

Dean, School of Engineering

Comprising an exceptional community of students, scholars, researchers, educators, and engineering practitioners, the MIT School of Engineering's mission is to educate the next generation of engineering leaders, to create new engineering and scientific knowledge, and to serve society. By providing innovative ideas and practical technologies and educating the people who will help create solutions to the greatest technological and social problems of the 21st century, the MIT School of Engineering fulfills its obligation as a world-leading institution.

To advance this mission, the dean, Ian A. Waitz, in close consultation with the School's leadership, has developed a vision and integrated strategy. The elements of this strategy include continuing to attract and support the education and professional development of exceptionally talented students, faculty, and staff; building collaborative intellectual communities—within MIT and with external partners—that enable us to best tackle complex technological and social problems; developing new paradigms for university-led innovation and entrepreneurship (I&E); and reinventing the future of engineering education.

The School of Engineering's eight academic departments and one division, its many research centers and laboratories, and its rich array of interdisciplinary graduate degree programs encompass a community of some of the world's most innovative and inventive thinkers. Approximately 37% of the Institute's faculty, 45% of graduate students, and about 46% of undergraduate majors collaborate in the School's 23 undergraduate degree programs and 52 graduate programs. The School's faculty research expenditures were approximately \$368.8 million in FY2012, accounting for 54% of the on-campus total. The achievements of the School's departments, laboratories, centers, and programs are extensive. Separate reports highlight the activities and accomplishments of the students, faculty, and staff in each of these units over the past year.

In 2011–2012, there were a number of leadership transitions within the School's departments, centers, and laboratories. Vladimir Bulović, professor of electrical engineering and a MacVicar Faculty Fellow, was named director of the Microsystems Technology Laboratories on October 1, 2011. Christopher A. Schuh, the Danae and Vasilios Salapatas professor of metallurgy and a MacVicar Faculty Fellow, was named the head of the Department of Materials Science and Engineering on October 12, 2011. The head of the Gordon-MIT Engineering Leadership Program, Ed Crawley, was named the founding president of the Skolkovo Institute of Science and Technology on December 22, 2011. Arup K. Chakraborty, the Robert T. Haslam professor of chemical engineering, chemistry, and biological engineering and founding member of the Ragon Institute of MGH, MIT, and Harvard, was named director of the newly formed Institute for Medical Engineering and Science on February 2, 2012. Daniela Rus, a professor in the Department of Electrical Engineering and Computer Science (EECS), was named director of the Computer Science and Artificial Intelligence Laboratory (CSAIL) on May 23, 2011. Rus succeeded Anant Agarwal, who was named president of edX, an online learning initiative of MIT and Harvard University, on March 16, 2011.

As a result of this year's faculty searches, nine candidates accepted faculty appointments in the School of Engineering, including one woman. Their appointments will add to the excellence, excitement, and energy critical to maintaining the School's high standards.

Awards and Honors

Every year, members of the MIT engineering community receive numerous honors in recognition of their research, scholarship, service, and overall excellence. This year was no exception. The reports of the School's departments, divisions, laboratories, centers, and programs make note of many of these awards. The following is a small sample of the honors and awards garnered by the School of Engineering in AY2012:

President Barack Obama named Institute Professor Mildred S. Dresselhaus as the 2011 winner of the Enrico Fermi Award, one of the government's oldest and most prestigious awards for scientific achievement.

Dresselhaus and fellow Institute Professor Ann Graybiel were named 2012 recipients of the Kavli Prize.

The National Science Foundation presented Faculty Early Career Development (CAREER) awards to Cullen Buie, Mitsui career development assistant professor in mechanical engineering; Anthony Buonassisi, associate professor of mechanical engineering; Dana Weinstein, assistant professor in EECS; and Bilge Yildiz, associate professor of nuclear science and engineering.

The Department of Energy awarded Early Career Research Program grants to Rohit Karnik, assistant professor of mechanical engineering, and Felix Parra, assistant professor of nuclear science and engineering.

Tomas Palacios, the Emmanuel E. Landsman associate professor of electrical engineering and computer science, was among the 94 young researchers presented 2011 Presidential Early Career Awards for Scientists and Engineers.

The Association for Computing Machinery honored Hal Abelson, the Class of 1922 professor of electrical engineering and computer science, with the Karl V. Karlstrom Outstanding Educator Award for his contributions to computer science education.

Intel honored Jesús del Alamo, Donner professor of electrical engineering and MacVicar Faculty Fellow, with the 2012 Intel Outstanding Researcher Award in Emerging Research Devices.

The Materials Research Society named Markus J. Buehler, associate professor of civil and environmental engineering, the 2012 recipient of the Outstanding Young Investigator Award.

Robert Langer, the David H. Koch Institute Professor, received the 2012 American Chemical Society's Priestley Medal and *The Economist's* 2011 Innovation Award in the category of bioscience.

The National Science Foundation honored Scott Aaronson, the TIBCO career development associate professor of electrical engineering and computer science, with the 2012 Alan T. Waterman Award.

The *Journal of Nuclear Materials* presented the 2012 Robert Cahn Award to Sidney Yip, professor emeritus of nuclear science and engineering.

Manolis Kellis, an associate professor in EECS, won the 2011 Niki Award from the Athens Information Technology Center of Excellence for Research and Education.

Li-Shiuan Peh, associate professor in EECS, was named an Association for Computing Machinery Distinguished Scientist.

Elazer R. Edelman, the Thomas D. and Virginia W. Cabot chair of health sciences and technology, received the 2011 Katz Prize in Cardiovascular Research.

David D. Clark '68, a senior research scientist with the Computer Science and Artificial Intelligence Laboratory, received the Oxford Internet Institute Lifetime Achievement Award.

Professors Tim Berners-Lee, Noam Chomsky, John McCarthy, and Marvin Minsky were inducted into the inaugural Artificial Intelligence Hall of Fame, established by the IEEE Computer Society's *IEEE Intelligent Systems Magazine*.

The American Nuclear Society honored Jacopo Buongiorno, an associate professor in the Department of Nuclear Science and Engineering, with the Landis Young Member Engineering Achievement Award.

EMPA, the Swiss Federal Research Laboratory for Materials Science and Technology, awarded the Golden Mirko Roš Medal to professor Oral Buyukozturk of the Department of Civil and Environmental Engineering.

Innovation and Entrepreneurship

A faculty committee was convened in AY2012 by Dean Waitz and dean David Schmittlein of the MIT Sloan School of Management and given a broad charge to recommend opportunities to advance the capabilities of our students, postdocs, staff, faculty, and alumni to change the world through invention, entrepreneurship, innovation, service learning opportunities, practical authentic learning opportunities, and engineering leadership and intrapreneurship. Chaired by Mary Boyce, Ford professor of engineering and head of the Department of Mechanical Engineering, and staffed with faculty from the School of Engineering and Sloan, the committee recommended strategic elements for MIT in these areas:

- Coordinate existing educational offerings and establish new curricular and cocurricular activities and programs at all levels: K–12, undergraduate, graduate, postdoctoral, and professional education
- Investigate organizational collocation of related activities and establish spaces that facilitate greater interaction among these activities
- Create linked innovation embassies around the world

Educational Activities

The School of Engineering made significant progress in the development of world-leading educational programs during AY2012. The School's strategic planning framework in the area of education calls for innovations and contributions in three major directions: those that affect "the few" (students engaged in residence-based education on the MIT campus), "the many" (students engaged in some form of accredited or certified activity, but not necessarily on campus), and "the all" (members of the general public

who wish to learn more about engineering or technology). Significant activities have been launched in each of these areas during the past year. Below are brief accounts of the largest of these activities.

MITx

MIT's most significant contribution to educational innovation in AY2012 was the creation of *MITx*. Led by (now) president L. Rafael Reif and spearheaded and developed by Professor Agarwal, *MITx* offered its first course in the spring of 2012, 6.002x Circuits and Electronics. Nearly 155,000 people from 160 countries registered for the course, which required a background in physics, calculus, and differential equations. Approximately 23,000 of the enrolled students tried the first problem set, 9,000 passed the midterm, and 7,157 passed the course as a whole.

In May 2012, MIT and Harvard University announced that they would combine their efforts in online education and formed edX; Professor Agarwal was named the president of the new partnership. MIT faculty, staff, and students will continue to assess how new models of online instruction might become integral parts of MIT students' on-campus education and explore how global learners can access MIT-quality instructional experiences.

Educating for Innovation and Entrepreneurship

In its findings, the faculty committee on innovation and entrepreneurship (see above) cited a strong need to create a cohesive curriculum with cocurricular activities focused on educating students to be skilled in I&E practices. The committee recommended that MIT establish an I&E foundational curriculum and take a leadership role in I&E research, leveraging existing activities as a base. Specifically, this could assume the form of an inter-School undergraduate I&E minor, a program for which there is enthusiastic faculty support. Furthermore, an innovation opportunities program, modeled after the Undergraduate Research Opportunities Program (UROP), could be created to expose undergraduates to entrepreneurship.

The committee recommended that the I&E curriculum be a partnership among the Sloan School of Management, the School of Engineering, and the School of Science to encourage joint teaching and joint listing of I&E subjects and to promote cross-campus faculty and student collaborations. The committee supports co-teaching between practitioners and academics to provide students with alternative perspectives and broader networks and recommends that MIT offer workshops to students, postdocs, faculty, and alumni for the development of demos and prototypes. The space dedicated to this activity should be designed and located to facilitate strong interaction among existing I&E centers and activities.

“Semester from Anywhere”

At the beginning of AY2012, the dean requested that each department head in the School investigate the possibility of creating mechanisms and programs through which the undergraduate students in their academic programs would be able to pursue their courses of study from remote locations for one semester or through which residential-based students would be able to use online resources to create additional flexibility and enhance their on-campus experiences. The Departments of Aeronautics and Astronautics and Mechanical Engineering have created functional prototypes of several subjects, and the Department of Materials Science and Engineering is planning to launch three such subjects for the spring 2013 semester. These prototypes were successfully implemented and tested with MIT students during the spring 2012 semester. The dean’s office has also been working with faculty from the School of Humanities, Arts, and Social Sciences and other offices and programs at the Institute to develop a sufficiently broad set of options for students to take a full schedule of subjects while they are away from campus for a semester. The School’s efforts to expand these options are expected to continue in AY2013.

MIT+K12

Launched in April 2012 in collaboration with Khan Academy (a free online education resource founded by MIT alumnus Salman Khan), [MIT+K12](#) is a program through which MIT students create short instructional videos for K–12 audiences. The videos are typically less than five minutes long and are devoted to hands-on explanations of engineering and science concepts at an age-appropriate level. All of the video content is produced by MIT students, fact checked by MIT postdoctoral associates, quality checked by video production professionals, and then released for free via YouTube and a variety of other online avenues. As of the end of AY2012, the MIT+K12 project had resulted in 50 videos, with a significant following on YouTube (1,000-plus subscribers), and nearly 200,000 video views.

Advanced Reporting Tools

With support from the Lord Foundation, the dean’s office in AY2012 embarked on two major projects through which we hope to improve our ability to measure and demonstrate the extent, range, and quality of interdisciplinary collaborations among researchers and educators in the School of Engineering.

Led by associate dean Cynthia Barnhart and coordinated through the School of Engineering Interdisciplinary Education Council (IEC), the first of these projects is a consolidation and rigorous analysis of data contained within MIT’s student information system and related domains. This project has allowed the dean’s office and the IEC to ask—and answer—a range of new questions regarding the instructional activities of faculty across the School and the Institute in general. It is now possible to understand and quantify, for example, the relative contributions that academic departments are making to student experiences in other departments’ degree programs. It is also possible to understand the relative proportion of instruction that students in different degree programs are receiving from their host departments and others.

In a second project, professor Regina Barzilay of EECS has created a set of tools to collect and visualize publication data from MIT faculty and research staff. This project, “the collaboration browser,” consists of a system that collects and disambiguates publication citations and sources from the Internet and then applies customized natural language processing algorithms to the full text of the documents to demonstrate connections and collaborations among faculty and researchers.

Finally, in the last several months of AY2012, the dean’s office commissioned and built a new system to collect and make better, more coordinated use of information about each of the faculty members and principal-investigator-level researchers in the School of Engineering. This system combines Institute-maintained data with information that has previously been maintained by individual faculty on their faculty personnel record, and all of this information is rendered as a set of reportable and manageable database fields. We expect this will become a valuable resource for the School on a variety of levels.

Communications and Development

The development and communications staff in the School worked in close collaboration on a range of projects throughout AY2012.

This year’s speaker in the School of Engineering Distinguished Lecture Series was Diane Greene, who gave a lecture titled “From Windsurfing to Virtualization and Beyond: A Lifelong Quest to Bring Ideas to Market” on April 2. Greene is on the boards of Google, Intuit, and the Peninsula Open Space Trust, and she is a member of the MIT Corporation. She was the cofounder and CEO of VMware and also the founding CEO of VXtreme, which became the basis for Microsoft’s media player. Greene was named to *BusinessWeek*’s “Most Important People” list and *Fortune*’s “50 Most Powerful Women” list. This year’s distinguished lecture was presented in collaboration with the Department of Mechanical Engineering and the Center for Ocean Engineering.

The primary communications vehicle for the School of Engineering remains its website, which attracts approximately 600,000 visitors per year. The site sees traffic from every country in the world, and 98% of the visitors are from outside the MIT network—indicating that the site truly is operating as a gateway to MIT Engineering for audiences beyond the Institute. The communications staff continues to expand the use of social networking tools. Continued developments in this area are expected.

In anticipation of the Institute’s upcoming capital campaign, the dean’s office has implemented a new staffing strategy for resource development. Specifically, new front-line resource development officers will be added at the department level (some will be shared among more than one unit) to supplement development-related activities. These staff members will report to the assistant dean for resource development and to the relevant department heads. These officers represent additional development capacity at an appropriately local level, and their activities will be coordinated through the dean’s office to align with the strategies and initiatives of MIT’s central resource development office.

Statistics for 2011–2012

Undergraduate Enrollment

- 2,019 students
- 843 women
- 186 international students

Graduate Enrollment

- 2,928 students
- 760 women
- 1,229 international students

Degrees Awarded, 2011

- 612 bachelor's degrees
- 696 master's degrees
- 288 doctoral and professional degrees

Faculty

- 248 full professors
- 72 associate professors
- 52 assistant professors

Ian Waitz

Dean

Jerome C. Hunsaker Professor of Aeronautics and Astronautics

MacVicar Faculty Fellow