The journey from question to answer is rarely a straight line. Discovery doesn’t come out of strictly regimented silos—rather, breakthroughs spring out of whirlwinds of collaborative thought.

The Case School of Engineering celebrates the hurricane-style thinking that produces innovation. We know that one idea can be a launching pad for a thousand more and that innovation isn’t orderly and doesn’t wait its turn.

Our engineers have big ideas percolating across the spectrum of the world’s toughest challenges in energy, health, advanced materials and other disciplines. The stories on the following pages highlight just a few of the many breakthroughs we’ve got brewing.
The world faces enormous challenges. Whether it’s supplying enough energy for future generations or ensuring they live healthier lives, these problems and their solutions begin the same way. They start small and grow big—like storms on the horizon.

And like storms, they have many moving pieces and parts—interconnected, churning layers that tear through the status quo and burst onto the scene. This annual report celebrates the disruptive swirl of thoughts and ideas that spawns innovation and refreshes our hopes for a better tomorrow.

Inside this hub of activity, you’ll find collaborative research institutes, expanded international programs and increased funding opportunities to benefit our faculty, students and community. These accomplishments and more, made possible through support from alumni and friends like you, are highlighted in the pages ahead.

They also remind me of what an honor and a privilege it has been to lead this great institution for the past five years. On Dec. 31, I will be stepping down as dean to return to the faculty. Again I thank you for your continued support of the Case School of Engineering, its faculty, students and aspirations.
Chemical engineering professors Robert Savinell and Jesse Wainright developed a model for cheaper systems to store and distribute the energy generated by alternative, but intermittent, sources of power like wind and solar. Flow batteries store energy in two tanks of chemical solutions and currently use a costly metal called vanadium as the active material for energy storage. A vanadium battery costs about $300 per kilowatt-hour produced for chemicals and tanks, but Savinell estimates using cheaper, more plentiful iron could knock the costs of a chemical storage system down to $45 per kilowatt-hour.

WERC Center director and materials engineer David Matthiesen is measuring the interface strength of ice when it sticks to the turbine blades, which could help improve performance in temperate climates.

Civil engineer Arthur Huckelbridge placed sensors deep in the concrete base to measure the turbine’s movements and the resulting stresses to help industry develop better standards for building more efficient foundations.

We put one of the country’s first campus-based wind research centers in motion this year with the construction of a 156-foot-tall wind turbine. Part of the $6 million Ohio Wind Energy Research and Commercialization (WERC) Center, this 100-kilowatt power tower—the first of three research turbines—supplies energy to neighboring campus facilities and gives university researchers and local companies the chance to study wind power technology in action.

Eight private companies are using the turbine as a proving ground for new products, including a paint coating designed to diminish ice buildup on blades.

This year the school launched the Solar-Durability and Lifetime Extension (S-DLE) Center to help engineers develop longer-lasting solar technology. Led by director and materials scientist Roger French, the $2.88 million center includes new labs and a sun farm that will allow researchers and industry partners to expose solar products to the equivalent of 25 years’ worth of solar radiation, fluctuating temperatures and other environmental factors in a fraction of the time. Evaluating these samples will help researchers study the degradation of solar products and develop technology that lasts longer and costs less than today’s systems.

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When imagining tomorrow’s energy solutions, identifying alternative sources is only part of the power picture. Once generated, that energy needs to be captured, stored and affordably delivered to consumers. The Case School of Engineering has energy innovation covered from the source to the switch.

The school launched two research centers this year dedicated to developing wind and solar energy technologies to augment the efforts of the Great Lakes Energy Institute. Our faculty members are using mirrors to pump up the output of solar panels and boosting the power of fuel cells one nanotube at a time. They are working on making the most innovative components—from the molecular level on up—and integrating those pieces into tomorrow’s energy systems.
Using a pulse of laser light, a team of researchers led by biomedical engineer Andrew Rollins and his research partner Michael Jenkins paced contractions in an avian embryonic heart, with no apparent damage to the tissue. This non-invasive device could help researchers learn more about the relationship between heart development and heart problems later in life.

Rollins’ lab is now conducting experiments to see whether the laser could be used as a pacemaker to keep a heart beating during surgery.

A nerve cuff developed by biomedical engineering professor Dustin Tyler could help restore mobility in paralyzed patients and sensation to persons with limb loss. In paralyzed patients, Tyler’s device engages the femoral nerve, which is divided into dozens of separate nerve bundles called fascicles that control different muscles in the leg. Since fascicles are bundled together, it’s tough to stimulate individual bunches to enable coordinated muscle movements. But Tyler’s nerve cuff electrode gently reshapes the femoral nerve to access individual fascicles. Controlling the intensity of the electrical stimulation makes more complex movements like standing and taking steps possible.

Electrical engineering and computer science professor Pedram Mohseni developed a device that uses microelectronic circuitry to bridge the gaps in the brain left by traumatic injury or stroke. Scientists believe that as the brain develops, it naturally establishes communication pathways between neurons that repeatedly fire together. Mohseni and research partner Randolph J. Nudo of Kansas University Medical Center believe that these pathways can be restored in the aftermath of an injury. But timing is critical—the brain is more malleable during the month following an injury. Mohseni’s device uses a microchip to connect populations of neurons in different parts of the brain. He and Nudo believe that re-establishing communications between these distant neurons could spark long-reaching axons to form and connect.

Exploring tendon structure from the atoms up helped biomedical engineering professor Steven Eppell identify the weak link in our connective tissue. Applying the same principles civil engineers use to stress-test structural steel, Eppell built a micro-device to test the threads of collagen that make up the bulk of our tendons and found they aren’t the most vulnerable to injury—it’s likely the molecular glue that binds the collagen threads together that puts our joints at risk.

Electrical engineering and computer science professor Wyatt Newman developed a prototype for a speech-driven motorized wheelchair that could eventually recognize voice commands, open and close doors, and even call elevators. He and his team are testing the technology’s ability to evaluate its surroundings and interpret commands.

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From the earliest prosthetic limbs and diagnostic tools, we’ve turned to technology to fix what ails us. The human body is an incredible machine, and engineers are dedicated to making it even more amazing—marrying medicine and mechanics to help people live longer, healthier lives.

Pooling bright ideas from nearly every engineering discipline—from electronics and computers to structural and chemical science—our faculty members are exploring the body’s systems and building revolutionary tools for a healthier tomorrow. This year, they found the atomic Achilles’ heel that puts our tendons at risk for injury, used robotics to help an aging population stay independent and safe, and developed microelectronic circuits to fill the gaps left by nature’s healing process.
An international team of engineers led by macromolecular science and engineering professor Stuart J. Rowan, director of the Institute for Advanced Materials, developed a brand-new polymer that heals itself in seconds when exposed to UV light. The self-repairing material could be used in a range of products from automotive paints to varnishes for furniture and floors in the not-too-distant future. The polymer’s unique molecular makeup allows it to disassemble temporarily under UV light and reform once the light is removed. Using light to get the molecules moving instead of heat allows engineers to focus the fix on the damaged area and leave the rest of the material untouched.

Chemical engineering professor Heidi Martin and electrical engineering professor Christian Zorman discovered the world’s hardest material could help medical implants last a lifetime. The team is in the early stages of building electrodes that use a combination of lab-grown diamond film and a flexible polymer that won’t corrode in the body’s harsh environment. Zorman and Martin are designing sensors and stimulators for the human brain—devices that could measure chemical or electrical changes or stimulate nerves.

Professor of macromolecular science and engineering Ica Manas-Zloczower found that using carbon-nanotube reinforced polymer composites on wind turbine blades could help the industry build bigger blades without breaking the budget.

Macromolecular science and engineering professor Liming Dai swapped pricey platinum catalysts in fuel cells for polymer-coated carbon nanomaterials, including nanotubes and graphene, to create significant cost savings.

A first in the field, world-renowned ceramics expert and NAE member Arthur Heuer used an ultra-high-resolution electron microscope to capture subatomic images of defects in synthetic sapphire during high-temperature experiments. His team studied how subtle shifts in atomic structure control the properties of this technologically important material. The information and imaging technique can be applied to all crystalline solids, from microchips to thermal protection systems that shield jet engines.
We’re asking a lot of the materials that will make up tomorrow’s technology. We need them to thrive in the most challenging environments—from inside the human body to the farthest reaches of outer space. We need them to be stronger, cheaper, multifaceted wonder-stuff. Thankfully, our faculty members are developing better building blocks across the board, from teaching old materials new tricks to inventing never-before-seen molecular structures.

This year, our engineers made advances from watching how atoms move in crystals to manipulating molecules to change a material’s key properties. They came up with new applications for precious metals, cost-effective coatings for fuel cell catalysts and even a material that redefines a do-it-yourself-fix.

What will tomorrow’s technology be made of?

Can coatings create stronger, more resilient products?

Can materials cut costs?

Ideas need room to grow—and not just a hypothetical home in the architecture of the mind. Ideas need actual, physical space in which to be tested, tweaked and brought to life.

For more than 150 years, we’ve proven ourselves not just as thinkers, but as doers, inventors and founders—bright engineering minds with a keen entrepreneurial bent. And with the help of generous alumni and other supporters, we are building the infrastructure to keep that spirit of innovation thriving.

Our engineering students mowed down the competition again at the Eighth Annual Institute on Navigation Robotic Lawn Mower Competition—winning first prize for the third year in a row, as well as a special Best Cut Award. The student team was led by professor Roger Quinn from the Department of Mechanical and Aerospace Engineering.

Electronic tags that can be digitally updated are common on store shelves across Europe and Asia, but haven’t caught on in the U.S. just yet. Mark Lorkowski, a fourth-year electrical engineering and computer science major, explored the technology as part of a design competition sponsored by Saint-Gobain and then founded LorkTech to take the product further.

LorkTech is in talks with potential partners and investors—as well as future retail customers—and plans to establish a headquarters in Northeast Ohio later this year.

A collaborative startup company that grew out of a Case School of Engineering design project. This year, a team of Case Western Reserve University students launched a company to bring electronic shelf labeling technology to U.S. stores and warehouses.

First-year computer science student Joshua Schwartz pitched to create a new Facebook app this year—that’s a new app every week.

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The Case School of Engineering has been renowned for excellence in teaching and research for 130 years. Upholding this tradition are more than 100 dedicated faculty members who pride themselves on their unique student-teacher research collaborations, which are often formed as early as the freshman year. To follow is a list of the administrators and tenured and tenure-track faculty who foster these relationships.

**Administration**

**Case Western Reserve University**  
Barbara R. Snyder  
President

William “Bud” Baeslack III  
Provost and Executive Vice President  
Professor of Materials Science and Engineering  
Case School of Engineering

Norman C. Tien  
Dean and Nord Professor of Engineering  
Ohio Eminent Scholar, Physics  
Case School of Engineering

Laura Bulgarelli  
Associate Dean, Finance and Administration

Patrick E. Crago  
Associate Dean, Professor of Biomedical Engineering

Daniel Ducoff  
Associate Dean of Development and External Affairs

Ica Manas-Zloczower  
Associate Dean of Faculty Development  
Professor of Macromolecular Science and Engineering  
Case School of Engineering

Clare M. Rimnac  
Associate Dean  
Wilbert J. Austin Professor of Engineering

Lisa Camp  
Assistant Dean for Special Initiatives

Lisa Camp  
Assistant Dean of Engineering Student Programs

This year, Case Western Reserve University launched its Engineering Strategic Hiring Initiative, seeking out exceptional researchers to augment the world-class faculty at the Case School of Engineering. Through this recruitment effort, the university aims to build on its existing strengths and create powerful new collaborations focused in three key areas—human health, energy and advanced materials—as well as increase faculty diversity. Alumnus Tom Seitz (CIT ’70) made the first major gift under the initiative, establishing the Thomas W. and Nancy P. Seitz Professorship in Advanced Materials and Energy.

**FACulty Honors and HIGHLIGHTS**

Alexis Abramson of mechanical and aerospace engineering has been selected to work with the U.S. Department of Energy’s Energy Efficiency and Renewable Energy Building Technologies Program.

Eric Baer of macromolecular science and engineering was named a fellow of the American Chemical Society.

Swarup Bhunia of electrical engineering and computer science earned an NSF CAREER Award.

Dominique Durand of biomedical engineering received a $6.3 million DARPA grant.

Erin Lavik of biomedical engineering was featured in *Popular Mechanics* for her work with synthetic platelets.

Melissa L. Knothe Tate of biomedical engineering and mechanical and aerospace engineering received the Chairman’s Distinguished Life Sciences Award from the Christopher Columbus Foundation—U.S. Chamber of Commerce.

Emeritus Professor Wen Ko of electrical engineering and computer science received the Founders’ Award at the 16th International Conference on Solid State Sensors, Actuators and Microsystems.

LaShanda Korley of macromolecular science and engineering earned the 2011 DuPont Young Professor, IUPAC Young Observer and the 3M Nontenured Faculty awards.

Joao Maia of macromolecular science and engineering won the Polymer Processing Society’s Morand Lamba Award and the British Society of Rheology’s Annual Award.

Christos A. Papachristou of electrical engineering and computer science received a $2.3 million DARPA research grant.

P. Hunter Peckham of biomedical engineering received a $7.4 million National Institute of Neurological Disorders and Strokes grant.

Roger Quinn of mechanical and aerospace engineering won a $1.1 million NSF grant.

Michael Rabinovich of electrical engineering and computer science was named editor-in-chief of *IEEE Internet Computing* magazine.

Professor Emeritus Eli Reshotko of mechanical and aerospace engineering was named to the NASA Aeronautics Research and Technology Roundtable.

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Associate Dean, Professor of Biomedical Engineering

Daniel Ducoff  
Associate Dean of Development and External Affairs

Ica Manas-Zloczower  
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Professor of Macromolecular Science and Engineering  
Case School of Engineering

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Wilbert J. Austin Professor of Engineering

Lisa Camp  
Assistant Dean for Special Initiatives

Deborah J. Fatica  
Assistant Dean of Engineering Student Programs

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Faculty

Biomedical Engineering

Jeffrey L. Duark
Chair and Allen H. and Constance T. Ford Professor in Biomedical Engineering

Eben Alisberg
Associate Professor

James Basilion
Associate Professor

Jeffrey R. Capadona
Assistant Professor

Patrick E. Crage
Associate Dean and Professor

Dominique Durand
Elmer Lincoln Lindseth Professor of Biomedical Engineering

Steven J. Eppell
Associate Professor

Milos Gratzl
Associate Professor

Kenneth J. Gustafson
Associate Professor

Efstathios “Stathis” Karathanasis
Assistant Professor*

Robert F. Kirsch
Professor

Melissa Knothe Tate
Professor

Erin B. Lawik
Elmer Lincoln Lindseth Associate Professor of Biomedical Engineering

Zheng-Rong Lu
M. Frank and Margaret Domiter Rudy Professor

Roger E. Marchant
Professor

Andrew M. Rollins
Associate Professor

Gerald M. Saidel
Professor

Nicole Seiberlich
Assistant Professor

Anirban Sen Gupta
Assistant Professor

Nicole Steinmetz
Assistant Professor*

Dustin J. Tyler
Associate Professor

Horst von Recum
Associate Professor

David L. Wilson
Robert J. Herbold Professor

Xin Yu
Associate Professor

Uziel Landau
Chair and Professor

Harshara Basakaran
Associate Professor

Donald L. Feke
Vice Provost and Professor

Eben Alsberg
Associate Professor

Chemical Engineering

Daniel J. Lacks
C. Benson Branch Professor of Chemical Engineering

Chung-Chun “C.C.” Liu
Wallace R. Persons Professor of Sensor Technology and Control

J. Adin Mann Jr.
Associate Professor

Heidi B. Martin
Associate Professor

Syed Qutubuddin
Associate Professor

R. Mohan Sankaran
Associate Professor

Dominique Durand
Elmer Lincoln Lindseth Professor of Biomedical Engineering

David L. Wilson
Robert J. Herbold Professor

Xin Yu
Associate Professor

Uziel Landau
Chair and Professor

Harshara Basakaran
Associate Professor

Donald L. Feke
Vice Provost and Professor

Mehmet Koyuturk
Theodore L. and Dana J. Schroeder Assistant Professor in Computer Science and Engineering

Michael Lewicki
Associate Professor

Jing Li
Associate Professor

Vincenzo Liberatore
Associate Professor

Wein Lin
Professor

Kenneth A. Loparo
Nord Professor of Engineering

* Case Western Reserve University School of Medicine campus
Departments
Biomedical Engineering
Chemical Engineering
Civil Engineering
Electrical Engineering and Computer Science
Macromolecular Science and Engineering
Materials Science and Engineering
Mechanical and Aerospace Engineering

Research Centers and Institutes
Case Center for Surface Engineering
Center for Biomaterials
Center for Layered Polymeric Systems
Center for Mechanical Characterization of Materials
Center for Modeling Integrated Metabolic Systems
Cleveland Functional Electrical Stimulation Center
Electronics Design Center
Great Lakes Energy Institute
Institute for Advanced Materials
Neural Engineering Center
Ohio Wind Energy Research and Commercialization Center
Solar-Durability and Lifetime Extension Center
Swagelok Center for Surface Analysis of Materials
Technology and Health Institute
The Institute for Management and Engineering

Visiting Committee
Robert T. Bond Jr., (CIT ’66), chair
Chi-Foon Chan (GRS ’74, ’77)
Walter J. Culver (GRS ’62, ’64)
John F. X. Daly (CWR ’89, GRS ’91)
Myra A. Dria (CIT ’76)
Robert A. Gingell Jr. (CIT ’77)
Karl Van Horn
Jennie S. Hwang (GRS ’76)
William M. James (CIT ’64)
Joseph P. Keithley
Martin P. Kress
Kenneth A. Loparo (GRS ’77)
Kenneth R. Lutchen (GRS ’80, ’83)
Gerald McNichols (CIT ’65)
Somsak Naviroj (GRS ’83)
Charles H. Phipps (CIT ’49)
Claiborne R. Rankin
Richard T. Schwarz (MGT ’78)
Thomas W. Seitz (CIT ’70)
Russell J. Warren (CIT ’60)
Gerald Wasserman (CIT ’76)
Andrew Wasynczuk (CIT ’79, GRS ’79)

2010-11 Campaign Leadership Committee
Lawrence M. Sears (CIT ’69), chair
Kenneth A. Barker (CIT ’70)
Robert T. Bond (CIT ’66)
Edward M. Esber Jr. (CIT ’74)
Ramon Gomez (CIT ’81)
William M. James (CIT ’64)
Richard G. LeFauve Jr. (CIT ’85)
Simon Ostrach
Charles H. Phipps (CIT ’49)
William E. Pritts II (CIT ’61)
Barry A. Romich (CIT ’67)
Robert L. Smialek (CIT ’65, GRS ’67, ’70)
John J. Tanis (CIT ’49)
Gerald Wasserman (CIT ’76)
Roger H. Cerne (CIT ’63), ex-officio
Frank N. Linsalata (CIT ’63), ex-officio
Kenneth A. Loparo (GRS ’77), ex-officio
Enrollment:
fall 2011

1,030 declared undergraduate engineering students

598 graduate and professional-degree students

1,628 total*

* In addition, 400 undergraduate students expressed interest in engineering majors but are not expected to declare majors until the end of their sophomore years.

Full-time faculty: fall 2011

112

Revenue budget: FY 2011

$84.1 million

Research and training revenue:
FY 2011

$41.1 million

Fundraising:
FY 2011

$18.8 million Case School of Engineering

$1.9 million Case Alumni Association

$20.7 million total

U.S. News & World Report rankings

Top 50 for undergraduate and graduate engineering programs

11th for graduate biomedical engineering programs

13th for undergraduate biomedical engineering programs

Every effort has been made to ensure the accuracy of this report. If you have any questions or concerns, please contact Helen Jones-Toms, director of marketing and communications, Case School of Engineering, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, Ohio 44106–7220, 216.368.8694, hjjt@case.edu.

For more news about the Case School of Engineering, go to engineering.case.edu.