ENGINEERING @
Northeastern
Spring 2016

STRENGTHENING THE ENGINEER

New program aligns engineering with business and entrepreneurship

Northeastern University
College of Engineering

Next-generation engineering education

Dear Friends,

A recent Washington Post op-ed cites the benefit of T-shaped education, in which the vertical bar of the T represents deep knowledge of one area, such as engineering, and the horizontal bar represents experience and skills in other areas. Of course, here at Northeastern we have long known the benefit of the horizontal bar – it is a core element of the co-op experience! The horizontal represents the broad-based skills that our students live and breathe during their time off campus, and that we can push even further during their time on campus. For instance, I hope you will read with interest about our newest innovation on engineering education: programs in innovation, entrepreneurship and business that (alongside our longstanding leadership program) support and enhance the real-world experience. The result? Our student engineers (and even the faculty) are learning, thriving, and innovating.

Throughout this issue, you will learn from members of our community who are immersing themselves in an engineering education that focuses on the horizontal and the vertical, to create the next generation of engineers who, through their experiences on and off campus, are fully-equipped to deal with next-generation engineering challenges. It is my great honor to work with so many dedicated alumni, students and faculty who, through their support and commitment, make our community a leader and innovator in this and many other areas of research and education.

Sincerely,

Nadine Aubry
Dean of Engineering
dean@coe.neu.edu

inside

COVER IMAGE

Students in the Sherman Center for Engineering Entrepreneurship Education brainstorm in a prototyping workshop. In this series of workshops students collaborate to design, model, and craft solutions to difficult design problems. The Sherman Center offers many interactive workshops, a mentoring program, 3D printing, and an entrepreneurial engineering minor.

Learn more about the Sherman Center on page **19**. >>

Learn more about the prototype on page **23**. >>

Questions and Comments

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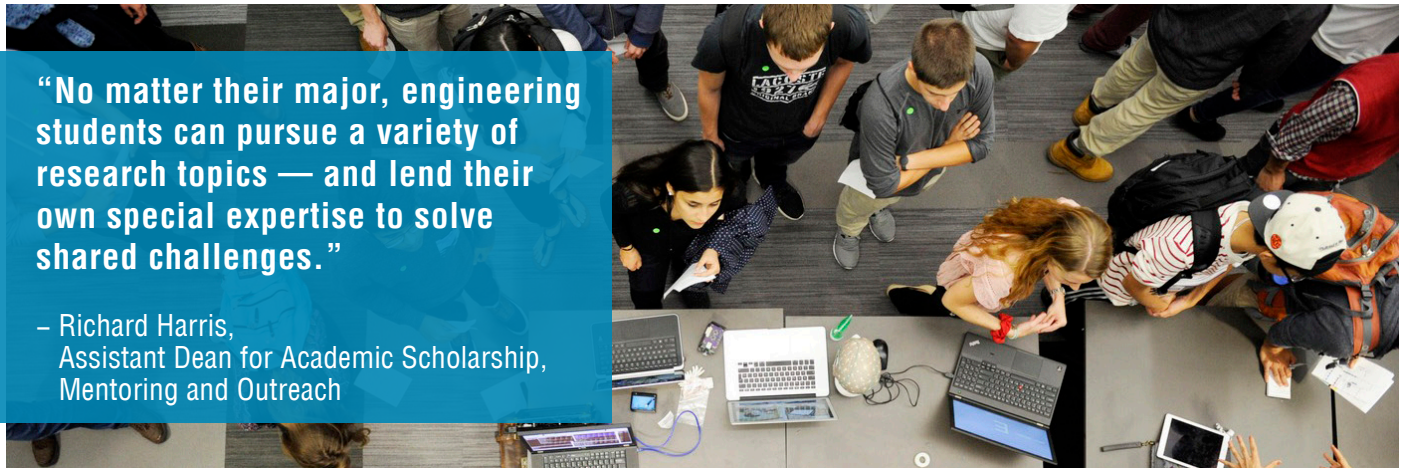
SPOTLIGHTING
Undergraduate Research

Eager to make an impact, engineering students explore research opportunities at annual Undergraduate Lab Fair



"No matter their major, engineering students can pursue a variety of research topics — and lend their own special expertise to solve shared challenges."

– Richard Harris,
Assistant Dean for Academic Scholarship, Mentoring and Outreach

Let's say you're a second-year Bioengineering major interested in studying how cracks propagate in bones. Or a third-year Electrical and Computer Engineering student with a passion for improving memory storage in computers. How do you find a research team in Northeastern's College of Engineering that dovetails with your interests? The answer is simple: Attend the annual Undergraduate Research Lab Fair.

This past fall, more than 550 students packed into the Curry Student Center Indoor Quad, where they eagerly engaged with faculty, researchers, and fellow students representing nearly 30 labs across the college.

Not only did undergrads have the chance to learn about the diverse opportunities open to them in the future — but they also showed off their impressive accomplishments as members of a current research team. For example, Moshe Ohayon E'17, helped "pitch" the opportunities available in the lab of mechanical engineering Associate Professor Rifat Sipahi.

Ohayon is part of a research group led by Profs. Rifat Sipahi, Andrew Gouldstone and Beverly Kris Jaeger (all from MIE), designing an innovative pen that will steady the handwriting of people with essential tremor, a condition impacting 10 million Americans. Since pen tip movements can be affected by different friction characteristics of paper, Ohayon analyzed how density of the ink on different types of paper was affected. Then he partnered with graduate students Siri Belton (MIE) and Emilie Dubois (a visiting scholar from France) to develop a pen with a cylinder-like stem that is easy to grasp. An attached motor on the pen helps writers get back on track should their trajectory veer off course.

Other research projects on display included robots that test the strength of steel girders, a computer system that enables people to steer a wheelchair with the mind, and electrochemical processes used to eliminate contaminants in groundwater.

Even first-year students can become part of groundbreaking research initiatives. For example, freshman James Tukpah has worked with Associate Professor Taskin Padir on control systems for humanoid robots (see next page) since meeting Padir at the Undergraduate Research Lab Fair in September.

"The annual Undergraduate Research Lab Fair is a great showcase for the depth and diversity of research happening across the College of Engineering today," says Richard Harris, Assistant Dean for Academic Scholarship, Mentoring and Outreach, who co-sponsors the event in collaboration with a group of student researchers. "This event also highlights the opportunities for cross-disciplinary collaboration. No matter their major, engineering students can pursue a variety of research topics — and lend their own special expertise to solve shared challenges."

Civil and Environmental Engineering Professor Mark Patterson talks with students during the COE Undergraduate Lab Fair

HUMANOID ROBOTS: THE NEW SPACE AGE

Valkyrie, NASA's humanoid robot prototype, arrived April 13 for a Northeastern-led team to perform advanced research and development

NASA has a vision for sending humanoid robots to Mars to conduct field studies and exploration. A Northeastern-led team — one of just two nationwide, the other led by MIT — is developing mission-critical guidance and control systems. ECE Associate Professor Taskin Padir is leveraging NASA funding to develop advanced technologies that allow robots to complete specific tasks such as exiting an airlock, using a ladder to reach Mars' surface, collecting rocks, and repairing equipment.

"If robots can be equipped with the intelligent capabilities to complete tasks typically assigned to humans, then the sky is the limit."

– Taskin Padir, associate professor of electrical and computer engineering

"If robots can be equipped with the intelligent capabilities to complete tasks typically assigned to humans, then the sky is the limit," notes Padir. "They can work alongside human astronauts or travel to extreme space environments that might be too hazardous for humans. And of course, robots have much to offer us here on Earth as well."

Northeastern was chosen to lead the NASA project after a rigorous selection process, which included participating — and placing highly — in the Defense Advanced Research Projects Agency (DARPA) Robotics Challenge, focused on addressing humanitarian needs that became obvious after the 2011 Fukushima tsunami.

Padir, the project's principal investigator, is supported by Assistant Professor Robert Platt of the College of Computer and Information Science at Northeastern, as well as Holly Yanco, a professor of computer science at UMass Lowell. Student researchers will also be integral members of the team. The Humanoid Robot R5 at the center of the project will be housed at the New England Robotics Validation and Experimentation (NERVE) Center at the University of Massachusetts Lowell — the largest indoor robot test facility in New England — but will frequently visit Padir's Robotics and Intelligent Vehicles Research Laboratory.

Beyond the Classroom

In nearby Mansfield, Civil and Environmental Engineering students have made a significant impact on residents' quality of life

Two years ago, Associate Teaching Professor Daniel Dulaski approached the Town of Mansfield — located in the southwestern suburbs of Boston — with a unique proposal. He offered to have a team of Civil and Environmental Engineering (CEE) students in his capstone design course focus on solving some of the town's transportation improvement needs. It was a win-win situation: the town would benefit from innovative thinking, while the students would gain hands-on experience.

Since 2010, seniors in Dulaski's capstone class have redesigned 31 downtown corridors in 15 Massachusetts municipalities. The capstone design class is a culmination of students' academic and cooperative experience. Students form small consulting groups, collect and analyze data, identify potential solutions, and generate a final design. At the end of the semester, the students present their ideas to the municipalities.

The Mansfield team included seniors Joseph Arroyo, Emily Boley, Joshua Cone-Roddy, Charles Franzini, and Jessica Lizza (all E '14). They focused on creating a transportation infrastructure around the town's commuter rail station that would be intuitive, safe, and accessible for all modes and abilities, while improving safety. Their plan included major intersection redesigns, enhancing pedestrian and bicycle access near the station, and creating additional parking.

After vetting the students' plans through both citizens and local review boards, the town applied for funding through MassWorks, a state program created to support public infrastructure improvements for economic development and job growth. Last fall, Mansfield received a MassWorks grant in the amount of $2.37 million to fund the project.

"The plans developed by the civil engineering students from Northeastern addressed several serious traffic and development issues that had stymied redevelopment in the area surrounding the Mansfield MBTA Commuter rail station for many years," says Town Manager William Ross. "The students brought innovative and fresh ideas that were reviewed by residents and business owners, as well as the Mansfield Board of Selectmen, with very few minor changes to address specific local needs."

Today, Jessica Lizza is a transportation engineer for Boston-based consulting firm Howard Stein Hudson, where she studies traffic patterns and designs roadway improvements — focusing on issues similar to those she studied as a senior. "The Mansfield project was a great learning experience and an opportunity to solve a real-world problem," she says. "I was excited to hear that our project had actually received funding and that our ideas will become a reality this summer. It's very gratifying to have made a lasting impact on a local community."

The Needle in the BIG DATA HAYSTACK

Three professors win an $860,000 grant from the National Science Foundation to develop new analysis techniques that uncover key findings in large volumes of data

In today's increasingly connected, technology-enabled world, it's easy to collect large volumes of information. But how can researchers sift through this data and identify key findings?

ECE Professors Jennifer Dy and David Kaeli, along with CEE Associate Professor April Gu, have won an $860,000 grant from the National Science Foundation (NSF) Big Data Science & Engineering program to help answer this question. Their proposed research, entitled "Exploring Analysis of Environment and Health Through Multiple Alternative Clustering," will create new ways to analyze data, speed up the analysis, and visualize the results of the analysis — enabling greater understanding of the information hidden in large, complex data sets.

Dy, Kaeli, and Gu will use data gathered by the Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) Center at Northeastern, which studies the connection between environmental pollutants and pre-term birth. The large-scale, multi-source data collected by PROTECT includes diverse information — from the contamination levels in a specific well on a specific day, to the chemical analysis of blood in the placenta — totaling billions of data points. Their work to define new tools for data analysis will benefit other researchers seeking to arrive at answers more quickly and efficiently in today's information-saturated environment.

Making a DIFFERENCE

Over the past five years, the student chapter of ASCE has renovated a public park in Walpole, creating a more attractive and user-friendly space

The student chapter of the American Society of Civil Engineers (ASCE) at Northeastern University is constantly working to enrich the local community, while gaining hands-on engineering experience via service projects.

Last fall, the chapter marked a major milestone in its five-year effort to renovate a local park for the community of Walpole, located about 13 miles south of Boston. After students permitted the entire project, they installed the footings for a 60-foot pedestrian bridge, as well as designed and constructed a ramada, Spring Brook Park was ready for its grand opening ceremony on October 3.

This multi-year project exposed students to such real-world challenges as design, permitting, and construction management. The pedestrian bridge, which spans Spring Brook, improves the Bay Circuit Trail and provides an off-road opportunity for trail users. The ramada provides a covered area for picnics, performances, and gatherings.

The Northeastern student chapter of the American Society of Civil Engineers (ASCE) at Spring Brook in Walpole, Massachusetts

Leaders of the project include Greg Sands (E'13), Evan Borsetti (E'13), Paul Yingling (E'13), Ezgi Kosereisoglu (E'15), Jonathan Martiniello (E'15), and Evan Hayes (E'16). Student volunteers have worked under the direction of CEE professors Dan Dulaski, Peter Furth, and Bob Tillman.

Civil Engineering Student **Awarded Rhodes Scholarship**

"Logan exemplifies the new, more multidisciplinary perspective on engineering that characterizes Northeastern's College of Engineering today."

– Nadine Aubry, Dean of Engineering

For the first time ever, a Northeastern student has won the prestigious Rhodes Scholarship, created in 1904 by British philanthropist Cecil Rhodes. That history-maker is Logan Jackson, a senior majoring in Civil Engineering. As one of 32 Rhodes Scholars chosen nationwide for 2016, Jackson will receive full funding for graduate study at the University of Oxford in England beginning in October.

Jackson plans to earn two master's degrees at Oxford — one in education and one in nature society and environmental governance. "I want to supplement the excellent engineering education I gained at Northeastern — as well as the hands-on experience I achieved through co-op — with a consideration of policy issues in higher education," she explains. "I'm particularly interested in bringing greater diversity to the fields of science, technology, engineering, and math."

The awards criteria, established by Rhodes, include academic excellence, energy, ambition, and the ability to work with others to achieve personal goals. In addition, winners must be committed to making a positive impact on the world and possess strong leadership skills. When Jackson was chosen from nearly 900 applicants, those who know her were not surprised. Dean Nadine

"I want to supplement the excellent engineering education I gained at Northeastern — as well as the hands-on experience I achieved through co-op — with a consideration of policy issues in higher education."

– Logan Jackson, Rhodes Scholar, civil engineering

Aubry notes that Jackson has excelled in a very rigorous engineering curriculum, is eager to take on new challenges, and is academically curious.

"In addition to her strong engineering credentials, Logan exemplifies the new, multidisciplinary perspective on engineering that characterizes Northeastern's College of Engineering today," says Aubry. "Her ability to combine a distinguished academic record in civil engineering, a focus on advanced research, and a passion for policy issues positions her as a leader and a role model. I'm confident that she will achieve tremendous success after graduation, as she continues to push traditional boundaries, tackle complex interdisciplinary issues, and above all, challenge herself."

At Northeastern, Jackson has focused on structural engineering. As an undergraduate research assistant, she helped assess the use of fiber-optic sensors to detect potential building collapses. She has completed co-ops with world-leading construction firms Hensel Phelps, Suffolk Construction, and Skanska USA Civil.

Jackson has also been a visible and involved presence on campus. She has served as president of Northeastern's chapter of the National Society of Black Engineers; received the university's Robert J. Shillman Award for Engineering Excellence, given to rising seniors with the highest cumulative GPAs; and was named to the Huntington 100 — an annual recognition bestowed on select students for making a broad impact. Jackson plays viola in the Northeastern Symphony Orchestra and has led a number of community service projects in her home state of Kentucky.

The changing student body of the College of Engineering

99%
undergraduates with full-time job or enrolled in graduate school, within 9 months of graduation, up from **97%** in three years

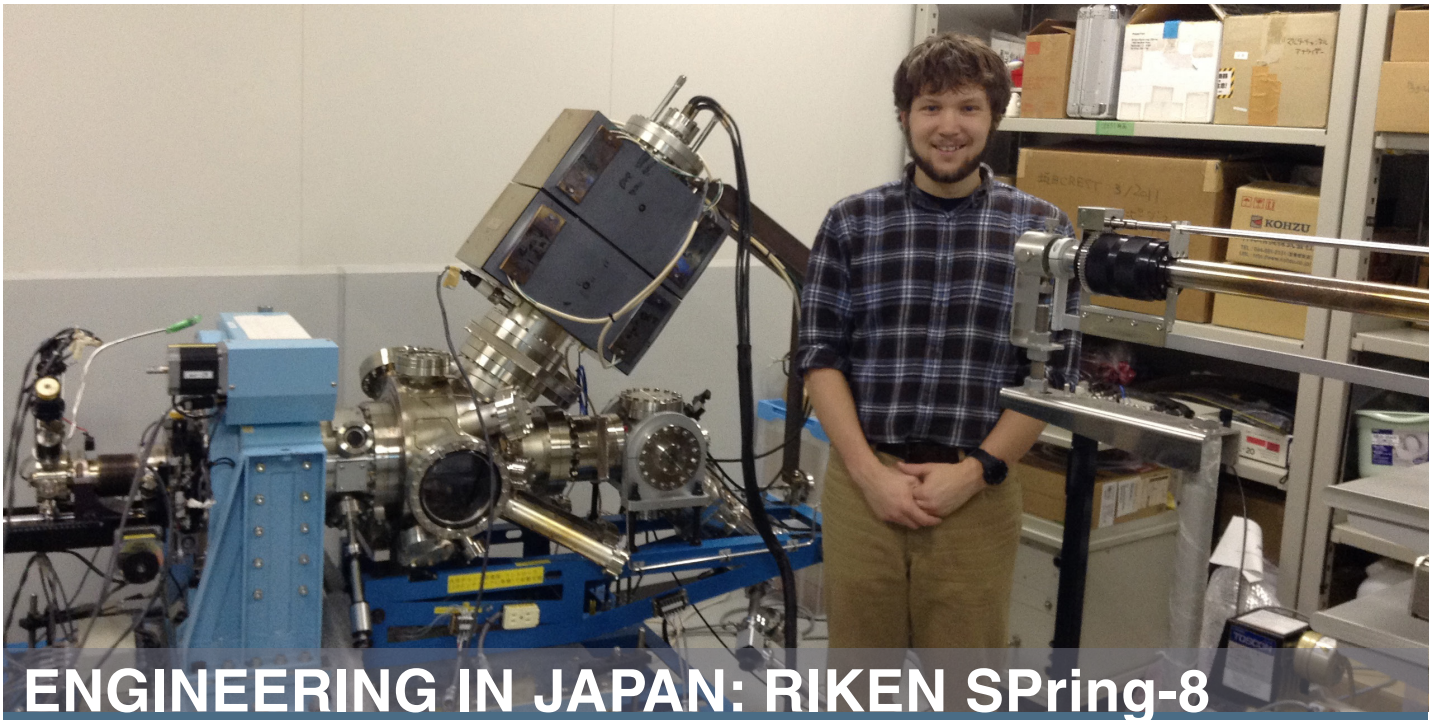
28%
women in entering freshman class, up from **22%** in three years

1447
average SAT score of incoming freshman class, up **53** points in three years

6100
students, up **40%** in three years

GLOBAL CO-OP

Updates from around the world



ENGINEERING IN JAPAN: RIKEN SPring-8

WRITTEN BY ZACHERY SHAW, FOURTH YEAR MECHANICAL ENGINEERING

I started working at RIKEN this January as my third and final co-op. For background, my first co-op was at SAPPI Fine Paper manufacturing specialty paper for the polyvinyl and polyethylene industries, and my second co-op was with GE Aviation in the Low Pressure Turbine division. Both of these prior experiences were within New England, so I wanted to expand the range of my work and go internationally for my third co-op. This eventually led me to RIKEN, a scientific research company based in Japan that several Northeastern students have worked at, but very few engineers. RIKEN SPring-8 is a facility run by RIKEN that houses a third generation synchrotron and an XFEL research facility. If you don't know what those are don't worry because I didn't understand any of it at first either.

Simply put, a synchrotron is a large ring that contains electrons moving at velocities very near the speed of light. The acronym SPring-8 (Super Photon ring 8 GeV) comes from this purpose, with 8 GeV being the energy stored in giga-electron volts. While similar to a facility like CERN, the purpose of a synchrotron isn't to smash molecules together, but to simply keep these electrons going around in a circle. The reason being that whenever an electron is forced to turn in its path around the circle, it emits powerful radiation, tangent to its path, normally in the soft or hard x-ray bandwidth. These high energy x-rays are directed by scientists into experimental hutches, where they shine them on various microscopic samples for their research. It's a very efficient and powerful method of producing highly energetic and brilliant x-ray radiation for scientific research.

As an engineer here, I have mostly worked with the SACLA XFEL, constructing vacuum chambers, building optical devices for the scientists to use, and installing components into experimental hutches. Researchers come to RIKEN SPring-8 from around the world, with a huge variety of needs and requests. The engineering team that I am on does their best to accommodate those needs. We also must maintain the systems they use while designing and building future expansions of the facility. The current long-term projects include installing more experimental hutches and improving the way we control and focus x-rays (think high energy, high radiation optics). While my work was a little slow to start, I've gradually been given more and more responsibility, and I've learned a great deal from the experience.

"Whenever I'm asked, 'why did you choose Northeastern?' the answer is simple: co-op." — Ellen Deninger, chemical engineering student

A TRIP OUTSIDE MY COMFORT ZONE

WRITTEN BY ELLEN DENINGER, FIFTH YEAR CHEMICAL ENGINEERING

Whenever I'm asked, "why did you choose Northeastern?" the answer is simple: co-op. I chose the standard five year, three co-op academic track, and I intended to complete all my co-ops in New England so that when I graduated, I would have three potential job opportunities in the area. To me, this was the most practical way to make the most out of my education. I still intended to get outside of the US at some point during my time at Northeastern, but as the years went by I found that I was running out of time, and it was becoming more and more difficult to fit an international experience into the remainder of my education. When I was near the end of my second co-op and still had no plans to go abroad, I realized there was only one option left—if I wanted to go abroad, it was going to be an international co-op. I scheduled a meeting with the CEO of the company I was working for at the time, who happens to be French, and asked him what he thought about my tentative career path. He told me that working internationally would give me a unique perspective to bring to future jobs and also the opportunity to broaden my horizons while experiencing a different work culture. I left my meeting with him feeling confident that this is what I would pursue.

Living in France has taught me many lessons. Some lessons are kind of funny (like when I pronounced 'shoes' wrong and my co-workers thought I was talking about going hunting), while other lessons are more meaningful. The most important lesson I've learned is how to adapt to change with an open mind and positive attitude. I have surprised myself in so many ways and have learned things about myself that I never would have known had I not had this experience. When I accepted this job back in March, I knew that I would enjoy the simple things that came with living in Paris, like eating a freshly baked chocolate croissant from the boulangerie on the corner and seeing the Eiffel Tower twinkle at night. I had no idea that I would have the opportunity to go hiking alone on a chilly morning in Norway, or the opportunity to present my research at a technical seminar in front of colleagues who traveled all the way from China and Malaysia.

DID YOU KNOW INTERNATIONAL CO-OP POSITIONS...

Are conducted in
ENGLISH

Majority of positions are
PAID

Can receive an additional
$6,000
through the presidential global scholars program

Number of International Co-op Companies		Students on International Co-op
41	2015	55
19	2012	19

Absorbed

Rebecca Carrier, associate professor of chemical engineering

Meet **Rebecca Carrier,** who is developing the first predictive models for how the fats people ingest affect the way they absorb drugs. The details of this process will allow doctors to fine-tune dosages, including those for oral chemotherapy treatments, and to minimize side effects.

Learn how Professor Carrier and our other faculty researchers are making the world healthier. Northeastern University: making tomorrow happen.

northeastern.edu/tomorrow

Northeastern University

Making Tomorrow Happen

"The Bioengineering department was one of the single biggest factors in my decision to come to Northeastern"

– Zachary Flinkstrom, E'19 bioengineering

A HEALTHY OUTLOOK

At Northeastern, more and more engineers are focusing on critical global issues that affect human health

Growing up in Maine, Zach Flinkstrom (E'19) always felt connected to the natural world through camping and outdoor sports. While he knew he wanted to study and solve problems as an engineer, he wanted those problems to involve biology or human health.

"Nature is an amazing example of engineering, and so many engineering challenges have been overcome simply by observing and mimicking what occurs in the natural world," notes Flinkstrom. "When I was looking at engineering schools, I applied to some schools with bioengineering majors and other schools, like Northeastern, that had the right interdisciplinary culture to facilitate a wide range of engineering studies."

When Flinkstrom received his acceptance letter from Northeastern's College of Engineering in early 2014, he learned exciting news: the university had just founded a Bioengineering department. If he enrolled at Northeastern, he would be one of the first class of bioengineering majors in the college's 118-year history.

Already leaning toward Northeastern, Flinkstrom was thrilled by the news. "The Bioengineering department was one of the single biggest factors in my decision to come to Northeastern," he says today. "I thought it would be an exciting and unique opportunity to be part of a brand new program. I couldn't wait to get started."

The creation of the department was a priority of Dean Nadine Aubry, who joined Northeastern in 2012. She saw it as the next logical step to the existing PhD in Bioengineering, for which candidates were advised by faculty from other engineering and science fields.

"Zach is just the kind of ambitious, energetic student we were envisioning when we founded the Bioengineering department," says Aubry. "With an aging global population, the skyrocketing cost of patient care, and emerging diseases like Ebola and Zika, we need young engineers like Zach to bring a fresh approach and new problem-solving skills to these issues. We're delighted that Northeastern's College of Engineering is now a training ground for next-generation bio-inspired innovation."

Creating a Hub of Research and Discovery

Today, the Bioengineering department has seven full-time faculty and approximately 80 affiliated faculty from across the university, and is hiring five more full-time faculty this year.

"It's been exciting to create a new academic department from the ground up," says Department Chair Lee Makowski, who came to Northeastern in 2010 after seven years in the Bioscience Division of Argonne National Laboratory, including serving as its director. Before chairing the Bioengineering department, he was jointly appointed in Electrical Engineering and Chemistry — which reflects the diverse nature of the faculty recruited to this new department.

Beyond the focus on health and medical applications, engineering in a biological context, this group also views bioengineering as bioinspired engineering. For example, understanding how bones can be both strong and flexible may help us to strengthen bones in human beings as well as create construction materials that can better withstand hurricane-force winds. Their research and education interests are broad, focusing on sensors and devices, mechanics and motor control, imaging and computing, cell and tissue engineering and bio-environmental interaction.

To achieve this new approach to bioengineering, Aubry points out, "All of these people need to come together in a collaborative team and share their knowledge. At Northeastern, we've worked for years to create the kind of

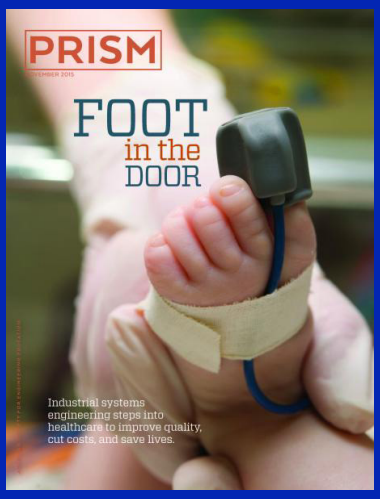
Prescription for *Change*

James Benneyan Seeks to Improve Healthcare via a Systems Engineering Approach

In most industries, process errors and inefficiencies result in short-term consequences such as expedited delivery charges or unhappy customers. But in the global healthcare industry, the stakes are much higher and can have permanent effects. Every year in the United States alone, it's estimated that 1.4 million patients are injured and 98,000 patients die from medical errors.

James Benneyan, professor of industrial engineering at Northeastern, has spent his career focusing on reducing healthcare errors. As founding director of Northeastern's Healthcare Systems Engineering (HSyE) Institute, Benneyan applies systems engineering approaches to the worldwide healthcare industry. By modeling, analyzing, predicting, improving, and optimizing many standard medical processes and procedures, Benneyan hopes to not only improve patient outcomes, but also reduce waste and inefficiency.

Testimony to its leadership and impact, HSyE has received five federally awarded research centers in the past six years to work on these problems and was featured on the cover of the November 2015 issue of *Prism*, the flagship publication of the American Society for Engineering Education (ASEE). In an article called "Industrial Rx for Healthcare," Benneyan and HSyE were celebrated for leading the effort to develop a national workforce to apply proven industrial and business practices to the medical industry.



"The United States spends over $3 trillion annually on healthcare. It is estimated that roughly a third of that is pure waste," says Benneyan. "Medical supply shortages, excessive waiting times, inefficient facility layouts — all of these add up to significant costs. Of course, there are many other issues that also directly impact patient health, such as bed shortages, lab errors, incorrectly administered drugs, and wasteful overuse."

Benneyan is solving these problems by applying proven methods that have already revolutionized the business world, including lean processes, six-sigma tools, and advanced mathematical models. "At its heart, healthcare is a system of systems, with the same types of flows, bottlenecks, shortages, and deadlines that characterize the industrial world," Benneyan explains. "Why not apply widely accepted systems engineering principles to also improve quality, reduce delays, minimize costs, and maximize efficiency in healthcare?"

To scale-up a new generation of healthcare leaders with these skills, HSyE offers undergraduate and graduate academic programs, experiential co-op opportunities, summer internships, and strategic partnerships that expose students to the systems concepts that underlie healthcare. In the past three years, the program has completed over 80 projects in partnership with healthcare systems across the U.S., achieving more than $76 million in savings, improved patient access to high-quality care, and prevented medical errors.

boundaryless, crossdisciplinary culture that fosters these kinds of partnerships."

Not only does the new Bioengineering department foster this kind of collaboration, but it's been carefully designed to address the real-world needs of students and their future employers. "We've tailored the curriculum, research initiatives, and co-op employers to optimally prepare our graduates to succeed — not just today, but over their entire career," says Makowski. The freshman class of 2014-15 was the first group of undergraduates who could elect a Bioengineering major, and 76 students enrolled (including Zach Flinkstrom, of course.) The department also has a pilot master's degree program, with eight students currently enrolled.

"This department has all the energy of a start-up company," he adds. "There's that same feeling of enthusiasm as we work to build the right culture, the right community of people, and the right blend of cutting-edge education and research that, taken together, are positioning Northeastern at the forefront of bioengineering."

Zach Flinkstrom is just one of many students already benefiting from the increased focus on bioengineering. "Even as a freshman last year, I was able to work in the lab of Bioengineering Professor Jeffrey Ruberti, who's focused on understanding how human cells respond to mechanical stresses — which dovetails with my own interests in tissue engineering," says Flinkstrom. "Currently I'm working as a co-op for a local pharmaceutical company, Acorda, which is exposing me to an entirely new set of human health challenges."

Collaboration Fuels Ongoing Growth

While the formal Bioengineering department is new, it's the outcome of years of biomedical and health-related research in the College of Engineering. Professor Dana Brooks of Electrical and Computer Engineering and Bioengineering, who earned his PhD at Northeastern in 1991 and subsequently joined the faculty has witnessed the growth of this research field at the university firsthand.

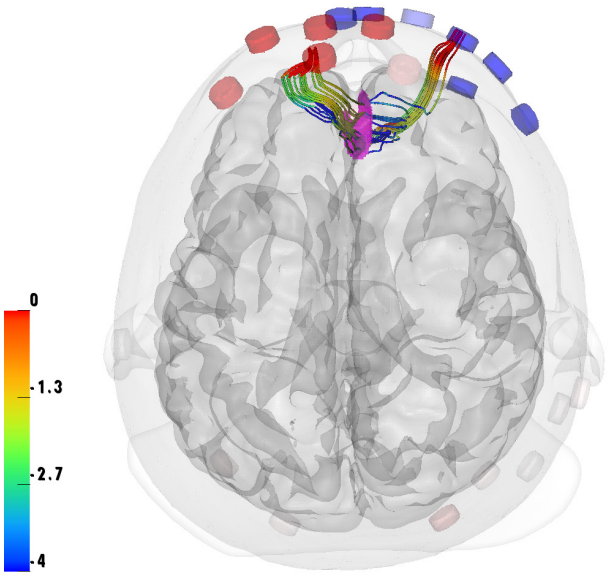
Since 1999, he has served as Northeastern's principal investigator for the Center for Integrative Biomedical Computing (CIBC), led by the University of Utah and funded by the National Institute of Health (NIH).

This center, recently renewed for a remarkable fourth time by the NIH, supports health researchers by providing next-generation, open-source software tools for the analysis, visualization, and understanding of biomedical imaging data. This means working with both clinicians and software developers to match user requirements with development of software to maximize both the speed and accuracy of medical diagnoses and biological analyses.

"At CIBC, we partner with doctors and biologists to uncover real-world issues, generally based on imaging of some sort — such as imaging different shapes of leg bones that might correspond to different types of hip implants. Then we deliver software tools that can be used to personalize medical treatment or biological analysis," Brooks explains.

"As another example, we work with clinicians and electrode system manufacturers to produce software tools that model and optimize control of brain stimulation, based on personalized models of an individual's head," he continues. "This allows stimulation to be applied in an optimal manner to address diseases such as epilepsy and Parkinson's. Only by bringing actual user needs together with technology can we significantly improve patient outcomes and biological insight. Creating that direct linkage is the mission of CIBC."

Brooks points out that Northeastern has been the only other CIBC core institution besides the University of Utah since its inception. "Here at Northeastern, we combine a strong research orientation with genuine enthusiasm for collaboration across disciplines." he says. "Our reputation for outstanding health research also allows us to attract top graduate students and external partners, such as Massachusetts General Hospital and Memorial Sloan Kettering Cancer Center, both of which have been collaborators in our research efforts. Northeastern's internal and external synergies have certainly fueled my own health-related research."



In one project, Dana Brooks and his CIBC colleagues have created software that models and optimizes electrical stimulation of the brain with scalp electrodes, for potential treatment of conditions such as depression and pain as well as for cognitive enhancement; this offers important advantages, as it is difficult to identify where it is best to inject current, and how much to inject, to simulate desired brain regions with maximum selectivity. The image shows the results of a current injection pattern optimized to target a particular target brain region (shown in pink) with current from scalp electrodes (colored disks on head surface): the streamlines visualize how current flows in the chosen region from electrodes to the target. Streamline color shows current intensity and direction; the intensity falls off as the current flows from electrodes into the tissue. The current injection pattern was calculated by the algorithm to maximize current through the target region in the desired direction while ensuring safety and controlling for potential side effects. As a result of this work, a simplified version of this approach has been incorporated into the hardware and software of the CIBC industrial collaborator's commercially available scalp electrode array.

"Here at Northeastern, we combine a strong research orientation with genuine enthusiasm for collaboration across disciplines."

–Dana Brooks, professor of electrical and computer engineering, and bioengineering

Research With Broad Implications

Another powerful example of the impact of ongoing health research in the college is Akram Alshawabkeh, the George A. Snell Professor of Engineering, who studies the effects of environmental pollutants on human health.

Alshawabkeh (a civil and environmental engineer with an affiliated appointment in bioengineering) leads the Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) Center, funded by the National Institute for Environmental Health Sciences (NIEHS) of the NIH to study whether Puerto Rico's high preterm birth rates are related to the island's 200+ hazardous waste sites.

PROTECT researchers at Northeastern and partners at the University of Michigan, University of Georgia, and University of Puerto Rico have obtained significant results with direct impact on public health in Puerto Rico and around the world, including development of a new environmentally-friendly, efficient technique for well water decontamination, identification of newly-understood mechanisms by which chemicals can stimulate preterm birth, as well as confirmation that the suspect chemicals of interest are present at elevated levels in the blood and urine of the women under study. One of their newest innovations is giving an "exposure report card" to each study participant which interprets their individual chemical exposures in a way that can be easily understood.

Enabling Engineering

Thanks to student volunteers from Northeastern, orphans in Ecuador with disabilities can communicate with the touch of a button

Undergraduate volunteers from the College of Engineering recently collaborated with physical therapy students to design two low-cost communication devices for children with disabilities living at a pair of orphanages in Ecuador.

At two locations of the For His Children Orphanage, modern technology is helping children with disabilities communicate more effectively. iPads equipped with an app called GoTalk Now have made great strides in giving a voice to children who have difficulty speaking. However, children who also have physical or cognitive disabilities were struggling to press the correct buttons on their iPads.

When a team of Northeastern students in the Enabling Engineering service organization learned of this challenge, they volunteered to develop a customizable iPad cover that makes it easier for children to select the correct items on their educational software.

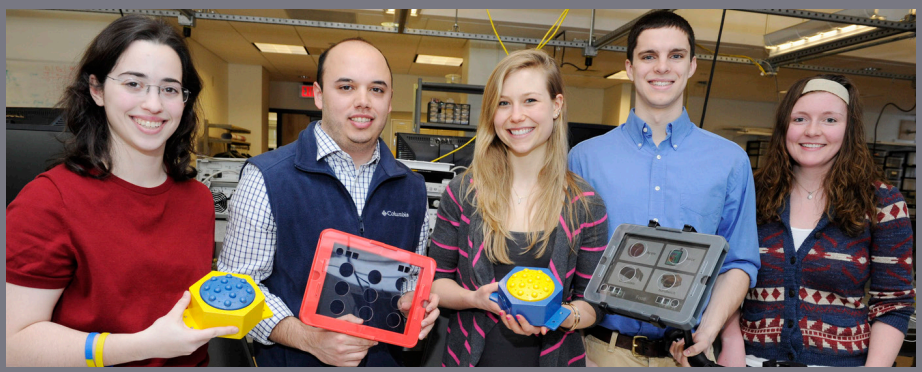
Working under the guidance of Waleed Meleis, associate professor of electrical and computer engineering who advises the Enabling Engineering group, and Lorna Hayward, associate professor of physical therapy, movement & rehabilitation science, students developed a 3D-printed case and a clear plastic screen guard featuring large holes to "guide" users' button pushing. The screen guard slides onto the case, which holds the iPad.

The students also designed a wall-mounted communication button, which runs on a nine-volt battery and is modeled after the Staples "Easy Button," which helps nonverbal children express their needs. The bright blue, bumpy wall button is mounted at eye level and includes such prerecorded commands as "Outside" or "I have to use the bathroom."

To accurately address the needs of children with disabilities, the engineering students collaborated with physical therapy students from Northeastern. The students were advised by industry mentor Paul Sabin, principal of the design firm Fikst. Their input led to such product features as the button's bumps, which are especially important for visually impaired users who rely on touch.

"By linking up the expertise of faculty and students in different colleges, we can inspire our students, help those in need, and build great and relevant projects," said Waleed Meleis, an associate professor of electrical and computer engineering who advises the Enabling Engineering group.

Marina Eaves, E'18, one of three students who helped design the device, says, "Working across boundaries was really great because it gave us a different perspective on what we were building. The physical therapy students knew things about the end users that we didn't know."



From left, Samantha Bell, E'18', Nick Mangone, BHS'16, Ariel Hovland, BHS'16, Zach Woolever, BHS'16, and Marina Eaves, E'18, developers of adaptive devices that are being used to support children with disabilities at a local schools

These results have led to new follow-on funding from the U.S. Environmental Protection Agency and NIEHS, to study a subset of 600 children whose prenatal exposure was documented in PROTECT, tracking them from birth through age four, to study the impact of environmental exposures on the early childhood health and neurodevelopment.

"We're looking not just at pollutant exposure and the biological mechanisms that might be triggered by contaminants — but also at the psychosocial and economic factors that could contribute to adverse health effects," states Alshawabkeh. "We're assessing an extremely complex problem, and that requires a sophisticated, multi-faceted research approach."

Alshawabkeh's research collaborators typify the crossdisciplinary teams needed to attack today's health challenges: at Northeastern, Engineering professors David Kaeli oversees the PROTECT database architecture and April Gu investigates water quality. Health sciences professors include Roger Giese, an analytical chemist; air pollution expert Helen Suh Macintosh, biostatistician Justin Manjourides and neurodevelopment specialist Emily Zimmerman, as well as Phil Brown, professor of sociology and health sciences and director of Northeastern's Social Science Environmental Health Research Institute.

"There are no real borders between academic departments, or even colleges, here. That allows us to quickly assemble the expertise we need to gather data, draw conclusions, and start making an impact on quality of life," says Alshawabkeh. "I believe our research is significantly accelerated by the highly collaborative culture here at the university."

"It's extremely rewarding and exciting to know that we are improving the quality of life in Puerto Rico, while also developing a base of knowledge that has the power to transform health in other regions of the world."

–Akram Alshawabkeh, George A. Snell Professor of Engineering

Making a Lasting Impact

However diverse their work may be, Northeastern's health researchers have one thing in common: a passion for addressing foundational medical challenges and making an impact on global health.

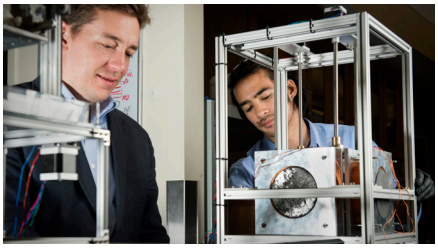
"It's important to do research in the lab and publish academic papers, but Northeastern has empowered me to go out into the world and improve people's lives," says Alshawabkeh. "It's extremely rewarding and exciting to know that we are improving the quality of life in Puerto Rico, while also developing a base of knowledge that has the power to transform health in other regions of the world."

Dana Brooks agrees. "Here at Northeastern, I'm part of a community of faculty and researchers who are hungry to do innovative research and solve meaningful problems, and that keeps my own energy level high," he states.

As for Zach Flinkstrom, he's confident that he made the right choice by enrolling in the new Bioengineering program. "My class is part of making history," he says, "and that doesn't happen very often. As students, we have input into the bioengineering curriculum, we have 'town hall' meetings where we can voice our opinions, and we have the opportunity — through research assignments, co-ops, and other collaborations — to shape our education to meet our own needs. I would never have this level of involvement or attention at another university."

Shaping the FUTURE

3D PRINTING ENABLES A BREAKTHROUGH IN MANUFACTURING CUSTOMIZED DEVICES



Every human body is unique in its shape, size, and other physical characteristics. Yet most medical devices are designed in a "one size fits all" manner that's meant to accommodate most patients. Often, an approximate size is all that's needed. For some devices, however, an inexact fit can compromise patient care.

Consider the case of premature babies. Plastic catheters are needed to deliver oxygen, nutrients, fluid, and medications that help these tiny humans stay alive. For these smallest patients, an ill-fitting catheter might cause vein punctures, tissue damage, or ineffective delivery of oxygen or medication. But historically catheters have only been available in standard shapes and sizes.

Randall Erb, an assistant professor of mechanical engineering, is working to change that. He and his doctoral student Joshua Martin have teamed up with N2 Biomedical to design highly customized medical devices, including neonatal catheters, via low-cost 3D printing technologies.

Erb and Martin have developed an innovative printing process that uses magnetic fields to shape composite materials — mixes of plastics and ceramics — into patient-specific products. The resulting biomedical devices are both stronger and lighter than current products. And, via materials engineering, they have been designed specifically for optimal performance and extreme structural stability. A paper describing their work appeared in the October 23 issue of Nature Communications.

"By controlling how the ceramic fibers are arranged, we can control the mechanical properties of the material itself," Erb notes. "Within a single patient-specific device, the corners, curves, and holes must all be reinforced by ceramic fibers arranged in just the right configuration to make the device mechanically robust."

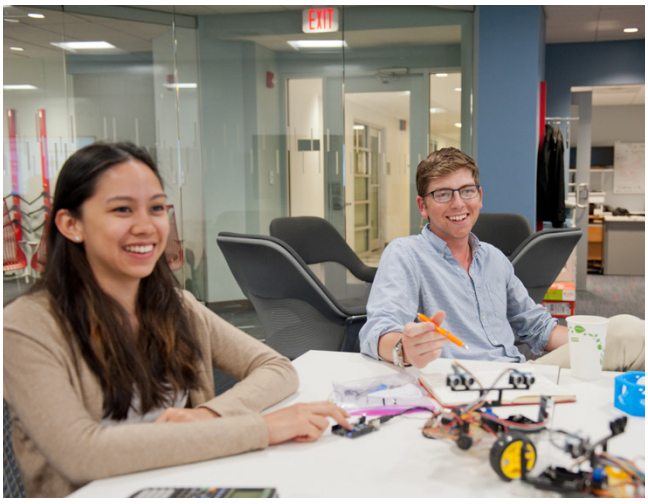
"For a long time, researchers have been trying to design better materials, but there's always been a gap between theory and experiment," adds Martin. "With this technology, we can finally design a particular fiber architecture that will lead to improved mechanical properties. And we can produce those complicated architectures rapidly and cost-efficiently via 3D printing."

Getting Down TO BUSINESS

The College of Engineering offers rich resources that help young engineers think like entrepreneurs — preparing them for success in today's job market.

"At Northeastern, we've made a concerted effort in recent years to help our students acquire the practical business skills they need to succeed as entrepreneurs."

— Nadine Aubry, Dean of Engineering



Students collaborate in the Michael J. and Ann Sherman Center for Engineering Entrepreneurship Education to bring their prototype ideas to life

One day last September, freshman Andrew Colabella (E'20) got caught in the rain on his way back to his dorm after class. Struggling to balance his heavy backpack while carrying an umbrella, he ended up getting soaked.

For most students, this would have been a minor, quickly forgotten incident. But, as Colabella vented his frustrations to his roommates — mechanical engineer Julian Costas (E'20) and bioengineer Matthew Dowling (E'20) — an idea began to take shape.

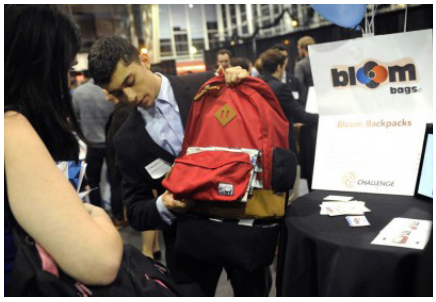
"We realized that existing backpacks have a lot of limitations," Colabella says. "They are big and bulky, they have a lot of wasted space, and they could include a lot more useful functionality — like maybe a built-in umbrella for rainy days. We began to imagine creating the ideal backpack, one that could be customized to every user's unique needs."

The three friends, who grew up together in New Jersey, thought they were onto something. Using principles they were learning in their Intro to Engineering class, they began to sketch designs for a new, modular backpack that would accommodate the needs of many users.

The three inventors realized they needed help to bring their product idea to life, so they visited the Michael J. and Ann Sherman Center for Engineering Entrepreneurship Education. Founded in 2014 through the generosity of Michael Sherman (E'68) and his wife Ann, this center in the College of Engineering helps students access the tools, concepts, and resources they need to foster creativity and develop commercially viable ideas. (See sidebar, "The Sherman Center: One-Stop Support for Entrepreneurs.")

Costas attended a workshop at the Sherman Center given by successful entrepreneur Dino Farina (E'89), CEO and founder of Proveris Scientific Corporation. A long-time supporter of the university's co-op program — who has hired multiple Northeastern graduates — Farina had just become involved in the REV (Resource for Engineering Ventures) mentoring program at the Sherman Center. He quickly agreed to serve as a mentor for Bloom Backpacks, the fledging company founded by Colabella, Costas, and Dowling.

"Matthew, Julian, and Andrew had a great backpack design," notes Farina. "I helped them think about how that product could be delivered to the marketplace profitably. We talked about user requirements, marketing, designing for manufacturability — all the practical



Andrew Colabella, E'20, describes what a customized Bloom Backpack could entail. Photo by Matthew Modoono, NEU

business issues I think about in my job every day."

With advice and encouragement from Farina, the three engineering students created a business plan and then entered the Husky Start-Up Challenge, a nine-week business competition sponsored by the Entrepreneurs Club at Northeastern. At an educational boot camp, they joined with two other students interested in start-up success: Amaury Lejay, a finance major, and Romain Jacques, an entrepreneurship major.

On November 16, the Bloom Backpacks team presented its business plan at Demo Day, the culmination of the Fall 2015 Husky Start-Up Challenge. They competed against more than 20 other student entrepreneurial teams and won first place, along with a cash prize of $2500.

"It's incredible to think that we were able to form a company, develop a business plan, and earn public recognition in just a matter of weeks," says Costas, who is working with his cofounders to lead the company — now named Vestra — toward market launch.

"Not only has the monetary prize jumpstarted our company financially, but this early win has given us motivation and encouragement to keep going," adds Dowling. "We're so grateful that we visited the Sherman Center, because that helped us make real progress very quickly."

Creating "T-Shaped" Engineers

It's no coincidence that students like Colabella, Costas, and Dowling have many avenues for education and support within the College of Engineering today. "At Northeastern, we've made a concerted effort in recent years to help our students acquire the practical business skills they need to succeed as entrepreneurs — or contribute in a more strategic way as corporate engineers," says Dean Nadine Aubry.

Aubry notes that employers today are looking for engineers who can think beyond their own function to see their contribution at a higher level. "In every field, professionals are being asked to have 'T-shaped' or broad-based skills," she notes. "The vertical bar on the T represents our students' engineering skills that they acquire in the core curriculum. The horizontal bar is the general business skills they need to succeed in today's competitive world."

"Whether they are executives of their own start-up or managers of a corporate engineering team, today's engineers need to understand not just the math and science involved in design, but complex issues like production costs and market potential," Aubry explains.

Shashi Murthy, director of the Sherman Center, points out that Northeastern's emphasis on co-op makes the university an early leader of the 'T-shaped' movement. "By emphasizing real-world experience, Northeastern has always graduated engineers with strong technical and professional skills," he says. "But we're now engaged in an aggressive effort to build entrepreneurial engineering into the core mission of the College of Engineering. And by 'entrepreneurial engineering,' I mean that all engineers need the ability to think and work innovatively, whether they found their own companies or not."

The Power of Committed Alumni

Leading this effort have been successful alumni Michael Sherman and Edward Galante (E'73), the latter of whom founded the Galante Engineering Business Program — which provides a progressive, multi-degree opportunity for engineering students to complement their technical education with business skills (see sidebar, "Edward Galante: A Pioneer of T-Shaped Thinking.")

Another strong advocate has been Steve Picheny (E'64), who founded his own medical device distribution business in 1974 with a $20,000 loan from his father. When he sold the company in 1998, it had grown to $48 million in annual revenues. A Northeastern

Members of the Galante Engineering Business Program at their seventh event of the year, "Bringing Your 'A' Game to a Business Dinner"

Corporator, an Advisory Board member for the IDEA venture accelerator, and a sponsor of scholarships, Picheny has made a personal commitment to give back to Northeastern and encourage the next generation of young engineers.

"When I look back on my own career, the real key to my success was the time I spent at Northeastern University," Picheny states. "My engineering classes and my co-ops gave me the skills and the confidence I needed to write my own success story. Now I'd like to help other young people write theirs."

Not only has Picheny been an enthusiastic fundraiser for the College of Engineering's various entrepreneurial programs, but he was one of the founders of the REV mentoring program — and actively recruits volunteers to act as coaches for students. "Obviously, students benefit from a mentoring relationship," he says, "but the coaches actually have just as much to gain. Today's students are passionate, they're excited, and they're ready to take on the world. It's exciting to be around brilliant, creative young people and help them achieve their vision. There's really nothing like it."

Mentor Dino Farina agrees. "There are so many lessons I can share, and hopefully I can make the road to success a little easier for students like Julian, Andrew, and Matthew," he notes. "When I was at Northeastern and when I was starting my business, I didn't have all the resources that are available now. I had to figure things out for myself. It's wonderful to see a whole community coming together to support these students' success."

Excelling at the Business of Engineering

Beginning in 2015, the College of Engineering began to offer a number of specialized courses that can be counted toward an Entrepreneurial Engineering minor. About 60 students are currently attending these classes in customer-driven innovation, creative product design, prototyping, and product development.

In addition, evening workshops at the Sherman Center focus on special-interest topics such as 3D printing, assembling electronic devices, and conducting market research. "Some of the students who come to the Sherman Center have to figure out how they're going to manufacture their product. Some of them need a business plan to attract financing. Some of them have practical problems like figuring out how to integrate hardware with software," says Murthy. "We want to become a one-stop resource for all their diverse needs."

"It used to be that only writers and artists needed to show a portfolio when they were looking for a job," Murthy adds. "Now the engineering job market is very competitive, and employers expect more than basic engineering skills. They want to see evidence of how students have creatively applied their knowledge to solve challenging and real problems."

Aubry concurs. "Whatever the industry, employers are looking for engineers who are leaders and strategic thinkers. The Sherman Center, the Galante Engineering Business Program, and all the other resources we've built within the College of Engineering are preparing our graduates for success, whether they want to start their own company or just succeed at the business of engineering."

EDWARD GALANTE: *A PIONEER OF T-SHAPED THINKING*

While "T-shaped" skill development is a hot topic today, Edward Galante (E'73) recognized the need for engineers to have general business expertise many years ago — when he was a young engineer entering the business world for the first time. Galante was hired by his co-op employer, ExxonMobil, and had a successful 34-year career there, but he often felt like he was playing catch-up when he attended high-level meetings with executives.

"Someone would be talking about discounted cash flow analysis, and I would have to go back to my office and research what that meant," Galante admits. "I had excellent technical training, but I had to learn about many general business concepts on my own."

To help the next generation of engineers combine their scientific knowledge with strategic insights, this committed alum founded the Galante Engineering Business Program, jointly sponsored by the College of Engineering and the D'Amore-McKim School of Business.

Students pursuing an MS in Engineering Management — either as a stand-alone degree or as part of the combined BS in Engineering/MS in Engineering Management degree option — can apply to become Galante Fellows. These students will have started their education at Northeastern in their engineering area of choice. Aligning with the vision of Ed Galante, they then learn to apply these skills in a business context by enrolling in four specialized courses in such areas as financial analysis and technological entrepreneurship.

In keeping with Galante's commitment to giving back, the Galante program also includes a project management and leadership component. Fellows choose a project, such as creating new co-ops or producing marketing materials, that directly contributes to the future success of the program.

A key feature of the Galante Program is found in its co-curricular elements. Fellows benefit from workshops, networking events, speakers from the corporate sector, specialists in career counseling, seminars providing advice for pursuing an M.B.A., panel discussions on navigating the business world, and presentations from successful engineering alumni who have chosen to integrate their technical foundations with business — including Ed Galante himself.

In addition to earning an MS degree, Fellows are awarded a Galante Engineering Business Certificate. To jumpstart these high-achieving students toward earning an M.B.A. in the D'Amore-McKim School — if they choose to do so — Galante-specific coursework is counted toward an M.B.A., whether students enroll immediately or return to business school later.

"The Galante Fellows represent a close-knit community, although the students are a diverse group of undergrads and graduate students with a variety of skill levels and experience," says program director Kris Jaeger-Helton. "They work hard to support one another and leverage the special resources that are available through Ed Galante's generosity."

The Sherman Center: *One-Stop Support for Entrepreneurs*

In 2013, Michael Sherman (E '68) and his wife Ann made a generous gift to the College of Engineering to establish the Sherman Center for Engineering Entrepreneurship Education. Sherman, a successful entrepreneur, credits his co-op experiences at Northeastern with giving him the skills he needed to found a successful company, AES Corporation, which produces and installs leading-edge security products in 130 countries.

With close links to the D'Amore-McKim School of Business, the IDEA venture accelerator program, and other business-related resources at Northeastern, the Sherman Center serves as a hub of information and networking for engineering students.

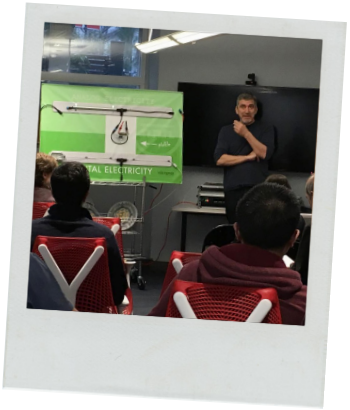
"My goal in creating the Sherman Center was to create a centralized resource that would help young entrepreneurs get their ideas off the ground — without a lot of the trial-and-error that people of my generation went through," Sherman says.

Sherman has worked closely with Dean Nadine Aubry and Shashi Murthy, who directs the center, to develop a full complement of resources that includes:

An entrepreneurial engineering minor. Engineering students can enroll in semester-long courses that include topics such as product design and prototyping. Currently there are four courses taught by expert entrepreneurs, with new courses under development.

REV mentoring program. To match current students with successful alums who can serve as coaches, the Sherman Center created the REV (Resource for Engineering Ventures) mentoring program. Mentors realize the satisfaction of giving back, while students shorten their learning curves and avoid rookie mistakes.

Generate. This brand-new student organization provides expertise in product design and prototyping to the entire Northeastern entrepreneurial ecosystem. Following a consultant-client model, student teams accept projects from entrepreneurs and render their concepts in physical form.



Speaker series. Engineering alumni and industry leaders have a wealth of insight and advice to share. An informative speaker series at the Sherman Center creates a forum for these professionals. Recent topics have included "Bootstrapping Your Way to Success" and "An Entrepreneur's Take on the Manufacturing Process."

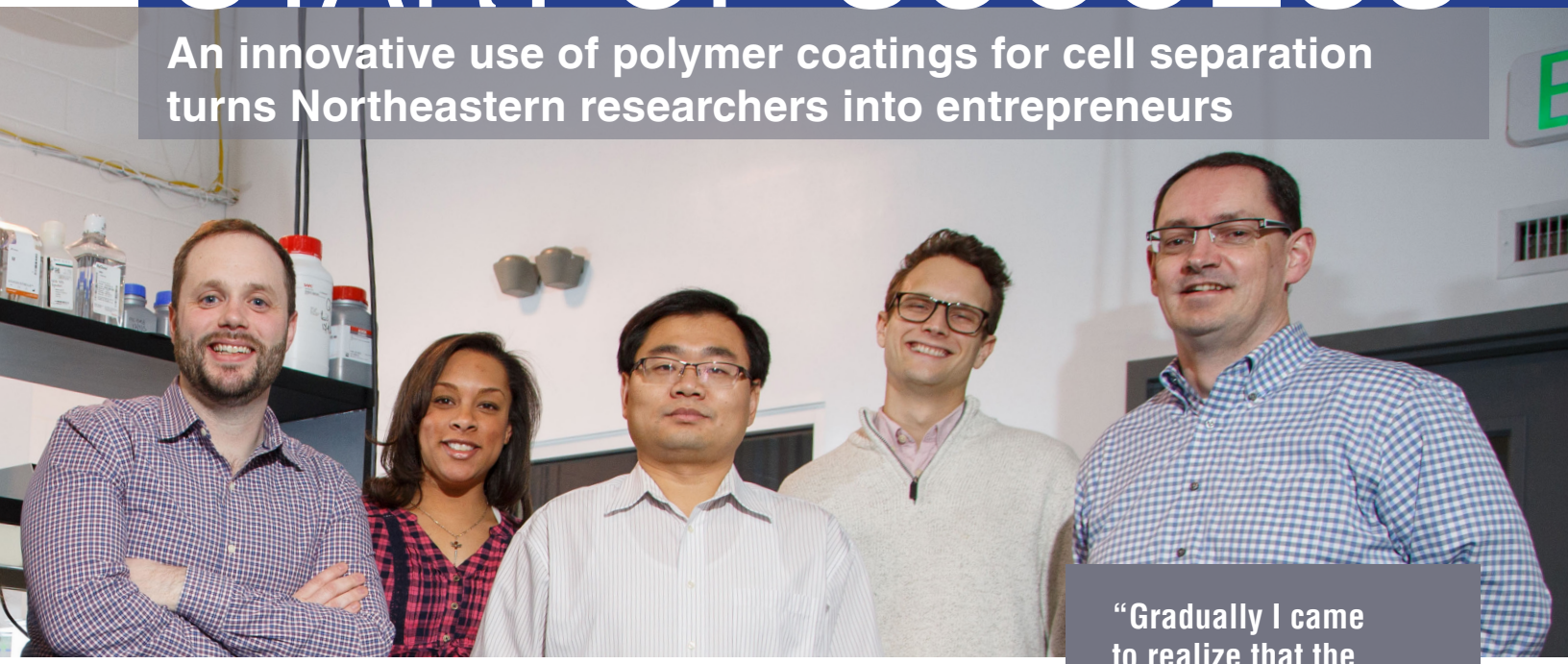
Evening workshops. A series of popular evening classes led by students helps young entrepreneurs gain practical knowledge and solve common problems. Whether they want to learn about low-cost manufacturing via 3D printing or how to conduct market research, attendees can explore topics not covered in the traditional curriculum.

Sherman Center co-op program. This new initiative offers students the opportunity to work on a technology venture concept by taking advantage of all the Sherman Center's resources. Selected students receive a stipend that provides them with the financial and intellectual bandwidth to focus their energy on their own ventures for six months.

There are many ways for Northeastern alumni to become involved in the exciting developments at the Sherman Center for Engineering Entrepreneurship Education. To make the connection, visit northeastern.edu/sherman or contact program manager Ted Johnson at **th.johnson@neu.edu**.

Attracted to START-UP SUCCESS

An innovative use of polymer coatings for cell separation turns Northeastern researchers into entrepreneurs



From left to right: CEO, Sean Kevlahan, PhD, E '13, Kiara Biagioni, Guokui Qin, PhD, Steven Wells, Andrew Ball, PhD

Back in 2003, Chemical Engineering Professor Shashi Murthy was a PhD candidate at MIT, watching his fellow students commercialize their ideas and thinking to himself, "I want to focus purely on research. I don't ever want to start my own company."

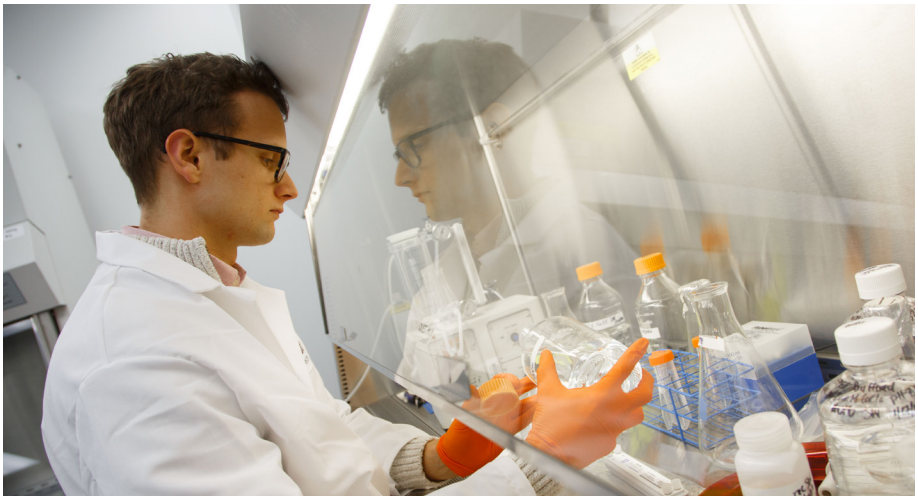
While his doctoral research on insulating coatings for brain implants held promise, Murthy believed it was best to let business and marketing experts bring research-based ideas to market. "My naïve belief was that everyone should stick to their own area of expertise," says Murthy. "I thought my place was in the lab and not a boardroom — where an entirely different set of skills was required."

Fast forward to 2016. Not only is Murthy a co-founder and chief scientific adviser of the successful start-up Quad Technologies, but he is also director of the Michael J. and Ann Sherman Center for Engineering Entrepreneurship at Northeastern. Founded in 2013, this initiative was created to arm engineering students with the appropriate entrepreneurial skills to successfully identify market needs and develop innovative products (see related story on page 19.)

Murthy has simultaneously become a world-renowned researcher, recently named to the 2016 Class of Fellows of the American Institute for Medical and Biological Engineering (AIMBE). But today, he is equally at home in the laboratory and the boardroom.

What happened to bring about this extreme change in Murthy's perspective? "Since 2006, I have been working with my PhD students on a unique cell-separation technology that addresses the historic problems associated with preserving cell integrity," explains Murthy. "Gradually I came to realize that the technologies we developed would remain within the restricted domains of academic scientific literature — unless we made a proactive effort to commercialize them in the form of products that address broad technological and societal needs. This realization was a major factor in the formation of Quad Technologies."

> **"Gradually I came to realize that the technologies we developed would remain within the restricted domains of academic scientific literature — unless we made a proactive effort to commercialize them…"**
>
> – Shashi Murthy, professor, chemical engineering



Quad's new office space supports an expanding team of R&D talent specializing in cell separation

Targeting a Real-World Need

Launched by CEO Dr. Sean Kevlahan (PhD'13) with fellow graduate students Adam Hatch (PhD'14) and Brian Plouffe (PhD'11), Quad Technologies targets a practical problem faced by biomedical and healthcare professionals: how to separate cells for various applications without compromising or damaging them.

"There are many applications where the cells in a multi-cell sample need to be isolated from one another for research or treatment purposes," says Murthy. "For example, one of the most exciting developments in cancer treatment today is immunotherapy — in which the patient's own cells are modified to locate and destroy cancer cells. This treatment approach relies on the isolation of a specific type of white blood cell, namely T cells, which can perform this role. However, traditional methods of cell separation have tended to cause damage or deterioration to the targeted cells."

Beginning in 2010, Murthy and his graduate students worked to develop a hydrogel coating that would adhere to individual cells, protecting them and allowing them to be separated from surrounding cells, blood and tissue. Eager to get their product — dubbed QuickGel™ — into the hands of researchers, drug developers, and clinicians, the team filed for a patent and formed Quad Technologies in 2012.

While the initial technology was designed to work within the highly controlled environment of an academic research lab, the team needed to make it work on a larger scale, with greater automation, in order to commercialize it for a broader marketplace. The answer was embedding microscopic magnetic beads in the gel coating.

The beads leverage the natural phenomenon of magnetism to pull cells apart, without exerting a physical force that could cause cell damage. In addition, the gel coating — including the magnetic beads — dissolves harmlessly less than a minute after cell separation. This biologically friendly buffer leaves the cells intact and viable for a range of critical applications.

Jeffrey Zonderman, Chief Operating Officer of Quad Technologies

"Every day as director of the Sherman Center, I tell my students, 'Answer a real customer need. Don't innovate just for the sake of innovation,'" notes Murthy. "That's a lesson I learned myself as the Quad Technologies team worked to perfect our product."

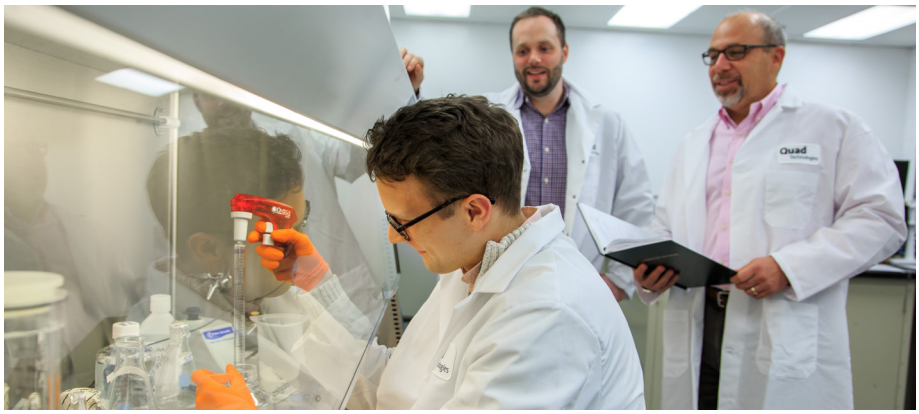
Leveraging the Power of Northeastern

In addition to listening to customers, the Quad Technologies team also sought input from a number of business experts at Northeastern, including faculty at the D'Amore-McKim School of Business and IDEA, Northeastern's venture accelerator. Northeastern's Center for Research Innovation (CRI) helped the team navigate the complex technology licensing process.

To complement their research expertise, the founders recruited Jeff Zonderman, BS'88, who has over 25 years of experience in selling and marketing life-science tools. "When I learned the potential of the technology, I knew it could be a game-changer for many critical health and life science applications," says Zonderman, now the company's chief operations officer. "What I brought was the ability to solve the practical business challenges associated with getting this revolutionary product into customers' hands. How will we produce it? How will we distribute it? How do we market it? Those were the kinds of questions I could answer, based on my own experience."

"I would have been interested in joining Quad Technologies just based on the product's potential impact," notes Zonderman. "But the fact that the technology came out of my alma mater, Northeastern, made the venture even more appealing."

"The great thing about Northeastern is that you can always find the expertise you need," points out Sean Kevlahan, the company's chief executive officer. "The collaborative, interdisciplinary environment here makes it easy to find faculty, students, and alumni who can contribute to your success — no matter what you're trying to accomplish. Quad Technologies' market launch was greatly accelerated by this boundary-less culture that quickly connected us with the business expertise we needed. We are also fortunate to have an extremely accomplished community of alumni – our connection with Jeff Zonderman is a great example."



A primary goal of the Quad Team is to expand Quickgel technology and Magcloudz product platform to solve the critical challenges in cell therapy

A Winning Product Idea

Beyond the campus, the Quad founders repeatedly proved the value of their product idea. The team was a winner of the 2013 Rice Business Plan Competition, the world's largest graduate-level student startup competition. This program is designed to give collegiate entrepreneurs exposure to funding sources, as well as expert feedback on their business plans and customer pitches.

That same year, Quad Technologies was a Silver Award winner in MassChallenge. This Boston-based competition recognizes promising start-ups with high-impact ideas and connects them with the resources required for success. MassChallenge provides practical support including mentorship, office space, and education, with the goal of accelerating market launch.

In addition, the fledgling company received a $45,000 cash award from the Center for the Advancement of Science in Space (CASIS), based on Quad's participation in MassChallenge. "Our production process leverages a dropping technique that capitalizes on gravitational forces," explains Murthy. "The CASIS funding helped us understand the impact of removing gravity from the equation — improving our core manufacturing process and also opening the door for space-based applications of our cell-separation technology in the future."

Road to Success

Not many people were happy about the high snowfall levels in Boston during the winter of 2014-2015. But for one university spin-off, the enormous snow accumulation — and the damage it caused to local roadways — meant a significant boost in awareness that is still paying dividends.

Founded by a team of Northeastern engineering faculty, StreetScan contracts with municipalities to provide continuous monitoring of road conditions, without impeding traffic. StreetScan's patented sensing technology collects data on potholes, pavement cracks, and other problems while driving — but that's only the beginning.

"Our technology also includes a decision-making toolbox that helps officials make informed decisions about which paving issues to address, in what order," explains Ralf Birken, a former civil and environmental engineering research assistant professor who now serves as the company's COO and CTO. "We've developed proprietary algorithms that ensure municipalities are balancing their maintenance costs with meaningful consumer benefits."

StreetScan was born at Northeastern in 2009 when Birken and his collaborative team won $9M in funding from the National Institute for Standards and Technology (NIST) to develop their idea. The interdisciplinary team included Professor Ming Wang of CEE and Professor Gunar Schirner of Electrical and Computer Engineering, both co-founders of StreetScan.

The start-up reached a key milestone in the fall of 2014, when Peter Ogren (E'69) learned about the promising young company and came onboard as CEO. According to Birken, the support of Ogren, a seasoned entrepreneur and engineering executive, was critical in attracting funding and raising awareness. The harsh winter that followed created both a storm of publicity and a plethora of new potholes that led to customer inquiries.

Today StreetScan has a roster of new projects and has hired four former graduate student researchers from Northeastern as full-time employees. This spring, look for the company's hard-working 'Scan Van' on a street near you.

An Inspiring Journey

Today, Quad Technologies has launched its flagship product, the MagCloudz™ Cell Separation kit, and sells the product on its website, quadtechnologies.com. With offices in Woburn, the company has eight full-time employees and sponsors two co-op students from Northeastern each term.

While Hatch has moved on to become a process scientist at AMPAC Fine Chemicals and Plouffe is now an assistant professor and biomedical engineering program director at Regis College, Kevlahan and Zonderman are working hard every day to deliver their innovative solution to the global healthcare community.

"It's been incredibly rewarding to see a product take shape in the research lab and move to market launch," says Kevlahan. "And I'm excited to see the future impact of our idea. We're participating in finding a cure for cancer — and that's ultimately what gets me up every morning."

Murthy notes that the success of Quad Technologies is inspiring other start-ups at Northeastern (see sidebars). Once a reluctant entrepreneur, today Murthy is committed to helping students map their own path to business success by identifying and addressing similar real-world challenges.

"Whether students end up starting their own company or taking a leadership role in an engineering organization, being exposed to actual market problems — and actively solving them — changes the way they think about their role as an engineer," Murthy concludes. "At Northeastern, we're committed to developing smart, business-minded engineers who, like Sean, get excited about their ability to change the world."

SECURING HER FUTURE

Abbey Titcomb is committed to revolutionizing personal safety devices — while still an undergrad

When she's not attending lectures, completing coursework, or hanging out with friends, Abbey Titcomb, E'18, is doing something pretty amazing for a third-year student: successfully launching a business. Her company, Knightly, markets an innovative personal security device designed specifically for college students.

"Like Northeastern, many universities are located in urban settings, which creates a certain level of risk for students," Titcomb points out. "Not only are most students unaware of the dangers around them — but they are also typically disconnected from resources that could help them, such as campus police."

To address this real-world need, Titcomb has developed a small device that can be easily clipped onto a college ID card, placed in a pocket, or thrown into a purse. Students can trigger the device when they are feeling uncomfortable, sending a text to friends who can make sure they get home. In an emergency, students can trigger the device to directly alert their campus police department. Campus police responders then use GPS technology to quickly locate and assist the device's owner.

Via a cell-phone app, Knightly also enables rapid access to vital information such as fire escape routes, shuttle schedules, and campus maps. When a crime or other security issue happens nearby, the app sends a real-time alert.

Knightly's device will be sold to universities, who would pre-program it with all the relevant information for their own campuses — then distribute it to every student. This summer, Titcomb is leveraging a grant from Northeastern's IDEA venture accelerator to conduct a pilot program in partnership with the Northeastern University Police Department. "I'm eager to get the device into the hands of actual users and get their feedback," says Titcomb. "I want to start making a difference quickly."

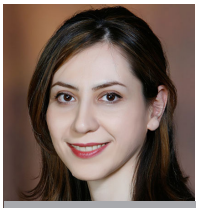
Titcomb envisioned herself as a "traditional" engineering student when she arrived at Northeastern — but, after taking a few business classes and discovering resources such as the Sherman Center (see page 19), she became passionate about starting her own company.

"Northeastern is really the perfect incubator for young entrepreneurs," Titcomb states. "Whether I need to solder electronic components or conduct market research, it's always easy to find someone to help me. Everyone here has the attitude of 'We can do it!' In this energized environment, it's been exciting, not scary, to start my own business as an undergrad. I really credit my success as a businessperson to Northeastern and the unbelievable resources here."

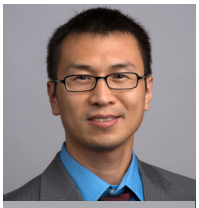
Welcome New Faculty

The College of Engineering has hired **36** faculty since 2013, and **12** in 2015.

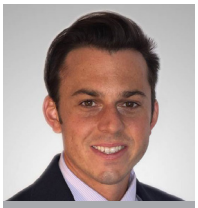

Muhammad Noor E Alam


Mahshid Amirabadi


Nasim Annabi


Qianqian Fang


Stratis Ioannidis


Ryan Koppes


Taskin Padir


Ameet Pinto


Hanumant Singh


Nikolai Slavov


John Peter Whitney


Hongli Julie Zhu

Muhammad Noor E Alam joins Northeastern as an assistant professor of mechanical and industrial engineering. His research focus is on applied operations research, large scale optimization, and data analytics.

Mahshid Amirabadi joins Northeastern as an assistant professor of electrical and computer engineering. Her research focus is on design, modeling and control of power converters, power electronics for renewable energy systems, microgrids, variable speed drives and wireless power transfer.

Nasim Annabi joins Northeastern as an assistant professor of chemical engineering. Her research focus is on engineering advanced biomaterials for cardiovascular tissue engineering applications.

Qianqian Fang joins Northeastern as an assistant professor of bioengineering. His research focus is on medical imaging and biomedical optics.

Stratis Ioannidis joins Northeastern as an assistant professor of electrical and computer engineering. His research focus is on big data, machine learning, privacy, and distributed systems.

Ryan Koppes joins Northeastern as an assistant professor of chemical engineering. His research focus is on neural interface technology, tissue engineering, and musculoskeletal biomechanics.

Taskin Padir joins Northeastern as an associate professor of electrical and computer engineering. His research focus is on modeling and control of robot systems, human-in-the-loop robot control, and realization of medical cyber-physical systems.

Ameet Pinto joins Northeastern as an assistant professor of civil and environmental engineering. His research focus is on microbial ecology and physiology, drinking water treatment and distribution, wastewater treatment, public health microbiology, molecular microbiology, 'omics analyses.

Hanumant Singh joins Northeastern as a professor of electrical and computer engineering. His research focus is on robotic sensors, systems, platforms, and algorithms including high resolution optical and acoustic sensing; underwater vehicles.

Nikolai Slavov joins Northeastern as an assistant professor of bioengineering. His research focus is on ribosome-mediated translational regulation, coordination of cell growth and differentiation; statistical inference, mass-spectrometry; cell metabolism; quantitative systems biology; computational biology, bioinformatics, proteomics and genomics.

John Peter Whitney joins Northeastern as an assistant professor of mechanical and industrial engineering. His research focus is on human-safe robots, medical robotics, soft robotics and soft material manufacturing, MEMS, microrobotics, bio-inspired design, flapping aerodynamics and insect flight.

Hongli Julie Zhu joins Northeastern as an assistant professor of mechanical and industrial engineering. Her focus is on advanced manufacturing; Multifunctional bio-inspired material from nature; Sustainable energy storage; Nano/micro fabrication of devices and materials.

PROMOTIONS

Mark Niedre (ECE, BioE) was promoted to associate professor, PhD University of Toronto

Jeffrey Ruberti (BioE) was promoted to professor, PhD Tulane University

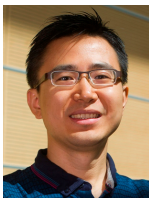
Nian Sun (ECE, BioE) was promoted to professor, PhD Stanford University

young INVESTIGATOR RECOGNITIONS

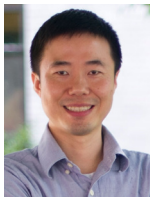
These faculty recognitions bring the total young investigator awards in the college to **53**, including **32** NSF CAREER and **11** DOD Young Investigator awards.

Kaushik Chowdhury, associate professor of electrical and computer engineering, has been awarded the Director of Research Early Career Grant from the Office of Naval Research for work on dynamic spectrum access networks for his project entitled "End-to-End Protocol Designs That Address the Challenges of Distributed Dynamic Spectrum Access Networks."

Matthew Eckelman, assistant professor of civil and environmental engineering, received a NSF CAREER award for his project entitled "*Building Chemical Synthesis Networks for Life Cycle Hazard Modeling.*"



Raymond Fu, associate professor of electrical and computer engineering, received a IEEE CIS Outstanding Early Career Award for contributions to neural computing, manifold learning, and visual intelligence.



Yongmin Liu, assistant professor of mechanical and industrial engineering, received an ONR Young Investigator Award for his project entitled "*Reconfigurable Metamaterials for Beam Steering, Imaging and Sensing at Infrared Frequencies.*"

Ningfang Mi, assistant professor of electrical and computer engineering, received a NSF CAREER Award for her project entitled "*Capacity Planning Methodologies for Large Clusters with Heterogeneous Architectures and Diverse Applications.*"

Andrew Myers, assistant professor of civil and environmental engineering, received a NSF CAREER Award for his project entitled "*Advancing Multi-Hazard Assessment and Risk-Based Design for Offshore Wind Energy Technology.*"

Marvin Onabajo, assistant professor of electrical and computer engineering, received a NSF CAREER Award for his project entitled "*Low-Power Transceiver Design Methods for Wireless Medical Monitoring.*"

Matteo Rinaldi, assistant professor of electrical and computer engineering, received an IEEE Sensors Council Early Career Award for his outstanding contributions to novel multi-functional piezoelectric micro and nano electro mechanical resonant sensors.

Rifat Sipahi, associate professor of mechanical and industrial engineering, received an ASME Dynamic Systems and Control Division Outstanding Young Investigator Award.

Ashkan Vaziri, associate professor of mechanical and industrial engineering, received the Air Force Young Investigator Award to study bio-inspired interfaces for hybrid structures.

HEART OF THE MATTER

Chemical Engineering Assistant Professor Eno Ebong has won a Mentored Career Development Award from the National Institutes of Health for her proposed research on the underlying causes of vascular disease. Eno aims to uncover the poorly understood cellular and molecular sources of atherosclerosis — the buildup of fatty deposits, or "plaques," in artery walls — that contribute to 795,000 strokes and 915,000 heart attacks each year in the US alone, according to the American Heart Association. On a macro scale, Ebong studies the trouble spots in blood-vessel geometry — the junctures, constrictions, and curvatures where blood is more likely to slam into a vessel wall and erode it, leaving lesions where fatty deposits can settle. On a micro scale, she focuses on how the mechanical forces of blood flow affect the cells that line and guard those vessels, the endothelial cells. Going even deeper, she zeros in on the thin, protective gel-like layer of sugar molecules and proteins coating the surface of those endothelial cells — called the glycocalyx — to understand, on a molecular level, how lesions are allowed to form and what researchers can do to reverse the process. In the long term, Ebong hopes to develop therapies that stop the progression of vascular disease before it can contribute to heart attack or stroke.

SHAKING THINGS **UP**

Professor George Adams has a novel idea in earthquake mechanics — and a namesake theory to prove it

It's not often that a scientist has a theory named after him. But Professor George Adams, a Distinguished Professor in the Mechanical and Industrial Engineering Department, can make that claim.

A faculty member at Northeastern since 1979, Adams has identified a phenomenon that describes the behavior of the waves generated when one very flat object slides over another. Because this theory applies to the movement of tectonic plates, seismologists have used it to increase their understanding of earthquake impacts —and have named the phenomenon Adams Instability.

"The theory of Adams Instability, in addition to its importance in the basic science of solid mechanics, allows more accurate predictions of the size of areas impacted by earthquakes."

– Hanchen Huang, Professor and Chair, Mechanical and Industrial Engineering

Adams specializes in applied mechanics, the branch of physical science studying how solid or fluid bodies respond to external forces. He claims to have developed his namesake theory in "a very roundabout way." Adams was actually investigating the behavior of computer tapes as they were pulled over a read/write head. He noticed that, intermittently, the thin film of air between the tape and the head collapsed, and the two surfaces made contact. "I recognized a type of instability I had not seen before," he says. "I thought, 'Maybe I can generalize this phenomenon.'"

Adams showed that this small disturbance grew larger and larger over time and distance — which made his theory extremely relevant to the field of seismology. "During an earthquake, all sorts of waves are generated by the plates moving against each other," he says. "It's those waves, and their instability, that cause damage as they travel. If seismologists can predict the behavior of those waves, perhaps it can lead to preventative measures that minimize earthquake damage."

Recent Fellows

Selected engineering faculty who have been elected as a Fellows of national professional societies

Stefano Basagni, associate professor of electrical and computer engineering, has been named a Distinguished Scientist of the Association for Computing Machinery.

Vincent Harris, University Distinguished Professor and William Lincoln Smith Chair Professor, has been elected a **Fellow** of the American Association for the Advancement of Science, and a Fulbright **Fellow** at Wayamba University in Sri Lanka. Dr. Harris' research focuses on design and processing of advanced materials with emphasis on high frequency device applications for radar, communication, and sensing.

Hanchen Huang, professor and chair of mechanical and industrial engineering, has been elected a **Fellow** of the Society of Engineering Science. Dr. Huang's research focuses on growth of nanorods using theoretical formulations, experiments, and atomistic simulations; mechanics and radiation damage of nanostructured materials using atomistic stimulations.

Shashi Murthy, professor of chemical engineering, has been elected a Fellow of the American Institute for Medical and Biological Engineering for outstanding contributions to the science and technology of cell purification for therapeutic and analytical applications. Dr. Murthy's research focuses on microfluidic isolation of stem and progenitor cells, point-of-care diagnostics, cell surface phenomena during microfluidic flow, and nanoscale probes for cell stimulation.

Mehrdad Sasani, associate professor of civil and environmental engineering, has been elected a Fellow of the American Society of Civil Engineers, and a Fellow of the Structural Engineering Institute. Dr. Sasani's research focuses on collapse resistance of structures under manmade and natural hazards.

Ming Wang, professor of civil and environmental engineering, has been elected a Fellow of the International Society for Optics and Photonics, for his achievements in electro-magnetic sensor and versatile onboard traffic-embedded roaming sensors. Dr. Wang's research focuses on structural health monitoring; structural damage assessment; sensor technology for infrastructure; experimental mechanics; fiber reinforced composites; construction materials; recycled waste materials; structural dynamics; and earthquake engineering.

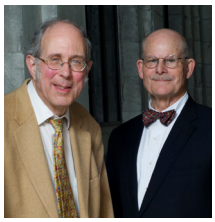
Thomas Webster, professor and Chair of chemical engineering, has been elected a Fellow of the International College of Fellows-Biomaterials Science and Engineering. Dr. Webster's research focuses on design, synthesis, and evaluation of nanomaterials for various medical applications, including self-assembled chemistries, nanoparticles, nanotubes, and nanostructured surfaces.

Katherine Ziemer, professor of chemical engineering and Vice Provost for Curriculum, has been elected a Fellow of the American Institute of Chemical Engineers. Dr. Ziemer's research focuses on engineering surfaces in order to integrate wide bandgap semiconductors with functional and multi-functional oxides, organic molecules, and/or biomaterials.

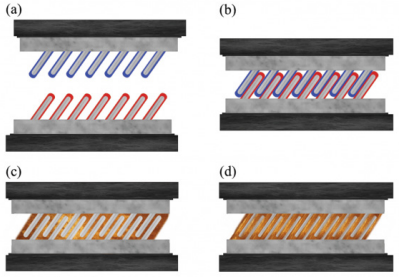
In the News

Electrical and computer engineering professors **Stratis Ioannidis** and **Miriam Leeser** have won a Google Faculty Research Award. Their proposal, titled "Privacy-Preserving Data Mining Over FPGAs in the Datacenter," will receive funding from Google to deploy and evaluate secure function evaluation algorithms over field-programmable gate arrays (FPGAs). Their research would enable companies that operate large data centers, like Google, to perform data mining operations efficiently while offering strong privacy guarantees. More than 950 proposals were submitted for Google Faculty Research Awards this year, and 151 were funded.

The research of **Purnima Ratilal**, associate professor of electrical and computer engineering, was recently featured in Nature. Ratilal has shown that whales tend to group into their own species when eating in large feeding areas. By using acoustic data, her team was able to map a series of highly protected whales and dolphins and observe their predator and prey interactions for the first time over a large expanse.



Michael Silevitch, professor of electrical and computer engineering, and ALERT's John Beaty (on right) were awarded a $1.2 million, two-year Task Order contract from the Department of Homeland Security in collaboration with Stephen P. Beaudoin of Purdue University. The ALERT team will be working to systematize the processes associated with sampling trace explosives using swipes for security screening equipment. This involves creating reference standards for the swipe materials, as well as the types of explosive residues and the substrates which contain the trace samples.



a) Coated rods are arranged along a substrate, like angled teeth on a comb. b) The teeth are then interlaced. c) When indium and galium come into contact, they form a liquid. d) The metal core of the rods turns that liquid into a solid. The resulting glue provides the strength and thermal/electrical conductance of a metal bond. From *"Advanced Materials & Processes,"* January 2016

Hanchen Huang, professor and chair of mechanical and industrial engineering, created the start-up company MesoGlue with two PhD students. The team designed a metallic glue that sets at room temperature — which has the potential to replace welding and soldering. This groundbreaking product can be used in applications ranging from computers' central processing units and printed circuit boards to the glass and metal filaments inside light bulbs. MesoGlue has received media coverage in over 100 different news outlets in over 20 countries.

Hanumant Singh, professor of electrical and computer engineering, is a co-author of "Drones in a Cold Climate," published recently in Earth & Space Science News and featured on the front cover. Singh and his collaborators studied the potential of having unmanned aerial vehicles (UAVs) collect data in the Arctic to support numerical models and forecasts of climate change. By launching pilot drones from the U.S. icebreaker Nathaniel B. Palmer, the researchers learned about the limitations of drones in extreme conditions that included sub-freezing temperatures, high winds, and the need to land on a moving ship. Their recommendations will help pave the way for future applications of drones in harsh environments.

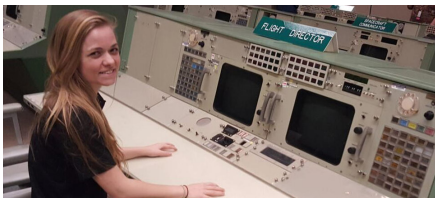
STUDENTS AND ALUMNI

Alanna Ferri, E'16 in mechanical engineering, and **Jonathan Gray**, E'16, were among the top 10 finalists to advance in NASA's Big Idea Challenge for college students. Big Idea seeks to rapidly advance fledgling technology for use in a wide variety of NASA missions. This year, the project involves designing an inflatable heat shield for a mission to Mars. Special emphasis is given on manipulating the shape of the shield to increase mission flexibility and chance of success.

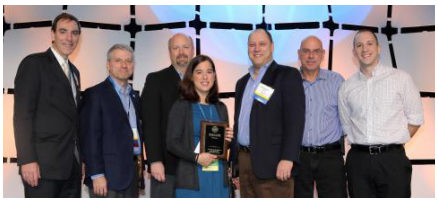
Sheng Li, a doctoral student in electrical and computer engineering, has been named a winner of the Award for Outstanding Self-Financed Students Abroad by the Chinese Government. This year, there are 500 winners globally, chosen from 400,000 candidates in all disciplines. Li is the only computer engineering major to win this award in the East Coast-New York region.

Kelly O'Connell, E'16 in civil and environmental engineering, received the 2015-2016 Co-op Student of the Year Award from the Cooperative and Experiential Education Division of the American Society of Engineering Education. The award is given annually to just one outstanding student nationwide. The last time a Northeastern student won the award was in 1997. O'Connell's co-ops have served as the cornerstone of her Northeastern experience, forging links between her professional work, her academics, and her leadership roles in student groups such as the Northeastern chapter of Engineers Without Borders, where she served as president for the 2014–2015 school year.

Doctoral student **Mahboobeh Rezaeeyazdi**, from the department of chemical engineering, was awarded the WAAIME Scholarship for the 2016-2017 academic year. The Women's Auxiliary to AIME (WAAIME) Scholarship fund provides scholarships on an annual basis to students pursuing degrees in the earth sciences as related to the minerals field. Rezaeeyazdi has a master's degree in chemical engineering from Northeastern and is currently working on nanoparticle-enhanced radiation therapy to develop next-generation platforms enabled by nanoparticles for early detection and treatment of cancer.



Murphy Wonsick, a first-year doctoral student in electrical and computer engineering, developed a system and app for automated tracking of blood samples from collection facilities to testing facilities in Liberia. This project was spun off from Professor Taskin Padir's NSF-supported research on next-generation Ebola treatments. Current practices in Liberia result in a loss of 20 percent of all blood samples, as they cannot be effectively traced back to patients. Murphy developed a system and designed a tablet-based app to make the data entry and tracking easier. Her system will be field tested in Liberia soon.



Sydney Shaw, a MS in chemical engineering alumna, won the ISPE International Poster Competition in the graduate student category at the recent ISPE Annual Meeting. ISPE, the International Society for Pharmaceutical Engineering, is focused on advancing scientific, technical, and regulatory excellence in the pharmaceutical industry. At the recent conference, Shaw competed against dozens of graduate students from universities across the US.

Solomon Mensah, a doctoral student in bioengineering, is the 2016 recipient of the prestigious National Science Foundation Graduate Research Fellowship Award. He will use his award to investigate inter-cellular interactions in cancer and cardiovascular diseases, with the goal of improving the effectiveness of treatments in the future. Mensah is also the CEO of Therapeutic Innovations, a social enterprise committed to redesigning medical devices for developing countries. Therapeutic Innovations was recently awarded gap funding from IDEA, a student-led organization that supports Northeastern's community of entrepreneurs. The IDEA funding supports the development of an innovative continuous positive airway pressure (CPAP) machine for neonatal infants with respiratory distress syndrome in Africa and India.

While attending the recent Society of Hispanic Professional Engineers (SHPE) National Conference, **Jose Ramirez**, E'17, **Hector Grande**, E'20, and **James Tukpah**, E'20 won first place in a group challenge presented by Google. The task was to invent an innovative application that would spark the interest of young students in science, technology, engineering, and math (STEM) fields. The three students conceived an app for tablets and phones that could be used to watch videos and tutorials on STEM, focusing on do-it-yourself projects. The app would also include math and science games, engineering simulations, and a "sandbox" area where kids could play with virtual, 3D Legos and K'NEX. The team received first-generation Moto 360 smart watches as a reward for their creativity and effort.

ALUMNI

Last year the University raised **$81.8** million through **Empower: The Campaign for Northeastern**.
To give to the College of Engineering visit » **coe.neu.edu/give**

Diane MacGillivray (right), senior vice president for university advancement, presents Northeastern's success through the Empower campaign in San Francisco.

Auroop Ganguly (center), associate professor of civil and environmental engineering, travels to Miami for the Empower campaign with some of Northeastern's undergraduate students.

William Robertson (above), assistant professor of electrical and computer engineering, and computer and information science, travels to San Francisco with the Empower campaign to display his Systems Security Lab which is co-directed with Engin Kirda, professor of electrical and computer engineering.

ALUMNI EVENTS

From homecoming to commencement, and everything else in between

Civil and Environmental Engineering Industry Leaders Night

The civil and environmental engineering department held it's 5th annual industry leaders night on December 1, 2015, featuring guest speaker Stephanie Pollack (right), Secretary of Transportation and CEO of MassDOT.

Secretary Pollack gave an excellent talk that emphasized that civil engineering projects must be designed consciously to target and integrate a broad spectrum of needs of the general public. Provost James Bean, College of Engineering Dean Nadine Aubry, and Civil and Environmental Engineering Chair Jerry Hajjar also provided an update on the university, college, and department. This year's event included over 100 students, faculty, and industry leaders.

Dino Farina, E'89 (founder and CEO at Proveris Scientific Corporation) discusses the fundamentals of bootstrapping students venture into success at the *Michael J. and Ann Sherman Center for Engineering Entrepreneurship Education.*

Faculty Farewell

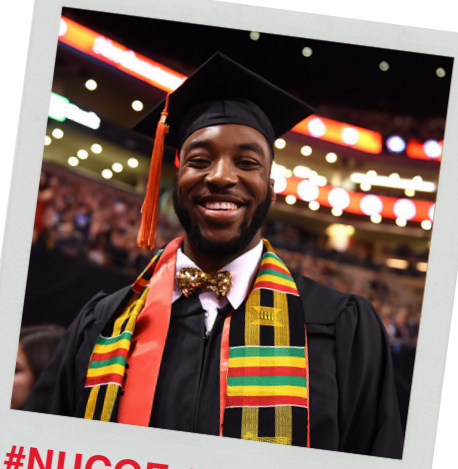
Robert Tillman EdD'88, who has served the Northeastern community for 39 years, retired in June 2015. Over the years, Tillman helped nearly five-thousand students launch career trajectories, a truly remarkable and distinctive achievement in engineering education. He was instrumental in the development of cooperative education in the civil engineering department, and in positioning the civil engineering program as one of the premier cooperative education-based programs in the country.

Tillman's dedication and commitment to the students has helped forge long-lasting relations with companies worldwide and has created countless opportunities for our students.

Dean Aubry (left) with host **Roger Grace**, E'66 and guest Michelle Thomas at the 2nd annual College of Engineering alumni gathering in Florida.

COE Graduation Celebration

The College of Engineering hosted its fourth annual **Graduation Celebration** in Matthews Arena. Held the day before the University commencement, the celebration invites students families to share in their accomplishment of hard work and dedication in the field of engineering.



#NUCOE 2016 grads

Presidential Convocation

Civil and environmental student Julieta Moradei (on left), E'16, was a speaker at the 2015 Presidential Convocation to incoming students. Moradei was involved in student clubs, participated in research in the Northeastern STReSS Lab with Professor Hajjar, and had two co-op opportunities at Disney World in structural engineering.

"If you put forth effort and energy, and hold true passion for what you're doing, people will respond to that by teaching you and helping you grow. I forged incredible relationships with mentors who have helped me shape the person I aspire to be."

— Julieta Moradei, E'16

HOMECOMING

November 3-8, 2015

» alumni.northeastern.edu

November 5
Alumni Relations Reunion »
More than a hundred young alumni (2005 - 2015) joined us in the Visitor's Center

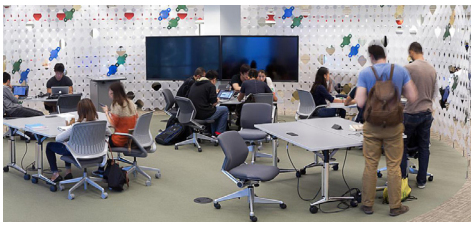
November 3
Husky Spirit Day »
Students showed their husky pride

The Galante Engineering Business Program DINNER EVENT

March 30, 2016

Galante Engineering Business Program hosted their seventh event since their start in fall of 2015. Held in the Alumni Center, 60+ students joined together for the "Bringing Your 'A' Game to a Business" Dinner. The 4-course meal was professionally run, and prepared students for proper etiquette and professionalism which will help them in their personal and professional careers.

Celebration of Snell Library's 25th anniversary



Snell Library celebrated it's 25th anniversary at the 2015 homecoming. The library welcomes over one million visitors a year, offering new technology including a 3D printing studio, electronic journal titles and streaming audio and visual titles.

Dear Alumni and Friends,

Students in the College of Engineering are piloting meaningful change in the world. They are debugging instruments for NASA's Mars Rover 2020. They are evaluating the Panama Canal's rainwater harvesting systems. They are enabling people with paraplegia to exercise independently. Like you did when you were here, they are growing as scholars and scientists—and they're being lauded for their successes.

Take Kelly O'Connell, E'16, who in February received the 2015–2016 Co-op Student of the Year award from the American Society of Engineering Education. Given annually to one student nationwide, the prize recognized Kelly's hands-on work with Engineers Without Borders and in sustainable international development.

Last year, 86,538 individuals raised $81.8 million through **Empower: The Campaign for Northeastern**, helping students like Kelly apply classroom knowledge to professional practice and research. Now, the university is increasing Empower's goal by 25 percent, to $1.25 billion, half in philanthropy and half in government and industry partnerships. This new target will make it possible to fund even more initiatives vital to educating students, championing faculty, and furthering research.

The engineering community is backing students at every turn. Professor Michael Silevitch, E'65, ME'66, PhD'71, is recognizing with scholarships undergraduates who lead and inspire their peers, while professor John Cipolla is helping meet the funding needs of doctoral students. Meanwhile, Chet Kanojia, ME'93, and his wife, Tracie Longman, are supporting graduate fellowships, and Ramesh Motwane, E'77, is creating scholarships for future undergraduates with an estate provision. And collectively, alumni giving is advancing mentoring in the Sherman Center for Engineering Entrepreneurship Education.

With your help, we are expanding the College of Engineering's pioneering approaches to instruction and investigation, all while pushing boundaries in new and emerging global fields. Thank you for your continued support and for all you have done to bring us to this distinctive moment.

Warm regards,

Nadine Aubry
Dean, College of Engineering

Learn how you can support Northeastern and the College of Engineering through the Empower campaign at **northeastern.edu/empower**.

Benefactors

The following donors are College of Engineering alumni or friends who have made a lifetime commitment of $1 million or more to Northeastern University, or friends who have made a lifetime commitment of $1 million or more to the College of Engineering by June 30, 2015. Benefactors are members of The Huntington Society.

KEY

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PNT designates parent(s) of a current student or 2015 graduate

*Leora L. Beaton**
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Francis A., E'59, and Joan A. Gicca
Bernard M., H'07, and Sophia Gordon
James W., E'54, and Sandra R. Healy
Charles J., ME'73, and Josephine Hoff
Martha E. Hurtig
Ellen Kariotis
George J. Kostas, E'43, H'07
*Farla H. Krentzman**
Irving M., E'57, and Lenore Levine
Francis A., E'63, and Marlene Long
Richard Lord, E'74
Anthony R., E'67, H'08, and Michele F. Manganaro
Roger M. Marino, E'61, H'96
Marcia Ruderman
Michael J., E'68, and Ann Sherman
Robert J., E'68, H'00, and Mao Shillman, PNT
Lorraine C. Snell
Sy, ME'68, H'12, and Laurie Sternberg
Arthur W., E'61, and Lisa Zafiropoulo
Anonymous (2)

The Huntington Society

Current members through June 30, 2015

The following donors are College of Engineering alumni and friends of the College of Engineering whose gift in support of the college qualifies for a five-year term in The Huntington Society. Members of the Huntington Society have made one-time commitments of $100,000 or more.

KEY
**Deceased*
PNT designates parent(s) of a current student or 2015 graduate

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Manuel, E'57, and Rose M. Correia
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David S., E'47, and Diane L. Feinzig
Robert H. Goodale, E'55
J. Barry Herring
David L. House, ME'69
William S., E'69, and Diane Howard
Chaitanya Kanojia, ME'93, and Tracie Longman
Robert R., E'73, and Louise Kursmark
Donna M. LaBonté
Linda M., E'82, and Robert B. MacIntosh
Frank P. Marangell, E'83, MBA'89
John A. Massa, E'59, ME'66
Georges A. Melhem, E'84, ME'86, PHD'88
Metri R., E'92, ME'95, and Ferial Metri
Laurence P. O'Toole, E'76
Leonard C., E'68, and Linda Perham
Dennis J., LI'59, UC'62, H'89, and Dolores Picard
Victor L., LC'70, MBA'81, and Carmel Poirier
Donald S., E'60, ME'66, and Holly Pottle
John V. Pulichino, ME'72
Eugene M., Jr., E'60, MEd'65, H'95, and Corinne C. Reppucci, LA'64, MEd'71
Kathleen Clinton Rochefort
Winslow L. Sargeant, E'86
Michael B. Silevitch, E'65, ME'66, PhD'71
Gordon H., Jr., E'66, ME'73, and Jane Slaney
James P., E'88, and Amie M. Smith, AS'87
Francis L., E'62, ME'64, and Marilyn Tempesta
Anonymous (4)

Frank Palmer Speare Society

The Frank Palmer Speare Society is named for Northeastern's first president and recognizes donors who have made estate provisions or other planned gifts in support of the university. The list below honors alumni of the College of Engineering who are members of the Frank Palmer Speare Society.

KEY
** Deceased*
† indicates new Speare Society member
PNT designates parent(s) of a current student or 2015 graduate

Robert B., E'47, and Sara Angus
George J. Antonucci, E'63, ME'65
Charles T. Barooshian, E'59
Harry R., Jr., E'50, and Audrey G. Bedell
Robert G. Blank, E'80†
Richard B., Jr., E'69, and Lennie Bourne
Thomas W. Brahms, E'71
Donald M. Brown, E'52
Ralph R. Burwell, E'50
Peter M. Bzowski, E'68†, and Orla J. Uber
Anthony J., E'48, and Ann E. Caggiano
Lynne S. Champion, E'69
Joel Barry Chase, E'67
Peter C., E'87 and Leslie Chatel
Harold T., E'63, and Kathleen Connors
Manuel, E'57, and Rose M. Correia
Joseph M. Cunniff, LI'51, B'54, MBA'59
Carl E., E'56, ME'64, and Claire T. Dantas, UC'83
Robert F., E'61, ME'68, and Susan R. Daylor, PNT
Thomas J. Jr., E'73, MBA'78, and Marie Falvey DeSisto, N'77
David A., E'59, and Louise Doane
Roger J., E'63, and Rochelle Kady
Dolan, E'63
Richard, E'52, and MJ Ebens
Donald K., E'55, and Donna C. Ellsworth
Mark D. Epstein, E'10, DMSB'11
William E. Epstein, E'72
Rita F. Fahy, LA'78, ME'89
Robert R. Feier, MS'64, ME'69
David S., E'47, and Diane L. Feinzig
George C. Frost, E'50
N. Paul Galluzzi, ME'58†
Francis A., E'59, and Joan A. Gicca
Robert M., E'62, and Deanne Glorioso
Robert L., E'59, and Frances Z. Goldberg
John J., E'44, B'49, and Alice M. Goode
Richard A. Grenier, E'76
Stephen P., E'78, and Kathryn Hannabury
William T., IV, ME'70, and Joan L. Hathaway
James W., E'54, and Sandra R. Healy
Kenneth W. Henderson, E'53
Kenneth W., E'56, and Barbara P. Hiseler
George M. Jett, E'70
Carl R. Johnson, E'73†
Donald Kerivan, E'49
Thomas J., E'69, ME'71, and Carol J. Kerr, Ed'73, MEd'76
Marilyn B. Kloss, E'82†
Jeffrey R., E'74, ME'76, and Diane S. Kontoff
Stanley R. Kovell, E'55
Frank Kozacka, E'71
Kenneth C. Kroohs, E'72†
Frederick H., E'57, and Carole Kurtz
Theodore Lavoot, E'64†
Milan W., E'57, and Corinne K. Lawson
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Irving M., E'57, and Lenore Levine
Linda M., E'82, and Robert B. MacIntosh
Robert T., E'72, and Loretta Maddock
Mark D. Malkasian, E'63†
Roger M. Marino, E'61, H'96
Charles D., E'54, and Elsie M. Mason, E'53
John A. Massa, E'59, ME'66
Donald F., E'56, and Gladys A. Meade
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Joseph H. Metelski, E'61
Daniel W. Miles, E'40
Marcus A. Moche, E'10†
Jack W. Morrissey, E'67
John D. Morrissey, E'59
William H. Newman, III, E'77
Edward T., E'59, ME'66, and Carol O'Keefe
Salandro S. Pesce, LI'45
Steven, E'64, and Helice Picheny
Victor L., LC'70, MBA'81, and Carmel Poirier
Mary Louise Pottle, E'48, MEd'60
Roger R. Potvin, E'64
Charles H., Jr., E'55, ME'60, and Imelda C. Price
Donald J. Price, LI'57, B'59, MBA'63
Joseph J. Prifti, E'59, ME'64, PhD'67
Alonzo C., Jr., E'45, and Margaret H. Rand
Leon W., E'47, and Marilyn Rank
Eugene M., Jr., E'60, MEd'65, H'95, and Corinne C. Reppucci, LA'64, MEd'71
Michael Riccio, E'70, ME'72†
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Michael P. Richardson, UC'91, SET'95
Kenneth J. Ritchie, E'49, MBA'54
Ricard V. Scheuerman, E'76†
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John J. Wroblewski, E'70
Joe, ME'88, and June Sun Zheng
John A. Zukowski, LI'55
Anonymous (2)

Dean's Society | College of Engineering

Listed below are College of Engineering alumni, students, and friends who have made gifts or pledge payments of $1,000 or more to any College of Engineering designation, and College of Engineering alumni who have given to any Northeastern designation at that level during FY15 (July 1, 2014 through June 30, 2015). Every effort was made to ensure the accuracy of this list. Our apologies for any errors or omissions that have occurred.

KEY
**Deceased*
PNT designates parent(s) of a current student or 2015 graduate

FOUNDER'S LEVEL
($25,000 and Higher)

Edward G., E'73, and Catherine Galante
Robert H. Goodale, E'55
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David L. House, ME'69
William S., E'69, and Diane Howard
George J. Kostas, E'43, H'07
Robert R., E'73, and Louise Kursmark
Francis A., E'63, and Marlene Long
Anthony R., E'67, H'08, and Michele F. Manganaro
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Edward T., E'59, ME'66, and Carol O'Keefe
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Mary Prendiville
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Winslow L. Sargeant, E'86
Michael J., E'68, and Ann Sherman
Robert J., E'68, H'00, and Mao Shillman, PNT
Michael B. Silevitch, E'65, ME'66, PhD'71
James P., E'88, and Amie M. Smith, AS'87
Sy, ME'68, H'12, and Laurie Sternberg
*Anne I. Toomey**
Arthur W., E'61, and Lisa Zafiropoulo
Anonymous (4)

VISIONARY'S LEVEL
($10,000 - $24,999)

Joseph J. Bradley, ME'95
Nicholas J., E'52, and Carol Cedrone
Jonathan DiVincenzo, E'88, PNT
Jon A. Ebacher, E'66, ME'68
Charles E., E'86, and Gail Evirs
Chaitanya Kanojia, ME'93, and Tracie Longman
Saul Kurlat, ME'62
Edward C. McCarthy, E'70
Donald F. Meade, E'56, and Gladys A. Meade
Georges A. Melhem, E'84, ME'86, PhD'88
*Stella H. Melville**
Maria E. Ortega-Wollberg, PNT
Laurence P. O'Toole, E'76
Fredric W. Pement, E'56
Russell L. Peterson, E'63, ME'70
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Michael Steven Pritula
John G. and Felia I. Proakis
Kenneth W., Jr., E'42, and Jeannetta Richardson
Richard A., E'71, and Martha Schoenfeld
Christopher H. Willis, E'82
Julian W. Wong, E'72
Anonymous

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Leslie C. Brown, E'73
Joel Barry Chase, E'67
Karen Ciliv
Thomas J., Jr., E'73, MBA'78, and Marie Falvey DeSisto, N'77
Daniel G. Dufresne, E'62
Heather M., E'79, ME'87, and Thomas Ford, E'78
Charles H. Gall, E'67
Francis A., E'59, and Joan A. Gicca
C. Gerald Gnerre, E'49
Subbiah Gopalraman, PHD'88
Louis L., E'59, and Janice M. Guerriere
Stephen P., E'78, and Kathryn Hannabury
Geoff P. Judge and Mary Ann Casati
Jennifer E. Judge, E'14
Gerald M. Karon, E'54, MBA'61
Christine M. Keville, ME'90
Matt B. Kowalski, E'07
Timothy J. McGrath, E'73, and Roberta A. Ferriani, LA'70
Milan M. Patel, E'96
Valerie W., E'86, and William Perlowitz
Alonzo C., Jr., E'45, and Margaret H. Rand
Patrick A., Sr., E'59, and Yvonne Rivelli
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Jawdat A. Shawwa, E'82, PNT
Richard H. Sioui, E'64
Francis L., E'62, ME'64, and Marilyn Tempesta
Stephen P. Tereshko, E'75
Raimund G. Vanderweil, Jr.
William L. Vanderweil
Donald G. Voghel, E'81
Robert E. White, E'70
Donald R., E'68, and Barbara Wood, N'68
Richard R. Yuse, E'74, ME'76
Ahmad Zameli, E'14
Anonymous (2)

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George D. Dick, LC'63, UC'67
Rita F. Fahy, LA'78, ME'89
Robert L., E'59, and Frances Z. Goldberg
Peter F. Hallemeier, E'93
Edward J. Higgins, E'52
Kenneth W., E'56, and Barbara P. Hiseler
Craig W. Horneck, E'70
Edward C. Hunt, MS/MBA'94
John J. Kennedy, E'72
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David C. Mores, E'72, ME'76
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Kenneth N. Rapp, E'84
Richard A., E'69, and Bernyd P. Rosenberg, PAH'67
Richard J. and Kathleen Scranton
Richard R. Thuma, III, E'78
Anonymous (2)

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($1,000 - $2,499)

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Bryan T. Alighieri, E'18
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Carlton C. Anderson, E'50
David J., E'83, and Claire M. Anderson
Frederick G. Aufiero, Jr., E'67, ME'79
Robert J., LC'85, and Linda J. Averill
Philip Ayers, E'69, L'74
Paul F. Bailey, E'70
Dean A. Bartlett, E'62, ME'76
Peter S. Benton, E'88
Brian M. E'81, and Renee D. Berliner, PNT
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Kenneth S. Bronstein, E'61
Sharon J. Brown, ME'90
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Daniel J. Casaletto, E'72, ME'76
Louis J Cassano, III, E'15
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Lynne S. Champion, E'69
Gep D. Chin, E'55
Jay C. Chinnaswamy, E'18
Gregory W. Condon, E'65
Brian C. Considine, E'62, ME'64
Manuel, E'57, and Rose M. Correia
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Dennis M., E'80, ME'88, and Mary Helen A. Darcy
Joseph G. Davis, E'65
Robert F., E'61, ME'68, and Susan R. Daylor, PNT
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Roger J., E'63, and Rochelle K. Dolan, E'63
Michael L. Doud, E'16
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Robert M., E'62, and Deanne Glorioso
Aime J. Grenier, ME'67
Stephanos S., ME'62, and Katherine A. Hadjiyannis
Jerome F. Hajjar
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Herbert C., E'40, and Lillian E. Hammond*
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Carl T. Hoefel, Jr., E'79, MBA'88
K. Steven Horlitz, ME'73
Dennis A. Huebner, E'67, ME'76
David H., E'67, and Janet A. Hurwitz
Carl R. Johnson, E'73
Courtney D Johnson, E'17
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Nicholas H. Katis, E'88
Robert E. Kearney, E'71
J. Robert Klinger, E'93

The Best Bet

Winslow Sargeant invests in technology—and Northeastern's engineers

For students who aspire to be engineers—maybe even the next Steve Jobs or Elon Musk—university trustee Winslow Sargeant, E'86, has some advice: "Raise your floor."

Tom Korbas, E'73
Scott D. Krentzman, E'89
Louis Y. Lin, E'87
John M. Looney, ME'67
G. Raymond Luddy, III, E'69
SuPing Lyu
Bruce R. MacDonald, E'86, PNT
Qunkai Mao, ME'00, and Cuie Hu, ME'02
Robert C., E'54, H'97, and Anne Marini
Roger M. Marino, E'61, H'96
Salvatore Marques, E'81
Robert L. Mayer, E'53
William C. McLeod, E'68
Paul. J. Merluzzi, E'66
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Ramesh K. Motwane, E'77
Ellen Nestervich, E'80, MBA'87
Khai H. Ngo, E'02
Kenneth O. Nilsen, E'69
Brian R., E'79, MBA'84, and Sandra M. O'Donnell, PNT
Gonzalo B. Otaola, E'83, and Claudia E. Cortina, PNT
George A. Papa, E'71
Arthur A., E'60, and Dianne L. Pappas
James Phelan, E'92
Eugene M. and Susan J. Pierce, PNT
Albert B. Pincince, E'63
Newton K., E'48, and Lucille M. Pratt
James M. Quigley, E'73
David A. Race, E'75, ME'76
John E. Reardon, E'58
C. Nicholas, E'63, and Patricia Reveliotty, Ed'65
Todd A. Ruderman, E'91
Steven K. Ruggieri, E'74
Magnus O. and Nancy A. Ryde, PNT
Carlo Sartori Pacifici, E'14
Donald W. Saulnier, E'51
John G. Schoepf, III, E'85
Thomas C. Sheahan
Kenneth A. Siegel, MEd'94
Jane Song, ME'00
Cyriaque Sukam, ME'00
Enqiang Sun, ME'09
Edward C. Swift, E'52
Theseia N. Tribble, E'91
Edward H. Tutun, E'47
Albert Vezza, ME'64
Armand J., E'53, and Patricia A. Viscosi
Daniel Wapner, E'68
John R. Wells, Jr., ME'66
Richard L., E'70, and Christine White
Randy E. Williams, E'83
Huiwen Wu, MS'99
Anonymous (7)

By "floor" he means the educational foundation on which careers are built. "We may not have a ceiling, but we do have a floor," counsels this seasoned entrepreneur, who has spent 30 years founding and funding technology companies.

"Invest in your education," he says. "A solid floor frees you to take calculated risks."

That principle has served Sargeant, a first-generation college graduate with a PhD in fiber optics, exceptionally well. As a Northeastern freshman, he learned that studying hard was the only way forward. After formative co-ops at LTX Corporation and General Electric, he earned a degree in electrical engineering, then left Boston to pursue a master's degree and doctorate.

Total immersion in research in the early 1990s, when the Information Superhighway was developing, positioned him to translate new knowledge into commercial products. At IBM and Lucent, he made his mark as a chip designer. Then, in 1997, he and several co-workers founded a company, Aanetcom, which they sold three years later to PMC-Sierra for $900 million.

"The reason I went to school was to be able to take risks," Sargeant says. With a wife and baby No. 2 on the way, "there were lots of naysayers, who couldn't understand why I'd leave Lucent." But for Sargeant, the edge of one's comfort zone is "where learning takes place."

Sargeant has continued to build up his skill set in positions on innovation's front lines. As an adjunct professor at the University of Pennsylvania, he forged ties to researchers, who steered him to the National Science Foundation's venture-funding arm. There he led a grant-making program for fledgling companies, developing drone-like planes that sprayed crops, sensors to detect breast cancer, and nano-compounds to make fabrics more durable.

From there, a restless Sargeant joined a venture capital firm, investing millions in new technologies and materials. A few years later, President Obama tapped him to head the Office of Advocacy for the U.S. Small Business Administration.

As of 2015, Sargeant is back to incubating startups. One, ArchPatent, a patent search company, supports the commercialization of university technology and intellectual property. Another, MyQVO.com, aims to revolutionize learning through video games.

With a penchant for spotting technologies with untapped potential, it's no wonder Sargeant backs young companies—and budding engineers. With his most recent gift to Northeastern, he is helping fund a scholarship for black engineers, enabling the best to raise their floors.

"Engineers are problem solvers," he asserts. "I can't think of a better investment."

SARGEANT'S OPERATING PRINCIPLES

RAISE YOUR FLOOR. We may not have a ceiling, but we all have a floor, the scaffolding of your future success. Invest in education and keep building your knowledge base.

BE AN OPTIMIST. Reframe challenges as problems to be solved.

SEEK TO ACHIEVE THE UNPRECEDENTED. Unlike lawyers, who are a trained to build on precedent, entrepreneurs must go where no one has gone before.

PRACTICE DOESN'T MAKE PERFECT; IT MAKES BETTER. Few people have the innate gifts required to be superstars. But with effort, everyone can improve.

BE SINGLE-MINDED. You don't have to be cutthroat or violate your own principles to beat the competition. But you must stay focused on goals and persevere despite naysaying and uncertainty.

CREATE VALUE. Expand your definition of success to include more than creating wealth and jobs.

A Gift for

GIVING BACK

After benefiting from financial aid themselves, Robert and Louise Kursmark are committed to helping others

Growing up in Mystic, Connecticut, Bob Kursmark, E'73, had never heard of Northeastern University or been to Boston. But he had a love of all things mechanical — cars, outboard motors, and lawnmower engines — that led him to pursue a degree in engineering.

By researching regional universities, he discovered Northeastern. "The more I learned about the university, the more I was drawn to Northeastern," recalls Bob. "I loved the idea of co-op — and welcomed the chance to graduate with real-world experience."

But the deciding factor came in the form of a much-needed scholarship from the university. "Without the financial aid offered by Northeastern, it would have been impossible for me to get a college degree," he says. "That scholarship was life-changing."

Bob's wife, Louise, also benefited from financial aid while earning a degree in business from Bay Path University in Longmeadow, Massachusetts. In addition, she studied English part-time at Northeastern for five years with tuition support from an employer. "Bob and I both know the value of an education and the opportunities it can create," notes Louise. "We're very grateful that someone gave us help when we needed it most."

To give back, the Kursmarks have provided a variety of financial support to Northeastern over the years — including a tuition scholarship for an engineering student who, like Bob, hails from Connecticut. Since the scholarship was established in 2004, six students have received aid, three of them for multiple years.

While Bob has had a successful 41-year career at GE Aviation and Louise owns a resume and career services company, the Kursmarks are quick to emphasize that they are not wealthy — just committed to helping others. "Gifts of all sizes are important to the university," says Louise, "and each of us is capable of making a difference."

"There are so many ways to give back," agrees Bob, "and we've been very happy with the way Northeastern has helped us custom-tailor a scholarship to dovetail with our own interests. It's very gratifying to think that we are helping young people change their lives, just as our lives were impacted many years ago."

"Our gift honors my dad, another alum who believed in co-op and who just retired—at 80."

—Linda MacIntosh, E'82

LEARNING TO 'MAKE ANYTHING'

Self-directed and curious, Linda MacIntosh, E'82, is her father's daughter. Like him—Richard Menelly S'59—she saw co-op as the perfect means to map a career path. "If I became a chemical engineer," she says of her major, "I would learn how to make anything."

On co-op at the Occupational Safety and Health Administration, MacIntosh inspected companies as an industrial hygienist; at Monsanto, she made consumer products on a massive scale. After graduating, she managed quality control at the Kendall Company and procured millions of dollars worth of chemicals for Gillette.

With a gift to the College of Engineering, Linda and her husband, Robert (left), will help renovate the Unit Operations Lab, where Linda once mastered processes like filtration and distillation. And with a bequest through their will, the couple will fund a co-op scholarship for tomorrow's talented chemical engineers.

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