SPRING 2013

ENGineer

Boston University College of Engineering

INSIDE

A CHANCE TO FLY

WHY ENG STUDENTS GO THE DISTANCE

BOSTON UNIVERSITY

BU IS MAKING HISTORY.

As part of The Campaign for Boston University: Choose to be Great, the College of Engineering aims to ensure that successful Societal Engineer programs can be nurtured and secured for the long term.

Your gift supports students' education beyond the classroom, helps recruit and retain the best faculty, ensures the future of successful experiential learning programs, and helps provide state-of-the-art educational and research facilities. With your partnership, the College will continue to graduate world-class Societal Engineers exceptionally prepared to improve our world.

YOU CAN MAKE A GIFT TO THE CAMPAIGN BY CONTACTING THE COLLEGE'S DEVELOPMENT & ALUMNI RELATIONS OFFICE AT BU.EDU/ENG/ALUMNI/GIVING.

The Campaign for Boston University

CHOOSE TO BE GREAT

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Join the ENG online community!

Post, tag, tweet, ask questions, reconnect with alumni, and learn about networking opportunities, job fairs, seminars and other news and events.

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BU **Boston University** College of Engineering

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ENGineer is produced for the alumni and friends of the Boston University College of Engineering.

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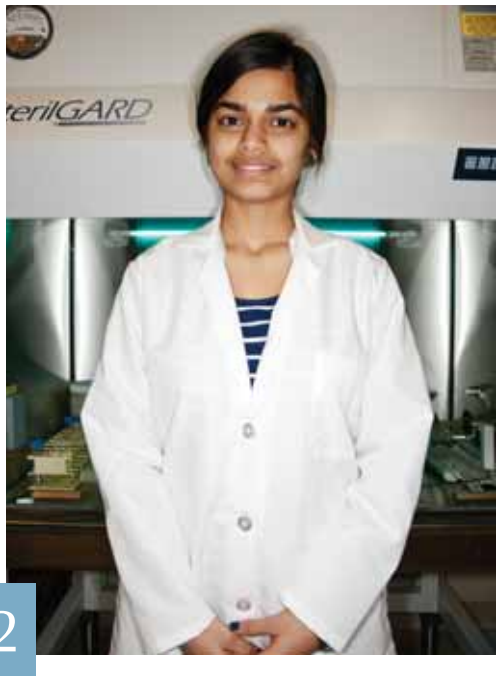

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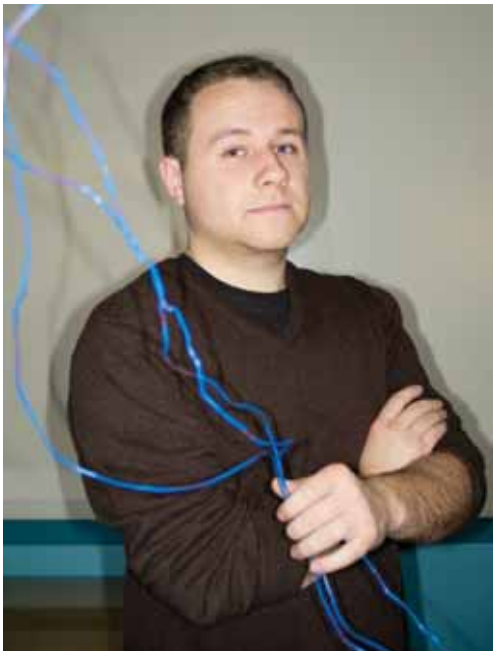
A Compelling Journey: Why ENG Undergrads Stay the Course



On the cover: David Harris, a sophomore majoring in mechanical engineering (top), with master's degree students Erik Knechtel (EE, MS'14) (center) and Elbara Ziade (ME'12, MS'14) (bottom) during the zero-G portion of a parabolic aircraft test flight over the Gulf of Mexico in August. NASA REDUCED GRAVITY OFFICE

CLOCKWISE FROM TOP RIGHT: KALMAN ZABARSKY, CYDNEY SCOTT (3)

We Can Build the Future

BY DEAN KENNETH R. LUTCHEN

Our recent initiatives aimed at creating Societal Engineers have been tremendously well received by our students, our faculty, people in industry who hire engineers, and, I suspect, our applicant pool: applications to the College of Engineering are up 35 percent this year. While all this is gratifying, success has presented us with the challenge of ensuring the long-term growth and viability of these programs and has prompted us to ask several questions. We've answered them with initiatives and plans for the short and long terms, and provided our alumni and friends with a concrete way to help make them reality.

First, the questions. How do we get children interested in becoming engineers and taking the necessary academic path to gain admission to engineering school? Once they are enrolled, how do we keep them engaged as they navigate the most demanding curriculum of any discipline? Finally, how do we transform them into Societal Engineers and get them excited about the impact people with an engineering degree can have on our society, even if they do not remain engineers throughout their careers?

The first challenge is a national one and I believe we may have found one of the very few solutions that can provide a sustainable and scalable impact. Our Technology Innovation Scholars Program sends some of our most talented and engaging undergraduates into elementary, middle and high schools around the country to show kids the exciting ways that engineers can improve lives and address society's challenges. The response to this program has been tremendous among the young students and their teachers—and among our own students.

Retaining engineering students during the first and second year is a national challenge, and while our track record has long been well above average, we are improving it. Several innovative programs show students how the foundational courses they take early in their undergraduate careers relate to meeting the societal challenges they yearn to address. You can read about some of them on p. 12.

Showing students what engineers do is one thing; creating Societal Engineers is another. We're showing students how to use their technical skills to create real products, and marrying that with global awareness, a passion for innovation and an understanding of how technology products are deployed in the marketplace.

All of these efforts—and several emerging ones—have been seeded and grown with philanthropic support, some by large commitments from a few alumni and friends; others by numerous smaller gifts to the Engineering Annual Fund. Why? Because they are beyond what tuition alone can cover.

For example, Binoy Singh's (BME'89) gift made possible the Imagineering Laboratory, which is increasingly utilized by our students; keeping it staffed and stocked with supplies will require ongoing support. Initial construction funds for our Engineering Product Innovation Center, which promises to be a national model for undergraduate engineering education, were provided by the University, but the College must raise $5 million to complete and operate it (we are halfway there). The Technology Innovation concentration, introduced last year and grown with support from the Annual Fund, will need more professors of practice and internships to meet rapidly growing student interest.

So how can you play a critical role in our obligation to meet and sustain these highly successful and effective programs? Well, for the first time in the history of Boston University, the College of Engineering has embarked on a capital campaign—Choose to be Great—which you can learn more about on p. 3. The College has worked hard to make it clear to our alumni and friends what programs and long-term goals we hope to build, sustain and achieve for this campaign. My hope is that every alumnus and friend feels compelled and excited to be part of the community of partners that will make us successful and create future generations of people dedicated to advancing society. ■

KALMAN ZABARSKY

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WRITTEN + EDITED BY MARK DWORTZAN

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The Campaign will help sustain experiential learning programs such as the ongoing operation of the Binoy K. Singh Imagineering Lab, where mechanical engineering undergrads Mehmet Akbulut ('16) and lab adviser Emily Metivier ('13) are developing a 3-D printer for space applications.

CYDNEY SCOTT

Choosing to Be a Great Engineering College

As part of Boston University's first-ever capital campaign—a seven-year drive called "The Campaign for Boston University: Choose to be Great"—the College of Engineering is asking our alumni and friends to support our leap into the top tier of the nation's engineering schools.

Recently, College of Engineering Dean Kenneth R. Lutchen observed that the College has been riding a rising tide of success in recent years, which is particularly noteworthy given the College's youth. Fifty years ago the College of Industrial Technology had yet to transition to the College of Engineering, and 20 years ago PhD programs were just being

launched. Through strong leadership, internally generated funding, and careful fiscal management, and despite a very modest endowment, the College has joined the company of iconic, world-class engineering schools much older and better endowed as it competes for top students and faculty.

"We are a young engineering school that now counts the nation's leading private universities, the best technology institutions and Ivy League engineering schools among its peers," said Lutchen. "We have worked very hard to become a new member of this club and our alumni are thrilled with our success to date. But, without question, in order to remain there and climb higher, we now need a coordinated effort to acquire competive resources that only philanthropic support can provide."

The College of Engineering's transformation is drawing widespread attention. Just six years ago it was ranked outside the top quartile by *U.S. News & World Report*. Today, the College is ranked among the top 20 percent of engineering graduate programs, making it one of the fastest-rising in the nation. In addition to increasing numbers of prestigious awards and honors, the faculty is winning more highly competitive external research funding—nearly $41 million last year alone—from the nation's leading funding agencies, and the quantity and quality of student applicants continues to rise each year.

Lutchen notes, however, that while the College's steepening trajectory of excellence and recognition is gratifying, that is not the ultimate objective of the Campaign.

"This is not about the College or how hard we are working to make it even better, though the Campaign will help that," he said. "This Campaign is about results. It is about people and specifically about the quality and kind of students we graduate, and about ensuring our alumni have the exciting opportunity to help us create them. That is how the success of the Campaign will be judged.

"Our academic program is exceptional," Lutchen added, "but in order to create Societal Engineers, we need to imbue them with a deep-seated passion for innovation and impact, and an appreciation for how the engineer's unique foundation can improve quality of life around the globe, regardless of one's long-term career trajectory. While tuition covers classroom and laboratory learning, it cannot fund and sustain the array of empowering experiential programs we have created, new faculty recruitment and the new state-of-the-art facilities needed to produce Societal Engineers. This Campaign will provide these vital elements."

An extremely positive sign, notes Assistant Dean for Alumni Relations & Development Bruce Jordan, is the tremendous and growing engagement of ENG alumni with their College, as expressed through their involvement and generosity. Attendance at alumni events has grown significantly, and the Engineering Annual Fund has tripled over the past five years, while the annual funds at other colleges and universities are struggling. Remarkably, during some of the most trying economic years of our nation's history, an increased number of alumni have amplified their giving and commitments to the College. The result has been extraordinary from the student's perspective.

THE CAMPAIGN IS ABOUT RESULTS. IT IS ABOUT PEOPLE AND SPECIFICALLY ABOUT THE QUALITY AND KIND OF STUDENTS WE GRADUATE.

"All of these metrics give us confidence in the Campaign's success," Jordan said. "The College's growing reputation, and Dean Lutchen's vision of creating Societal Engineers, are clearly resonating among our alumni and friends. We hope that our alumni, parents and friends, even those who haven't been actively involved in the life of the College, will choose to participate in this student-centered effort in a big way."

Campaign gifts will be used in four major areas—students, faculty, programs and facilities.

While all four areas ultimately benefit students, the portion of the Campaign earmarked for them will include summer research support and funding for engineering-specific student activities and clubs, including the Societal Engineering Fund; support to sustain the increased effort to introduce students to technology innovation and product design; and scholarships and fellowships for undergraduate and graduate students. To help attract and retain the best faculty, the Campaign will seek endowed professorships, distinguished faculty awards for outstanding teachers and researchers, and funds to support innovations in engineering teaching methods.

The Campaign will also benefit many of the programs that are key to creating Societal Engineers, such as the Technology Innovation Scholars Program, which sends undergraduates into middle and high schools to instill a sense of excitement about engineering in young people; Engineers Without Borders, which helps communities in developing countries improve their quality of life; and the planned Summer Institute for Technology & Innovation Leadership, run jointly with the School of Management.

Additionally, the Campaign will fund extensive renovations and well-equipped new facilities to provide opportunities for undergraduates to get direct, hands-on experience. Among these projects are a new Engineering Product Innovation Center dedicated to ensuring undergraduate engineering students have hands-on exposure to the technologies and software for product design and deployment; the recently opened Binoy K. Singh Imagineering Laboratory, which allows undergraduates to tinker and create their own innovations; and laboratories and offices for the College's growing number of excellent research-active faculty.

Jordan noted that early, pace-setting major gifts and pledges made during the two-year nucleus phase of the Campaign are approaching $25 million toward a Campaign goal of $50 to $60 million.

"This is truly remarkable," Jordan said, "given that, until now, the College had never in our history conducted a robust program to engage alumni and ask them to make the College a giving priority. The response so far has been outstanding, and now that the Campaign is launched, I'm confident our alumni and friends will continue to respond."

—Michael Seele

You can make a gift to the Campaign by contacting the College's Development & Alumni Relations Office at www.bu.edu/eng/alumni/giving.

Engineers and Scientists Acquire Top-Tier Computing Power

Boston University engineering and science researchers now have top-tier computing power that enables them to run simulations of unprecedented complexity on campus. Thanks to a gift of hardware from Hewlett-Packard, now researchers can create simulations in three dimensions as they explore disciplines like aerodynamics, bioinformatics, particle physics and others.

The gift of 160 graphics processing units—or GPUs—increases the power of an existing system fivefold to 80 teraflops in peak performance. GPUs have a capacity that is useful for researchers seeking mathematical representations of highly complex models. Previously, if researchers wanted to run these kinds of complex simulations, they needed to apply for time on the massive computers housed at government-funded national laboratories around the county, a highly competitive and time-consuming process.

Hewlett-Packard representative Bryan Marler said the new BU system "is the most powerful GPU system in academia on the East Coast and one of the top 10 in the country."

Assistant Professor Lorena Barba (ME) is one of the BU researchers who welcomes the additional power of the new system. She is working with a biologist at Virginia Tech studying a species of Southeast Asian snake that glides in the air between trees. The biologists have video of the snake in flight, but that doesn't provide the engineer with enough understanding of the aerodynamics the snake uses to maneuver in air.

"These snakes are very good gliders, but you can't put a snake in a wind tunnel," Barba said, so computer modeling is the most effective way for the engineer to study it. Barba, who has won several honors for her GPU-related research, hopes to glean enough data from the video and other sources, feed it into the computer and emerge with a three-dimensional model of the aerodynamic forces at work.

"With the old system, we could do some smaller-scale modeling, but only in two dimensions," Barba said. "It was limited. Now, with the new system, we have an exponential increase in capability and we can model them in 3D."—*Michael Seele*

See page 12 for more on how ENG students chase their passions.

The BUSAT Microgravity Team: Josh Koerpel, Christopher Hoffman, Nathan Darling, David Harris, Erik Knechtel, Elbara Ziade and Steven Yee.

Going Weightless

SEVEN ENG STUDENTS TEST SATELLITE ON ZERO-G FLIGHTS

On August 17–25, seven College of Engineering students got a taste of the ups and downs of spaceflight when they participated in a series of parabolic aircraft flights above the Gulf of Mexico designed to test, under zero- and microgravity conditions, hardware they'd developed for a Boston University satellite.

The ENG participants, master's degree students Nathan Darling (ME'13), Erik Knechtel (EE'14), Josh Koerpel (ME'13), Steven Yee (AE'11, SE'13) and Elbara Ziade (ME'12, '14); and undergrads David Harris (ME'15) and Christopher Hoffman (EE'13), are members of the Boston University Student Satellite for Applications & Training (BUSAT) team. Partially funded by the U.S. Air Force through the University Nanosat Program, BUSAT is a two-year student project to develop a functional satellite with a modular, scalable, scientific spacecraft platform for low-cost space research, and to use the platform to explore interactions between the Earth's ionosphere and magnetosphere. The team currently includes about 20 BU engineering, computer science, physics and astronomy students.

"The NASA Flight Opportunities Program offers zero-G flights as a means for studying and analyzing student projects that require a micro-gravity environment," said Yee, noting that each flight, launched from a NASA facility in Houston, consisted of approximately 40 parabolas over the course of about two hours, with the zero-gravity portion lasting about 20 seconds per parabola. "The purpose of our flights was to validate and analyze the solar panel and antenna deployment system."

BUSAT team members also participated in flight tests of the main BUSAT avionics module in Texas and New Mexico as part of a NASA and Louisiana State University very high altitude balloon program, and successfully completed a U.S. Air Force performance review of the BUSAT project at the Small Satellite Conference in Utah.

"It was a busy month," said Darling, the team's project manager. ■

NASA REDUCED GRAVITY OFFICE

Joint ENG-SED Program Meets Need for STEM Educator-Engineers

The College of Engineering is partnering with the School of Education to address a need for educators who have the knowledge and passion to teach technology in the nation's K–12 system. This unique program is called the STEM Educator-Engineer Program (STEEP) and will enable College of Engineering undergraduates to earn a Bachelor of Science in their chosen engineering major and a Master of Arts in Teaching in five years. The result will be an inspirational educator-engineer licensed to teach math, science, technology and engineering in nearly every state in the nation.

Current national efforts in science, technology, engineering and math (STEM) focus largely on science and math, often because teachers do not have backgrounds in technology and engineering. STEEP is aimed at populating secondary schools with teachers who are naturally able to connect science and math to engineering and better able to communicate the excitement of the field to young learners.

"This unique and powerful partnership between the College of Engineering and the School of Education is aimed at addressing the long-term impact of teaching how science and math connect to engineering and technology innovation throughout the K–12 education system," said College of Engineering Dean Kenneth R. Lutchen.

"This joint program between the schools of Education and Engineering will allow engineering students to become certified teachers, pursue academic careers in a university with their strong pedagogical training or become professional engineers," said SED Dean Hardin Coleman. "In any case, they will be prepared to increase the numbers who are interested in starting a career in science, technology, math and engineering."

THE RESULT WILL BE AN INSPIRATIONAL EDUCATOR-ENGINEER LICENSED TO TEACH MATH, SCIENCE, TECHNOLOGY AND ENGINEERING IN NEARLY EVERY STATE IN THE NATION.

STEEP will be directed by Gretchen Fougere, the College of Engineering's assistant dean for Outreach & Diversity. "This program is designed to create teachers who regularly and naturally guide the application of math and science lessons to engineering design and technology development," she said. "These STEEP graduates will have a passion for technology and an understanding of the innovation process, and hold strong pedagogical skills to be effective educators, impacting and inspiring in a regular and sustained way."

Consisting of coursework, field experience and student teaching, the STEEP curriculum is designed to fit both degrees without accommodations or need for summer courses. Students will complete the required courses for any of the four engineering majors and will be guided by graduate advisors from SED in addition to their undergraduate ENG advisor. Students will start education courses during their undergraduate years, and can explore this potential career by participating as Inspiration Ambassadors in the Technology Innovation Scholars Program or in other ENG outreach programs. After the fifth year, STEEP graduates will be certified to teach in middle or high schools in 44 states.

—Kathrin Havrilla

Guided by ENG Inspiration Ambassadors, fifth-graders in Melrose, Massachusetts, design, build and test their own mini wind turbines.

MELODY KOMYEROV

Designing a Synthetic Biology Assembly Line

Today's synthetic biologists tend to work in silos, developing novel, biologically engineered materials and devices on dedicated platforms through sophisticated, trial-and-error experiments. As a result, new biologically manufactured products often require more than seven years to build and tens to hundreds of millions of dollars to finance. But a new, more universal synthetic biology platform is emerging that promises to dramatically accelerate the process, enabling on-demand production of new materials and devices, from biofuels to wound sealants, at a much lower cost.

In pursuit of this vision, the Defense Advanced Research Projects Agency (DARPA) has awarded a $3.6 million, 30-month grant to Assistant Professor Douglas Densmore (ECE, BME), post-doctoral fellow Swapnil Bhatia (ECE) and collaborators at MIT, the University of California, San Francisco and Pivot Bio (a biotech startup) to help establish a "living foundry" where researchers can access, design, assemble and test synthetic genetic systems composed of hundreds of DNA parts. The new project is administered by DARPA's Living Foundries Program, which seeks to create an engineering framework for biology that speeds production and reduces its costs by a factor of ten while radically expanding the complexity of systems that can be engineered.

The research team's proposed method consists of three sequential tasks. The first is to create a library of more than 10,000 modular DNA parts, derived from bacteria, that would serve as biological building blocks. The team's second challenge is to develop an automated process to systematically assemble and use these parts to perform specific biological functions, from processing nitrogen to producing antimalarial drugs.

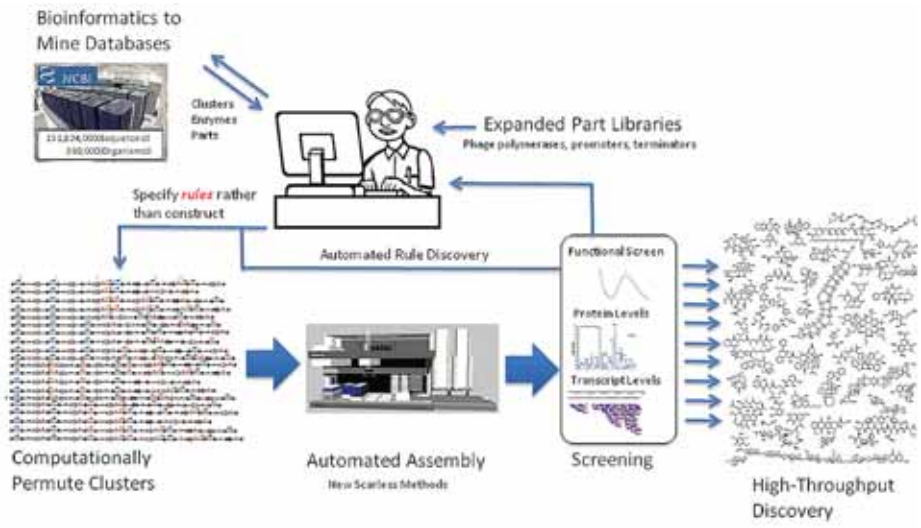
Densmore will be deeply involved in the third task, which is to apply this process to the production of *siderophores*, chemicals that bind to metal surfaces and form a protective layer to prevent corrosion, a widespread and costly (an estimated $23 billion per year) problem faced by the Department of Defense, which must operate in some of the most corrosively aggressive environments on the planet. Siderophores could be sprayed on ships, planes and other military vehicles and equipment to prolong their operational lifetimes.

"Our goal is to engineer bacteria that can create siderophore compounds in a more tuned, engineered way so that they are better performing, cheaper to manufacture and faster to produce," said Densmore. "To accomplish that goal, I will use the Eugene programming language my group has developed to create new gene clusters with machine learning techniques that use rules to bias new designs away from past failures and toward future successes."

Once the collaborators identify the gene clusters they believe will perform the best, Densmore will synthesize them using liquid-handling robots at BU.

"We envision an automated process in which people send us materials they want to design, we learn from them and improve them, and then we build new ones," he said. ■

A NEW, MORE UNIVERSAL SYNTHETIC BIOLOGY PLATFORM IS EMERGING THAT PROMISES TO DRAMATICALLY ACCELERATE THE PROCESS, ENABLING ON-DEMAND PRODUCTION OF NEW MATERIALS AND DEVICES, FROM BIOFUELS TO WOUND SEALANTS, AT A MUCH LOWER COST.



Assistant Professor Douglas Densmore (ECE, BME) aims to help establish a "living foundry" where researchers can access, design, assemble and test synthetic genetic systems composed of hundreds of DNA parts.

Tracing the Source of Bioterror Agents

Through genetic manipulation or growth in the laboratory, microbes can be engineered for either harm, such as anonymous anthrax attacks, or good, such as vaccines, fuel cells or pollution control systems. A better understanding of how the conditions in which a bacterial cell is grown impact its metabolism and biochemical composition could lead to new tools to help counter potential bioterror threats and advance the development of a wide range of peaceful applications.

Now an interdisciplinary team of systems engineers, computer scientists, microbiologists and biochemists—including Boston University researchers (Professor Yannis Paschalidis [ECE, SE] and Associate Professor Daniel Segrè [Biology, BME, Bioinformatics, MSE]), as well as the University of Texas and Harvard University—seeks to establish clear links between bacterial cells' growth conditions and their resulting composition by developing and testing advanced mathematical methods. Funded by a $7.5 million grant from the U.S. Army Research Office, the five-year project could lead to new ways to track the source of a bacterial pathogen, and to help discriminate between natural infectious outbreaks and the deliberate spread of pathogens.

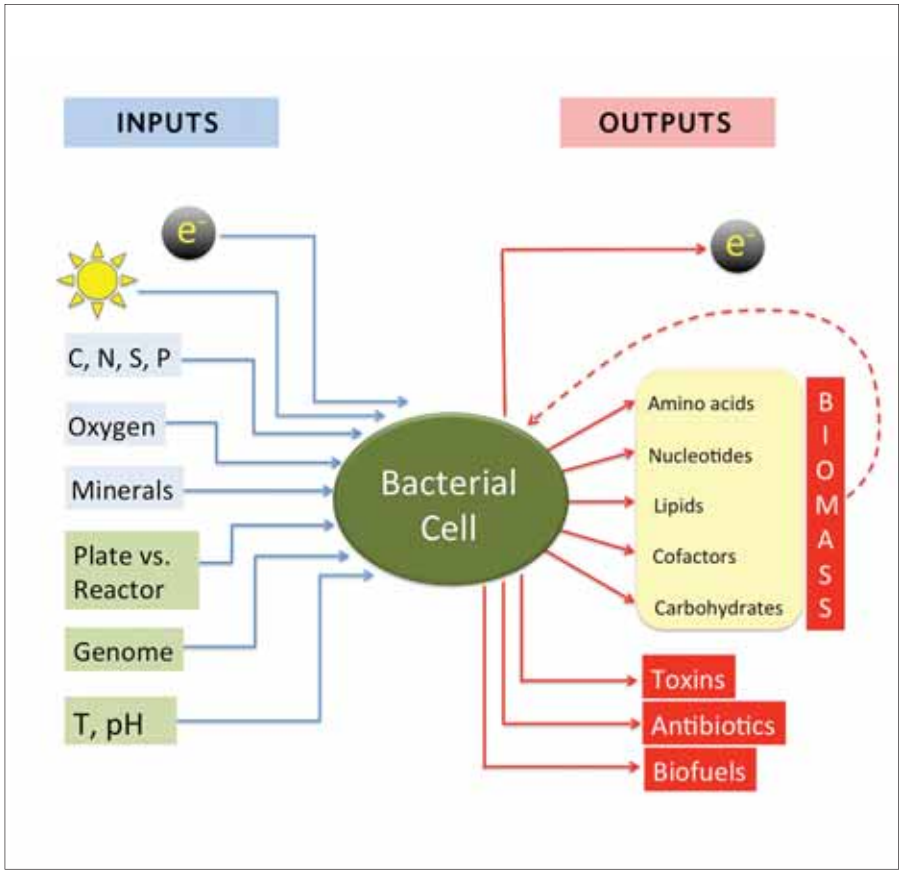
Bacterial cells are typically grown in a nutrient-rich broth containing all the raw materials they need to grow and multiply. The growth medium and environmental factors particular to a lab, such as temperature or pH, constitute the growth conditions that collectively influence the metabolism and biochemical composition of a microorganism. To draw links between a bacterial cell's growth conditions and its current composition, the researchers plan to model the cell as a system with inputs (growth conditions) and outputs (cell composition), and devise a functional mapping, or mathematical formulas, that transform inputs to outputs and vice versa.

Paschalidis plans to apply optimization techniques to produce these mappings.

"If we observe the cell composition, what can we say about the environment and growth factors impacting that composition?" he said. "The challenge in identifying the source of a bioterror attack is to solve this problem and infer the input from the output."

Segrè, an expert in the use of mathematical models to drive biological discovery, will develop computer simulations of microbial metabolism and growth under a wide range of possible laboratory conditions. Based on these simulations and experimental measurements to validate their accuracy, Paschalidis will infer how various growth conditions impact the composition of a bacterial cell.

"The composition of the microbial cell may carry information on where it grew and how it evolved, like a hidden signature, that we will try to characterize and interpret," Segrè observed. "If a bacterium grew under unusual circumstances, or was artificially evolved in a lab, this will likely be reflected in the cell composition." ■



By combining experimental measurements and mathematical models, Paschalidis and Segrè aim to predict a bacterial cell's output (current composition) given its input (growth conditions) or vice versa—enabling researchers to track the source of potential pathogens.

Clean Coal, at Last?

BU RESEARCHERS AIM TO GENERATE EFFICIENT, ECO-FRIENDLY ELECTRICITY FROM FOSSIL FUELS

ENG RESEARCHERS WILL ATTEMPT TO PRODUCE A FUEL CELL WITH AT LEAST A 50 PERCENT POWER DENSITY IMPROVEMENT OVER CURRENT TECHNOLOGY.

In 2011 coal-fired power plants generated more than 40 percent of U.S. electricity—and nearly 80 percent of carbon dioxide emissions produced by the entire electric power sector. One of the National Academy of Engineering's Grand Challenges for Engineering is to capture and store this carbon dioxide and thereby reduce global warming, but doing so without driving up the cost of electricity is no easy task.

Now the Department of Energy is awarding $3.5 million to seven university-based research teams across the country—including one from Boston University—to spend the next two years advancing fuel cells that generate efficient, cost-competitive electricity from domestic coal with near-zero emissions of carbon dioxide and air pollutants. Fueled by gasified coal, such fuel cells could automatically capture up to 99 percent of carbon dioxide emissions while emitting virtually none of the nitrogen and sulfur oxides (major components of smog) produced by coal-fired power plants.

Building on six years of previous, DOE-funded research, the BU team—Associate Professor Srikanth Gopalan, Professors Soumendra Basu and Uday Pal, and Assistant Professor Xi Lin (all ME, MSE), and Professor Karl Ludwig (Physics), along with many graduate and undergraduate students—is tasked to demonstrate a 50 percent improvement in maximum power density of solid oxide fuel cells. To achieve this goal, they plan to use new, lower-cost, higher-performing materials and a variety of experimental and computational tools.

"Clean energy research today tends to focus on renewables such as solar, wind, hydro, wind and biofuels, but they're still a long way off in providing high-efficiency power generation systems," said Gopalan, the project's principal investigator. "By increasing the efficiency of coal and other fossil fuel-based systems, we can decrease the carbon dioxide emissions that they produce and the cost of generating electricity from them."

The team aims to produce lower-cost, higher-performing solid oxide fuel cells (SOFCs) by identifying new materials that deliver higher performance at lower operating temperatures. Guided by a computational model that simulates electrochemical reactions within the cell using different candidate materials, the researchers will conduct experiments that test promising materials in a fuel cell for improved power density and durability.

"We're also expected to deliver to the DOE an actual cell with at least 50 percent performance improvement at lower temperatures," said Gopalan. "We're one of the few teams in this program to make a fuel cell from concept to fabricated device." ■

Better Data Management, Lower Health Costs

Today, people with diabetes and other chronic conditions are benefiting from real-time monitoring devices such as miniaturized implants, home monitoring equipment and smartphone applications. But while methods for tracking a person's symptoms and vitals have improved, hospitals and their medical teams are not yet ready to take advantage of all the personalized health data generated by new medical devices.

Now Professor Yannis Paschalidis (ECE, SE) and Associate Professor William Adams (BMC) have teamed up with MIT Professor Dimitris Bertsimas to develop algorithms that can systematically process all patient data in hospital electronic medical records and personalized health records. These algorithms will be designed to classify patients based on their risk of developing an acute condition requiring hospitalization; such information can then be used to drive preventative actions.

"What motivated us to start this project is the recognition that the U.S. health care system is extremely inefficient, as it is geared toward treating acute conditions," said Paschalidis. "There are tremendous opportunities for preventing the occurrence of these conditions and the expensive hospitalizations they cause."

The National Science Foundation has awarded Paschalidis, Adams and Bertsimas a five-year, nearly $2 million grant for the project. By focusing on disease prevention and keeping patients out of the hospital, their research has the potential to improve what many regard as a highly expensive and inefficient health care system.

Yannis Paschalidis (ECE, SE)

The project will utilize Paschalidis's expertise in data models, optimization and decision theory, and Adams's ability to work with physicians to obtain feedback on the outcome of the algorithms.

"The main challenge will be the adoption of the techniques we develop by physicians in particular and the health care system in general," Paschalidis said. "Dr. Adams will serve as our ambassador to that community."

Welcoming this new partnership, Adams observed that the Boston Medical Center has spent more than 10 years developing a robust and rich informatics infrastructure for clinical care and research.

"Translational science involves collaborative efforts between traditionally independent scientists," he said. "This project is innovative and important in that it brings together mathematicians, engineers, clinicians and informatics experts to better understand and improve health care."—*Rachel Harrington*

Smart City Research Gains Funding

Professor Christos Cassandras (ECE, SE) and systems engineering graduate student Yanfeng Geng (PhD'13) developed a preliminary version of a Smart Parking system that enables a driver to enter a desired destination and price range into a mobile device and reserve a vacant, appropriately priced parking space that's closest to the destination.

Imagine driving in a city where you never have to search for a parking spot, traffic tie-ups are rare and information on nearby accidents is displayed on your dashboard almost instantaneously. If a research team led by Professor Christos Cassandras (ECE, SE) achieves its goals, such "smart cities" could become commonplace across the U.S. in the coming decade.

The team—which includes Professors Yannis Paschalidis (ECE, SE), Azer Bestavros (CS, SE) and Assaf Kfoury (CS, SE) from Boston University; University of Massachusetts-Amherst Professor Weibo Gong (ECE); and University of Connecticut Professor Robert Gao (ME)—has received a $1 million grant from the National Science Foundation to create the technological infrastructure for a wide range of Smart City applications aimed at reducing the congestion, pollution, fossil fuel consumption, accidents, cost and sheer inconvenience associated with operating motor vehicles in urban environments.

"Our Smart City focus has the potential of revolutionizing the way we view the city in the future: from a passive living and working environment to a highly dynamic one with new ways to deal with transportation, energy and safety," said Cassandras.

These new ways include a Smart Parking system that assigns and reserves parking spaces based on a driver's requested destination and price range, a traffic regulation system that dynamically controls traffic lights based on real-time road conditions to improve the flow of vehicles throughout a city, and electric vehicle charging stations where drivers can pay to download electric power to their vehicle from a smart grid—or get paid to upload excess electric power from their vehicle to the grid.

To create an infrastructure for these and other Smart City applications, the team plans to design a mobile sensor network of motor vehicles, each equipped to collect data from its onboard sensor and quickly transmit it across the network from one vehicle to the next. The network could be used to collect and exchange data such as accident locations or hazardous road conditions; dynamically allocate resources such as available parking spaces or electric vehicle charging stations; ensure secure and reliable data exchange across the network; and make real-time decisions, such as coordinating sets of traffic lights, without compromising the safety of drivers, bikers or pedestrians. To achieve those objectives, the team will advance new sensing, data acquisition, decision-making and dynamic resource allocation capabilities.

They will test these capabilities via the Sustainable Neighborhood Lab (SNL), a BU-organized living laboratory for sustainable urban development in Boston's Back Bay, and a parking garage at BU.

"The whole concept of a Smart City is beginning to gain prominence in the U.S. and abroad," said Cassandras. "Our approach is unique in its focus on sensor network infrastructure, its use of optimization techniques for dynamic resource allocation, and its development of a new software framework for real-time, Smart City applications." ■

Reporting to NASA
ECE graduate student Schuyler Eldridge (BS'09, PhD'15) (right) and his advisor, Assistant Professor Ajay Joshi (ECE) (center), met with NASA Space Technology Program Director Michael Gazarik (left) when Gazarik visited BU in December. This year Eldridge received a NASA Space Technology Research Fellowship to support his project, "Biologically Inspired Hardware for Land/Aerial Robots," which aims to design a new type of computer that can sense, learn and adapt—just like a living brain. He hopes to see the hardware he's designing wind up in a future interplanetary rover.

TOP: VERNON DOUCETTE

Designing a More Self-Sufficient Solar Panel

As companies and homeowners seek greener ways to power their homes and businesses, solar panels are becoming an increasingly popular option. Unfortunately, how much energy a solar panel generates depends on how clean the equipment is, and it's not always easy—or cheap—to keep the panels spotless. Dust and dirt can block sunlight and reduce the amount of energy yielded.

At Boston University, Research Professor Malay Mazumder (ECE, MSE), Professor Mark Horenstein (ECE) and Associate Professor Nitin Joglekar (SMG) aim to solve this problem by designing a more self-sufficient panel with a cleaning component that would electrodynamically remove dust.

"Because cleaning solar collectors with water is expensive in desert conditions, solar plants often operate with dusty panels until water is absolutely necessary," said Mazumder. "Electrodynamic dust removal would not require water and could be operated as frequently as needed at a miniscule cost."

The BU team is now one step closer to achieving its goal after the U.S. Department of Energy (DOE) and the Massachusetts Clean Energy Center (MassCEC) awarded grants to support this research. The DOE will provide $955,340 for solar mirrors for photothermal energy conversion while MassCEC will give another $40,000 that will be used toward developing self-cleaning photovoltaic solar panels.

Mazumder, Horenstein and Joglekar are now advancing prototypes that use electric fields to lift and move dust particles across the solar collector and ultimately remove them entirely. The BU team will partner with Abengoa Solar, a leader in solar energy technology development, which will assist in developing and testing the prototype devices in the field. Abengoa is currently installing the world's largest solar plant in Arizona. Sandia National Laboratories will also help evaluate the new solar collectors.

Mazumder has been working toward developing an electrodynamic screen for solar panels for nearly 12 years. NASA funded his initial project, which centered on developing self-cleaning panels that could be used in missions to Mars and the moon.

—Rachel Harrington

Inspiration Ambassadors Garner Support

In just two years, 86 College of Engineering undergraduates known as Inspiration Ambassadors have shared their excitement about engineering and its impact on society with more than 4,300 elementary, middle and high school students across the country through interactive presentations, hands-on design challenges and FIRST Robotics Competition mentoring.

The ultimate goal of these enterprising College of Engineering undergraduates—to inspire as many students as possible to consider becoming engineers—couldn't be more timely. Last year the President's Council of Advisors on Science and Technology projected a need for about 1 million more science, technology, engineering and math (STEM) professionals than the U.S. will produce at the current rate over the next decade. Although K–12 STEM programs have proliferated in recent years, most give short shrift to technology and engineering.

To help fill this gap and meet a growing demand for Inspiration Ambassadors in greater Boston and beyond, the College of Engineering now aims to further expand its Technology Innovation Scholars Program (TISP), which professionally trains the Ambassadors.

"This program has taken off like wildfire, with exponential growth in the number of Inspiration Ambassadors and the schools they serve, and national impact on K–12 students," said TISP Director Gretchen Fougere, the College's assistant dean for Outreach & Diversity. "We wish we could hire all the Societal Engineers at BU who apply and deliver more to our 'customers' in schools and out-of-school programs clamoring for repeat visits. To continue to scale the program, we're now reaching out to new partners in the technology industry."

Building on support from the program's main sponsor, the Kern Family Foundation, and alumni, the College has instituted COOL: COrporate Outreach Leaders Program, whereby interested corporate partners may sponsor multiple Inspiration Ambassadors. As partners, they may also collaborate with the Ambassadors in developing presentations and design challenges. The first COOL partner, Argosy Foundation, has committed $25,000 to support 10 Inspiration Ambassadors starting in September.

Fougere views the program as a systemic way to impart the excitement of engineering and a diverse array of leading-edge technologies to K–12 students through accessible, engaging role models—and have a lasting impact on their educational and career trajectories.

"It's a veritable hat trick," she said. "Younger students are inspired by relatable role models, teachers have partners to complement and connect their lessons to technology careers and COOL partners like Argosy and high-tech companies can amplify our content and scale to develop a workforce of Societal Engineers." ■

College of Engineering Inspiration Ambassador Rana Alrabeh (CE'14) (right) and Science Club for Girls members explore Smart Lighting and LEDs at a middle school in Cambridge, Massachusetts.

Matthew Pollack (ME'14) (left) and Alexander Kithes (EE'14) (right) testing the low-cost, portable wind turbine that they designed, built and tested as sophomores for the College's first Imagineering Competition in 2012. In the Binoy K. Singh Imagineering Lab, undergraduates pursue their own technological solutions to a wide range of societal challenges. (Photo by Cydney Scott.)

A Compelling Journey

WHY ENG UNDERGRADS

STAY THE COURSE

BY MARK DWORTZAN

"WE BOTH FELT A SENSE OF ACCOMPLISHMENT IN THAT WE HAD SUCCESSFULLY DESIGNED AND ENGINEERED SOMETHING REAL FOR THE FIRST TIME. THAT WAS DEFINITELY AN EXCITING FEELING."
MATTHEW POLLACK (ME'14)

Having spent countless hours immersed in textbooks, problem sets and exams designed to give them a solid foundation in math and science, Matthew Pollack (ME'14) and Alexander Kithes (EE'14) couldn't wait to put it all to the test. In preparation for last year's inaugural Imagineering Competition, the two then-sophomores designed, built and tested a low-cost, portable wind turbine in the Binoy K. Singh Imagineering Lab, a gleaming new facility where College of Engineering students pursue their own technological solutions to a wide range of societal challenges. To construct the turbine, they cut out precise wood and plastic components with various power tools in the lab and mated them to electrical components designed to convert mechanical energy from spinning turbine blades into electrical energy to power laptops or household appliances.

"Alex and I had a great time applying physics concepts to calculate how much power we could generate from our wind turbine," says Pollack. "When we finished it, we both felt a sense of accomplishment in that we had successfully designed and engineered something real for the first time. That was definitely an exciting feeling."

"My favorite part of the prototyping process in the Imagineering Lab was actually seeing something that my friend and I had conceived on paper become reality," Kithes recalls. "The profound effect of having, with our own hands, constructed a device that *actually generates clean energy,* really cemented in my mind my desire to become an engineer in the alternative energy sector."

Retaining students during the first two years of arduous foundational courses is a perennial challenge for U.S. engineering schools, but the growing national demand for engineers has prompted many schools to reexamine their instructional methods. At Boston University, engineering student retention has long been well above the national average and is improving—the graduation rate for incoming freshmen rose 20 percent over the past five years. One likely reason is the College's concerted effort to connect actual devices and technologies that move society forward to the concepts explored in the first two years of coursework; enabling freshmen and sophomores to taste the excitement and impact of engineering through experiential opportunities encourages them to stick with the demanding program.

With that goal in mind, the College of Engineering also offers concentrations, minors, study abroad, dual degree and other optional programs that empower students to enhance the core curriculum to reflect their interests and expand their horizons. In addition, the College works to connect freshmen and sophomores with student and faculty advisors, tutors and other resources across campus to help them weather the academic rigors of a world-class engineering program, get the most out of their time at BU and experience a sense of community. Finally, the College frames the entire undergraduate experience as a once-in-a-lifetime opportunity for students not only to cultivate an engineer's skillset, but also to learn how to apply it to improve the world in meaningful ways, from developing more economically viable clean energy technologies to creating more precisely targeted cancer therapies.

In other words, to become Societal Engineers ready to use their engineering skills to take on society's grand challenges.

"Today's high school and college students are interested in contributing to society in a way that's different from other generations," says Professor Thomas D. C. Little (ECE, SE), associate dean for Educational Initiatives. "Recognizing this, the College of Engineering, under Dean [Kenneth R.] Lutchen's leadership, has developed a slew of programs directed toward creating Societal Engineers. These programs address problem solving, communication skills and teamwork, systems thinking, global awareness, entrepreneurial strategies, social consciousness and other key attributes."

As a result, students are more motivated, says Ruthie Jean, director of Undergraduate Programs. "The College's focus on creating Societal Engineers has led to a more inclusive and engaging undergraduate experience," she observes.

Buoyed by experiential learning opportunities, a customizable curriculum and substantial academic support systems—all informed by the Societal Engineer framework—today's College of Engineering incoming freshmen have an excellent chance of becoming tomorrow's graduating seniors.

Opportunities to Move Society Forward

According to the American Society for Engineering Education, active, project-based learning is more effective than lectures in keeping engineering freshmen and sophomores motivated to continue their studies. Taking this message to heart, the College of Engineering curriculum has boosted active learning opportunities in recent years.

"Our students are attracted to doing things and figuring them out later," says Sol Eisenberg, associate dean for Undergraduate Programs. "They prefer learning by doing over a frontal lecture. There's no way to short-circuit the math and science foundation, but you can transmit excitement about engineering through content."

For example, in some sections of the required freshman Introduction to Engineering courses, which focus on engineering analysis and design in different disciplines, students build light-bending photonics devices or learn about acoustics by working with an electric guitar. In another required freshman course, Engineering Computation, students learn selected programming concepts through small projects such as analyzing the performance of a mini wind turbine.

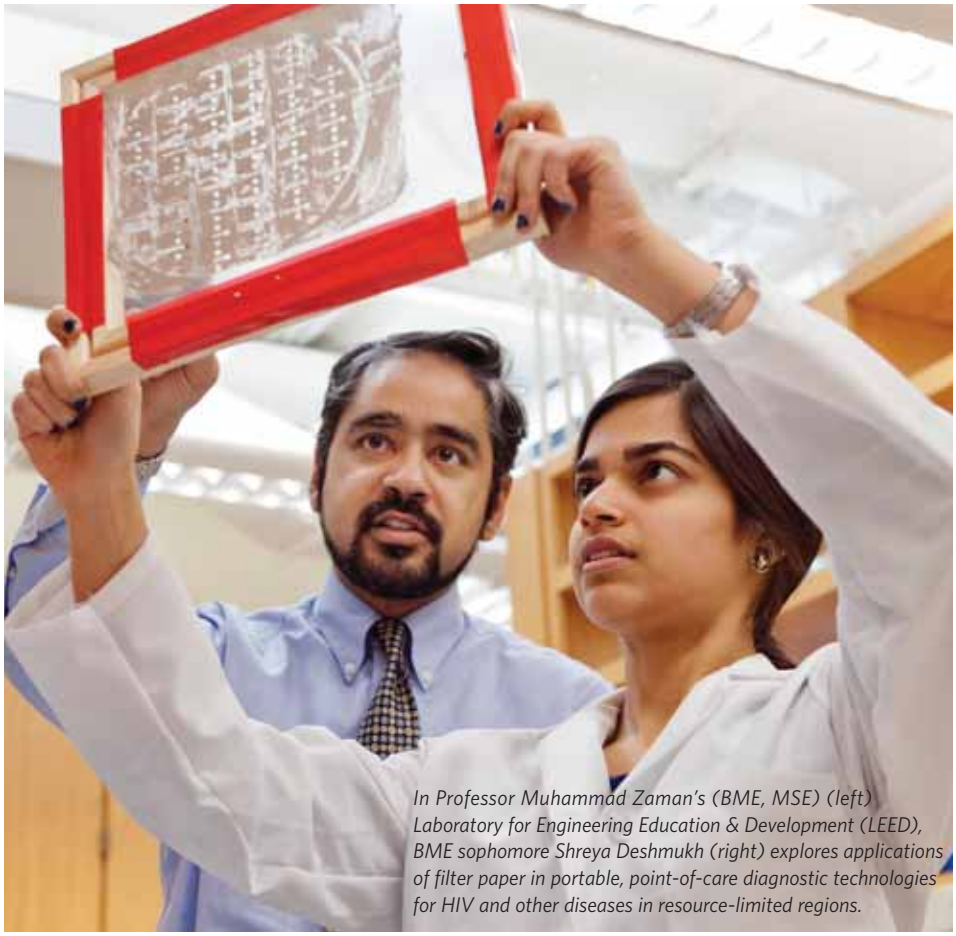
"The more enthusiasm a professor puts into his or her class, especially in attempts to link to real-life applications and connections to other subjects, the easier it is to become passionate about it as a student, too," says Shreya Deshmukh (BME'15).

The sophomore year continues this experiential thread through Engineers in the Real World, a two-year-old program in which accomplished alumni and other professionals provide concrete

STAYING THE COURSE
Experiential learning

Sophomore ***Shreya Deshmukh*** *(BME'15) on how hands-on research in the Laboratory for Engineering Education & Development (LEED) has amplified her excitement about engineering:*

"LEED's research is particularly interesting to me as it is concerned with global health applications, and that is exactly the context in which I hope to apply my knowledge and skills in the future. Through the projects I'm working on, which explore applications of filter paper in portable, point-of-care diagnostic technologies for HIV and other diseases in resource-limited regions, I am getting to do that now. This research not only gives more meaning to the introductory science and math courses I'm taking, but also reinforces what I learn in them."



In Professor Muhammad Zaman's (BME, MSE) (left) Laboratory for Engineering Education & Development (LEED), BME sophomore Shreya Deshmukh (right) explores applications of filter paper in portable, point-of-care diagnostic technologies for HIV and other diseases in resource-limited regions.

KALMAN ZABARSKY

"THE OPPORTUNITY TO CHASE THEIR PASSIONS IN A VARIETY OF EXTRA-CURRICULAR ACTIVITIES REALLY PROVIDES THE ENJOYMENT AND EXCITEMENT THAT ENGINEERING STUDENTS CRAVE."
DAVID HARRIS (ME'15)

President of the BU Rocket Team and one of seven College of Engineering members of the BU Student Satellite for Applications & Training (BUSAT) team, ME sophomore David Harris (right) helped design and build a satellite prototype that the BUSAT team tested in a weeklong series of NASA microgravity flights over the Gulf of Mexico. (Photo courtesy of NASA Reduced Gravity Office)

examples of how they've applied their engineering skills to address specific challenges in diverse fields, from engineering to finance to medicine. Through this program, 16 distinguished professionals addressed students in sections of Engineering Mechanics and Electric Circuit Theory courses last year, presenting real-world problems and asking students to explore how they would approach them before explaining how they ultimately reached solutions.

"Engineers in the Real World was a great opportunity to hear from people who had been in our positions, made it through and became immensely successful in their fields," says Maria Ferreira-Cesar (ME'14). "It was greatly motivating to see what a tremendous impact we as engineers can have and how our hard work pays off in successful, meaningful careers."

Sophomores are also eligible to participate in the Technology Innovation Scholars Program (TISP), in which they may develop and facilitate design challenges for K–12 students in greater Boston and in their hometowns across the country, share the excitement and societal impact of engineering through fun and interactive presentations and mentor local teams in the regional FIRST Robotics competition. Supported by the Kern Family Foundation, TISP awards $1,200 stipends and travel expenses to sophomores, juniors and seniors selected to serve among the College's corps of Inspiration Ambassadors, now 41 strong.

"When they go to K–12 schools and engage kids in hands-on, tangible engineering, they remember and become reinspired themselves," says Gretchen Fougere, associate dean for Outreach & Diversity. "They're learning by teaching content, but remembering why they're slogging through all those difficult courses."

A case in point is Gabriella Stueber (BME'14). "The excitement I see in students' faces when their robot starts to move or when their quantum dots light up energizes me to continue my studies," says Stueber.

Freshmen and sophomores may also pursue hands-on projects with graduate students and faculty in labs throughout the College through a wide variety of undergraduate research programs, or team up with peers in selected student organizations. President of the BU Rocket Team and a participant in the BU Student Satellite for Applications & Training (BUSAT) program, David Harris (ME'15) has helped design and build a satellite prototype that the BUSAT team tested in a weeklong series of NASA microgravity flights over the Gulf of Mexico.

"The opportunity to chase their passions in a variety of extracurricular activities really provides the enjoyment and excitement that engineering students crave," says Harris, who has also worked in the Imagineering Lab to turn his vision of a low-cost sounding rocket for sub-orbital science experiments into reality, garnering first prize in the lab's first Imagineering Competition.

"As engineers, our passion is to actually design and build things—not sit in class all day and do homework," he stresses. "All great engineering minds have a desire to tinker and to touch, to foresee and to build. The Imagineering Lab supports this by giving undergraduates a forum for creativity, and the competition gave me the opportunity to do real engineering early on in my undergraduate studies."

A Customized Curriculum

By offering a variety of concentrations, minors, dual degree, study abroad and other optional programs that build on a solid foundation of required core courses, the College of Engineering empowers undergraduates to pursue their interests and increase their motivation to go the distance.

"We are providing more opportunities for students to add personally relevant texture to their undergraduate experience," says Eisenberg. "Finding their own way to express their interests helps make the required core courses more meaningful."

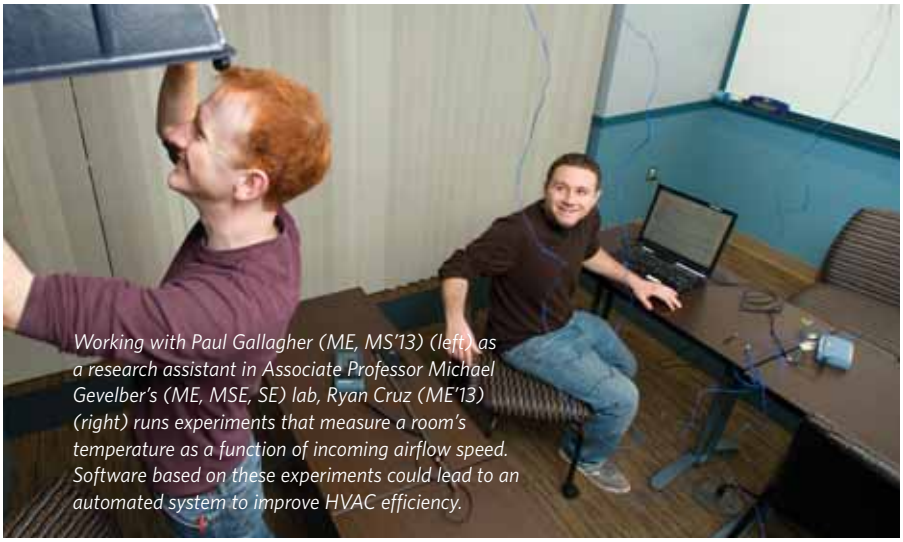
In the past year, the College has added three new opportunities for students to do just that—two study abroad programs, a Technology Innovation concentration and a five-year degree program for aspiring engineer/educators.

The College of Engineering has launched new study abroad sites for second-semester sophomores in Grenoble, France and Madrid, Spain that join existing sites in Dresden, Germany and Tel Aviv, Israel.

All four programs are designed to enable undergraduates to seamlessly incorporate a study abroad experience into their programs without additional cost and time commitment. They also offer students the chance to become immersed in other cultures, further preparing them for technical careers in the global engineering marketplace.

"Studying abroad made me want to continue pursuing engineering because I learned so much more about the field," says

NASA REDUCED GRAVITY OFFICE



Working with Paul Gallagher (ME, MS'13) (left) as a research assistant in Associate Professor Michael Gevelber's (ME, MSE, SE) lab, Ryan Cruz (ME'13) (right) runs experiments that measure a room's temperature as a function of incoming airflow speed. Software based on these experiments could lead to an automated system to improve HVAC efficiency.

STAYING THE COURSE
Meaningful program options

Ryan Cruz (ME'13) *on how the Energy Technologies concentration has inspired and focused him on his studies and career goals:*

"I chose the concentration because the energy field is diverse and offers a lot of opportunities, as many companies are attempting to 'go green.' Coursework and projects—from a summer internship at Babcock Power focused on power plant emissions control to a research assistant position in a professor's lab advancing a new method to optimize HVAC systems to save energy and money—have helped me to find my niche within mechanical engineering. When I graduate, I would ideally like to work with HVAC systems or in energy management and efficiency."

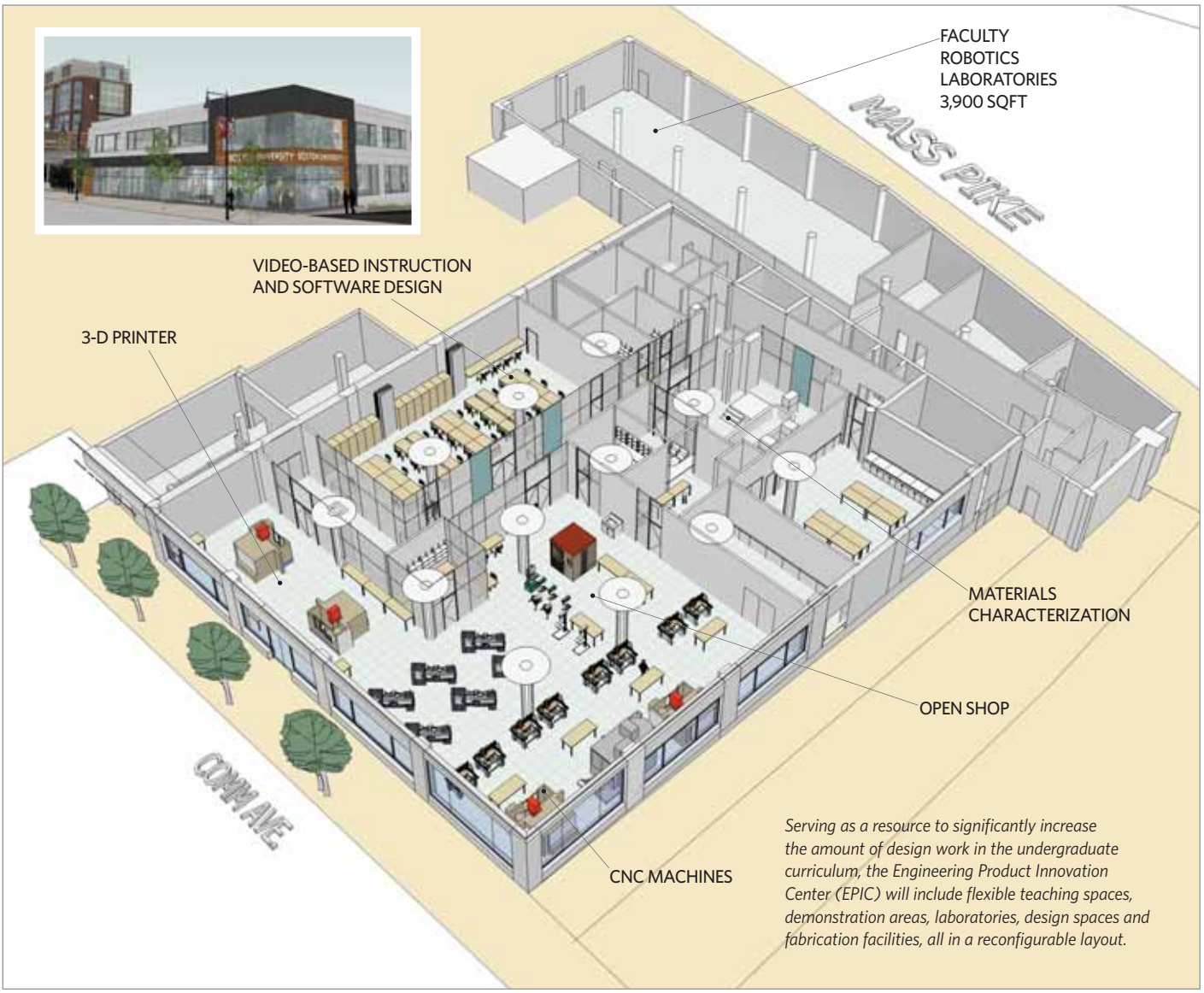
STAYING THE COURSE
A supportive community

Student Advisor **Tristan Campbell (ECE'13),** *on helping freshmen navigate the challenges of their first year on campus:*

"I applied for the student advisor program simply because I understand the challenges that freshmen will face, and wanted to be sure that they are equipped to make the right decisions. For example, one freshman scored poorly on his chemistry exam and arranged an emergency meeting with me. He didn't feel like he could sustain himself in taking on a rigorous curriculum. After our talk, I concluded that he did poorly because he was unaware of the resources at his disposal. He regained his confidence after tutoring sessions because he now understands that he is not alone in his struggles."

Student Advisor Tristan Campbell (ECE'13) (right) with freshman advisee Emily Betrus.

CYDNEY SCOTT



Serving as a resource to significantly increase the amount of design work in the undergraduate curriculum, the Engineering Product Innovation Center (EPIC) will include flexible teaching spaces, demonstration areas, laboratories, design spaces and fabrication facilities, all in a reconfigurable layout.

Gabriel Begun (CE'14), who attended the Grenoble program last spring.

A semester in Dresden helped Maria Ferreira-Cesar realize how well respected and valued an engineering career is throughout the world.

"It reinforced my belief that the world needs more engineers to drive our progress, sustain our lifestyles and protect our planet," she says.

In partnership with the School of Management, the new Technology Innovation concentration instills an entrepreneurial mindset in BU's engineering students, preparing them to recognize and take advantage of opportunities for technical innovations that can lead to viable commercial products, profitable businesses and societal impact. The Technology Innovation concentration joins the College's four other concentrations—Nanotechnology, Energy Technologies, Aerospace Engineering and Manufacturing Engineering—each designed to give students an opportunity to go deep in a specific, timely, leading-edge area without extra coursework.

Kamil Makhnejia (BME'14) chose the Nanotechnology concentration because he was excited about the future of the nanotechnology industry and how other industries could utilize the technology. "This concentration has encouraged me to continue exploring my interests in engineering as well as to continue wondering about technology's marvels," he says.

Finally, the STEM Educator-Engineer Program (STEEP), which starts this fall, allows students to graduate in five years with a BS in their chosen engineering major, an MA in Teaching, and certification to teach science, technology, engineering or mathematics in middle and high schools in 44 states. STEEP aims to populate secondary schools with teachers who are not only proficient in science and math, but also able to connect these subjects to engineering and communicate the excitement of the field to young learners.

"This program will produce a new kind of educator who helps fill the nation's pipeline with young people inspired to improve society through innovative and exciting technologies," says Dean Lutchen.

COURTESY OF WILSON ARCHITECTS

"HAVING BEEN IN THEIR SHOES, I KNEW THAT I COULD RELATE TO WHAT HAS BEEN GOING THROUGH THEIR MINDS AND HELP THEM MAKE THE MOST OF THEIR FRESHMAN YEAR."
EDA ASLANOBA (CE'14)

A Supportive Community

A recent study by the *Journal of Engineering Education* identified three key reasons that engineering undergraduates transfer or drop out: poor teaching and advising; the difficulty of the curriculum; and disconnection to fellow students and faculty. Recognizing these potential pitfalls, the College of Engineering places great emphasis on faculty and peer advising, tutoring, and creating a cohesive on-campus community.

Academic and social support is at the heart of the EK100 Freshman Advising Seminar, which introduces students to BU, the College of Engineering and the field of engineering. Students meet with faculty and student advisors in small group sessions and attend lectures to get acquainted with College of Engineering and BU policies, expectations, opportunities and support services, with topics including career options, study abroad programs and social events.

"EK100 helps College of Engineering students immediately attach with a group and keep them engaged," says Undergraduate Programs Director Ruthie Jean.

Student advisors play an instrumental role for freshmen who need individualized support in navigating through their first year.

"I wanted to be a student advisor because I believed I could be a good mentor to freshmen by providing them as much information as possible to ease their way into college," says Eda Aslanoba (CE'14). "Having been in their shoes, I knew that I could relate to what has been going through their minds and help them make the most of their freshman year."

Meanwhile, freshmen and sophomores who hit stumbling blocks in a particular course or discipline can consult with upperclassmen who have volunteered to tutor that subject.

"I have had plenty of students who did not understand the material in their courses, and I was able to enrich their understanding," says Jarrod Milshtein (ME'13), who covers 25 courses. "Recently a student came in with a section of a chemistry textbook and claimed to understand none of it. I took the book and worked through the text with him, outlining the key points of what he should be learning. By removing some of the technical jargon in the textbook and writing key points on the white board, he was able to grasp the necessary concepts."

When a student continues to struggle or loses interest despite support from EK100, academic advisors and tutors, there is another solution.

"Sometimes we have to help students fine-tune their study skills and prioritization, and sometimes it's just not the right match, says Jean. "If it's not the right match, at least we can help them find another program at BU."

Perhaps the most powerful source of support to College of Engineering students is not a program at all.

"My main motivation to stick with this program has been my classmates," says Elaine Steranka (BME'13). "Boston University has a keen ability to choose engineering students who know how to work hard, yet still enjoy their time in college. We have all become very close over the years through our struggles and have been able to help keep each other afloat through the rough times."

That community spirit extends beyond the student body, observes Ryan Cruz (ME'13): "Though the College does expect a lot from us, the professors have always been there to provide support and guidance."

Another prime motivator to stay the course is the promise of a meaningful and potentially lucrative career.

"I have seen College of Engineering students who have obtained jobs even before they graduate," says Amber Campa (ME'14). "This shows me that although the curriculum is tough, companies know the hard work we have put in and are willing to hire BU students."

A Compelling Future

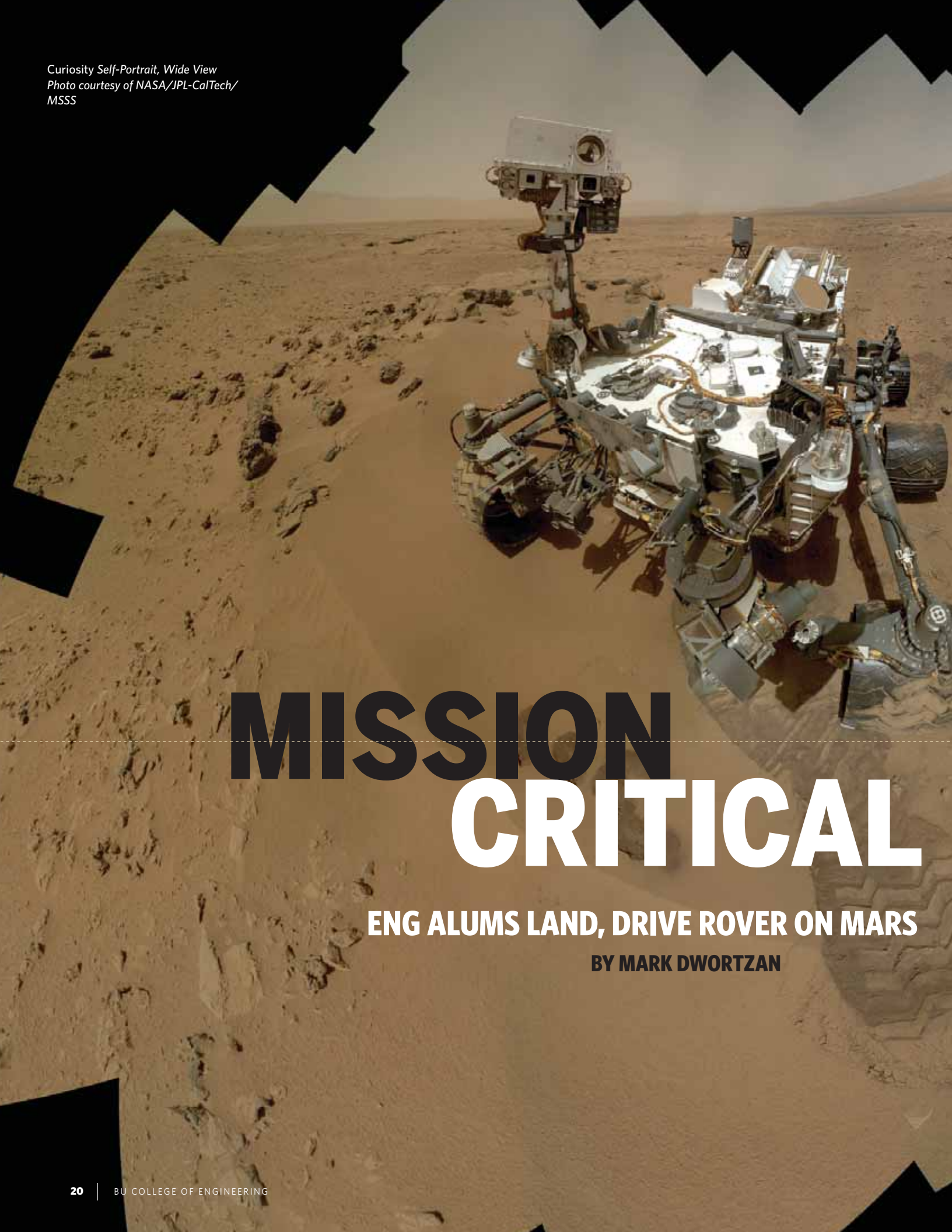
Recognizing the value of experiential learning opportunities in keeping engineering undergraduates engaged in their studies and inspired to complete them, the College of Engineering plans to launch the Engineering Product Innovation Center (EPIC) in the coming academic year. EPIC will serve as a resource to significantly increase the amount of design work in the undergraduate curriculum through stand-alone courses, enhancements to existing courses, and opportunities to collaborate with fellow students, faculty and working engineers from a variety of disciplines.

"By doing this in an interdisciplinary way, we'll have an opportunity to show our budding engineers how design is a common discipline that affects all fields," says Professor Little.

EPIC will include flexible teaching spaces, demonstration areas, laboratories, design spaces and fabrication facilities—all in a reconfigurable layout. Students will have access to advanced machine tools, laser processing equipment, rapid 3-D prototyping tools, intelligent robotics and state-of-the-art software tools. Once EPIC goes live, students will learn everything from product design to prototyping to fabrication to manufacturing and deployment skills that are essential to the innovation process.

"We approach the construction of the EPIC facility with a belief that the reason high school students want to become engineers is that they like to build stuff," says EPIC Director and Professor of Practice Gerald Fine (ME, MSE). "We also believe that engineering design is an important part of engineering education and should be woven into the curriculum starting in the freshman year."

Now weaving into the undergraduate journey four key strands—substantial experiential learning opportunities, meaningful program options, a highly supportive community and an overarching mission to positively transform society—the College of Engineering looks forward to inspiring the Class of 2017 to reach for Commencement and beyond. ■



Curiosity *Self-Portrait, Wide View*
Photo courtesy of NASA/JPL-CalTech/ MSSS

MISSION CRITICAL

ENG ALUMS LAND, DRIVE ROVER ON MARS

BY MARK DWORTZAN

Last August two College of Engineering alumni played crucial, high-profile roles in NASA's Mars Science Laboratory (MSL) mission, the most advanced effort yet to assess whether Mars has ever had an environment capable of supporting life. Anita Sengupta (Aero'98), a senior systems engineer at the Jet Propulsion Laboratory (JPL), helped enable the *Curiosity* rover to touch down safely on the surface of the Red Planet, and Matthew Heverly (MS, ME'05), a mobility systems engineer at JPL, began serving as the rover's lead driver.

ANITA SENGUPTA: LANDING SAFELY

August 5, 2012, 10:24 p.m., Pacific Daylight Time, about 3 p.m. on Mars, seven minutes from touchdown. Encapsulated in a 15.5-foot-diameter, heat-shielded, aerodynamic entry vehicle penetrating the top of Mars's thin atmosphere at a speed of 13,000 miles per hour, the one-ton, compact-car-sized rover has just seven minutes to slow down to two miles per hour so it can land safely on the planet's surface. Any malfunction could cause eight years of preparation and $2.5 billion of U.S. taxpayer money to evaporate in an instant.

Due to a 14-minute communication delay between Earth and Mars, *Curiosity* must land on automatic pilot, with absolutely no input from ground controllers. The next phase, at about seven miles above the surface, is critical: to decelerate from 900 miles per hour (twice the speed of sound on Mars) to 200, the entry vehicle will deploy a 70-foot-diameter, supersonic parachute—the largest and strongest ever flown on Mars, built to withstand 65,000 pounds of force—and then fire eight retrorockets to further reduce its speed to a comfortable two mph. Once jettisoned from the entry vehicle, the rover will converge on its designated landing site on Gale Crater, a vast expanse believed to be an ancient riverbed. But at 60 feet above the surface, another critical event looms. A "sky crane" attached to the rover will lower the vehicle with a 23-foot-long tether, so as to gently deposit it, wheels down, on the surface—then veer off to land at a safe distance away.

At 10:32 pm PDT, just one minute late, the rover lands safely, its parachute intact. Thanks, in more than one way, to Anita Sengupta.

A member of the mission's EDL—that's Entry, Descent and Landing, for the uninitiated—team since 2005, Sengupta helped design the parachute to withstand the extreme aerodynamic environment associated with plummeting through the atmosphere at mach 2.2, the highest ever for a parachute opening on Mars. She also took measures to ensure that the sky crane-assisted touchdown would go smoothly.

"The challenge is that we're landing the biggest and heaviest rover ever with the best precision ever," she explains. "We wouldn't have been able to do so without a sophisticated landing system."

Sengupta's first challenge was to solve a decades-old mystery: why do parachutes deployed on Mars landers rapidly and repeatedly collapse and expand—akin to the skirt of a jellyfish opening and closing—as they plummet through the atmosphere at supersonic speeds, degrading their ability to slow down their cargo and, in some cases, resulting in loss of the parachute?

After two years of wind tunnel tests with small-scale parachutes, Sengupta and her colleagues confirmed her hypothesis that the parachute oscillations were caused by pressure changes resulting from interaction between the turbulent wake generated by the descending entry vehicle and the shockwave at the front of the parachute. They then used this knowledge to design a parachute strong enough to escort the largest and fastest entry vehicle to date through its tortuous supersonic descent.

"For decades, our Mars missions have been relying on the test results from a handful of expensive, high-altitude supersonic parachute inflation tests performed in the early 1970s to provide that the parachute will successfully inflate and remain that way under the high-speed, low-density conditions on Mars," says MSL Chief Engineer Rob Manning. "Anita and her team coupled subscale parachutes in supersonic wind tunnels with state-of-the-art supercomputer simulations to give all of us on MSL confidence that the world's largest supersonic parachute would work on Mars. And it did!"

Holding a small-scale replica of the parachute used in the Mars Science Laboratory mission, Sengupta took questions from BU mechanical engineering students. In October she delivered a Department of Mechanical Engineering seminar before a packed audience.

Sengupta's second challenge was to ensure that hydrazine engine plumes emitted during the low-altitude sky crane maneuver would not damage the rover or bury it with sand and dirt kicked up by the plumes. To assess the likely amount of blowback, she and her team spent two weeks conducting small-scale tests in a vacuum chamber designed to simulate the Mars atmosphere, firing an engine into a sandbox at varying altitudes above the surface.

"We saw there would be a significant amount of ground erosion, so we added dust covers to all rover instruments," says Sengupta. "We also ensured that a sufficient layer of optical paint was in place to protect the rover's thermal system."

"The landing was a complete success; everything went according to plan and was nominal," she adds. "I would have to say MSL has been the highlight of my career so far."

There are likely to be more highlights. As soon as *Curiosity* was safely on Martian soil, Sengupta became the project manager of a quantum physics experiment that may be launched to the International Space Station by 2015. She is also helping to design a spacecraft to search for signs of life on Europa, one of Jupiter's moons.

Throughout her career, Sengupta has drawn on the intellectual foundation she received at the College of Engineering, where she was the student chapter president of the American Society of Mechanical Engineers.

COURTESY OF ANITA SENGUPTA

"I use every single textbook of every class I've ever taken," she maintains, citing fluid mechanics, thermodynamics and experimental design classes as examples. "There's not a course I've taken that I haven't used on the job."

MATT HEVERLY: DRIVING *CURIOSITY*

"We just received telemetry for sol 52," reports Matt Heverly, referring to the previous day on Mars, the 52nd since *Curiosity* landed. "I planned the drive that day and went home to dinner with my family. Today we drove to the edge of a cliff that we couldn't see beyond, and we'll plan what the rover will do tomorrow."

All in a day's work—a 24-hour-and-40-minute Martian day, that is—for Heverly, a robotics specialist and lead driver on a team of 16

To test out commands he plans to upload to Curiosity *later in the day, Matt Heverly (MS, ME'05) and his team practice with a full-scale mockup in the Mars Yard.*

earthbound engineers at JPL who plan *Curiosity*'s activities on the surface of the Red Planet. Each Mars day, the six-wheeled, nuclear-powered rover receives hundreds of uploaded commands (e.g., move two meters straight, turn left, scoop soil) from the team at 9 a.m. local time; starts driving at noon, when the weather is warm enough for safe travel; and at 6 p.m., just before turning in for the night, emails mission control a set of images, scientific measurements and technical details on how well the rover and its various tools and instruments performed. Based on this update, the science team determines where to send the rover next.

Heverly's job is to get the vehicle to go from point A to point B as it maneuvers around rocks, sand dunes, canyons and mountain inclines at a steady clip of 0.1 miles per hour. To make sure the commands will take the rover safely to its destination, the driver team simulates the process in 3-D video on a computer and, occasionally, with a full-scale mockup in the Mars Yard, a testing ground at JPL consisting of different arrangements of dirt, rocks and sand representing Mars surface features.

COURTESY OF MATT HEVERLY

"WHAT FEELS GREAT IS THAT WE SUCCESSFULLY DROVE ANOTHER 100 METERS ON THE SURFACE OF MARS TODAY," SAYS HEVERLY. "I LOVE THAT WE'RE ADVANCING THE STATE OF ENGINEERING AND SENDING MACHINES WHERE HUMANS CAN'T GO."

As I talk to Heverly by phone, it's about 4:34 p.m. on Mars, 1 p.m. PDT. Just as he had for the past 52 days, he arrived at work shortly after 6 p.m. Mars time—40 minutes later on Earth than the day before—just in time to receive the latest downlink from *Curiosity*. Earlier in the mission, he once arrived at 10 p.m., got home by 10 a.m., slept for six hours, picked up his six-month-old and 3-year-old kids from daycare and made dinner.

"They don't understand Mars time," he quips, noting that the constantly jet-lagged team planned to shift to a less demanding schedule after the first three months of the mission.

While the Mars science team and armchair space explorers eagerly await each downlink for signs of life and other new discoveries about the Red Planet, what Heverly finds most exciting about the mission is the ability to control a machine from 120 million miles away.

"What feels great is that we successfully drove another 100 meters on the surface of Mars today," says Heverly. "I love that we're advancing the state of engineering and sending machines where humans can't go."

Since joining JPL's Robotics Hardware Systems Group in 2005, Heverly has helped develop ATHLETE, a six-legged robot with wheels on the end of each leg designed to prospect for ice and hydrogen in lunar craters and maneuver in low-gravity environments; served as a driver for *Opportunity*, the last Mars rover that's still sending back data after seven years of operation; and helped prepare *Curiosity* for its current mission, test-driving different versions of the rover in the Mars Yard to make sure onboard software and hardware worked well together.

"Thanks in large part to his work, we have a very capable rover," says Scott Maxwell, lead driver for Mars rovers *Spirit* and *Opportunity*, and one of *Curiosity*'s 16 rover planners. "We can drive a long way while avoiding obstacles and yet stopping periodically to take pictures, just by flipping a few switches."

According to Maxwell, Heverly is remarkably thorough and prolifically inventive, yet ego-free: "He's a great team player, liberally deflecting credit to his co-workers—one of the nicest, most laid-back guys you're ever going to work with."

After graduating from California Polytechnic State University, San Luis Obispo in his native state, Heverly worked on robotics for a JPL contractor before deciding he wanted a master's degree. At the College of Engineering, he produced a prototype device that could enable a surgeon to perform in vitro heart surgery on a developing fetus, and earned a patent related to the work.

As he continues to serve as tour guide for *Curiosity*'s daily expeditions on Mars and teach mechanical engineering design at the California Institute of Technology, Heverly remains a fountainhead of new ways to advance state-of-the-art robotics.

"We put in a lot of hard work preparing *Curiosity*, and to have it successfully travel on the surface of Mars is so gratifying," he says. "I love the fact that we're pushing the boundaries of what people can do with robots." ■

GAME CH

HANGER

ALUM LINKS ENGINEERING & GOLF COURSE DESIGN

BY MARK DWORTZAN

Most golf course architects have a degree in landscape architecture or turf management, but that didn't stop engineer Mike Nuzzo (Aero'90) from venturing into the field. In fact, his engineering background has been key to his success in designing and improving more than a dozen golf courses since 2000. Applying the most sophisticated design technology in the industry, Nuzzo is using his Boston University engineering education to develop some of the world's most innovative golf courses.

"Our goals are to design and build a golf course that's as fun as possible, can be maintained as easily as possible and can be constructed as efficiently as possible," says Nuzzo, whose firm, Nuzzo Course Design, is based in Houston.

To boost the fun factor, Nuzzo favors large fairways that enable golfers to choose from a wide range of tee locations and types of shots, a stimulating variety of green shapes and hole lengths, and a park-like design that accentuates the beauty of the existing landscape. To streamline course maintenance, Nuzzo fashions highly efficient irrigation and drainage systems and applies consistent construction methods that simplify operations. These methods exploit the natural contours of the land to minimize earth-moving operations and rely primarily on local materials and labor.

Optimizing a golf course to maximize fun, maintainability and efficiency is where engineering comes in. Day by day, as he surveys a course-in-progress, Nuzzo carries a handheld GPS receiver that shows an illustration of the planned golf course superimposed on an aerial photograph. This technology enables him to precisely define and update course boundaries and features and tweak them on the fly as he walks the extent of the course.

That's how, from 2006 to 2008, Nuzzo transformed a 200-acre cattle ranch on the Texas Gulf Coast into Wolf Point, a world-class, 18-hole golf course designed for the owner's personal use. To bring in the fun—an aesthetically pleasing, natural-looking field with large fairways and multishaped greens that promote a wide variety of shots—Nuzzo used his integrated PC/GPS receiver to ensure that everything was situated exactly where he wanted it, and as much of the land as possible—about 100 acres in the end—remained undisturbed.

"Wolf Point is a lot more fun than the typical PGA [Professional Golfers' Association] course, where the fairways are smaller so it's easier to lose balls, the greens are built for the same type of shot (long and high), and everything is so well defined it looks like a puzzle or game board," he explains.

Nuzzo also used his GPS to map existing drainage features and plan an extensive drainage and irrigation piping network to keep turf in ideal condition, thus reducing maintenance costs. Linking pipes to natural swells in the landscape to move water through the network, he minimized the need for piping materials and earth work. To construct the piping network efficiently, Nuzzo used his GPS to determine the precise locations of about 750 rotors used to distribute water across it.

All these measures clearly paid off.

"Most golf courses are built for 5–15 million dollars and cost half a million to 2 million a year to maintain," Nuzzo says. "Wolf Point was built for 3 million and is maintained for a lot less than 500,000 dollars."

"NOT ONLY IS IT PROBABLY THE BEST FIRST COURSE BY A MODERN ARCHITECT THAT I HAVE SEEN, BUT IT IS ALSO A LIVING CASE STUDY FOR THE FUTURE OF GOLF DESIGN AND CONSTRUCTION."

Adam Lawrence, *Golf Course Architecture* magazine

It has also received glowing reviews. In the March issue of *Golf Magazine*, leading golf course architect Tom Doak rated Wolf Point number three in his "Top 10 Discoveries of 2012." According to *Texas Golfer* magazine, "Wolf Point is a revelation." Adam Lawrence, editor of United Kingdom's *Golf Course Architecture* magazine, concurred. "Astounding . . . one of the very greatest courses I have seen . . . full of clever design work," he reported. "Not only is it probably the best first course by a modern architect that I have seen, but it is also a living case study for the future of golf design and construction."

At the heart of Nuzzo's success is his intense passion for the game and its design, says his wife Nancy (SMG'91). "Because golf is always on his mind, ideas can pop in his head at any time, day or night," she says, "from how a routing could be positioned differently to make it more fun to play, to how an irrigation system could be redesigned to be more cost effective."

Nuzzo's fervor for both golf and design goes back to his childhood. As a child, he played the game with his father and designed mini-golf courses around and under furniture in the den of his family's apartment; as a teen he caddied at a club in his hometown of Maplewood, New Jersey. Meanwhile, he cultivated a strong aptitude for engineering and design, leading him to major in aerospace engineering at BU.

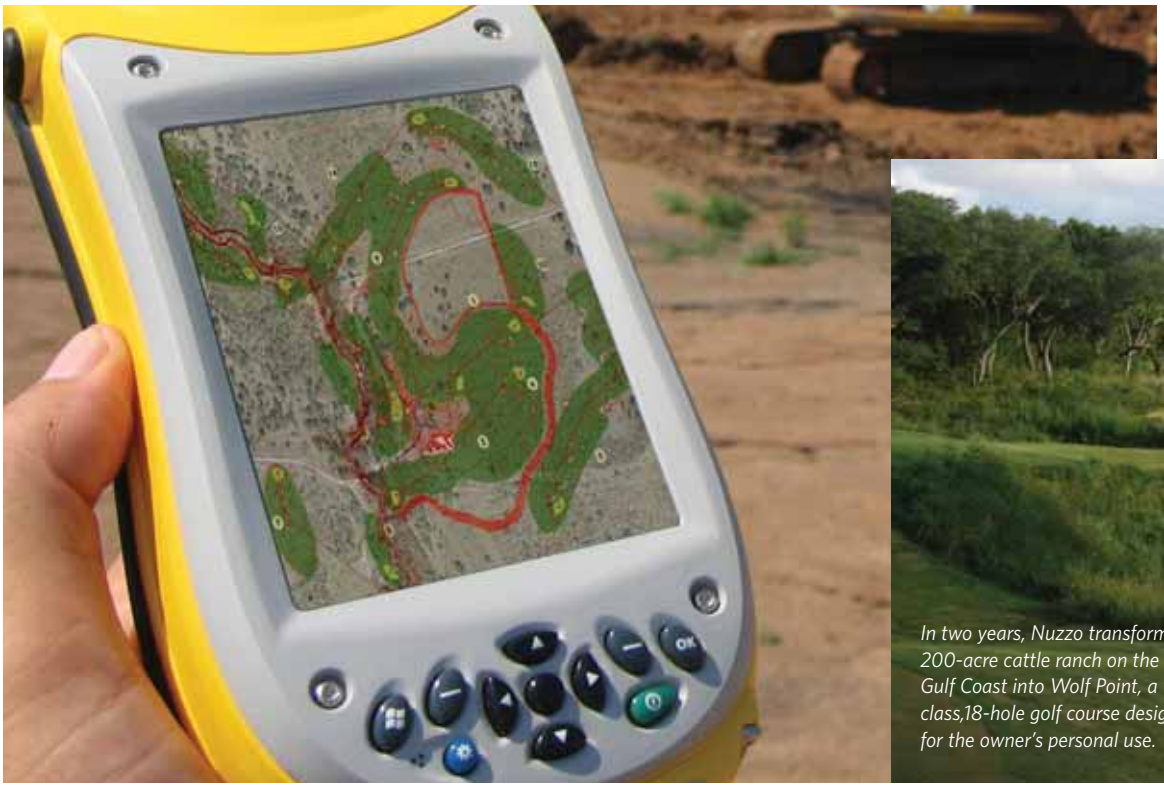
A major highlight of his time at the College of Engineering was learning how to use computer-aided design (CAD), a tool he applied in his senior design project to design an aircraft. His CAD expertise helped him land his first job upon graduation with Becton Dickinson, a global medical technology firm, where he earned a patent for a labware product; it continued to serve him well when he was a lead engineer at Lockheed Martin, the world's largest aerospace company, where he spearheaded the development of a satellite antenna that provides phone and data communication services for up to 60 percent of the world's population. Although he enjoyed the creative challenges of this work, the golf bug proved too compelling to ignore.

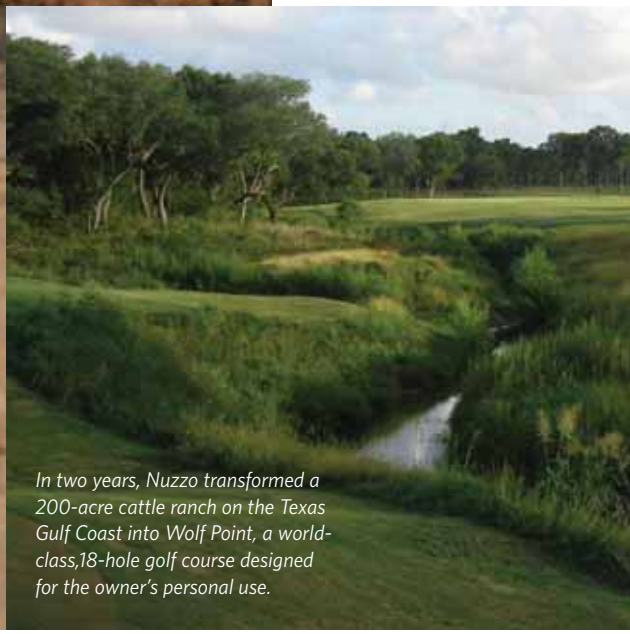
Armed with leading-edge CAD tools he had used at Lockheed Martin, an intimate knowledge of GPS, and solid design and planning skills, Nuzzo, then 32, reinvented himself as a golf course design consultant, supporting architects, builders and existing golf courses and developers. While he initially aspired to become an associate at a golf course architectural firm, his resounding success with Wolf Point convinced him to partner with a construction manager and run his own firm.

His 7- and 10-year-old daughters are no strangers to the fabled Gulf Coast course—while all the golf courses in Houston cater to more advanced players, Wolf Point is the only place Nuzzo can take them to play the game. Sure beats miniature golf in the den. ■

More information on Nuzzo Course Design is available at www.mnuzzo.com.

Nuzzo is using his Boston University engineering education to develop some of the world's most innovative golf courses.





In two years, Nuzzo transformed a 200-acre cattle ranch on the Texas Gulf Coast into Wolf Point, a world-class,18-hole golf course designed for the owner's personal use.

COURTESY OF NUZZO COURSE DESIGN

faculty

THREE ENG PROFS RECOGNIZED WITH PRESTIGIOUS FELLOWSHIPS 30

NEW EDUCATIONAL INITIATIVES DEAN 31

Doctors, Engineers Team Up to Fight Cancer

$9 MILLION NIH GRANT FOUNDS BU-BASED CENTER

BY LESLIE FRIDAY, *BU TODAY*

Imagine a world where a simple mouth swab could predict lung cancer, a blood test could warn of a recurrence of melanoma and a rectal scan could tell if you would benefit from a colonoscopy.

That world is the vision of the Center for Future Technologies in Cancer Care (FTCC), founded here in July with help from a five-year, $9 million grant from the National Institute of Biomedical Imaging and Bioengineering (NIBIB) at the National Institutes of Health. The center will foster collaboration among doctors, engineers, and public health and business professionals at Boston University and elsewhere who hope to develop technology to diagnose, screen and treat a variety of cancers faster, cheaper and better than is done now.

BU is one of three recipients, with Harvard and Johns Hopkins University, of a U54 award, given by NIBIB's Point-of-Care Technologies Research Network.

Catherine Klapperich (BME, ME, MSE), the FTCC director, says this isn't the first time that BU engineers and clinicians have collaborated to tackle major health problems. The FTCC effort is unique, however, in its focus on cancer care. The new center will draw expertise from programs like the W. H. Coulter Translational Partnership Program and the Boston University/Fraunhofer Alliance for Medical Devices, Instrumentation and Diagnostics and will try to develop and commercialize promising prototypes.

"Cathie understands that cancer is not a high- or middle-income country problem; it's a global problem," says Jonathon Simon, director of the Center for Global Health & Development and the School of Public Health Robert A. Knox Professor. "With the increasing longevity of populations in low- and middle-income countries and our ability to manage the infectious disease and maternal mortality burdens, there's just a lot more cancer that comes about because of the age structure of populations, but also because the competing risks on what else is getting people have been diminished."

The center's first five seed projects focus on lung, colon, skin and liver cancers. Avrum Spira (ENG'02), a School of Medicine professor of medicine, pathology, and bioinformatics and a pulmonologist at Boston Medical Center (BMC), has found a way to detect lung cancer at an earlier and therefore far more treatable stage than it is usually found, by studying changes in cells in the windpipes of smokers. With help from the FTCC, he hopes to develop a blood test or mouth or nose swab that could reveal a high risk of lung cancer.

Irving Bigio (BME, ECE) and Satish Singh, a MED assistant professor of medicine and a BMC gastroenterologist, have teamed up to develop a prescreening tool for colon cancer, the second leading cause of death by cancer in the U.S.

Doctors recommend that everyone age 50 and over have a colonoscopy at least once every 10 years, yet compliance is low, Bigio and Singh say, because people dislike the invasive nature of the procedure. Singh notes that only half of those people who undergo a colonoscopy actually have intestinal polyps, and half of those have precancerous polyps. With this in mind, Bigio developed a fiber-optic probe that uses light and a spectrometer to detect potentially cancerous polyps, and thus signal a real need for a colonoscopy. FTCC funding will advance their research, and if it's successful, help develop a prototype that is disposable and affordable.

Klapperich herself is working with San Francisco–based Wave 80 Biosciences to develop a blood test to detect liver cancer. The researchers are designing a cartridge that would separate the nucleic acid RNA from blood or plasma samples and use isolated nucleic acid to flag liver cancer, which kills more than 20,500 people yearly in the U.S., according to the American Cancer Society.

Rhoda Alani, MED's Herbert Mescon Professor and Chair of dermatology, chief of BMC's department of dermatology, and one of four NIBIB co-principal investigators, hopes to develop a similar technology with colleagues from the University of Texas at Austin that will analyze RNA within patients' blood samples to determine the likelihood of a recurrence of melanoma, an aggressive form of skin cancer discovered yearly in more than 76,000 people in the U.S., according to American Cancer Society figures.

The center's fifth seed project, a collaboration between MIT and Michigan State University called My LifeCloud, is a cell phone–based system aimed at empowering patients at risk for colorectal cancer—particularly the African American population, which the American Cancer Society says has the highest incidence of, and mortality rate from, colorectal cancer of all racial groups in the U.S.

Over the five-year NIBIB grant period, Klapperich says the center will encourage several new proposals, weed out a few and provide funding for an annual summer innovation fellowship to transition lab research to a working prototype.

The grant will also allow another NIBIB co-principal investigator, **Bennett Goldberg (Physics, BME, MSE)**, director of the Center for Nanoscience & Nanobiotechnology, to lead training workshops and informal meetings at BU and around the country for students, clinicians and faculty interested in an interdisciplinary approach to tackling cancer.

The other two NIBIB co–principal investigators are David Seldin, a MED professor of medicine and microbiology and BMC's chief of hematology-oncology, and **Arthur Rosenthal (BME)**, director of the Coulter Translational Partnership Program.

Franklin Huang, a fellow in the department of medical oncology at the Dana-Farber Cancer Institute, will guide the public health side of the center's pursuits, determining population needs and assessing which advances might have the greatest impact. "One criterion for screening technology," says the CGHD's Simon, "is that the movement forward of science should to the greatest extent possible benefit the largest numbers of people."

Klapperich echoes Simon's objective to do the greatest good. As engineers, she says, she and her colleagues could sit around and "impress each other with the stuff that we made," or they could apply their expertise in ways that will do the greatest good. ■

Top left: Catherine Klapperich (BME, ME, MSE), the FTCC director, will lead BU's effort to fight cancer by teaming doctors with engineers. (Photo by Kalman Zabarsky.)

Top right: Rhoda Alani, MED's Herbert Mescon Professor and Chair of dermatology and chief of BMC's dermatology department, hopes blood samples are the key to early detection of a melanoma recurrence. (Photo by Vernon Doucette.)

Bottom: Irving Bigio (BME, ECE) demonstrates how a fiber-optic probe can read tissue samples. (Photo by Chitose Suzuki.)

Three ENG Profs Named National Academy of Inventors Charter Fellows

The National Academy of Inventors (NAI) has elected Professors **James Collins (BME, MSE, SE), Mark Grinstaff (BME, MSE)** and **Theodore Moustakas (ECE, MSE)** as Charter Fellows, a high professional distinction that recognizes academic innovators who have created or facilitated outstanding inventions that have made a tangible impact on society—and have been a named inventor on at least one patent issued by the U.S. Patent and Trademark Office (USPTO).

They are among 98 innovators to receive this honor, representing 54 prestigious research universities and nonprofit research institutes and more than 3,200 U.S. patents. The new Fellows include eight Nobel Laureates, two Fellows of the Royal Society, 12 presidents of research universities and nonprofit research institutes, 50 members of the National Academies, 11 inductees of the National Inventors Hall of Fame, three recipients of the National Medal of Technology and Innovation, four recipients of the National Medal of Science and 29 AAAS Fellows.

Collins, Grinstaff and Moustakas were recognized for research that has resulted in several high-impact inventions.

A pioneer in both synthetic and systems biology, Collins has developed innovative ways to design and reprogram gene networks within bacteria and other organisms to attack tumors, direct stem cell development and perform other desired tasks that could bring about clean energy solutions, cheaper drugs and more effective treatments of antibiotic-resistant infections. His antibiotics research was recently recognized by the National Academy of Sciences' Institute of Medicine, which elected Collins as one of 70 new members. Also a trailblazer in efforts to improve function of physiological and biological systems, Collins has spearheaded several new medical devices such as vibrating insoles to improve balance in elderly people and a device to treat stroke-induced brain failure.

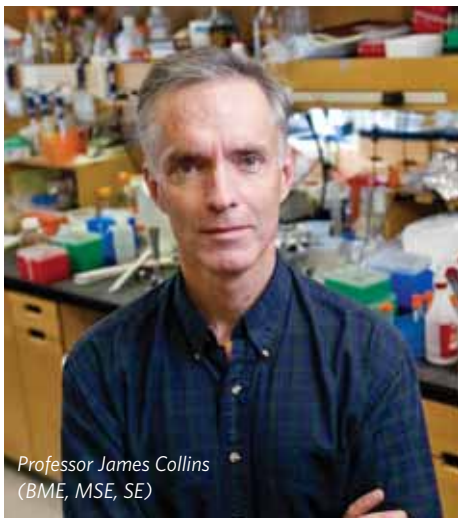
Grinstaff has pursued highly interdisciplinary research in biomedical engineering and chemistry, aimed at elucidating underlying fundamental chemistry and engineering principles and applying them to develop new materials and devices for clinical applications. His recent inventions include a unique material and drug delivery mechanism that could pave the way for implants that release a drug at a designated rate for months; and a new drug delivery device for the prevention of lung tumor recurrence after surgical resection.

Moustakas has pioneered the nucleation steps for the growth of gallium nitride on sapphire and other substrates, an essential process for the manufacture of blue LEDs, which are widely used in solid state lighting applications; and developed highly efficient, deep ultraviolet (UV) LEDs, which are expected to provide environmentally friendly water and air purification.

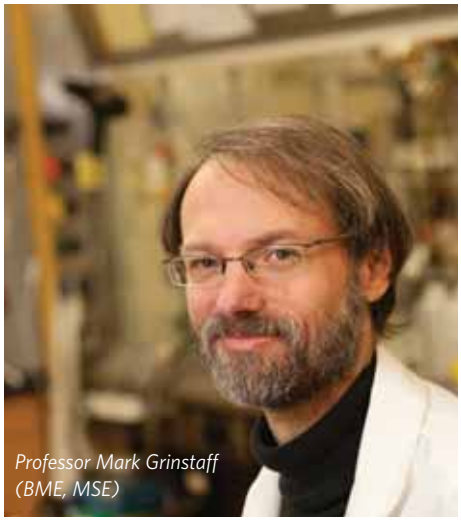
The three College of Engineering faculty members were inducted as Fellows by the U.S. Commissioner for Patents, Margaret A. Focarino, during the Conference of the National Academy of Inventors on Feb. 22 in Tampa, Florida.

The NAI Fellows Selection Committee was comprised of recipients of National Medals, a National Inventors Hall of Fame inductee, 14 members from the National Academies, senior officials from the USPTO, the American Association for the Advancement of Science, the Association of University Technology Managers (AUTM) and the United Inventors Association, and leaders from several research universities. The mission of the NAI is to honor academic invention; recognize and encourage inventors; enhance the visibility of university and nonprofit research institute technology and innovation; encourage the disclosure of intellectual property; educate and mentor innovative students; and translate the inventions of its members to benefit society.

Barbara Gilchrest, professor and chair emerita of the Department of Dermatology at Boston University School of Medicine and Boston Medical Center, was also elected as an NAI Charter Fellow. ■



Professor James Collins (BME, MSE, SE)



Professor Mark Grinstaff (BME, MSE)

Professor Theodore Moustakas (ECE, MSE)

KALMAN ZABARSKY

Xue Han Receives NIH Director's New Innovator Award

Assistant Professor **Xue Han (BME)** has received a 2012 National Institutes of Health (NIH) Director's New Innovator Award, which supports exceptionally creative, early career researchers pursuing highly innovative projects with the potential to transform their field of endeavor and bring about improved health outcomes. Chosen from hundreds of applicants from across the U.S., Han and 50 other award recipients were announced at the eighth annual NIH Director's Pioneer Award Symposium on September 13.

Assistant Professor Xue Han (BME)

The award provides up to $1.5 million in funding for five years and will support Han's efforts to develop a novel method to study the functions of biomolecules in the brain. The method, which uses nanoscale robots to safely probe a variety of molecules, peptides and proteins in intact brains with pulses of visible light, could open up new frontiers in basic molecular and systems neuroscience, drug development and side-effect assessment.

Han develops and applies high-precision genetic, molecular, optical and electrical tools and other nanotechnologies to study neural circuits in the brain. By using light to momentarily activate or silence individual brain cells, she and her research team seek to identify connections between neural circuit dynamics and behavioral phenomena such as movement, attention, memory and decision-making. Establishing such connections could improve our understanding of cognitive functioning and lead to new treatments for Parkinson's disease, schizophrenia, attention deficit disorders and other neurological diseases.

Han was also recognized recently as a Pew Scholar in the Biomedical Sciences, Sloan Research Fellow and Peter Paul Fellow. ■

Thomas Little Appointed Associate Dean for Educational Initiatives

Dean Kenneth R. Lutchen has appointed Professor **Thomas D.C. Little (ECE, SE)** the College of Engineering's associate dean for Educational Initiatives. Little will be responsible for designing, overseeing, catalyzing and implementing new and existing College-wide and cross-college or school educational initiatives that involve innovation in curriculum design or course delivery in undergraduate, graduate and professional education programs.

"Tom has expertise and passion for emerging educational technologies and digital education methodologies that are anticipated to radically impact engineering education," said Lutchen. "As associate dean, he will advance new programs with other schools and colleges at BU, continue to advance our professional master's programs, oversee innovative faculty teaching programs and help the College navigate the impact of digital technologies on engineering education."

"It's an exciting time to be involved in education," said Little, who has served as associate chair of both undergraduate and graduate studies in ECE. "Students now enter the University adept with personal media devices and with expectations of constant connectivity to social networks, search engines, streaming media and global information resources and peers. Like other societal conventions in transformation, there is a wonderful opportunity for engineering education to adapt to these changes to enhance and enrich the outcomes of our program."

Thomas D.C. Little (ECE, SE)

To make the most of that opportunity, Little will draw on extensive experience in research, outreach and entrepreneurship.

"TOM HAS EXPERTISE AND PASSION FOR EMERGING EDUCATIONAL TECHNOLOGIES AND DIGITAL EDUCATION METHODOLOGIES THAT ARE ANTICIPATED TO RADICALLY IMPACT ENGINEERING EDUCATION."

His research explores the intersection of networking, free-space optical communications and the "anywhere" computing that they enable. For example, he is principal investigator and associate director of the NSF Smart Lighting Engineering Research Center, where his work centers on the adaptation of novel LED-based materials, devices and systems for the support of health, productivity and energy benefits. He is also a senior member of the IEEE and a member of the Association for Computing Machinery.

A past winner of the College of Engineering Faculty Service Award, Little has participated in outreach activities such as the BU Summer Challenge Program, Summer Pathways and the College of Engineering UDesign Program. Named a Kern Faculty Fellow in 2010 for his work in developing innovative ways to stimulate the entrepreneurial mindset among undergraduates, he is a successful entrepreneur and has served as an advisor to ParkWhiz, Cantina Consulting, ByteLight and other companies. ■

FACULTY

› Assistant Professor **Lorena Barba** (ME) was selected as one of 72 outstanding, innovative early career educators from U.S. engineering programs to participate in the National Academy of Engineering's fourth annual Frontiers of Engineering Education Symposium on October 14–17 in Irvine, California. Barba's innovative educational approaches include "flipping the classroom" and posting the College of Engineering's first course on iTunes U.

› **Timothy Alan Barbari**, the former dean of the Graduate School of Arts and Sciences and associate provost for research at Georgetown University, was appointed to the new position of associate provost for graduate affairs. Barbari, who has served as a bioengineering, chemical engineering and physics faculty member at various universities in the past 25 years, will hold an appointment in the Biomedical Engineering department.

› A special memorial session of the 1st Underwater Acoustics Conference will be dedicated to Professor **William Carey** (ME), a leading researcher in the field who died last July. The conference takes place June 23 to 28 on the Greek island of Corfu.

› Associate Professor **Luca Dal Negro** (ECE, MSE) has received a two-year grant for $379,989 from the Air Force Office of Scientific Research for research aimed at creating novel, silicon-based light sources for on-chip, optical communications. His work could help bring about low-cost, mass-produced optoelectronic devices that improve the way computer chips communicate with each other.

› Assistant Professor **Douglas Densmore** (ECE, BME) was named as a Hariri Institute 2012–2014 Junior Faculty Fellow, along with four other BU faculty members. The program was established to recognize outstanding junior faculty at BU working in diverse areas of the computational sciences, and to provide focal points for supporting broader collaborative research in these areas at BU and beyond. Densmore was featured in the August 17 issue of *ACS Synthetic Biology*.

› Professor **James A. Hamilton** (BUSM, BME) was elected to the Massachusetts Academy of Sciences, a prestigious community of scientists, engineers, physicians and others focused on science and science education in the commonwealth.

› The National Science Foundation has awarded Professor **Janusz Konrad** (ECE), Associate Professor **Prakash Ishwar** (ECE, SE) and collaborators at the Polytechnic Institute of New York nearly $800,000 for electronic device security research. Konrad and Ishwar will examine how hand and body gestures can be used for authentication.

› Associate Professor **Elise Morgan** (ME, BME, MSE), a leading researcher in orthopaedic biomechanics and mechanobiology, received the 2013 Kappa Delta Young Investigator Award from the American Association of Orthopaedic Surgeons. Bestowed for outstanding manuscripts that focus on basic and/or clinical research related to the musculoskeletal system, the award recognizes high-impact, highly significant research in orthopaedic surgery.


Harold Park

› Assistant Professor **Harold Park** (ME, MSE) received the 2012 Sia Nemat-Nasser Early Career Award from the Materials Division of the ASME at the ASME International Mechanical Engineering Congress and Exposition in Houston in November. The award recognizes research excellence in experimental, computational and theoretical mechanics and materials by young investigators.

› The Defense Advanced Research Projects Agency (DARPA) awarded Associate Professor **Siddharth Ramachandran** (ECE, MSE) and collaborators at MIT Lincoln Laboratory and OFS-Fitel with a grant for about $800,000 to continue studying optical vortices, which could lead to advances in telecommunications and other fields.

› Professor **Alexander Sergienko** (ECE) has received a $1.3 million grant from DARPA to develop secure quantum cryptographic communication technology. The funding is part of a $4 million grant shared with researchers at the University of Maryland, Baltimore, and the University of Rochester.


Assistant Professor Cara Stepp (SAR, BME), a 2012 Peter Paul Professorship recipient, in her Sargent College lab, with Alan Pacheco (ENG'12)

› Assistant Professor **Cara Stepp** (SAR, BME) is one of four young scholars at BU to be recognized with a Peter Paul Professorship, which provides $40,000 in research funds annually for three years to outstanding BU researchers and educators. Stepp helps stroke victims and other patients who have difficulty swallowing by having them play video games with their necks, all to foster faster motor learning than traditional therapy does.

STUDENTS & ALUMNI

› Cofounded by **Aaron Ganick** (ECE'10) and **Daniel Ryan** (ECE'10), Cambridge startup ByteLight obtained $1.25 million in funding and advanced a plan to commercialize technology that turns LED lights into "GPS-like" indoor-positioning systems. The technology could enable people, based on their location, to get directions inside a building or notification of discounts in a store. Their work was profiled on Wired.com in January.

› **Alonso Holmes** (Aero'12), **Patrick Walsh** (ME'12) and Ethan Sherr (CAS'12) have created an app called "Levr" that helps businesses promote in-store offers by putting them in front of a wide mobile audience. Levr is available at www.levr.com.

› **Kangping Hu**'s (ECE'13) Undergraduate Research Opportunities Program (UROP) poster paper took first place out of 219 participants at the 15th Annual BU Undergraduate Research Symposium in October. Hu's work explores the effects of wave-particle interactions in the ionosphere, which has implications for wireless communications and remote sensing.

› PhD student **Amira Hussein** (ME) presented a poster of her research


Amira Hussein

advancing understanding of the biomechanics of spine fractures at the annual meeting of the American Society for Bone and Mineral Research that won her one of 57 Presidential Poster Awards. She also received a $500 Force and Motion Foundation Travel Scholarship.

› **Tianqiang Liu** (ECE, MS'11) and **Meng Wang** (ECE, MS'12), BU cofounders of Orbeus, a joint BU-MIT alumni startup offering services for detecting, recognizing and tagging faces as well as recognizing scenes in any photo, have released a new Application Programming Interface, ReKognition.com, that allows developers to test the platform on websites and mobile apps.

› **Harrison Macris** (ME'09), **Devin Maloney** (ME'09) and **Aleks Zosuls** (BME'01) launched Macris Industries, a new Connecticut-based company that develops harsh environment products for consumer, commercial and military markets. This spring they are releasing new underwater LED lights that can withstand extreme environmental conditions and provide brighter, more uniform output than competitors' products.

› **Huan-Yu Wu** (ECE, MS'10) develops the recognition and translation algorithm for Waygo, an app that instantly translates Chinese to English via an iPhone when the iPhone camera is pointed at the text. Wu is part of a four-man startup called Translate Abroad, which received high praise for Waygo at the Global Mobile Internet Conference—Silicon Valley last October. The app took home top honors and $5,000 in the event's appAttack contest, beating out over 200 competitors.

› **Paul Trunfio** (ENG'89) was elected as a Fellow to the 2012 Massachusetts Academy of Sciences, a prestigious community of scientists, engineers, physicians and others focused on science and science education in the commonwealth.

— Mark Dwortzan, Rich Barlow, Sneha Dasgupta, Rachel Harrington and John O'Rourke

CLOCKWISE FROM LEFT: KALMAN ZABARSKY, CYDNEY SCOTT

Bifano, Densmore and Morgan Win Faculty Awards

The College of Engineering has announced the 2012–13 recipients of three prestigious annual awards: the Distinguished Scholar Award—Professor Thomas Bifano (ME, MSE); the Distinguished Faculty Fellow Award—Associate Professor Elise Morgan (ME, BME, MSE); and the Early Career Research Excellence Award—Assistant Professor Douglas Densmore (ECE, BME).

DISTINGUISHED SCHOLAR

The Distinguished Scholar Award honors a faculty member engaged in outstanding, high-impact research, and provides the recipient with a public forum to discuss and showcase research before the Boston University academic community.

Professor **Thomas Bifano**'s research focuses on the design and manufacture of micro-electro-mechanical systems (MEMS) in optical applications. For more than a decade, Bifano has developed deformable mirrors that are widely used to compensate for optical aberrations in telescopes and microscopes. His "adaptive optics" technique uses MEMS technology—electrostatic actuators and flexible layers of silicon—to shape the mirrors precisely and to bring images of everything from planets to retinal cells into sharper focus, all at a competitive cost.

In his public lecture scheduled for the spring semester, "Shaping Light: BU deformable mirrors untwinkling the stars and deblurring our eyes," Bifano will describe his efforts at BU and at Boston Micromachines Corporation (as founder and CTO) to design, fabricate and control MEMS deformable mirrors for adaptive optics applications.

Bifano has served as a BU professor of mechanical engineering for 25 years, chair of the Manufacturing Engineering department from 1999 to 2006, and chair of the University Research Council from 2008 to 2011. He directs the BU Photonics Center, where since 2006, he has led programs for education, research and development of advanced photonic device prototypes for commercial and military applications.

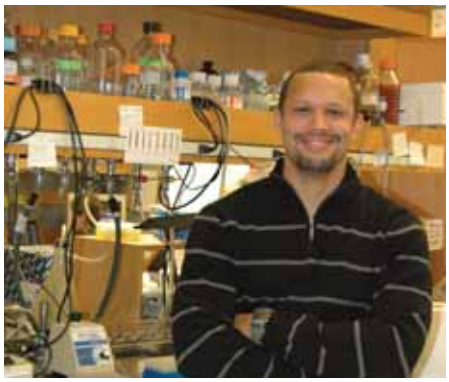
Associate Professor Elise Morgan (ME, BME, MSE)

DISTINGUISHED FACULTY FELLOW

The Distinguished Faculty Fellow Award recognizes mid-career faculty members who have made significant contributions to their field and provides $20,000 a year for five years to support their research.

Associate Professor **Elise Morgan** has worked to advance our understanding of the role of the mechanical function of tissues and organs in skeletal health, repair and development, with the ultimate goal of pinpointing causes and treatments for osteoporosis, osteoarthritis, poor bone healing, and other diseases and conditions. She joined the College of Engineering faculty in 2003.

Morgan studies the interplay among the mechanical behavior, structure and biological function of tissues. Drawing on methods from engineering mechanics, materials science, and cell and molecular biology, and combining experimentation and computational modeling, Morgan's lab investigates how mechanical factors contribute to the development, adaptation, failure and regeneration of bone and cartilage. Current projects include using mechanical stimulation to promote bone regeneration, the biomechanics of spine fractures and bone healing, and noninvasive diagnostics of bone healing.



Assistant Professor Douglas Densmore (ECE, BME)

Professor Thomas Bifano (ME, MSE)

EARLY CAREER RESEARCH EXCELLENCE

The Early Career Research Excellence Award celebrates exemplary, tenure-track faculty and their significant, high-impact research accomplishments within 10 years of receiving their PhD.

Assistant Professor **Douglas Densmore** has been a College of Engineering faculty member since September 2010. Combining computer science, electrical engineering and systems biology ideas, he develops automated tools for the specification, design and assembly of synthetic biological systems. His published tools, Clotho and Eugene, have gained widespread acceptance in the synthetic biology community, and the concepts behind them are explored in the recently published *Design and Analysis of Bio-Molecular Circuits*, which he co-edited.

At BU, Densmore was named the first Reidy Family Career Development Professor during the 2010–2011 academic year, and a junior faculty fellow of the Hariri Institute for Computing and Computational Science & Engineering in 2012. ■

BOTTOM RIGHT: KALMAN ZABARSKY

alumni

WE WANT TO HEAR FROM YOU! SEND YOUR CLASS NOTES SUBMISSIONS TO ENGALUM@BU.EDU OR VISIT WWW.BU.EDU/ENG/ALUMNI.

Paul Karger (ENG'00), Dean Kenneth R. Lutchen, Rao Mulpuri (ENG MS'92, PhD'96) and Peter Cocolis (ENG'64)

CYDNEY SCOTT

ENG Grads Receive Distinguished Alumni Awards

The College of Engineering celebrated its alumni and announced the 2012 Distinguished Alumni Awards at a September 20 ceremony featuring a champagne toast, buffet dinner, keynote address by Associate Professor Catherine Klapperich (BME, MSE) and commanding views of the city from the top of Boston University's Student Village 1. The awards recognize individuals who have made significant contributions to their alma mater, community and profession.

Peter Cocolis (ENG'64), former senior director of Business and Government Affairs at Boeing, Air Force Lieutenant Colonel and negotiator in the Strategic Arms Reduction Talks, received the **Service to Alma Mater** award, which honors alumni who have enhanced the College of Engineering's stature through voluntary service to BU.

Cocolis has served as a member of the BU Alumni Club of Washington, D.C., regularly meeting with students and assisting them with career advice; and as president of the Cape Cod and Islands BU Alumni Network. He has also collaborated with the College of Engineering Career Development Office, reviewing resumes with students and preparing them for interviews.

Paul Karger (ENG'00), co-founder and managing partner of his own investment firm, Twin Focus Capital Partners, and a former vice president at Paine Webber, received the **Distinguished Young Alumni** award, which honors outstanding alumni within ten years of graduation for outstanding service to their profession or community.

Within a few years of founding Twin Focus, he was named #7 on the *Institutional Investor News* "20 Rising Stars—Wealth Management" list. Twin Focus has grown to a 15-person team that manages over $1.5 billion in assets for a select group of ultra-high-net worth families, individuals and institutional investors. The product of an economically disadvantaged upbringing, Karger has taken major leadership roles or contributed funds to several organizations seeking to empower disadvantaged children to lead healthy, productive lives.

Rao Mulpuri (ENG MS'92, PhD'96), founder and CEO of Soladigm, an emerging technology company that makes "smart windows," and a member of the Dean's West Coast Alumni Leadership Council, received the **Service to the Profession** award, which honors alumni whose work has significantly contributed to the advancement of their profession and brought them recognition within their field.

Soladigm's highly energy-efficient dynamic glass switches from clear to tinted on demand to reflect or admit sunlight, resulting in significant energy cost savings and environmental benefits. One of the world's biggest glass manufacturers, Guardian Industries, is partnering with Soladigm to introduce its Dynamic Glass in a range of applications. In 2010, GE selected Soladigm as one of 12 winners in their first GE Ecomagination Challenge, beating out 3,800 ideas from 150 countries for $200 million in funding.

top, left:
Several ENG alums and family members attended the awards ceremony at the top of Boston University's Student Village 1.

top, right:
Foreground: BU Trustee Ron Garriques (ENG'86) and Assistant Dean for Development & Alumni Relations Bruce Jordan.
Background: Associate Professor Ted de Winter and Roger Dorf (ENG'70)

right:
Lorraine Cocolis (SAR'63), Peter Cocolis (ENG'64) and Cheryl Armstrong (ENG'70)

Another major BU Alumni Weekend event for College of Engineering alums, the College of Industrial Technology Class of '62 50th Reunion Celebration, was held on September 22 at the Singh Imagineering Lab. The College of Industrial Technology was renamed the College of Engineering in 1964. Shown here are CIT alums Tom Melvin and Richard Coco.

Chase Edmunds (ENG'08) and Julia Ridgway (SED'07) with BU mascot Rhett, the Boston Terrier, at a BU-BC hockey pregame reception in November. The Terriers defeated the Eagles, 4-2.

TOP PHOTOS: CYDNEY SCOTT

Want to earn an ENG T-shirt? Send your class notes submissions to **engalum@bu.edu** or visit **www.bu.edu/eng/alumni**. Contributors of all published notes receive a red BU Engineering T-shirt!

1989

Mary Lundquist, MS, West Hartford, Connecticut
Mary was appointed Farmington High School's new dean of students and named Farmington's 2011–2012 Teacher of the Year. She had previously served as a math teacher and department head at the school since 1995, overseeing an increase in student performance and enrollment in higher-level math courses.

1992

Diana Joch, BS, Centreville, Virginia
Diana received the Distinguished Service Award at the annual conference of the Society of Women Engineers. Joch is a systems engineer with Northrop Grumman's Information Systems sector, where she is currently the software release manager and test director for the Modernized Integrated Database program.

1995

Hilda L. Gigioli, MS, Maryland
Hilda has become the first information technology specialist to lead the Philippine Association of Metropolitan Washington Engineers (PAMWE), one of Metro Washington, D.C.'s most active Philippine-American organizations. She has also served as president of the prestigious District of Columbia Council of Engineering and Architectural Societies.

Husam Nazer, BS, Beverly Hills, California
A member of the Dean's West Coast Leadership Council, Husam was hired as an equities portfolio manager and partner in DoubleLine Equity LP. He previously served as an equities portfolio manager at the investment firm TCW. DoubleLine employs more than 80 people and manages more than $53 billion in asset allocation, bond and stock strategies.

1997

Chris Nichols, BS, Burbank, California
Chris Nichols and his wife Mora are proud to announce that their son Grady John Nichols arrived safely on January 24, 2012. Grady weighed in at 6 pounds, 8 ounces and measured 19.5 inches long. Big sister Grace couldn't be happier! Chris works as manager of Coating Operations for the M.C. Gill Corporation.

Woosung (Calvin) Choi, BS, Massachusetts
The Watertown Evangelical Church has appointed Woosung as its new pastor. After working as an engineer, he sensed a call to ministry, and subsequently earned a MDiv at Westminster Theological Seminary in Philadelphia and a post-graduate degree in homiletics at Gordon-Conwell Theological Seminary. He is completing PhD work in homiletics at London School of Theology.

2002

Navroop Mitter, BS, Reston, Virginia
Navroop recently achieved notoriety on Twitter, other social media and ABC as "the man in the pink turban" after he attended a press conference at the White House where he stood between President Obama and Vice President Biden. Previously an information security specialist at Accenture, he is now a co-founder and CEO of Gryphn Corporation, which focuses on mobile device security.

2004

Matthew Hunter, MS, East Granby, Connecticut
Matthew has been named provisional executive director of Bath Electric Gas and Water Systems. He has worked in the Coast Guard as an engineer, manager and director, and in the private sector for Osram Sylvania, Spincraft and, most recently, Goodrich Corporation.

Remembering Professor Emeritus John W. Brackett

Professor Emeritus John W. Brackett (ECE), a College of Engineering faculty member since 1987, died at Dartmouth Hitchcock Medical Center in New Hampshire on September 9 after a brief illness. A memorial service was held on November 9 at Boston University's Marsh Chapel.

Brackett served as professor of computer systems engineering in the College of Engineering and as a visiting professor in the Graduate School of Management, teaching graduate courses in systems and software requirements definition, software architecture for distributed systems, and information technology project management. His research focused on software engineering, software requirements definition, object-oriented testing and rapid prototyping of embedded systems. An emeritus professor since 1999, he remained passionate about his curricular vision over the years, recently participating in a national effort to develop a graduate curriculum for teaching software engineering.

"John was a dedicated instructor with a vision to develop a PhD program in software engineering," said Professor David Castañón (ECE, SE), ECE Department Chair. "He joined the Wang Institute [of Graduate Studies] and subsequently BU to instantiate this vision, and he created a graduate curriculum of professional software engineering courses. For his efforts, he was nominated for the Metcalf Award, BU's highest recognition for excellence in teaching."

Before embarking on his academic career, Brackett spent 17 years in industry advancing major computer-based systems. He was a cofounder of SofTech, a Boston-based software company which in 15 years grew from a staff of five to over 700 employees with offices in the U.S., the United Kingdom and Japan; and served as president and CEO and as a director of the company from 1976 to 1984. In addition, he worked as vice president of the Business Products Division of Infocom, Inc.

A consultant for software and other high tech companies, Brackett served on multiple program committees for the International Conference on Software Engineering and the International Conference on Requirements Engineering, and participated in software program review panels for the Department of Defense and National Science Foundation.

He received his BS from MIT in 1959 and his PhD from Purdue University in 1963, and served as a post-doctoral research associate at MIT's Laboratory for Computer Science.

Brackett is survived by his daughter Julienne Brackett, her mother Donna Colleen Brackett, and his grandchildren Alyssa Nicole Gredinger and Andrew Noah Gredinger. Condolences may be addressed to Donna Colleen Brackett at 757 Highland Avenue, Apt. 206S, Needham Heights, MA 02494.

PASSINGS

Jason M. Cartwright ('09), W. Lafayette, IN
Donna J. Lin ('91), Trinidad, CA
Mark R. Curtis ('85), Carrabassett Valley, ME
Paul W. Dippolito ('70), Weston, MA
Joseph A. Doucette ('70), Cape Elizabeth, ME
Dennis L. Sanford ('65), Exeter, NH
Peter R. Contarino ('60), Salem, NH
Patrick J. Barry ('57), Highlands, NC
William T. Jackson ('57), Wilmington, NC
Michael R. Mitchell ('56, '60, '62), Port Charlotte, FL
John H. Westerback ('56), Brewster, MA
John X. Tsirimokos ('55), La Jolla, CA
Russell Croteau ('54), Sugar Hill, GA
Andrew Kapravy ('53), Stoughton, MA
William Morgenstern ('51), East Falmouth, MA
Shirley H. Spencer ('50), Smyrna, GA

The Engineering Annual Fund—
Providing Real-World Experience to Engineering Students

Thanks to generous gifts from alumni and parents, the Engineering Annual Fund (EAF) gives students exceptional hands-on, faculty-guided research experience that prepares them to apply their engineering knowledge and skills to impact society. One example is the Summer Term Alumni Research Scholars (STARS) Program, which provides a summer housing allowance to students engaged in research in faculty labs.

> The goal of my study is to supply new data that can help brain researchers pinpoint structural abnormalities in the cerebral cortex that may underlie mental disorders such as dyslexia, schizophrenia and autism. This invaluable, hands-on experience has allowed me to use neuroscience knowledge in a real-world context.
>
> When I graduate I plan to pursue a PhD in neural engineering in order to develop additional and more powerful brain-computer interfaces designed to improve the quality of life for people with neurological diseases.
>
> Joseph Schlatter (BME'15), STARS Program

Joseph Schlatter with his STARS faculty sponsor, Sargent College Professor of Health Sciences Helen Barbas, inspecting an electron microscope image of a cerebral cortex sample in the Neural Systems Lab.

VERNON DOUCETTE

Support students like Joseph by contributing to the Engineering Annual Fund. Visit www.bu.edu/eng/alumni to make your gift today.

BU

Boston University College of Engineering

Lorena Barba

PhD, California Institute of Technology
Assistant Professor, Department of Mechanical Engineering

Computational science uses computers to create a virtual laboratory where experiments run in software. We need this approach whenever physical experiments are impossible. For example, to understand what tricks animals use to fly or glide so well, we use computer simulations of the fluid flow, because it's impossible to put a flying snake in a wind tunnel. The same applies to understanding the tricks of proteins to fold and mold and bind. My group works in computational fluid dynamics, computational biophysics and designing the algorithms and software to run our experiments.

It's an exciting time for computational science because, finally, computers are fast enough to run many experiments that were not feasible only a few years ago. Devices like graphics processing units (GPUs), which evolved from PC graphics chips, have shortened runtimes from weeks to hours. But we still have to wrestle with the mathematics and design intricate computer codes to get that speed.

Computational science is burgeoning at Boston University. We built a community across departments and now the University has the largest academic GPU cluster on the East Coast. Using that system, we'll fly some virtual snakes and find out the secret to their glide.

To learn more, visit www.bu.edu/eng.