ENGINEERING@ Northeastern

2010

NEW RESEARCH INITIATIVES

+ HEALTHCARE P. 2

SECURITY P. 6

SUSTAINABILITY P. 8

Is there an **ENGINEER** in the house?

HEALING A SICK HEALTHCARE SYSTEM

Northeastern University
College *of* Engineering

College of Engineering

David E. Luzzi, Dean

Yaman Yener, Senior Associate Dean,
Faculty and Academic Affairs

David Kaeli, Associate Dean,
Undergraduate Education

Sara Wadia-Fascetti, Associate Dean,
Graduate Education and Research

David Navick, Associate Dean,
Administration and Finance

Mark O'Donnell, Associate Dean,
Development and Alumni Relations

Departments and Chairs

Chemical Engineering
Laura H. Lewis, lhlewis@neu.edu

Civil and Environmental Engineering
Jerome F. Hajjar, jf.hajjar@neu.edu

Electrical and Computer Engineering
Ali Abur, abur@ece.neu.edu

Mechanical and Industrial Engineering
Hameed Metghalchi, metghalchi@coe.neu.edu

Questions and Comments

David E. Luzzi, Dean — dean@coe.neu.edu
College of Engineering
230 Snell Engineering Center
Northeastern University
360 Huntington Avenue
Boston, MA 02115
617.373.2152

Dear Friends,

When the patient is ailing, call a doctor. When the system is ailing, call an engineer.

The potential and need for industrial engineering to contribute to the improvement of almost all aspects of healthcare processes are profound, and we are excited to be a partner university with Texas A&M Health Science Center and Georgia Tech in the Center for Health Organization Transformation (CHOT), funded by the National Science Foundation.

We bring to CHOT the expertise of principal investigator and mechanical engineering professor James Benneyan and his colleagues, along with several major health system partners. You will find more about CHOT and other College of Engineering health-focused research on page 3.

The pages within also highlight our work on the three great issues of our time — security, sustainability, and human health. As with our healthcare initiatives, engineering faculty and students are in many cases addressing these challenges in collaboration with counterparts in Northeastern's colleges of business, information systems, health, and science, as well as with other universities, corporations, and federal agencies. Take special note of the new Homeland Security research center we are building through a $12 million gift from industrialist George J. Kostas, E'43, H'07 (page 6).

Our global agenda continues to expand: a new partnership with Technion of Israel, funded in part by technology entrepreneur Robert Shillman '68; clean-water systems for Honduran and Ugandan villages, thanks to our Engineers Without Borders student chapter; international cooperative education opportunities; and emerging joint ventures with companies and universities in China, Greece, and Turkey.

As indicated by the "Vital Statistics" here and the profiles and articles within, we continue to increase our teacher-scholar ranks, and the size of our doctoral programs as well.

I invite you to read, learn, and enjoy … and let me know your comments, questions, and ideas.

David E. Luzzi
Dean of Engineering
dean@coe.neu.edu

Editorial
Susan Pasternack
Sheila Purdie
Peter Kent
Design: Fyfe Design

Photography Credits
Craig Bailey
Mary Knox Merrill
Lauren McFalls

vital statistics COE by the numbers:

inside

CURRENT FACULTY MEMBERS 122 — faculty

BS DEGREES conferred 2007–2010 **1,043***

MS DEGREES conferred 2007–2010 **871***

PHD DEGREES conferred 2007–2010 **98***

*Academic Year totals — degrees

BS DEGREE PROGRAMS offered **9**

MS DEGREE PROGRAMS offered **12**

PHD DEGREE PROGRAMS offered **8** — programs

COMPANIES EMPLOYING COE CO-OP STUDENTS: 600 IN 33 STATES AND AROUND THE GLOBE — co-op

RESEARCH AWARDS Fiscal Year 2009–2010

AWARDS RECEIVED 141

MORE THAN $30 MILLION IN ANNUAL FEDERAL FUNDING — research

RESEARCH CENTERS:

CENTERS CONDUCTING INTERDISCIPLINARY RESEARCH: 13

Awareness and Localization of Explosives-Related Threats (ALERT), a Department of Homeland Security Center of Excellence www.northeastern.edu/alert

Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS) www.censsis.neu.edu

New England Healthcare Engineering Partnership, a Department of Veterans Affairs Engineering Resource Center www.coe.neu.edu/healthcare

NSF Center for Health Organization Transformation (Industry-University Collaborative Research Center) www.coe.neu.edu/healthcare

NSF Center for High-rate Nanomanufacturing www.northeastern.edu/chn

Puerto Rico Testsite for Exploring Contamination Threats (PROTECT), an NIH P42 program www.northeastern.edu/protect

NIST Center for Versatile Onboard Traffic Embedded Roaming Sensors (VOTERS) www.northeastern.edu/voters

IMPROVING HEALTHCARE THROUGH ENGINEERING In scholarly themes that the College of Engineering is emphasizing in our classrooms and research facilities, we are working to significantly improve healthcare systems through engineering-based solutions.

Systems Engineering for Better Healthcare

It costs more than $2.3 trillion annually, is the nation's largest industry (18 percent of U.S. GDP), but is riddled with inefficiencies, problems, and errors: This is healthcare in America. Conservative estimates suggest that annually

CHOT WAS CREATED TO DEVELOP A CRITICAL MASS OF EXPERTISE DEEPLY FOCUSED ON SOLVING LARGE AND PERVASIVE PROBLEMS ACROSS ALL DIMENSIONS OF HEALTHCARE.

30 percent of all healthcare costs are due to poor quality, $9 billion in costs and 98,000 deaths are caused by medical error, and only 55 percent of patients are shown to receive the best care. The U.S. healthcare system ranks last or close to last among developed nations in every dimension—safety, access, efficiency, effectiveness, equity, and patient-centeredness.

These sobering facts recently prompted the National Academy of Sciences, the National Science Foundation, and the Institute for Healthcare Improvement to advocate greater utilization of systems engineering and management science methods employed effectively in other complex industries. Northeastern University and its partners in the Center for Health Organization Transformation (CHOT), a National Science Foundation industry-university collaboration, have launched a national initiative to test if applying these same methods can improve delivery, safety, costs, and outcomes. CHOT is a large-scale multisite research center partnering 15 of the top healthcare systems with leading systems-engineering researchers, including "hubs" with complementary expertise at Texas A&M University and the Georgia Institute of Technology.

Among the founding partners are MD Anderson Cancer Center, Beth Israel Deaconess Medical Center, Partners HealthCare, the New England VA Healthcare System, and several others. CHOT is expected to grow to some 50 member organizations and 500 facilities nationally, with a vision for integrating systems engineering, health services research, and health policy.

Professor James Benneyan, Northeastern professor of industrial engineering and operations research, is director of the Northeastern CHOT site, co-director of CHOT nationally, and an international leader in the application of systems engineering to healthcare.

Systems engineers use a variety of mathematical, statistical, and computer methods to model, analyze, improve, and optimize the performance of complex systems, saving billions of dollars annually in other industries. And although these methods have been used periodically in healthcare for almost a century, the overall impact has been slow and unfocused. CHOT was created to develop a critical mass of expertise focused on solving pervasive problems across all dimensions of healthcare.

CHOT's mission, simply, is to have a broad and sustained impact on healthcare. "There are lots of ways to improve healthcare systems and lots of good work ongoing, with varied success," says Benneyan. "But no one has ever effectively used systems engineering on a large scale to impact healthcare nationwide. We aim to do precisely that, and in the process develop the pipeline of graduates necessary to scale up this work over the next several decades. We intend to do for healthcare what operations research, industrial engineering, Six Sigma, quality management, and Toyota did for the airline, automobile, manufacturing, and other industries." For additional information, visit www.coe.neu.edu/healthcare.

Groundwater Toxins and Preterm Births

What is the impact of exposure to environmental contamination on preterm birth rates? How can we develop sustainable solutions to address this leading cause of neonatal mortality in the United States?

Answers to these questions are the focus of a $9.9 million grant from the National Institutes of Health (NIH) supporting the work of researchers from Northeastern's College of Engineering, Bouvé College of Health Sciences, and the Barnett Institute in collaboration with colleagues from the University of Puerto Rico–Medical Sciences Campus, the University of Puerto Rico Mayaguez, and the University of Michigan. Directing the interdisciplinary effort (known as the Puerto Rico Testsite for Exploring Contamination Threats, or PROTECT) are Akram Alshawabkeh, professor of civil and environmental engineering at Northeastern, and José F. Cordero, dean of the Graduate School of Public Health at the University of Puerto Rico–Medical Sciences Campus.

PRETERM BIRTH IS A MAJOR AND COSTLY HEALTH PROBLEM IN THE U.S., CONTRIBUTING TO MORE THAN ONE-THIRD OF INFANT DEATHS.

The team will explore whether exposure to commonly found environmental contaminants and chemicals contributes to the high incidence of preterm births in Puerto Rico. The island was selected as a test site because it has the highest rate of preterm birth (approximately 20 percent) among U.S. states and territories and because of the extent of hazardous waste contamination: Puerto Rico is home to more than 150 contaminated sites, including 15 Superfund locations.

"The potential for exposure to the chemicals from these sites and its effects on public health are not well understood," says Alshawabkeh, the principal investigator. "The multifaceted approach will allow us to validate our hypothesis that exposure to chemicals and environmental contaminants contributes to the high number of preterm births in Puerto Rico."

Preterm birth is a major and costly health problem in the United States, contributing to more than one-third of infant deaths. In 2005, it was estimated that the associated annual costs approached $26.2 billion. This project is the first to investigate the causal relationships between environmental pollutants and preterm birth in this at-risk population. The researchers will follow a group of women through pregnancy as part of an epidemiological study, collect data on their everyday activities, measure their potential exposure to chemicals, and identify correlations between exposure and subsequent risk for preterm birth. Based on the data, the team will develop environmentally sustainable ways to mitigate the effects of toxic contaminants that exist in groundwater.

The new knowledge and technology that emerge from the PROTECT program will have broad applications in the field of environmental health and be applicable to other populations around the world, says Alshawabkeh. For further information, visit www.northeastern.edu/protect.

Highlighting Research in Healthcare

More Than Meets the Eye

Employing "hybrid tissue engineering" to produce corneas for human transplant is the research focus of associate professor of mechanical and industrial engineering Jeff Ruberti and his colleagues. Their work is supported by the National Institutes of Health through a two-year, $785,000 grant.

More than 33,000 Americans require corneal transplants every year. The explosive growth in LASIK eye surgery renders corneas unsuitable for transplant, making it important to develop a viable method of producing corneas in the laboratory. Made primarily of collagen, the cornea is one of the most well organized and structurally uniform tissues in the human body. Replicating that natural organization has been difficult. Ruberti and his colleagues are looking at an alternative source to build this intricate tissue. Taking a sample of collagen from the skin of a cow and using specific environmental conditions, the team manipulates it into a template. Human corneal cells are then combined with the template, where they produce, organize, and build new tissue.

A Cell Detective on the Trail

A new technology to track rare cells in the bloodstream is being developed by Mark Niedre, an assistant professor of electrical and computer engineering at Northeastern. The technology has the potential to allow detection of metastatic cancer cells and circulating hematopoietic stem cells. Work is currently under way to build the prototype of the tomographic in vivo flow cytometer. The research is supported by a two-year, $400,000 grant from the National Institutes of Health.

The ring-shaped device will fit around the limb of a mouse and, utilizing fiber optics, noninvasively view and collect data on cells that have been fluorescently tagged. Traditional blood samples might not capture the sought-after cells and only provide a "snapshot" of the bloodstream, not a continuous view of how these rare cells are moving about over time. The research could shed light on how cancer metastasizes, and how those cancer cells respond to new drugs. Niedre was also recently awarded a $1.3 million grant from NIH to develop a scanner to image an entire animal to study where tumors are formed and how cancer spreads.

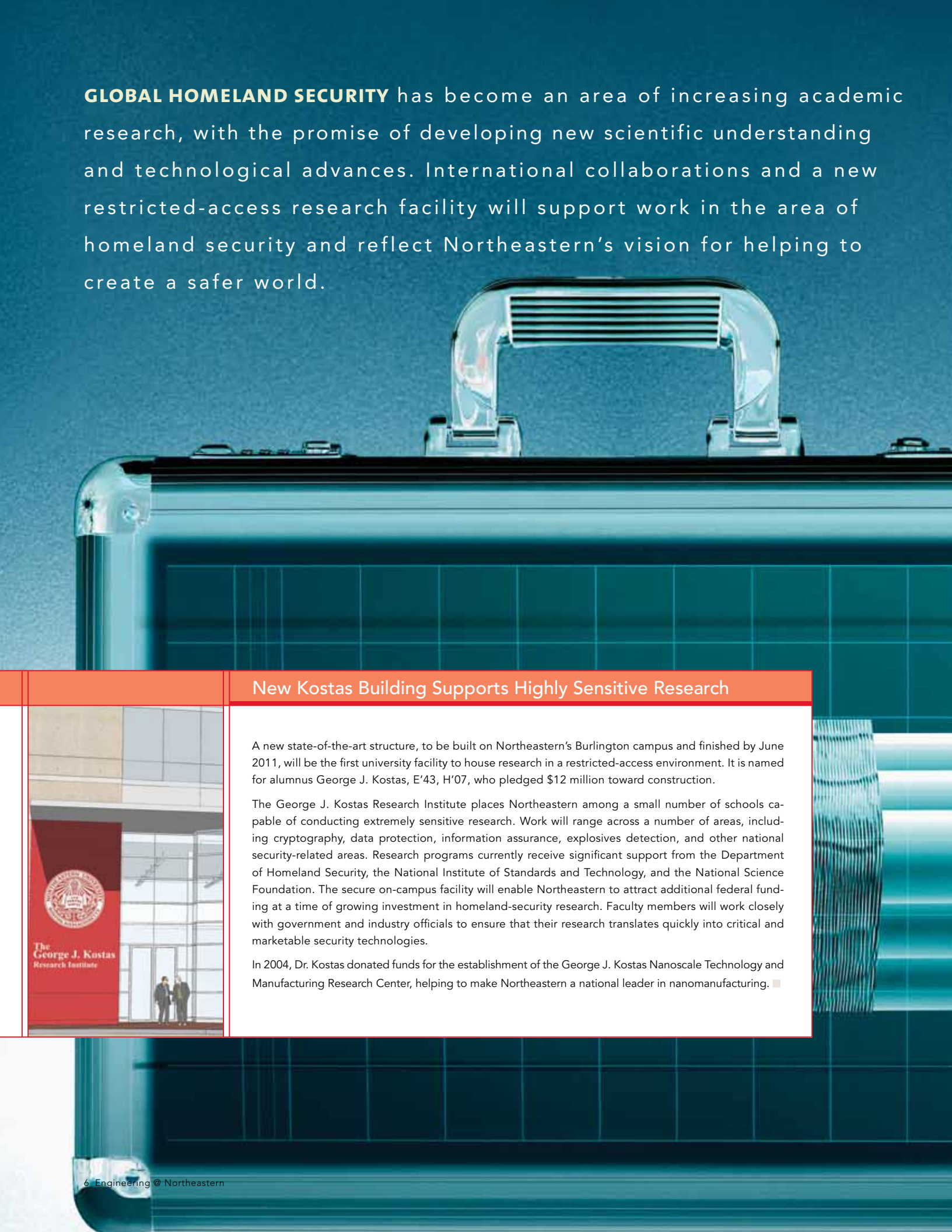
Repairing Damaged Tissue

Shashi Murthy, assistant professor of chemical engineering, has been awarded a three-year, $1.9 million grant from the National Institutes of Health to develop innovative techniques for isolating and cultivating stem cells, which, under certain conditions, have the capacity to repair damaged tissue. An international team of researchers led by Murthy will design and build small devices to extract cell types that help to grow new tissue or repair diseased or nonfunctional tissue. The team will develop a new family of devices, called microfluidic systems, that will enable greater efficiency and accuracy in the separation of stem cells from a small tissue or blood sample.

Murthy will also collaborate with other scientists on related research, such as exploring ways of repairing diseased heart tissue by obtaining cardiac stem cells from normal tissue and implanting them into damaged tissue, and studying how stem cells extracted from hair follicles in normal skin can repair severely burned skin by growing new hair follicles and sweat glands.

Photograph of Professor Shashi Murthy by Mary Knox Merrill

GLOBAL HOMELAND SECURITY has become an area of increasing academic research, with the promise of developing new scientific understanding and technological advances. International collaborations and a new restricted-access research facility will support work in the area of homeland security and reflect Northeastern's vision for helping to create a safer world.

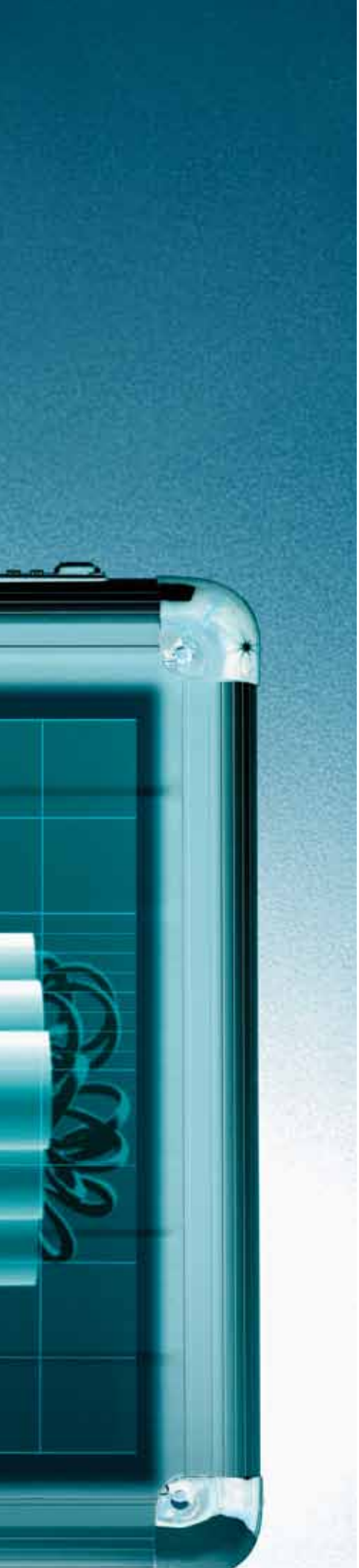


New Kostas Building Supports Highly Sensitive Research

A new state-of-the-art structure, to be built on Northeastern's Burlington campus and finished by June 2011, will be the first university facility to house research in a restricted-access environment. It is named for alumnus George J. Kostas, E'43, H'07, who pledged $12 million toward construction.

The George J. Kostas Research Institute places Northeastern among a small number of schools capable of conducting extremely sensitive research. Work will range across a number of areas, including cryptography, data protection, information assurance, explosives detection, and other national security-related areas. Research programs currently receive significant support from the Department of Homeland Security, the National Institute of Standards and Technology, and the National Science Foundation. The secure on-campus facility will enable Northeastern to attract additional federal funding at a time of growing investment in homeland-security research. Faculty members will work closely with government and industry officials to ensure that their research translates quickly into critical and marketable security technologies.

In 2004, Dr. Kostas donated funds for the establishment of the George J. Kostas Nanoscale Technology and Manufacturing Research Center, helping to make Northeastern a national leader in nanomanufacturing.



Shillman Fund Enables Collaboration with Technion

Enabling leading engineers and scientists from different parts of the world to work together to exchange information, uncover new knowledge, and accelerate the development of new technologies and bring them to market

THE GOAL OF THE COLLABORATION BETWEEN NORTHEASTERN AND TECHNION IS TO DEVELOP NOVEL WAYS OF FIGHTING TERRORISM.

has been a long-standing goal of the College of Engineering. The recent establishment of the Dr. Robert E. Shillman Global Homeland Security Research Innovation Fund through a $1 million gift from engineering alumnus Robert E. Shillman, E'68, H'00, is now making this global partnership a reality.

The Shillman Fund currently supports a collaboration established in fall 2009 between Northeastern and Technion Institute of Technology in Israel for a research framework where faculty from both institutions can take advantage of their individual strengths to create global engineering solutions to respond to terrorism. The goal is to develop novel ways of fighting terrorism, especially through preventing or diminishing explosives attacks.

Technion is Israel's oldest and largest scientific technology university, known for work in nanotechnology, computer science, biotechnology, water-resource management, materials engineering, aerospace, and medicine. Its researchers have special expertise in the development of advanced sensing technology for the detection of underground tunnels.

Technion's strengths in the area of global security complement those of Northeastern. In 2008, Northeastern won a major Center of Excellence award from the Department of Homeland Security (DHS). The center's work concerns explosives detection, mitigation, and response, and is known as ALERT (Awareness and Localization of Explosives-Related Threats). Michael Silevitch, the Robert D. Black Professor of Engineering, orchestrated the winning proposal and is the director of the DHS center. ALERT is an extension of Northeastern's Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS), which has, over the past decade, developed technologies to probe hidden regions for abnormalities, such as cracks beneath a roadbed or (in the case of ALERT) a concealed explosive within a suitcase.

Among the research directions in which faculty from both institutions are expected to submit joint proposals are areas that can be described broadly as the detection of security-related anomalies. This might encompass developing new methods for passenger screening at airports or on subway platforms; detecting buried tunnels that could be used by terrorists to transport weapons of destruction; or detecting anomalies in crowd behavior through video and image analysis methods to support effective monitoring by security cameras.

Supporting a Sustainable Environment

NORTHEASTERN IS EMBARKING UPON IMPORTANT WORK TO RECONCILE THE ENVIRONMENTAL, SOCIAL, AND ECONOMIC ASPECTS OF ACHIEVING A SUSTAINABLE FUTURE.

Among the principles that define Northeastern's academic initiatives in sustainability is the imperative to provide cost-effective solutions for conserving resources while creating and maintaining a safe and functioning urban environment for the benefit of society. Those leading the College of Engineering's efforts in sustainability research and teaching include Jerome F. Hajjar, the new chair of the Department of Civil and Environmental Engineering.

What changes are taking place in civil and environmental engineering concerning sustainability and how are those changes being reflected in research and teaching at Northeastern?

I think this is an exciting and dynamic time. Northeastern has a long and illustrious history dealing with issues of infrastructure and the built environment. Addressing urban challenges is among the main strengths on which the university has flourished; these are also the opportunities with which we will move forward and grow. It is an excellent time for innovative thinking and innovative solutions. I see opportunities for the university to make major contributions in sustainability, moving beyond traditional strategies for preventing or minimizing loss of life and damage to the infrastructure and environment by developing new types of infrastructure and environmental systems that transform the way these systems are designed and built to create robust and sustainable urban environments.

In what ways do you see academic institutions such as Northeastern contributing to the development of new and sustainable systems for the urban environments of the future?

In the sustainable future, new opportunities in both scholarship and translational research will address complex problems that exist at the interfaces of disciplines. Among the most prominent examples of the new approach to sustainability is green building technology, where entire new industries are being created and where the field of civil and environmental engineering is poised to contribute in important ways. Research and scholarship will provide a more nuanced and complex understanding of our environment, which will be needed for both the public and private sectors in order to optimize the use of resources and develop strategies that will foster societal change.

How will Northeastern be playing a role in this societal transformation?

The issue of sustainability has become one of local, national, and global significance. Northeastern, with its commitment to entrepreneurial and translational research, is in position to make an impact. Northeastern is an urban university with a long and deep commitment to its surrounding community and expertise that can be applied to the region, the nation, and the world. In the College of Engineering, initiatives range from the VOTERS (Versatile Onboard Traffic Embedded Roaming Sensors) project, which utilizes advances in sensor technologies to maintain and restore our roadways, to our faculty who are working to improve water quality with the goal of creating a healthier environment. Collaborations with the Department of Architecture are being pursued to develop multifunctional cladding panels that serve structural and architectural needs while also addressing issues of sustainability: from varying thermal capabilities to the need for reducing light demands to energy harvesting.

Can you share some of the specific plans that the college has to make the study of sustainability more prominent in the curriculum?

We have plans to add a new interdisciplinary emphasis in engineering of urban systems, including modern approaches to large-scale simulations of regions, networks, and associated resource management; ubiquitous sensing of the environment and infrastructure; and related topics. We are also exploring opportunities to create new options for students, such as an interdisciplinary master's degree program with a strong sustainability component.

Northeastern is well known for its translational research. How do you see this developing further in relation to initiatives in sustainability?

Northeastern has some great partners doing important work and research in areas related to sustainability, from the many companies that provide co-op opportunities for our students to our alumni who maintain professional ties with the college to the knowledge and wisdom of those who serve on our advisory boards. I see increased collaboration with industrial partners to extend our reach around the world by offering technological and fundamental solutions to issues ranging from population growth and economic resilience to energy conservation and public health.

International Village, Northeastern University, features recycled materials and structural innovations. Photograph by Craig Bailey
Photograph of Jerome F. Hajjar by Tracy Powell

Capstones Inspire Innovation

At Northeastern, the culmination of the undergraduate engineering program is the annual capstone demonstration, an opportunity for students to interact with one another and across disciplines in the name of innovation.

As green as you want to be

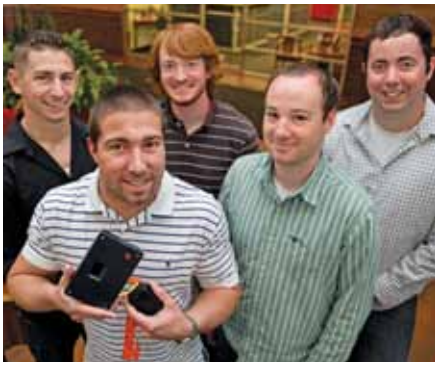
A home power-monitoring system that not only tracks how much energy specific devices use but gives consumers simple ways of making greener decisions has been developed by a group of students under the sponsorship of National Grid. Dubbed Numbers Empower, the system offers a detailed picture of energy-consumption habits through wireless radio sensors attached to home electronic devices; this information is then transmitted to a router that collects the power-usage data. An online computer program can convert the data into customizable graphs that show how much power a specific device or the house uses during a particular hour, day, week, or year. Numbers Empower enables consumers to set up automated schedules for turning their appliances on and off, and an innovative Web-based component allows electronic devices to be controlled remotely: a smartphone can turn off a lamp left on by mistake or the work computer can be used to turn on a home air conditioner.

Helping hands

A team of undergraduates designed a glove to help stroke patients regain fine motor skills in their hands. Known as the Agile Tracking and Location at Home System (ATLAS) bimanual rehabilitation glove, the low-cost virtual-environment glove system can be used for motor retraining of the arm, hand, fingers, and thumb in patients who have suffered a stroke. It was designed to be simple and affordable enough for patients to use independently in their homes, and works through a series of sensors to provide resistance in hand exercises. The glove is wired to a computer, which displays virtual-reality games that sync to hand exercises.

Pitching an idea

Elbow injuries suffered by pitchers in Major League Baseball occur frequently and result in tens of millions of dollars in losses each season for teams with pitchers who cannot perform due to injury. Pitchers become more susceptible to injury when they lose consistency in their mechanics, the physics of how they throw the baseball, pitch after pitch. Students have developed a data-logging uniform shirt for pitchers that can help prevent elbow injuries while providing an electronic analysis of pitching mechanics. Through a display of real-time information on a monitor in the dugout, it can be used to show when a player becomes fatigued and his mechanics worsen.



Advancing emergency alert technology

Enabling users to live safely and independently was the priority for the students who developed an automated emergency alert system to help elderly people in sudden need of medical attention. The technology they created is a non-invasive wireless wrist device that automatically alerts emergency responders should the gadget detect a sudden change in the user's vital signs or in speed of movement, as with a fall.

Transforming waste plastic into an alternative fuel

Creating an alternative source of fuel was the impetus behind a waste combustor that breaks down nonbiodegradable plastics to create an alternative source of fuel. Plastic waste is first processed in an upper tank through pyrolysis, which converts solid plastic into gas. Next, the gas flows to a lower tank, where it is burned with oxidants to generate heat and steam. The heat sustains the combustor while the steam can be used to generate electric power. Calculations show that the new technology has the potential to replace up to 462 million gallons of petroleum in the U.S. alone, if all recycled plastics were processed.

Brain powered

A squat, round robot scurries along the floor of a laboratory, moving left, then right, then left again, before coming to a stop. A student researcher commands the gadget through a brain-computer interface that controls the movement of the robot using signals produced by the visual cortex: The brain generates electrical activity at the same frequency as the retina, a phenomenon this technology exploits. The program wirelessly transmits the control command from the user to a laptop mounted on the robot. Applications for the technology range from assisting or enhancing cognitive or sensory motor functions in disabled or neurologically impaired users to controlling military vehicles, light switches, and wheelchairs.

Preparing the next generation of engineering leaders for the challenges of the 21st century

GORDON ENGINEERING Leadership Program

INTERVIEW WITH SIMON PITTS, DIRECTOR, GORDON ENGINEERING LEADERSHIP PROGRAM

Pitts comes to Northeastern after leadership positions in the automotive industry in engineering, product development, strategy, and manufacturing, and most recently as the executive director of the Ford-MIT Research Alliance at Ford Motor Company.

When and how was the Gordon Engineering Leadership Program established?

The Gordon Engineering Leadership Program (GEL) was launched in 2007 with a $20 million gift from the Gordon Foundation, established by Bernard and Sophia Gordon, to prepare the next generation of engineering leaders. A 1986 National Medal of Technology recipient, Dr. Gordon has had an extraordinarily accomplished technical career, culminating with his roles as founder and chairman of Analogic and cofounder and executive chairman of NeuroLogica. His gift represents the single largest endowment in the history of Northeastern University.

What is the Gordon Engineering Leadership Program's mission and what need was it designed to fill?

The program's mission is to create an elite cadre of engineering leaders who stand out from their peers in their ability to innovate, invent, and implement engineering projects from concept to market success. These leaders will demonstrate an exceptional ability to lead engineering teams by providing purpose, direction, and motivation to influence others to achieve the leader's goals.

What are the advantages to joining the program and what specific skills will candidates acquire?

The program accelerates the development of individual leadership skills in aspiring engineers within an engineering context. In addition to expanding proficiencies in math, physics, and advanced technology, candidates hone essential leadership capabilities, such as decision making and leading the delivery of specifications across disciplines. At the end of the program, Gordon Fellows have gained important competencies that enable them to meet performance, business, and time-to-market goals equal to those achieved by experienced engineering leaders.

What pedagogical strategies are employed in teaching these skills?

Every aspect of GEL is grounded in real-world application. Through interdisciplinary coursework in leadership development and advanced engineering practices, candidates learn to inspire and influence teams to deliver superior results for their organizations and their end customers. Leadership labs reinforce the knowledge, skills, and attitudes gained in the classroom. Candidates also pursue a Challenge Project based on their employers' needs, which provides an opportunity for each candidate to develop self-confidence and real-world skills under time, business, performance, and quality constraints.

Briefly explain the purpose of the real-world Challenge Project and how that is central to the mission of the program.

The cornerstone of GEL is the Challenge Project, an intense individual project in product or process development that results in system integration and/or commercialization of the technology. Each candidate defines and leads a project from concept to completion, with support from mentors. The project is the analog of the thesis experience for someone whose goal is in technology deliverables and deployment, rather than in research.

In the workplace, what will distinguish Gordon Fellows from other master's-level engineers and what will be the advantages for their employers?

The program provides significant advantages for bright, talented professionals who aspire to become engineering leaders and for employers who wish to develop their most promising in-house talent. Gordon Fellows are distinguished by their ability to lead cross-functional teams to take on increased technical challenges, and they become unique because of the accelerated pace at which they can direct larger projects earlier in their careers. The advanced engineering and leadership skills they've acquired resonate across a range of disciplines.

Paul Head, center, with Northeastern professor Carey Rappaport (at left) and Cory Lloyd, Gordon Fellow, 2008

EVIDENCE OF GEL'S ONGOING IMPACT WITHIN THE ENGINEERING INDUSTRY IS SHOWN BY ITS PARTNERSHIPS WITH LEADING MULTINATIONAL CORPORATIONS

Analog Devices
Analogic Corporation
Bose Corporation
Cipher Tech Solutions
GE Healthcare
Intelligent Medical Implants
Lockheed Martin
NeuroLogica Corporation
Pacific Northwest Laboratory
Physical Sciences, Inc.
Raytheon Company
Textron Systems
U.S. Air Force
U.S. Army Night Vision Lab

Chitra Subramanian at the Analogic OnGuard™ Cobra® CT System used to scan baggage in airports and other high-threat facilities

Raytheon Company Paul Head, Gordon Fellow, 2008

After earning a bachelor's in electrical engineering and working for Raytheon for two years, Paul Head was ready to take his career to the next level. "What attracted me to the Gordon Engineering Leadership Program was the idea of engineers needing more leadership education within an engineering background rather than a business background. It really was an alignment of ideologies." For his Challenge Project, Head worked with his company to develop a high-efficiency amplifier for use in radar and communication applications. Based on his own design, Head improved the efficiency of the amplifier by 30 percent, resulting in a 60 percent increase in radar capability. Since completing the program in 2008, Head has enjoyed significant career advancement. "The program had a huge effect on my career. The Challenge Project was my first opportunity to work on my own designs."

Analogic Corporation Chitra Subramanian, Current Gordon Student

Chitra Subramanian earned a master's in electrical and computer engineering from Rutgers and has worked as an imaging engineer at Analogic for nine years. It was at Analogic that she first learned about the Gordon Engineering Leadership Program. She considers the interdisciplinary curriculum one of the most valuable features of GEL. "Even though I'm a computer engineer, I have developed a basic understanding of other disciplines. I'm now able to see the big picture." For her Challenge Project, Subramanian is designing a dual-energy CT scanner that will help identify threats and limit false alarms when detecting explosives in baggage. She believes her work will enable Analogic to capture more market share and help prepare her to transition into project engineering roles. "This program has provided me with more visibility, and responsibility, within the company."

Faculty Accomplishments
IN RESEARCH AND TEACHING

New Faculty Members

Edgar D. Goluch, Assistant Professor of Chemical Engineering, has done research in molecular biophysics, nanofluidics, and single molecule detection. He earned a PhD at the University of Illinois at Urbana-Champaign.

Jerome F. Hajjar, Professor and Chair, Department of Civil and Environmental Engineering, came to the college from the University of Illinois at Urbana-Champaign, where he was a professor and Narbey Khachaturian Faculty Scholar. His research and teaching relate to the analysis, testing, and design of steel and composite steel-concrete structures. He was a structural engineer at Skidmore, Owings & Merrill. Hajjar has contributed to more than 100 publications and is the author or editor of three books. His national honors include the 2009 Shortridge Hardesty Award from the American Society of Civil Engineers. He earned a PhD in structural engineering at Cornell.

Engin Kirda, Associate Professor, College of Computer and Information Science and COE Department of Electrical and Computer Engineering, has held appointments at Eurecom and at the Technical University of Vienna, where he earned a PhD in computer science. His research focuses on systems, software, and network security.

Philip Larese-Casanova, Assistant Professor of Civil and Environmental Engineering, has conducted research in iron geochemistry and contaminant transformation processes. He holds a PhD in civil and environmental engineering from the University of Iowa.

Lee Makowski, Professor of Electrical and Computer Engineering and of Chemistry and Chemical Biology, studies molecular and biomolecular structure and function with particular emphasis on developing new biophysical methods using x-ray and neutron scattering and imaging. He was a senior scientist and division director at Argonne National Laboratory and a program director at the National Science Foundation. He received a PhD in electrical engineering at MIT.

Marilyn Minus, Assistant Professor of Mechanical and Industrial Engineering, researches the fabrication and characterization of advanced high-performance polymer nanocomposites. She is a member of the American Physical Society, the American Chemical Society, and the Materials Research Society. She holds a PhD in polymer, textile, and fiber engineering from the Georgia Institute of Technology.

Ayten Turkcan, Assistant Professor of Mechanical and Industrial Engineering, focuses her research on development of optimization methods in solving planning and scheduling problems in production, transportation, and healthcare systems. She holds a PhD from Bilkent University in Turkey.

University Promotions

James C. Benneyan, Professor of Industrial Engineering and Operations Research, is director of both the NSF Center for Health Organization Transformation and the New England VA Engineering Resource Center, and a nationally recognized leader in healthcare systems engineering research. He received his PhD in industrial engineering and operations research from the University of Massachusetts, Amherst.

Dionisio Bernal, Professor of Civil and Environmental Engineering, conducts research on structural dynamics, system identification, and structural health monitoring. He received the American Society of Civil Engineers' Moisseiff Award in 1993 for his work on instability of buildings during strong earthquakes. He earned a PhD in civil engineering at the University of Tennessee.

"The most important achievement of my first two years as dean has been the growth of the faculty. We have increased its size by some 20 percent, and we are filling the positions with world-class scholars. Adding faculty is vitally important to the continued success of the college and extremely beneficial to our students." **DEAN DAVID E. LUZZI**

David Kaeli, Associate Dean for Undergraduate Education and Professor of Electrical and Computer Engineering, is director of the Computer Architecture Research Laboratory, co-leader of the Institute for Information Assurance, a leader in the Center for Subsurface Sensing and Imaging Systems, and a member of the Institute for Complex Scientific Software. His research explores the design of high-performance computer systems and software. He is a fellow of the IEEE and a member of the Association for Computing Machinery. He earned a PhD in electrical engineering from Rutgers.

Mieczyslaw Kokar, Professor of Electrical and Computer Engineering, conducts research in information fusion, cognitive radios, self-controlling software, and ontological modeling and inference. He earned a PhD in computer systems engineering from Wroclaw University of Technology in Poland. He is a senior member of the IEEE and a member of the Association for Computing Machinery.

Sara Wadia-Fascetti, Associate Dean for Graduate Education and Research and Professor of Civil and Environmental Engineering, focuses her research on condition assessment methodologies for infrastructure systems, nondestructive sensing technologies, and life-cycle analysis. She leads several large-scale university initiatives and has received national recognition, including a presidential award for mentoring, American Society for Engineering Education awards, and a National Science Foundation CAREER award. She holds a PhD in civil engineering from Stanford.

Awarded Tenure

Ferdinand Hellweger, Associate Professor of Civil and Environmental Engineering, researches water quality, biogeochemistry, and microbial ecology of surface waters. He is a member of the American Society of Civil Engineers, the American Society for Engineering Education, and the Association of Environmental Engineering and Science Professors. He earned a PhD in engineering science at Columbia.

Edwin Marengo, Associate Professor of Electrical and Computer Engineering, focuses his research on physics-based signal processing and imaging, and electromagnetic information theory. He is a member of the IEEE, the American Physical Society, and the Optical Society of America. He earned a PhD in electrical engineering at Northeastern.

Purnima Ratilal, Associate Professor of Electrical and Computer Engineering, has extensive experimental and theoretical experience in remote sensing with acoustics and ultrasonics. Among her awards are the ONR Postdoctoral Award in ocean acoustics in 2002, the Bruce Lindsay Award from the Acoustical Society of America in 2006, the ONR Young Investigator (YIP) Award in 2007, and the Presidential Early Career Award for Scientists and Engineers (PECASE) in 2008. She holds a PhD in acoustics from MIT.

Jeff Ruberti, Associate Professor of Mechanical and Industrial Engineering, focuses on the study of the kinetics of collagen assembly and degradation at the nano, micro, and tissue scale. He directs the doctoral program in bioengineering. Ruberti earned a PhD in biomedical engineering at Tulane.

Awards

Charles DiMarzio, Associate Professor of Electrical and Computer Engineering, received a patent for "Enhanced detection of acousto-photonic emissions in optically turbid media using a photo-refractive crystal-based detection system."

Susan Freeman, Beverly Jaeger, and **Richard Whalen,** Academic Specialists, won Best Paper for PIC III and Best Paper Overall at the 2010 American Society for Engineering Education (ASEE) Annual Conference for "Successful Students: Smart or Tough?"

Andrew Gouldstone, Assistant Professor of Mechanical and Industrial Engineering, was named a 2010 SAE Ralph R. Teetor Educational Award recipient.

April Gu, Assistant Professor of Civil and Environmental Engineering, received a $430,000 NSF CAREER grant to determine the levels of contaminants and toxicity in water supplies using prokaryotic real-time gene-expressing profiling.

Jerome F. Hajjar, Professor and Chair of Civil and Environmental Engineering, was awarded the 2010 Breakthrough Award from *Popular Mechanics*.

Jackie Isaacs, Professor of Mechanical and Industrial Engineering, received the ASEE Best Paper Award for "Assessing the Effectiveness of Using a Computer Game to Bridge a Research Agenda with a Teaching Agenda."

David Kaeli, Associate Dean for Undergraduate Education and Professor of Electrical and Computer Engineering, was named a Fellow of IEEE for his contributions to profile-guided optimization algorithms and dynamic branch prediction designs.

Yingzi Lin, Assistant Professor of Mechanical and Industrial Engineering, received a $400,000 NSF CAREER award for "Bridging Cognitive Science and Sensor Technology: Non-intrusive and Multi-modality Sensing in Human-Machine Interactions."

Hossein Mosallaei, Assistant Professor of Electrical and Computer Engineering, was awarded a patent for his work in "Dielectric and magnetic particles–based metamaterials."

Mark Niedre, Assistant Professor of Electrical and Computer Engineering, received a $1.3 million R01 grant from NIH to develop a new high-resolution fluorescence imaging system.

John G. Proakis, Professor Emeritus of Electrical and Computer Engineering, was awarded an honorary doctorate in digital communications and signal processing from the University of Athens.

Rachelle Reisberg, Director of Women in Engineering, won the ASEE 2010 Denice D. Denton Best Paper Award for "The Effect of Gender on Support and Self-Efficacy in Undergraduate Engineering Programs."

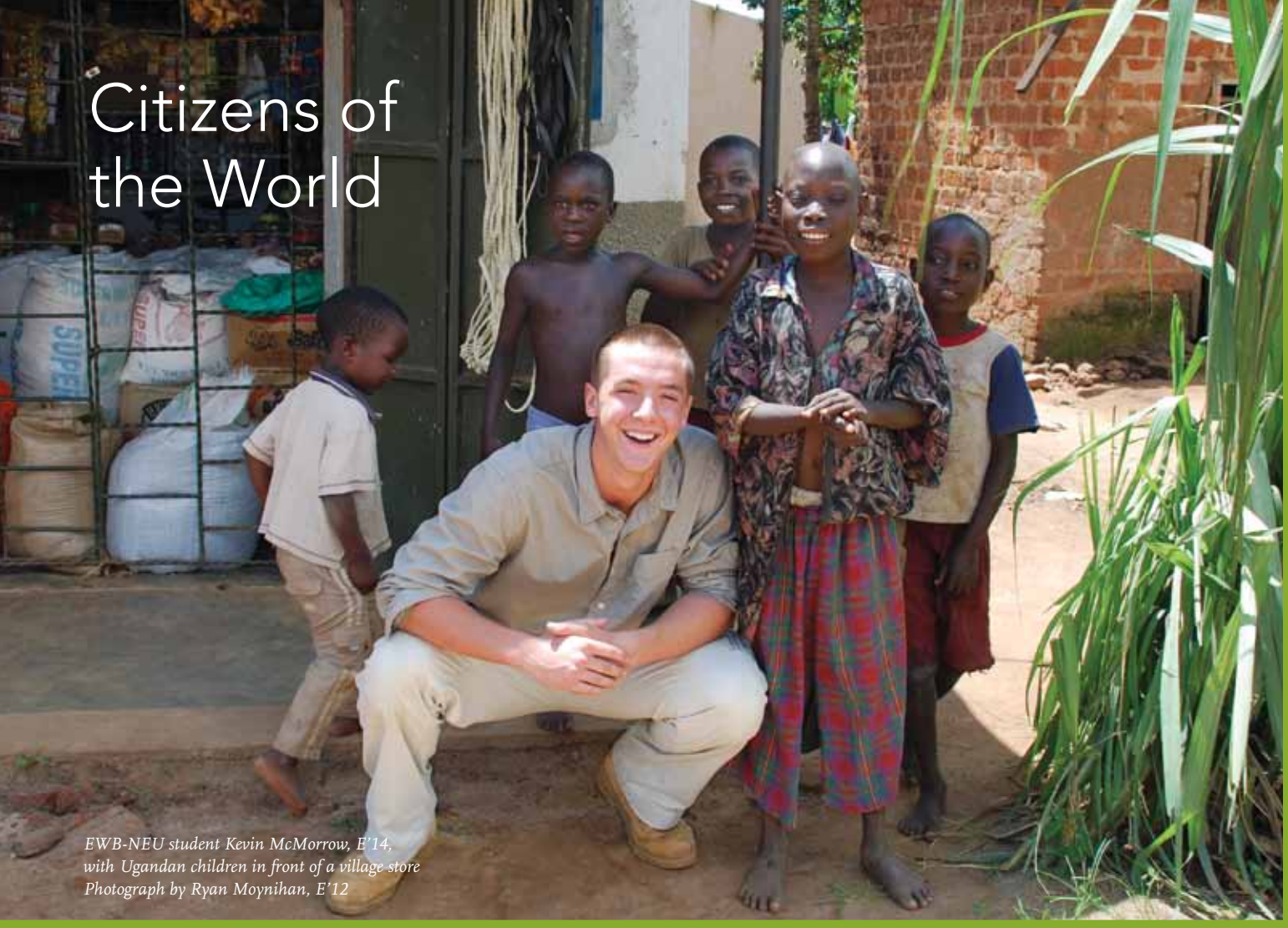
Albert Sacco Jr., Professor of Chemical Engineering, received the 2010 Distinguished Chemist Award from the New England Institute of Chemists.

Milica Stojanovic, Associate Professor of Electrical and Computer Engineering, was named a Fellow of IEEE for her contributions to underwater acoustic communications.

Ali Touran, Associate Professor of Civil and Environmental Engineering, was elected secretary of the Boston Society of Civil Engineers.

Ashkan Vaziri, Assistant Professor of Mechanical and Industrial Engineering, received the Air Force Young Investigator Award to study bio-inspired interfaces for hybrid structures.

Citizens of the World



EWB-NEU student Kevin McMorrow, E'14, with Ugandan children in front of a village store
Photograph by Ryan Moynihan, E'12

GLOBALIZATION CREATES AN IMPERATIVE FOR COLLEGES AND UNIVERSITIES TO PREPARE STUDENTS TO BE CITIZENS OF THE WORLD. NORTHEASTERN STUDENTS ARE LEARNING WHAT THAT MEANS FIRSTHAND.

International Co-op

Through international cooperative education, Northeastern students can pursue meaningful learning opportunities while developing the knowledge, awareness, perspective, and confidence to feel comfortable anywhere in the world. The experience gained through an international co-op assignment is significantly broader and deeper than the experience offered in traditional foreign-study programs. Northeastern students can pursue a six-month international experiential learning opportunity on 6 continents in more than 49 countries and 99 cities in industries that range from engineering to computer technology to biomedicine. Neil Hannah, a mechanical engineering major, recently returned from working in Fenggang, China, at Eastek International, and understands the value of his experience. "Co-op gave me a 'foot in the door.' Working in China for six months is invaluable in this job market. Almost all manufacturing takes place in China, Korea, and Japan, and I've already shown an ability to succeed there."

A Sustainable Future in Honduras and Uganda

Northeastern's chapter of Engineers Without Borders has extensive experience implementing sustainable engineering projects around the world. Teams of students have been operating for six years in a rural district of Honduras, with two water-distribution systems completed, a third now under way, and a fourth being designed. Another team is preparing to begin the group's first work in Uganda. They have completed two assessment trips and returned in August to drill two wells to supply water to more than 800 villagers. Secondary tasks to enhance rainwater collection efforts and to increase the level of hygiene in the village of Bbanda are planned as well.

Northeastern University
College *of* Engineering

College of Engineering
230 Snell Engineering Center
Northeastern University
360 Huntington Avenue
Boston, MA 02115

Nonprofit Organization
U.S. Postage
PAID
Boston, MA
Permit No. 430

The College of Engineering at Northeastern University offers an **INTERDISCIPLINARY PHD IN BIOENGINEERING.**

The program draws on faculty across the university and reflects the significant strengths of bioengineering research in multiple areas. Students in the program will complete a rigorous core curriculum in basic bioengineering science followed by completion of an immersion track curriculum, which currently comprises seven areas from which to choose:

- Committee-Guided, Custom Track
- Bioimaging and Signal Processing
- Biomechanics and Mechanobiology
- BioMEMs/BioNANO
- Biochemical and Bioenvironmental Engineering
- Motor Control
- Biocomputing

The field of bioengineering is broad and includes all research at the interface of engineering and biology. At Northeastern, bioengineering PhD students will be trained to appreciate advances in bioengineering across a wide range of disciplines while they perform highly focused and cutting-edge bioengineering research with one of our many affiliated faculty.

PROGRAM DIRECTOR: Jeff Ruberti, Associate Professor of Mechanical and Industrial Engineering