

## Department of Civil and Environmental Engineering

It has been 20 years since Course 1 became the [Department of Civil and Environmental Engineering](#) (CEE), formally acknowledging the emergence of environmental science and engineering as significant areas within our research and educational programs. With energy and the environment now established as global themes, the department has carried out a strategic assessment of our research activities. Through this planning process, the faculty has identified six overlapping cross-disciplinary areas that support the mission of the department and frame major directions for future research: Smarter Cities, Ecosystems, Coastal Zone, Water and Energy Resources, Chemicals in the Environment, and Materials. A soon-to-be-published report titled *CEE Looking Forward* highlights the department's research strengths in each area, with examples of projects and their impacts, and offers a prospectus on future opportunities. The document also summarizes CEE's goals for advancing education through departmental academic programs and engagement in broader educational initiatives at MIT.

The department has seen a large increase in research volume over the past few years (up almost 66% over the past five-year period), with a concomitant increase in the number of researchers (particularly postdoctoral associates). These trends have brought about considerable pressure with respect to office space and created significant demand for renovation of lab space. During the past year we built a new microfluidics lab (led by professor Roman Stocker), a new microbiology lab (professor Martin Polz), a new shared aquatic chemistry lab (professors Harry Hemond and Phil Gschwend), and an upgraded hydrology lab (professors Charles Harvey and Ruben Juanes)—all in Building 48—and are now preparing to construct a new lab in Building 1 to house the Concrete Sustainability Hub (CSH) for professors Franz-Josef Ulm and Hamlin Jennings.

Research in the department continues to garner national attention and professional recognition at the highest levels. Of particular note this year, Professor Ulm received the prestigious Theodore von Karman medal from the American Society of Civil Engineers for his contributions to the development of nanomechanics of cement-based materials and theoretical poromechanics. Professor Markus Buehler was awarded the Alfred Noble prize from the combined engineering societies of the United States and also won an Outstanding Investigator Award from the Materials Research Society. The American Meteorological Society named professor Dara Entekhabi the Robert E. Horton Lecturer in Hydrology for his innovative and insightful contributions in hydroclimatology, and professor Sallie (Penny) Chisholm received the 2012 Ruth Patrick Award from the Association for the Sciences of Limnology and Oceanography for her work in raising awareness of the uncertainties and potential dangers of large-scale ocean iron fertilization.

The department is very pleased to report that Colette Heald was promoted to associate professor without tenure and professor Stocker received tenure. The department teamed up with the Bernard M. Gordon–MIT Engineering Leadership Program to recruit Rick Schuhmann as a senior lecturer at MIT. He holds a PhD in environmental engineering

and has spent the last 15 years at Penn State University, most recently as the Walter L. Robb director of engineering leadership. He will revitalize the teaching of project management for CEE undergraduates and supervise research projects through the MEng program.

We are also very pleased to salute our team of undergraduate students who came in second place in the National Steel Bridge Competition. This annual event, organized by the American Society of Civil Engineers, attracts teams from 200 schools. Each year, since first entering the competition in 2007, our team has recorded more impressive performances, attempting to outdo its predecessors and outwit much larger, better-resourced teams from other schools. Next year MIT will host the regional competition.

MIT is the top-rated civil and structural engineering school in the world according to the recently released [QS World University Rankings](#) of 200 universities. QS (Quacquarelli Symonds Ltd.) also ranked MIT in third place in earth and marine sciences and fourth place in environmental sciences, the primary research fields of many CEE faculty members and researchers.

## **Educational Activities**

### **Undergraduate Programs**

Twenty-five freshmen selected CEE as their home department for 2013. During AY2012, CEE had an enrollment of 84 undergraduates: 45 civil engineering (Course 1-C), 30 environmental engineering science (Course 1-E), and 9 CEE general (Course 1-A). In spring 2012, CEE awarded 29 SB degrees. Fourteen of them were in 1-C, 11 in 1-E, and four in 1-A.

### **Undergraduate Research and Practical Applications**

#### ***Coursework***

As sophomores, the 1-A, 1-E, and 1-C majors take the common core classes together, including the sophomore engineering design lab. In their junior year they split into their respective majors, and in their senior year they come together again for the capstone course in civil and environmental engineering design.

This year students from 1.102 Introduction to Civil and Environmental Engineering Design II designed and built sections of an underwater remotely operated vehicle. The vehicle was assembled and successfully tested in a swimming pool at the end of the term under the direction of Professor Hemond and senior lecturer John Germaine.

CEE seniors in the capstone subject 1.013 Senior Civil and Environmental Engineering Design, taught by professor Herbert Einstein and senior lecturer Pete Shanahan, designed a new building at the corner of Massachusetts Avenue and Vassar Street that would house both CEE and the Department of Earth, Atmospheric, and Planetary Sciences (EAPS). This “idea competition” gave the seniors the unique opportunity to design a facility that would be used by CEE faculty, teaching staff, and graduate students, as well as by the undergraduate students’ peers, in the future. The seniors built and tested physical models

of the structures they designed, wrote reports, and then edited and/or rewrote the reports to incorporate feedback they had received throughout the process. The students also designed, assembled, and load-tested their bridges in Lobby 7.

This year the department offered a new freshman seminar, 1.S991 EES-Lab: Engineering for Environment and Sustainability, organized by professors Stocker and Jesse Kroll during the spring term. This laboratory-based class centered on engineering problems associated with the built and natural environments and was organized around three themes: sustainable cities, energy and climate, and air, water, and health.

### ***Traveling Research Environmental Experiences***

Traveling Research Environmental Experiences (TREX) is a six-credit field research course offered during Independent Activities Period (IAP) to all Course 1 undergraduates. TREX (Course 1.992) gives students an opportunity to gain hands-on fieldwork and research experience in a global context.

Fourteen undergraduates and seven advisors participated in TREX 2012 from January 16 to 30. Their research on the big island of Hawaii encompassed atmospheric chemistry and associated water chemistry. Participants determined the concentration of sulfuric acid in the atmosphere caused by volcanic eruptions.

During the first week, participants stayed on top of the active volcano Kilauea, running tests with atmospheric chemistry instruments, including an aerosol mass spectrometer with a generator mounted on the back of an SUV. Using a mobile laboratory, they carried out tests to track the plume of the volcano looking for sulfuric acid aerosols.

In the second week, the students studied ombrotrophic bogs, bogs that receive nutrients and moisture from precipitation and clouds rather than groundwater. They performed experiments to determine whether the bogs were actually ombrotrophic and tested the nutrient levels of the water for methanogens—microorganisms (archaea) that produce methane as a metabolic by-product in anoxic conditions—and methanotrophs—bacteria that metabolize methane as a source of carbon and energy.

Sheila Frankel, senior lecturer and assistant director of the Parsons Laboratory for Environmental Science and Engineering, is the director and founder of TREX. Scientist Don Frankel and professors Eric Alm, Kroll, and Janelle Thompson accompanied the students, teaching and directing research on the island. Graduate student Kelly Daumit and postdoctoral associate Eben Cross served as teaching assistants.

### ***Steel Bridge Team***

Like most MIT students, Course 1 majors are highly competitive and ambitious. This year our student-led [MIT steel bridge team placed second](#) in the National Steel Bridge Competition. Since 2007 our student-led teams have placed first or second at the regional competition, securing their spot at nationals, where they have recorded ever-more-impressive performances each year: 24th, 21st, 18th, sixth, fifth, and (in 2012) second place. About 200 schools from throughout the United States, Canada, Mexico, and China participate in the competition.

The annual contest requires student teams to design an approximately 20-foot scale model of a bridge for a hypothetical site that meets specifications outlined in a request for proposals. Teams must fabricate steel pieces to build the bridge and, during the competition, be able to assemble it very quickly. The rules are rigid, reflecting the safety needs and landscape characteristics of an actual site. Bridges must be able to withstand a 2,500-pound load without sagging; a deflection of more than one centimeter, for instance, might be considered too large.

Team members earn four credit units for their work by enrolling in a steel bridge design competition (1.055 for undergraduates and 1.58 for graduate students) during the fall, Independent Activities Period (IAP), and spring terms. Professor Jerome Connor leads the course.

The competition is sponsored by the American Society of Civil Engineers and the American Institute of Steel Construction.

### **Terrascope**

CEE continues its involvement in the freshman learning community, [Terrascope](#), through its codirection with EAPS of the spring subject 1.016 Communicating Complex Environmental Issues: Building Solutions and Communicating Ideas. This subject offers freshmen the opportunity to participate directly in faculty-guided research while working more rigorously on solutions to the problems they studied in the fall Terrascope class.

In 2011–2012 Professor Polz and lecturer Ari Epstein taught the subject, with a focus on biodiversity. Four teams of freshmen were formed (each with an undergraduate teaching fellow) and assigned to one of the four most popular projects offered:

- Proposals and designs for enhancing local biodiversity through the use of native species in urban landscaping
- Key components of a pedal-powered monorail system designed to encourage sustainable means of transportation
- A multiplayer game that teaches players, firsthand, about the tradeoffs inherent in preserving global biodiversity
- A series of interactive exhibits highlighting the diversity of microbial life and the role microbial diversity plays in sustaining ecosystems

### **Graduate Programs**

During 2011–2012, the department awarded 18 doctorates, 17 master of science degrees, 16 master of science in transportation (MST) degrees, 34 master of engineering (MEng) degrees, and 1 engineer's degree.

While many of our graduate students go on to doctoral studies and careers in academia, most students in the MEng and MST programs typically accept jobs in industry or

government, where they often hold leadership positions by the time they reach the midpoint of their careers.

Our doctoral students are critical to the department's mission to educate intellectual leaders for academia and national research laboratories. Although research is often interdisciplinary, the program curricula are organized around the following areas of study: aquatic sciences, hydrology, environmental fluid mechanics and coastal engineering, information technology, transportation, civil and environmental systems, geotechnical and geoenvironmental engineering, and structures and materials. During 2011–2012, CEE had 78 doctoral students in the total population of 247 graduate students. Of the 18 who received a PhD, 11 accepted faculty or postdoctoral positions at academic institutions.

### ***MEng Students***

Student teams in the MEng water quality and engineering track again spent January engaged in on-site research and fieldwork. Projects included working on small-scale drinking water and sanitation systems in Ghana, working with the Singapore Public Utility Board to measure and control bacterial pollution in surface waters of the Kranji Catchment, and performing a life-cycle assessment and analysis of the carbon footprint of wastewater treatment plants in Spain.

Students in the high-performance structures and geotechnical MEng track designed bridge crossings and underpasses for the Charles River, a new CEE headquarters building on the Charles River, and a commuter rail station. They also joined Professor Connor on a January study tour in London.

### ***Transportation Students***

Students in the transportation track explored a possible new commuter rail line connecting the existing Worcester/Framingham line with North Station. In January, transportation alumni, faculty, and students attended the Transportation Research Board annual meeting in Washington, DC, where many of them presented papers and posters. Two recent CEE graduates were honored during the conference: Vikrant Vaze PhD '12 received an award from the Council of University Transportation Centers for his doctoral dissertation, and Angelo Guevara PhD '10 received an honorable mention in the 2010 Eric Pas Dissertation Prize competition of the International Association for Travel Behavior Research.

Several MST students helped plan the second annual MIT Transportation Showcase, held at the MIT Museum on November 17 and hosted by the MIT Transportation Club. The showcase brought together more than 250 students, faculty, alumni, and representatives of transportation companies and agencies for an evening featuring transportation research posters and industry networking.

MST students also participated in the daylong Transportation@MIT Data Hack-A-Thon event, where individuals with different talents and skills gathered to develop projects using transportation-related data.



## Lectures and Symposia

The department sponsored the first event in the new [DES4: Distinguished Engineering and Science Speaker Seminar Series](#) organized by the CEE junior faculty. This new CEE series will present speakers from around the world who are pioneers in some of the most exciting frontiers of civil and environmental engineering research. The first talk featured Albert-László Barabási, distinguished professor and director of the Center for Complex Network Research at Northeastern University, who spoke on “From Network Science to Human Dynamics” October 26 in the Star Conference Room at the Stata Center. The talk generated a great deal of interest and was attended by many CEE faculty, graduate and undergraduate students, and staff.

CEE held its second [Research Speed Dating Day](#) in Bartos Theater on February 10. During this event, which was also organized by the CEE junior faculty, 22 faculty, postdoctoral associates, graduate students, and researcher associates gave short research presentations followed by a cheese and wine reception.

The department cohosted the annual [John R. Freeman Lecture](#) with the Boston Society of Civil Engineers on April 23 in Wong Auditorium. Richard N. Palmer, department head and professor of civil and environmental engineering at the University of Massachusetts, Amherst, spoke on “Climate Change and Water Resources: Characterizing Uncertainties for Decision Makers.” The lecture series is named for the MIT alumnus who designed the original Charles River Dam.

This year professor Joseph Sussman, who was serving as interim head of the Engineering Systems Division (ESD), gave the annual [Charles L. Miller Lecture](#) on April 25 in MIT’s Bartos Theater. Sussman, the JR East professor of civil and environmental engineering, spoke on “Complex Sociotechnical Systems: The Case for a New Field of Study.”

An IAP seminar series, [The Science and Engineering of Gas Shales](#), jointly organized by Professor Ulm and the MIT Energy Initiative (MITEI), hosted four talks from January 17–20.

MIT’s [Environmental Research Council](#), which is headed by Professor Entekhabi, held a daylong forum December 15 in the Kirsch Auditorium to outline research priorities and an implementation plan for the proposed MIT Global Environment Initiative. In addition to Professor Entekhabi, speakers included Professors Chisholm, Alm, and Gschwend.

## Research

The department’s research is both broad and deep and covers a wide variety of focal areas in civil and environmental engineering, with about one book published and many papers appearing in peer-reviewed journals and presented at scientific conferences each year. The monthly research newsletter, [On Balance](#), focuses on one paper or book each month to provide a sampling of CEE research. The titles of the issues from 2011–2012 and the CEE researchers’ names follow.

- “Atomistic Simulation Combines With Experiment to Reveal Nanomechanics of Mutant Proteins in Disease,” Professor Buehler, graduate student Zhao Qin, and coauthors, September 2011
- “Molecular Simulation Reveals Water’s Effect on an Epoxy-Silica Interface Often Seen in Structures,” professor Oral Buyukozturk, Professor Buehler, Denvid Lau PhD ’12, and Chakrapan Tuakta PhD ’11, October 2011
- “MIT Model Accurately Characterizes Hydrocarbon Intrusions Observed at Deepwater Horizon Oil Spill,” senior lecturer and senior research engineer Eric Adams, professor Scott Socolofsky PhD ’01 of Texas A&M University, and coauthors, November 2011
- “Scratch Test Redefined as Measure of Fracture Resistance,” Professor Ulm, professor Pedro Reis, and doctoral student Ange-Therese Akono, December 2011
- “Flow of Bacterial Genes in the Environment Analyzed,” Professor Alm and graduate students Chris Smillie and Mark Smith, January 2012
- “Traditional Social Networks Fueled Twitter’s Spread,” professor Marta González and ESD graduate student Jameson Toole, February 2012
- “Marine Virus Exploits Bacteria Host’s Nutrient Cravings to Activate Its Own Food-Gathering Genes,” professor Chisholm, Maureen Coleman PhD ’08, and postdoctoral associate Qinglu Zeng, March 2012
- “Storage of CO<sub>2</sub> Emissions in Deep Saline Aquifers in the U.S. Is Geologically Viable for at Least a Century,” Professor Juanes, graduate student Michael Szulczewski, Christopher MacMinn ’12, and Howard Herzog, MITEI senior research engineer, April 2012
- “Rigorous Analysis of Rainwater Harvesting System Design Can Improve Reliability and Water Quality,” senior lecturer Peter Shanahan and Kelly Doyle SM ’08, May 2012
- “The ‘Buckliball,’ a Morphable Buckling Structure, Turns Structural Failure Into Desirable Functionality,” Professor Reis, Jongmin Shim PhD ’10, and coauthors, summer 2012

Below are some of the MIT news stories and MIT news releases about CEE research published during the past academic year.

- “Study Takes a Micro-Mechanics Approach to Understanding How Water Impacts Fiber-Wrapped Concrete Structures,” July 11, 2011
- “MIT Ranks No. 1 Worldwide in Civil and Structural Engineering, According to New Rankings,” July 12, 2011
- “Pedro Reis Attends NAE’s Japan-America Frontiers of Engineering Symposium,” July 15, 2011
- “CEE Researchers Lead New Collaborative Program Between France and MIT,” July 28, 2011
- “Microbial Study Reveals Sophisticated Sensory Response,” August 1, 2011

- “Pulling the Tail of Mutated Protein Could Help Illuminate Mechanics Behind Rapid-Aging Disease,” September 13, 2011
- “Microbes Have Quick, Effective Way to Exchange Genetic Information Coding for Antibiotic Resistance, Other Functions,” November 1, 2011
- “Many Man-Made and Natural Networks Have Same Underlying Architecture,” November 3, 2011
- “Researchers Link Patterns Seen in Spider Silk, Melodies,” December 7, 2011
- “Traditional Social Networks Fueled Twitter’s Spread,” December 20, 2011
- “Viruses Con Bacteria Into Working for Them,” January 26, 2012
- “Explaining a Spider Web’s Strength,” February 2, 2012
- “Researchers Create First Large-Scale Model of Human Mobility That Incorporates Human Nature,” February 28, 2012
- “Inspired by a Toy, the ‘Buckliball’ Opens New Avenue in the Design of 3-D Origami-Like Structures,” March 26, 2012
- “Study Shows Unified Process of Evolution in Bacteria and Sexual Eukaryotes and Opens Door to Concept of ‘Species’ in Bacteria,” April 5, 2012
- “Civil Engineers Find Savings Where the Rubber Meets the Road,” May 22, 2012

### Faculty and Staff Notes

Professor Buehler and former postdoctoral associate Raffaella Paparcone received the 2011 Alfred Noble Prize for a paper published in the journal *JOM* last year (“Failure of Alzheimer’s A $\beta$ (1-40) Amyloid Nanofibrils Under Compressive Loading,” *JOM*, 2010, Vol. 62, No. 4, pp. 64–68,). The prize is presented annually by the combined engineering societies of the United States to a person 35 years of age or younger. Buehler was also honored by three other national societies. Last fall, the Applied Mechanics Division of the American Society of Mechanical Engineers presented him with the Thomas J.R. Hughes Young Investigator Award. In January, the Society of Engineering Science awarded him the Young Investigator Medal. And in April, the Materials Research Society presented him with the Outstanding Young Investigator Award. He and doctoral student Steven Cranford are coauthors of a new book, *Biomateriomics*, in the Springer Series in Materials Science. The book introduces a holistic approach to the study of biological and bioinspired materials from a systems perspective, makes current and new experimental and computational techniques available to a wider community of engineers and scientists, discusses the development of integrated mechanical models and experiments for hierarchical biomaterials, and covers recent advances in understanding of multiscale deformation and failure of biomaterials.

Professor Buyukozturk and graduate student Justin Chen received an American Society for Nondestructive Testing Fellowship Award for their research on “Remote Detection of Damage in FRP-Retrofitted Concrete Structures Using Acoustic-Laser Vibrometry.”



Professor Chisholm and professor John Cullen of Dalhousie University will receive the American Society for Limnology and Oceanography's Ruth Patrick Award—which honors research in basic aquatic science that helps identify, analyze, and/or solve environmental problems—for their “significant contributions to the global community in their foresight and effective efforts in addressing the environmental impacts of ocean iron fertilization.” Shortly after the idea surfaced in 1988 of using iron fertilization to prompt the growth of phytoplankton, which might serve as a CO<sub>2</sub> sink, Professors Chisholm and Cullen cochaired an international symposium to foster discussion on this topic among scientists. The conference ended with a resolution that, because of the potential damage that could result from such a large-scale experiment, iron fertilization should not be viewed as a method for solving the CO<sub>2</sub> emissions problem. Professors Chisholm and Cullen went on to write several influential articles on the science and policy dimensions of ocean fertilization.

*Chemical & Engineering News* magazine ran an article about Professor Chisholm in the February 27 issue. In the article, she talks about the importance of public outreach as a means of improving scientific literacy regarding photosynthesis and about her children's books written with coauthor and illustrator Molly Bang: *Living Sunlight* (Blue Sky Press, 2009), which focused on photosynthesis, and *Ocean Sunlight* (Blue Sky Press, May 2012), which is about the phytoplankton *Prochlorococcus*.

*Flexibility in Engineering Design* (MIT Press, 2011) by professor Richard de Neufville and Stefan Scholtes of the University of Cambridge describes methods to identify, select, and implement useful flexibility in design.

An interview with Professor Einstein ran in the January/February 2012 issue of *World Tunneling* magazine. In the article, titled “A Rock-Solid Career,” Professor Einstein comments on tunneling research and education and on recent important advances in rock mechanics and tunneling.

Professor Entekhabi was the Robert E. Horton Lecturer in Hydrology at the 2012 meeting of the American Meteorological Society. He was selected for his “innovative and insightful contributions in hydroclimatology and its role in regional and global climate, and for pioneering achievements in the remote sensing of the hydrosphere.” Professor Entekhabi delivered his lecture, “Use of Remote Sensing Data to Diagnose the Closure Relationship Between Landsurface Water and Energy Balance,” on January 25, with an introduction from the society's president, Louis Uccellini.

MIT's Environmental Research Council—led by Professor Entekhabi—put forward a detailed implementation plan to establish a [Global Environmental Initiative](#) to complement the MIT Energy Initiative. The interdisciplinary, faculty-led council presented the plan to the MIT community on December 15 in a forum held in the Stata Center. Council members outlined an initiative that would bring together MIT's core strengths to help solve the world's pressing environmental challenges, from mitigating climate change to curbing contamination and maintaining fresh water supplies. Speakers included Professors Alm, Chisholm, Entekhabi, and Gschwend.

In a story published in the *Engineering News Record*, Professor Jennings, executive director of the Concrete Sustainability Hub (CHS), (an interdisciplinary research program housed in CEE that aims to reduce the environmental footprint of concrete), noted that developing an understanding of the microstructure in concrete is yielding new ways to manipulate the material. Professor Ulm explained that one of the goals of CSH research is to “unleash the innovation potential of sustainable development.”

For its August 11 Industry Day, CSH released reports on “Construction Alternatives,” “Concrete Building Life Cycle,” and “Pavement Life Cycle.”

At the March 12 dinner of the MIT engineering honor society, professor Ole Madsen gave the DaVinci Lecture on “The Monster,” a 10-meter-long research water tunnel in Singapore.

Two teams (OpenIR and wecyclers) from senior lecturer Susan Murcott’s SP.723 D-Lab III: Dissemination: Implementing Innovations for the Common Good class won \$7,500 prizes in the MIT IDEAS Global Challenge competition. The wecyclers team intends to set up kiosks in the developing world so that people living in places such as Lagos, Nigeria, can exchange recyclable items and materials for clean water, cell phone minutes, and other marketable “goods.”

The Ruth and Joel Spira Award for Excellence in Teaching rotates among five engineering departments at MIT. This year’s award went to CEE professor Heidi Nepf.

Long-time lecturer Lisa O’Donnell was honored with the CEE Excellence in Academic Service Award for her work with MEng students on their projects in high-performance structures and geotechnical projects and with Course 1 seniors on their capstone projects.

A paper by senior research scientist Roland Pellenq, recent CEE graduate Rouzbeh Shahsavari PhD 11, and Professors Ulm and Buehler has been selected by the Cements Division of the American Ceramic Society as winner of the 2010 Stephen Brunauer Award. The winning paper, “First-Principles Study of Elastic Constants and Interlayer Interactions of Complex Hydrated Oxides: Case Study of Tobermorite and Jennite,” appeared in the *Journal of the American Ceramic Society* in 2009.

National Public Radio’s *Morning Edition* interviewed Professor Reis in late December, asking him about the work of a French physicist who used the size and shape of tree branches to explain Leonardo’s rule. NPR also posted Professor Reis’s own video (made in conjunction with a paper that appeared in *Physics Review Letters* in November 2010) describing why book pages flap in the wind, making a clapping sound.

Professor Sussman was named interim director of the Engineering Systems Division by Ian Waitz, dean of engineering, effective September 1. As an early member of ESD, Professor Sussman played an integral part in launching the division’s doctoral degree program. He also created the transportation systems focus area for the MIT Portugal Program, a five-year program in engineering established in 2006. MIT and the East Japan

Railway Company celebrated the 20th anniversary of the East Japan Railway Company Professorship on October 13 with a reception at the MIT Faculty Club. Professor Sussman has held the chair since its establishment in 1991.

The Engineering Mechanics Division of the American Society of Civil Engineers selected Professor Ulm to receive the 2012 Theodore von Karman Medal, which recognizes distinguished achievements in engineering mechanics. The selection committee chose Professor Ulm for his “contribution to the development of nanomechanics of cement-based materials and theoretical poromechanics” and noted in particular his contributions to construction engineering, petroleum engineering and rock mechanics, and biomechanics. Professor Ulm received the award during the Engineering Mechanics Institute’s 2012 conference in June. In late June, MIT announced a new collaborative program with the French national scientific research center (Le Centre National de la Recherche Scientifique) to be codirected by Professor Ulm and Pellenq, a senior research scientist in CEE. The collaboration will create a joint laboratory housed at MIT and focused on multiscale materials science for energy and the environment.

Professor John Williams, graduate student Sergio Herrero-Lopez, and research scientist Abel Sanchez of the Laboratory for Manufacturing and Productivity presented work at the Institute of Electrical and Electronics Engineers (IEEE) Cluster conference, held September 26–30 in Austin, on a model that will help data center operators predict the consequences of adding new hardware configurations, software applications, or other network changes without affecting service.

At the School of Engineering’s 12th annual Infinite Mile Awards ceremony in April, CEE administrative officer Patricia Dixon received the Infinite Mile Award for Diversity and Community. Dixon is celebrating her 40th year as a staff member in CEE. Also, research engineer John MacFarlane received an Infinite Mile Award for Excellence. He is celebrating 25 years working at the Parsons Laboratory.

### **Graduate Student Awards and Notes**

Doctoral student Hamed Alemohammad—who works with Professor Entekhabi and professor Dennis McLaughlin to combine different types of satellite-derived rainfall data in order to improve the accuracy of rainstorm estimation models—was selected as one of two student representatives serving on the Global Environmental Change Focus Group of the American Geophysical Union.

Doctoral student Amer Deirieh was selected by the MIT Global Fellows Program to attend a workshop about research collaborations held March 26–30 at the Imperial College London. Deirieh works with Professor Ulm.

Doctoral student Chelsea Humbyrd won a School of Engineering award honoring extraordinary teaching and mentoring by a graduate student.

Recent CEE graduate Daniel Jimenez ’10, MEng ’11 was named a Fulbright Scholar. He will travel to the Philippines to develop more cost-efficient and environmentally friendly construction technologies and methods.

An essay by MST student Dianne Kamfonik was one of 13 selected for publication in the January 6 issue of *Science* in the NextGenVoices section. *Science* solicited essays that addressed the question “How will the practice of science change in your lifetime?” and printed the 13 top submissions in their entirety. Kamfonik’s essay begins: “Science is becoming increasingly accessible to minorities, women, and people from a variety of cultural and socioeconomic backgrounds. Since more people are now being exposed to science, I predict that the speed and significance of scientific advancements will increase dramatically over the next 100 years.”

Samar Malek was named a 2012 Marshall Sherfield Fellow. She will conduct research at the University of Bath with Chris Williams, the world expert on the mechanics of grid shells.

CEE’s Matt Orosz PhD ’12 was named a 2012 Echoing Green Fellow for his work on a sustainable energy project in Lesotho, Africa. With the two-year fellowship, Orosz will continue that work, likely under the aegis of STG International, a nonprofit organization he cofounded with Amy Mueller PhD ’12. Both Orosz and Mueller did their graduate research under the direction of Professor Hemond, creating new technology that relies on sunlight to drive a heat engine and produce hot water via an organic Rankine cycle process.

An image from a Nature paper authored by graduate students Chris Smillie, Mark Smith, and Jonathan Friedman; postdoctoral associate Otto Cordero; alumnus Lawrence David PhD ’11; and Professor Alm appears in a [Wired magazine article](#) as one of 10 outstanding research graphics. “The graphic...represents the first attempt to measure gene flow between bacteria around the world, as organized by ecological niche and with an eye towards antibiotic resistance—something that’s flowing out of farms at alarming rates,” wrote Brandon Keim in Wired.

### **Undergraduate Student Awards and Notes**

The MIT chapter of the civil engineering honor society, Chi Epsilon, welcomed nine new initiates at its banquet held April 23 at the MIT Faculty Club. The CEE students joining the honor society are juniors Talal Al-Mulla, Rebecca Hawton, Di Jin, Anna Falvello Tomas, and Jibo Wen and seniors Tiffany Cheng, Julia Hopkins, Elizabeth Jones, and Reece Otsuka.

CEE seniors Michael Chen and Tzipora Wagner were elected to Phi Beta Kappa, the nation’s oldest honor society.

CEE and urban studies and planning major Juhee Bae, a junior, was a member of a team that won a \$7,500 prize in the MIT Global Challenge Competition in May for OpenIR, a web application designed to make data accessible after disasters.

In a summer internship with a collaborative program run by the US Environmental Protection Agency and the National Aeronautics and Space Administration (NASA) Ames Research Center in California, CEE senior Tiffany Cheng (Course 1-E) created a remote-sensing toolkit for state and local agencies to use in analyzing air quality during and after uncontrollable events such as wildfires and volcanic eruptions. Cheng was named an American Association of University Women Selected Professions Fellow for the 2012–2013 academic year. (She is now studying for a master’s degree in coastal engineering at Oregon State University.) In addition, she was awarded a scholarship from Rhode Island Consulting Engineers (RICE). RICE, a nonprofit professional organization representing independent consulting engineering firms, awards three scholarships each year to undergraduate students based on academic achievement and extracurricular and community activities.

In April, CEE junior Jonté Craighead was elected president of the MIT Undergraduate Association (UA) for the 2012–2013 academic year.

Scott Landers (Course 1-E) was awarded a scholarship from RICE. Landers also received a scholarship from the New England Water Environment Association.

At the Institute Awards Convocation in May, Course 1-E senior Columbus “Bus” Leonard, the goalie of the MIT water polo team, received the Howard W. Johnson Award for best male senior athlete. Leonard was also named honorable mention All-American in the sport by the National Collegiate Athletic Association.

CEE sophomore Alexis Ludena, alumni relations chair for Theta Delta Chi fraternity, accepted the D. Reid Weedon Award for alumni relations on behalf of the fraternity at the May 9 Institute Awards Convocation.

CEE senior Kimberly Sparling, former Panhellenic Association president and a veteran of several campus committees, was one of three undergraduates chosen by the Undergraduate Association to serve on the six-member MIT Presidential Search Student Advisory Committee.

### **Departmental Awards**

Professor Stocker was recognized with the Maseeh Award for Excellence in Teaching.

The Maseeh Award for Excellence as a Teaching Assistant went to doctoral student Rory Clune, teaching assistant for 1.035 Mechanics of Structures and Soils.

The Trond Kaalstad (Class of 1957) Fellowship was awarded to doctoral student Zenzie Brooks. The award, named for a long-time CEE administrative officer, recognizes graduate students who display leadership and/or contribute significantly to the well-being of the CEE community.



Course 1-C senior Lorna Omondi received the Leo (Class of 1924) and Mary Grossman Award, which is given to an undergraduate who has a strong academic record and interest in transportation.

Senior Tzipora Wagner received the Paul L. Busch (1958) Prize, which goes to an undergraduate in environmental science and engineering for academic achievement and contributions to the CEE community.

MEng student Brooke Goodman received the Tucker-Voss Award for her thesis titled “An Analysis of Bridge Design Competitions: Are They Effective at Producing a Better Bridge for the Public?” The award is given to a student who shows particular promise in the field of building construction.

**Andrew J. Whittle**  
**Department Head**  
**Edmund K. Turner Professor**