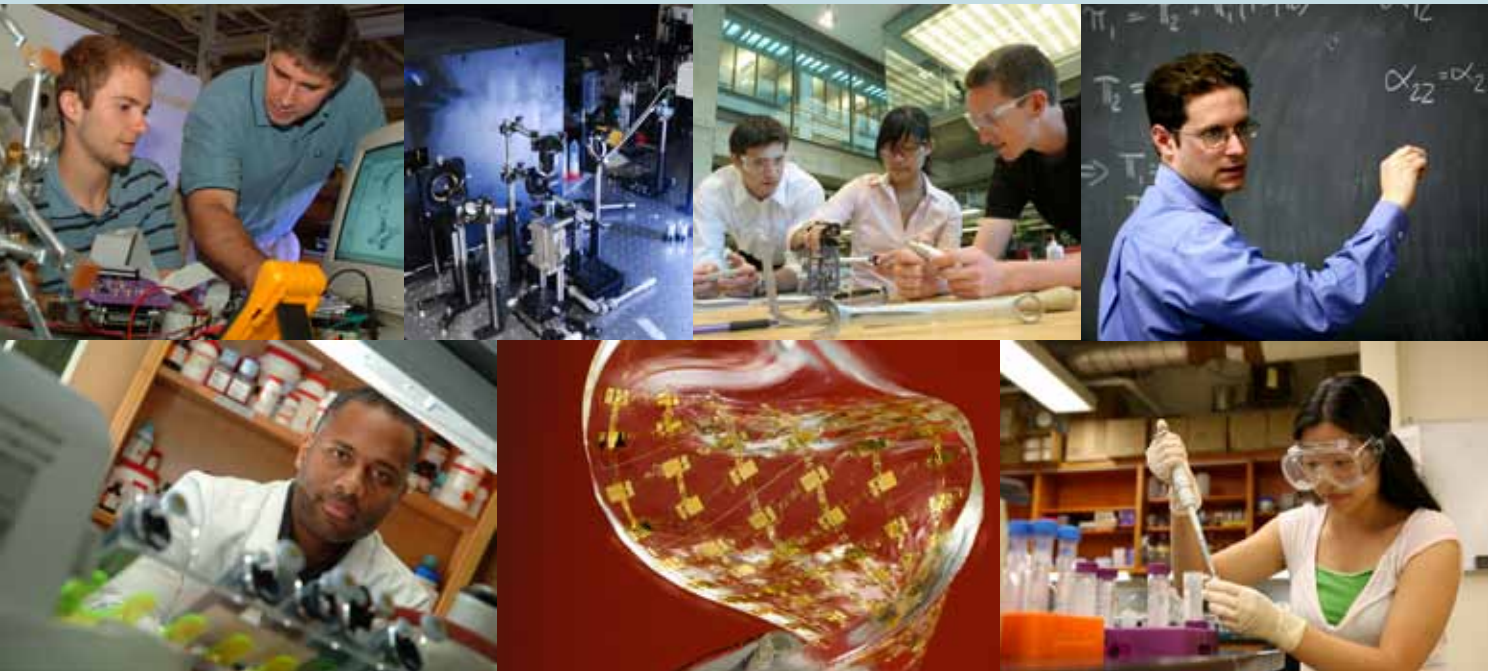


McCormick

Northwestern Engineering

A compass for the future:
The state of McCormick 2009



Julio M. Ottino, Dean

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

Explore
Create
Transform
100
Years

This is a year that brings changes in both our national and University leadership, so it is appropriate to pause and reflect on the state of McCormick. I would like to provide you with an integrated view of our strategy and results: how we think and what have we accomplished. I then want to discuss our plans for the future. Nearly four years ago we embarked on an effort to achieve “Excellence at All Levels” at McCormick — a lofty goal — but one that has provided clear focus to our efforts. We began by analyzing McCormick, looking at our core strengths and our place in the world, and then defined a vision to lead us into the future. Given the many challenges facing us at the present time, it is important to have a sense of direction, a timeless compass for the future. We have accomplished a lot, but have much further to go.



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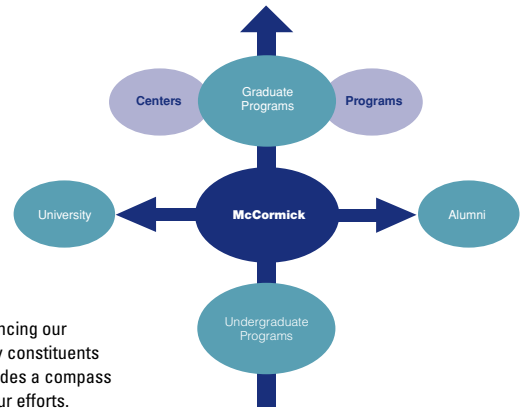
How we think

It is an exciting time to be in engineering. The boundaries between science, technology, engineering, and medicine are blurring. Breakthroughs happen every day, often at the intersection of these domains. The pace of change is accelerating, the waves of technological innovation are becoming shorter, and the ability to innovate quickly has become a key competitive advantage.

The world is increasingly connected. As the world gets smaller, information and, to some extent, knowledge have become commodities available to almost everyone everywhere. Knowledge is no longer a key American advantage. The easy dissemination of knowledge at all levels of society is dramatically altering the landscape in which we operate. This dizzying rate of change brings significant challenges, but challenges bring opportunities. Our goal is to ensure that McCormick is poised to adapt and capitalize on emerging opportunities in this quickly changing landscape.

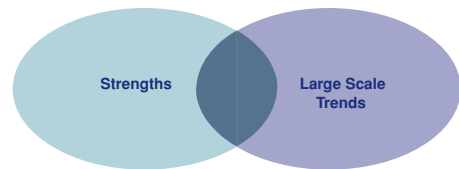
Our strategy

The path forward for McCormick depends on artfully balancing several critical needs: nurturing and growing a vibrant, solid, and entrepreneurial undergraduate program; developing cutting-edge knowledge in our graduate programs; developing and maintaining relationships with all units within Northwestern; and serving the needs of our alumni, our peers, industry, and the nation. Mindful of these constituents, we charted our path: one firmly rooted in our undergraduate programs, driven into the future by the strength of graduate research, and balanced by Northwestern peers, alumni, industry, and government. The resulting picture is a compass, a timeless guide, a sense of identity that provides direction to all of our efforts.



Balancing our many constituents provides a compass for our efforts.

We analyzed two areas: large-scale trends affecting the world and McCormick’s unique strengths. At the intersection of these trends and our strengths lies our greatest opportunity for growth; this intersection defines the challenges that we are best prepared to meet.



Our greatest opportunities lie at the intersection of our strengths and large-scale trends.

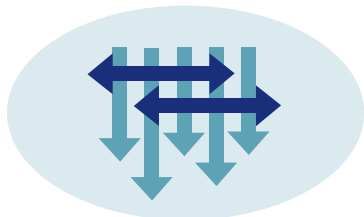
Cross-linking and adaptability

Key to our strategy are two concepts: cross-linking and adaptability. They are the common denominators that emanate from an analysis of the large-scale forces shaping the world today and our specific strengths; they underlie all of our actions.

Given that the size of our faculty and student body will continue to be a limiting factor and that our

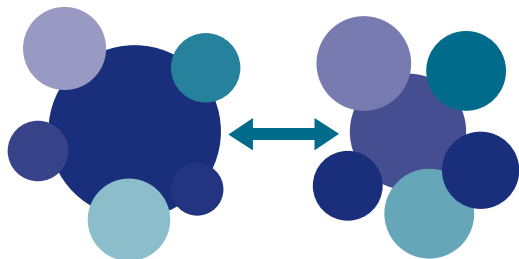
strength will never reside in sheer numbers, it is critical that we relentlessly pursue excellence at all levels and leverage our strengths across multiple areas through effective cross-linking. The highly interdisciplinary environment at Northwestern is a key strength for McCormick, but in order for future cross-linking to become a competitive advantage, we must creatively pursue strategic joint faculty appointments as well as targeted cross-school and cross-University collaborations. Continued collaboration with individuals and research organizations outside of Northwestern is essential for future success.

In addition to researchers who go deeply in one area, we must have others who cross-link disciplines.



Equally important for our success is the recognition by our faculty of shifts in research dominance: the waves of research innovation are becoming shorter and shorter. It is no longer possible to presume that an entire career can be spent in one area of research. The pursuit of flexibility and adaptability applies to all members of the McCormick community; adaptability is a core competency to remain relevant in a constantly changing world.

A key strategy for ensuring adaptability is careful attention to the balance between what we call core and periphery. Core strengths are areas in which we excel — areas that are required for success in today's world. Peripheral strengths are those that provide unique opportunities today and that could become future areas of strength. To constantly evolve, we must monitor the interaction between all of the core and peripheral areas, which include our research, our teaching, and our operations. Core areas of today must be balanced with investments in peripheral areas — either through faculty hiring or through enhanced support for an emerging area of research or curricular development.



Core strengths must be balanced with continual investment in peripheral and emerging areas.

Whole-brain engineering

Engineers used to be thought of in terms of what they made. At McCormick we believe that engineers should be thought of in terms of how they think. Engineering is now a foundational discipline; students with degrees in engineering pursue a multitude of career options. Regardless of the fields they choose, engineering thinking stays with them. We believe that creative engineering — engineering thinking with lasting impact — requires whole-brain engineers. Engineering is an activity grounded in analysis, logic, synthesis, and math — all considered elements of left-brain or convergent thinking. Left-brain skills are essential in engineering, but to prosper in this rapidly changing world and to foster adaptability and cross-linking, we need to add another high-level thinking skill: right-brain or divergent thinking — the thinking that is at the root of intuition, artistic ability, and creativity. If innovation and leadership are the goals, divergent thinking is a must.

One way, though not the only way, to infuse right-brain thinking in engineering is through design. Design is one McCormick's core competencies. Our view of design is broad: it extends from product design to systems design to design of services, and it includes such areas as health-care systems, financial products, and architecture.

At both the undergraduate and graduate levels we are interested in design because we want to foster design thinking — the ability to solve the right problem behind the perceived problem. Engineering teaches problem solving; design teaches problem framing. These skills differentiate our students from their peers.

Our unique opportunity: The future belongs to whole-brained organizations

The world is increasingly connected; important problems are linked along multiple dimensions. The most pressing problems facing the world — energy and sustainability, global health and epidemics, aging demographics, poverty, and education — all require integrated and global solutions. These solutions involve multiple considerations: ethical, economic, technical, and legal. Engineering thinking can greatly contribute to these solutions.

We strive to position ourselves as a whole-brain, complete, and balanced school; a place where technical skills are deep but are accompanied by creativity and humanistic depth; a place where faculty are preparing students to address the most challenging global problems. We are poised to make a difference.

New initiatives

New initiatives build on opportunities, strengths, demands, and the competitive advantage of Northwestern's highly collaborative environment.

Over the past four years McCormick has aggressively launched new initiatives and refined existing programs. Our efforts to develop a new culture of change at McCormick include the enhancement of undergraduate and graduate programs, the development of research initiatives in emerging areas, and the creation of new administrative structures. Here is a sampling of some of the major initiatives that have driven our progress:

- The Segal Design Institute, funded by a gift from Gordon and Carole Segal, is the center for design activities at Northwestern. The main driver for the creation of Segal is the development of design-related programming for undergraduate and graduate students at McCormick. Segal has already launched a new master's degree program in engineering design and innovation, and it is adding a design component to the MMM Program, McCormick's flagship collaboration with the Kellogg School of Management.
- The Farley Center for Entrepreneurship and Innovation, named in honor of a gift from James and Nancy Farley, encourages the evolution of engineering beyond the applications of the sciences to the creation of businesses that capitalize on innovations. The Farley Center focuses on interdisciplinary curriculum development; empowerment of students, faculty, and alumni; corporate and community outreach; and research.
- The Initiative for Sustainability and Energy at Northwestern enhances the University's research, teaching, and outreach activities in the areas of energy and sustainability. Its particular focus is on sustainable energy supply, demand, and use. McCormick had a central role in creating the initiative and has taken a lead role in its current activities, including the creation of new curricula.
- McCormick's Center for Innovation in Global Health Technologies partners with the Kellogg School of Management and the Feinberg School of Medicine to create a community of engineers, scientists, business professionals, and corporate allies to address the needs in resource-limited settings, in places such as Africa, with a holistic approach that focuses on patients, health-care providers, and the public health environment. The center is now unveiling a \$1 diagnostic kit for AIDS.
- The new undergraduate concentration in architectural engineering and design, supported by the Halpern–RISE International endowment, gives Northwestern a foothold in architecture and creates an opportunity to combine Chicago's architectural strengths with ongoing efforts in design at Northwestern.
- The research partnership between McCormick and the Art Institute of Chicago, funded by the Mellon Foundation, has provided unique opportunities for our faculty and students. Working with conservation scientists at the Art Institute, our researchers and students apply engineering expertise to art conservation projects at the museum. The projects provide new research challenges and lead to new discoveries about the collection.
- Two new initiatives strengthen our relationship with the Kellogg School of Management: Business for Scientists and Engineers, a set of classes taught by Kellogg faculty, equips McCormick and Northwestern faculty with the skills they need to become academic leaders; and a new certificate in managerial analytics trains undergraduate students in business analytics.

Ongoing activities

While many of our new initiatives are maturing, our ongoing activities illustrate our continuing efforts to develop creative partnerships and programming.

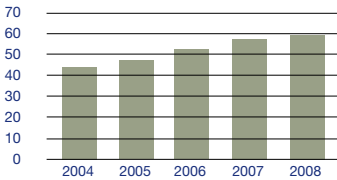
Many of our new initiatives have quickly become core strengths. Our ongoing activities augment these initiatives, explore new areas for collaboration, and place bets on the core strengths of the future. These are just a sampling:

- We continue efforts to improve the undergraduate experience. McCormick has launched a new personal development initiative designed to expand upon our strong cooperative engineering education program. The program prepares students for entry into the workforce and provides an opportunity to begin career planning during the first year of study.
- Our collaboration with industry continues to grow, highlighted by a new alliance with Baxter Healthcare. The alliance, which provides initial funding of \$1 million each year for three years for research projects at Northwestern, is open to researchers from throughout the University but administered through McCormick.
- McCormick's partnership with Argonne National Laboratory continues to grow through workshops, joint graduate students, joint faculty appointments, cross-linking seminars, and increased faculty collaboration. The proximity of Argonne and complementarity of key strengths is a key competitive advantage among our peer schools.
- We are increasing connectivity with the Feinberg School of Medicine. We are developing a vision for expanded cancer research at Northwestern, leveraging synergistic actions between engineering, medicine, and basic science to search for solutions to the myriad problems presented by cancer. Northwestern is in an excellent position to seamlessly link all these domains, combining the strengths of faculty and staff across disciplines and leveraging their combined strengths.
- We have made critical cross-linking appointments. For example, Bruce Mau, creative director of Bruce Mau Design Inc. and a member of the faculty at the School of the Art Institute of Chicago, is now a Distinguished Fellow at the Segal Design Institute. Mau has already given several lectures, and he will be an integral part of our third annual Design:Chicago conference, which brings design professionals from throughout the Chicago area to McCormick for discussions and lectures on design.
- We are exploring opportunities with the Department of Art Theory and Practice in the Judd A. and Marjorie Weinberg College of Arts and Sciences to bring art and art theory to engineering students. This will give our students another chance to cultivate their right-brain skills.
- A new emphasis has been placed on strategic international collaboration. In recent annual reports, nearly half of McCormick faculty reported international engagement — a total of nearly 600 relationships. All international partnerships are coordinated centrally, and we are developing a web site to showcase these activities.
- Finally, McCormick will celebrate its centennial during the 2009–10 academic year. A series of celebrations will provide opportunities for alumni and friends to become more engaged with the school, including a local gathering for the McCormick community, an event in Chicago, and several events scheduled throughout the country. Watch for the McCormick centennial web site this summer.

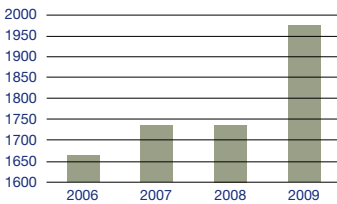
Progress over four years

Sponsored Research Activity

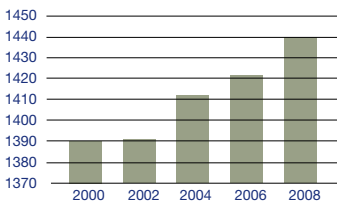
\$ in Millions



PhD Applications

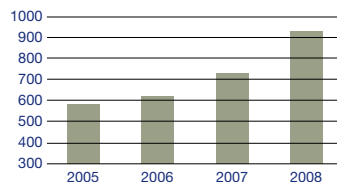


Undergraduate SAT Scores



Unrestricted Dean's Fund

\$ in Thousands



McCormick by the Numbers, 2009

1400 undergraduate students
770 PhD students
540 master's degree students
180 faculty
180 staff

Faculty The size of the faculty grew from 160 to 180 during the last three years. When factoring in retirements and departures, there has been a 22 percent change in faculty since 2005. McCormick improved the quality and efficiency of faculty hiring, with an average hiring success rate over 80 percent in last three years; the success rate in 2007 was upwards of 90 percent. Cross-linking among faculty is on the rise: 10 percent of faculty hold joint appointments with another department in McCormick, while 13 percent hold appointments in other schools at Northwestern. Sixty-three researchers outside McCormick hold courtesy appointments and collaborate with us on joint research projects. Media exposure has increased, and programs were created to improve media skills. McCormick faculty are highly sought after by media outlets for their expertise — particularly in transportation, infrastructure, and nanotechnology.

Awards McCormick has had unprecedented success with junior faculty awards. For example, 10 faculty members in the Department of Electrical Engineering and Computer Science have received National Science Foundation CAREER Awards since 2006. At Northwestern's annual award dinners, McCormick routinely receives 14–20 percent of the awards despite constituting just 8 percent of the faculty.

Publications in high-impact journals McCormick faculty wrote 17 percent of the papers published by Northwestern faculty in highly cited journals such as *Nature*, *Science*, and the *Proceedings of the National Academy of Sciences* in 1999–2003; in 2004–08 this percentage climbed to 27 percent. Many of these papers were featured on the journal covers, which now line the main hallways of the Technological Institute.

Graduate students McCormick graduates a third of all PhDs at Northwestern and, last year, half of the PhDs in the underrepresented minority category. We are fourth among private U.S. universities in the number of PhDs graduated per year. Our new e-brochure, an innovation developed by McCormick staff members, has resulted in significant application increases. In 2008 our applications increased 25 percent, as compared with 14 percent for the University as a whole. Master's degree program applications have increased 42 percent over the past three years.

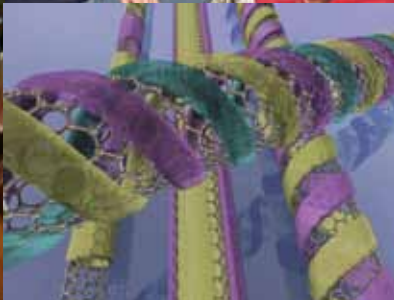
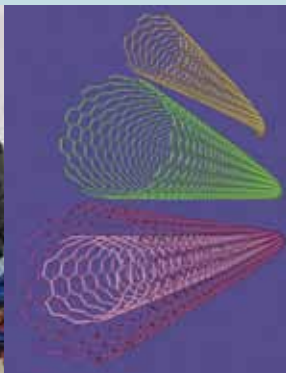
Undergraduate students We have worked closely with the Office of Undergraduate Admission in several ways to redefine the quality and skills needed by the engineering students of the future. Undergraduate applications in engineering have increased 23 percent over the past three years, and the selectivity percentage (percent of applicants admitted) has improved by 5 percent. Applications for the class entering fall 2009 increased 7.5 percent over the previous year. In addition:

- McCormick has the highest SAT math and verbal scores (1447) among the six undergraduate schools at Northwestern
- The student body represents high levels of diversity for an engineering program: 30 percent of McCormick undergraduates are women vs. 17 percent nationally
- 35 percent of students participate in the Walter P. Murphy Cooperative Engineering Education Program; most others do internships or research
- 55 percent of our students do on-campus research during the academic year
- 20 percent of the McCormick curriculum is in the humanities, social sciences, and communication (the U.S. average for engineering schools is 8–12 percent)

Proposals and funding The dollar value of proposals submitted by McCormick faculty rose 22 percent from 2004 to 2007. In that same period, funding awarded from submitted proposals rose 28 percent. In the first half of 2008 the dollars awarded rose by 11 percent compared with the same period the previous year. Annual research expenditures are about \$100 million, with half centered in McCormick and half in collaboration with other institutions (e.g., Argonne National Laboratory). Success in proposal funding increased significantly in 2008. McCormick is projected to submit almost half a billion dollars in research proposals by the end of its fiscal year in August. This is approximately \$200 million more than the highest amount submitted by the school in any previous fiscal year.

Fund-raising In three years McCormick has raised \$30 million in cash and \$30 million in commitments. Unrestricted giving is up 42 percent over the past three years, and individual major-gift support quintupled during 2005–08 as compared with 2002–05. McCormick now enjoys the highest participation rate for alumni giving among undergraduate schools at Northwestern.





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