

Herbert SuYuen Cheng, Walter P. Murphy Professor Emeritus of Mechanical Engineering, passed away at age 92 on October 24, 2022.

Cheng joined Northwestern Engineering in 1968 as a professor in the Department of Mechanical Engineering after previously working in the private sector and at Syracuse University. His research contributions included establishing several engineering theories in the areas of elasto-hydrodynamic and mixed-film lubrication and applying them in various projects such as the NASA Space Shuttle program, domestic and foreign car industries, nuclear-powered submarines, and medical joint replacement implants.

In 1987, he was elected to the National Academy of Engineering for “pioneering contributions to the tribology of gas, elasto-hydrodynamic, plasto-hydrodynamic, and mixed lubrication, and for leadership in developing collaborative university and industrial research in tribology.”

His other honors included the 1987 Society of Tribologists and Lubrication Engineers National Award, the 1990 American Society of Mechanical Engineers Mayo D. Hersey Award, and the 1992 Institution of Mechanical Engineers Gold Medal.



**PROFESSOR
EMERITUS
LAWRENCE
HENSCHEN**

Lawrence J. Henschen, professor emeritus of electrical and computer engineering, passed away at age 78 on January 8, 2023.

An author of more than 120 academic papers, Henschen was an expert in web-based programming for wireless sensor network nodes, visual interfaces for program development, energy harvesting, universal access in human-computer interaction, and automated reasoning with applications to heterogeneous databases.

From 2000 to 2009, Henschen served as the associate dean of students at the Graduate School at Northwestern. As the graduate director of the department from 1989 to 2001, he was responsible for the department’s graduate curriculum, policy, and application process. From 1980 to 1996, he was the chair of the Computer and Information Studies program at Northwestern’s Weinberg College of Arts and Sciences.

He supervised 69 PhD students and earned multiple teaching accolades, including the McCormick TECH Teaching Award, the Illinois Gamma Chapter of Tau Beta Pi outstanding teacher award, and the Charles Deering McCormick Professor of Teaching Excellence award.



**ASSOCIATE
PROFESSOR
CHI-HAUR
WU**

Chi-Haur Wu, associate professor of electrical and computer engineering, passed away at age 71 on October 22, 2022.

Wu joined Northwestern Engineering in 1983 after previously working at Unimation Robotics. He investigated industrial and interactive robotics, CAD/CAM, industrial control applications, automated manufacturing, neural networks, computer graphics and images, automated medical instrumentations, and surgical robot systems.

He authored more than 20 academic papers, and he and his collaborators secured four patents. His most recent research interests included the areas of biomimicking muscle damping control, autonomous robotics, assembly/disassembly automation, and product life evaluation.

Throughout his career, he supervised 11 PhD students and 30 master’s degree students and chaired the department’s instructional labs committee for many years. An expert in solar-powered and battery-powered electrical motor-driven vehicles, Wu also served as a longtime faculty adviser for the Northwestern University Solar Car Team.

Thomas H. Barton '46
Neil E. Hiatt '46
Wallace B. Behnke Jr. '47
James C. Wulliman '47
Merle E. Kersten '48
James F. Derry '50
William C. Schumacher Jr. '50
Herbert J. Nelson Jr. '51
Logan H. Schlipf '51
Gordon F. Kingsley '52
Albert P. Christensen Jr. '53, '55
John W. Dresely '53
Donald K. Huber '53, '56
Donald E. Amundson '54
Ronald G. Schultz '54

George L. Kummer Jr. '56
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William C. Laser '58
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Umesh R. Hattikudur '69, '74
William J. Humphrey '69
Walter F. Podolski '69, '73
James W. Tingey '70

Michael P. Lidrich '72, '79
John E. Racek '73
Predrag Golombovski '74
Paul D. Pospischil '74
William P. Pantos '80
Basil C. P. Borun '81
Daryl J. Eigen '81
Mark Iserloth '85, '90
Kenneth R. Giroux '87
John J. Kennelly '91
Curtis J. Kreklau '91
Victor Judnic '97
Christopher A. Smolen '98
Ryan Joseph Letcher '07, '12, '12
James W. Tingey '70

BIG IDEA

CONFRONTING WATER SCARCITY DROP BY DROP

New research from Kyoo-Chul Kenneth Park, assistant professor of mechanical engineering, found that when droplets on a fiber coalesce, they self-propel and increase their speed by up to 270 percent. Park tested droplets of different sizes and viscosities on wires with varying diameters, looking for the optimal combination for speed and energy. When he identified the right ratio, the joined droplets' speed increased nearly threefold. This, he realized, could help optimize a key area of his research—fog harvesting.

As the challenge of water scarcity has grown globally, fog harvesters—hydrophilic mesh sheets stretched across vertical posts—have emerged as an inexpensive and accessible way to collect water from air. Unfortunately, today's harvesters are inefficient because water droplets often escape through the mesh if the wires are sized incorrectly.

Park's research could further the design of new, more efficient fog harvesters. His finding could also help researchers optimize other environmental processes, including mist elimination, filtration, oil/water separation, and microplastics collection.



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FROZEN FLASH

Toro, the Northwestern Baja Motorcats' lead vehicle, finished fifth at the 2023 Winter Baja race, held January 28 in Houghton, Michigan. Hosted by Michigan Technological University, the annual snow-and-ice Baja competition pitted 45 off-road cars, including three from Northwestern, against each other in challenging winter conditions meant to test every aspect of the student-built cars.

