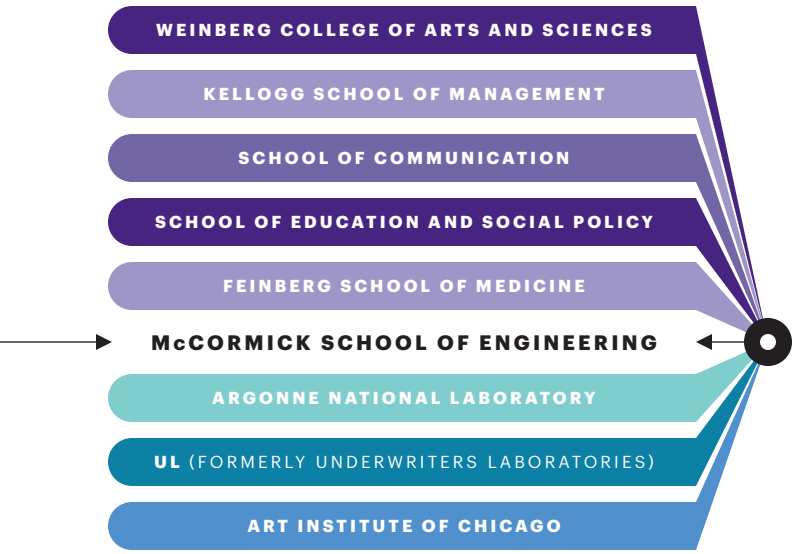
From Disparate to Interdisciplinary
Transforming the Research Enterprise

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

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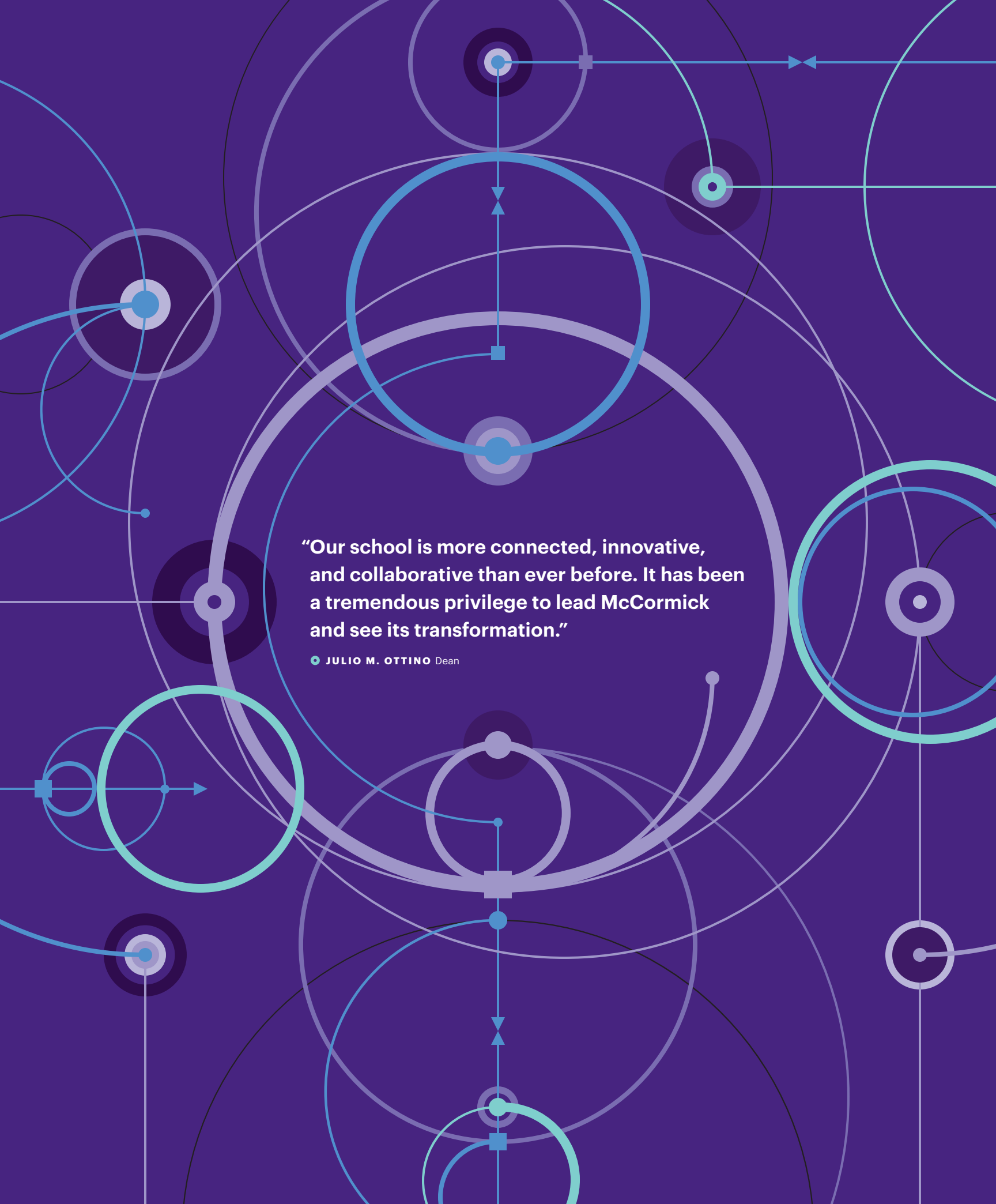

"Our school is more connected, innovative, and collaborative than ever before. It has been a tremendous privilege to lead McCormick and see its transformation."

JULIO M. OTTINO Dean