Department of Electrical Engineering and Computer Science

The Department of Electrical Engineering and Computer Science (EECS) is MIT's largest department, with 133 faculty conducting research in four affiliated labs: the Computer Science and Artificial Intelligence Laboratory (CSAIL), the Laboratory for Information and Decision Systems (LIDS), the Microsystems Technology Laboratories (MTL), and the Research Laboratory of Electronics (RLE).

EECS is also home to a growing portion of MIT's student body. In the 2019 academic year, 1,338 undergraduates and 268 master of engineering (MEng) students were enrolled in the department. As of June 30, 2019, the department had 709 active graduate students.

EECS and the MIT Stephen A. Schwarzman College of Computing

Throughout the time covered by this report, EECS leadership and faculty were actively engaged in conversations about the department's role in the MIT Stephen A. Schwarzman College of Computing (SCC). Details about SCC's structure—including its leadership team and a new EECS organizational plan—were announced several months after July 1, 2019, so we will discuss them in more depth in the 2019–2020 report.

However, we did want to highlight the department's involvement in Hello World, Hello MIT, the high-profile celebration of the new SCC in February 2019. Department head Asu Ozdaglar, associate department head Saman Amarasinghe, and Vice President of Open Learning Sanjay Sarma co-chaired Teach: The Academic Symposium, which explored the future of education in a world of pervasive computing. The daylong symposium attracted more than 300 attendees. It featured keynote addresses from two college presidents (Farnam Jahanian of Carnegie Mellon University and Maria Klawe of Harvey Mudd College) and five panels whose distinguished members discussed everything from "Teaching Ethics and Policy in Computer Science" to "Teaching Computer Science to All." The event concluded with a panel discussion, moderated by CSAIL director and EECS faculty member Daniela Rus, featuring several MIT winners of the Association for Computing Machinery (ACM) A.M. Turing Award, often called "the Nobel Prize of Computing."

Several MIT A.M. Turing Award winners, all EECS faculty members, discuss the new MIT Schwarzman College of Computing on February 27, 2019. Left to right: Tim Berners-Lee, Shafi Goldwasser, Butler Lampson, Barbara Liskov, Ronald Rivest, Michael Stonebraker, and moderator and CSAIL director Daniela Rus. Not pictured: Silvio Micali, Fernando Corbato. Photo by Rose Lincoln.

Undergraduate Program

Overall Enrollment

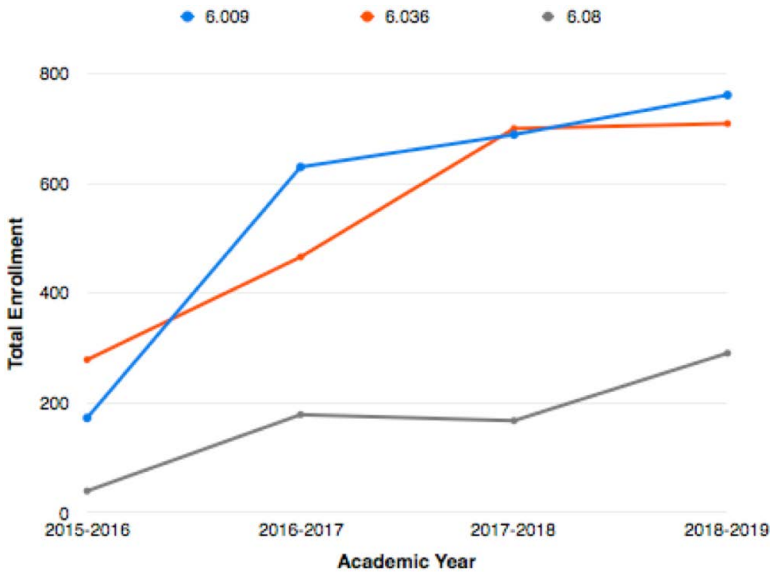
As noted above, 1,338 undergraduate students were enrolled in the department in AY2019. The department also enrolled 268 MEng students (this figure includes participants in the 6-A MEng Thesis Program).

Undergraduate enrollment was split across the department's five majors (percentages are rounded):

- Course 6-1 Electrical Science and Engineering: 61 students (5%)
- Course 6-2 Electrical Engineering and Computer Science: 369 students (28%)
- Course 6-3 Computer Science and Engineering: 774 students (58%)
- Course 6-7 Computer Science and Molecular Biology: 65 students (5%)
- Course 6-14 Computer Science, Economics, and Data Science: 69 students (5%)

Class Enrollment

The department has also seen increased enrollments in subject offerings. Total enrollment rose by approximately 17% in spring term 2019. This enrollment increase is evident in subjects such as 6.009 Fundamentals of Programming, 6.036 Introduction to Machine Learning, and 6.08 Introduction to EECS via Interconnected Embedded Systems.



Enrollment in EECS courses 6.009, 6.036, and 6.08, AY2016–AY2019.

Curricular Innovation

In recent years, EECS has revitalized many of its introductory electrical engineering subjects. Updates on those subjects are provided below.

6.002 Circuits and Electronics

The goal for the revitalization of 6.002 Circuits and Electronics was rethinking the course's content and delivery. Specifically, the subject has been refocused on processing signals and energy, as well as on linear devices; there is now less focus on circuitry for computation as the prime motivator.

In addition, 6.002 now includes a weekly lab component with authentic examples building on subject content, culminating in a multi-week lab that uses the Doppler effect to infer velocity from ultrasound waves. Homework in the subject has been moved to an online system (CAT-SOOP) that provides instant feedback and removes the need for manual grading.

6.003 Signals and Systems

Over the years, new content has been added to 6.003 Signals and Systems, most significantly in the area of discrete-time signals and systems, which have become increasingly important as digital electronic systems have become widely available. To make room for this new material, hands-on activities were reduced in scope and, ultimately, entirely removed from the course. To better communicate both the technical content and its utility, the department has refactored the content in 6.003 and its follow-on subjects so that signal processing theory and its applications are combined in a single subject. The new 6.003 includes a series of recently developed laboratory exercises that build directly on signal processing concepts retained from the previous version of the course.

The revitalization of these two core electrical engineering subjects has led to improvements in follow-on subjects.

6.302 Feedback System Design

One example is 6.302 Feedback System Design, which provides a hands-on introduction to feedback and control. The reformulation of this course combines key ideas from classical methods (which have always been a key part of the course) with modern discrete-time methods. Students' responses to the new reformulation have been phenomenal, with enrollments increasing from about 30 to 40 in 2016 and 2017 to 65 in 2018 and 112 in 2019.

Other Course Highlights

Below are snapshots of other new, revamped, or otherwise notable EECS classes.

6.08 Introduction to EECS via Interconnected Embedded Systems

This popular class offers an introduction to embedded systems in the context of connected devices, wearables, and the Internet of Things (IoT). Topics include energy utilization, algorithms, sensors, networking, cryptography, local versus distributed computation, and more. Students work with multiple platforms, servers, databases, and microcontrollers.

For their final project, student teams design, program, build, and demonstrate their own cloud-connected, handheld, or wearable IoT systems. The spring 2019 class included a showcase of about 85 final projects ranging from a "smart suit" that assesses a user's pushup form to a frisbee that analyzes velocity and acceleration to track shuttle locations.

The course was created by EECS professor and associate department head Joel Voldman and principal lecturer Joseph Steinmeyer. The spring 2019 class was taught by Steinmeyer and two other EECS faculty members, Stefanie Mueller and Max Shulaker.

6.883/6.S083 Modeling with Machine Learning: From Algorithms to Applications

This class, offered for the first time during the spring 2019 term, was created as an experimental alternative to the wildly popular 6.036 Introduction to Machine Learning, which was designed and originally taught by EECS faculty members Regina Barzilay and Tommi Jaakkola. After receiving feedback that 6.036 was too specialized for some students not majoring in electrical engineering and computer science, Barzilay and Jaakkola designed 6.883/6.S083 to focus on different applications of machine learning. Their goal: to provide a broader range of students with tools allowing them to solve problems in their own specialty areas.

Open to both undergraduate and graduate students, 6.883/6.S083 enrolled 66 students for credit in its debut semester. About two thirds of these students were from architecture, biology, business, and other fields outside electrical engineering and computer science.

The class featured live lectures focused on modeling and online materials for building a shared background in machine learning methods, including tutorials for students with less prior exposure to the subject.

6.S897/HST.956 Machine Learning for Healthcare

In this pioneering class, offered jointly by EECS and the Harvard-MIT Program in Health Sciences and Technology (HST), students learn about the many ways in which machine learning is being applied in healthcare systems.

The updated spring 2019 class introduced about 70 students to the latest machine learning algorithms for analyzing doctors' clinical notes, patient medical scans, and electronic health records, among other data. In addition, they explored the risks of using automated methods to explore large, often messy observational data sets.

Students in the course also read recent scientific papers, solve problem sets based on current topics such as opioid addiction and infant mortality, and hear from physicians and engineers who are developing more data-driven approaches to healthcare.

The class was developed and taught by EECS faculty members David Sontag and Peter Szolovits.

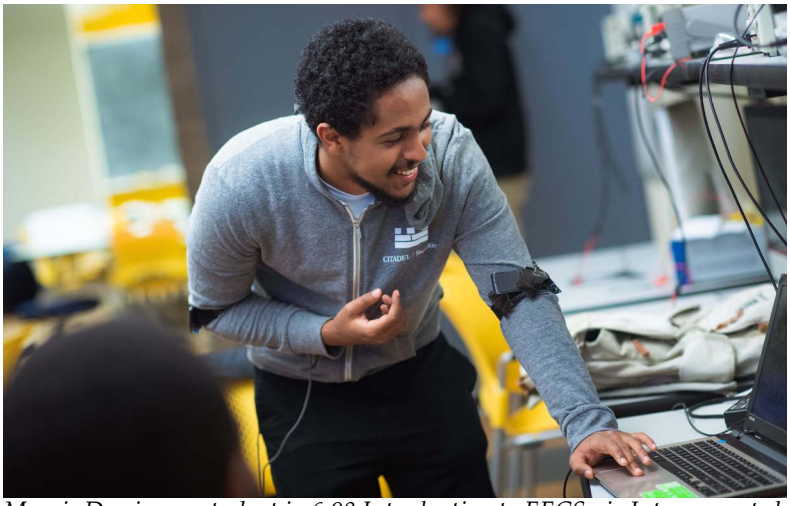
6.012 Nanoelectronics and Computing Systems

This class has been completely revised and updated with new lectures, recitations, problem sets, optional labs, and tests as well as a final project. The key changes are as follows:

- The class content emphasizes cross-layer interactions. It begins by examining key metrics of a realistic computing system and how low-level device physics is critical in determining the specifications of a computing system. This motivates the majority of the coursework, which focuses on understanding device physics.

- A new final project challenges students to modify a starting transistor to realize the most energy-efficient commercial processor core. In this project, students use industry-standard computer-aided design tools and connect device design all the way through system performance.
- An optional lab (in which most students choose to participate) allows students to fabricate their own transistors and small logic gates, giving them a unique hands-on experience with nanofabrication.
- The class now focuses on developing intuition and understanding practical problems rather than on crunching numbers and matching equations to problems.
- Finally, the class delves into advanced state-of-the-art devices and technologies and covers the remarkable progression of semiconductor technology over the decades.

The class was revamped and is taught by EECS faculty member Max Shulaker.



Mussie Demisse, a student in 6.08 Introduction to EECS via Interconnected Embedded Systems demonstrates his team's "smart suit" for workouts. Photo by Gretchen Ertl.

Updates on Joint Majors and the Computer Science Minor

Course 6-14: Designing the Virtual Marketplaces of the Future

In fall 2017 EECS and the Department of Economics launched a new joint major, Computer Science, Economics, and Data Science (Course 6-14). The major is designed to meet the increasing need for graduates with skills in both computer science and economics. Specifically, employers are seeking graduates who can apply machine learning, data analysis, and other computer science skills to the complex economic problems that have emerged from e-commerce, online social networks, and other aspects of the digital economy.

To prepare students to address such challenges, Course 6-14 combines coursework in algorithms, statistics and probability, data science, and microeconomics. Enrollment has increased steadily since the major's launch, with 69 students enrolled during AY2019 and four graduating in that academic year; 100 students have enrolled for fall 2019.

Course 11-6: Combining Urban Planning and Computer Science

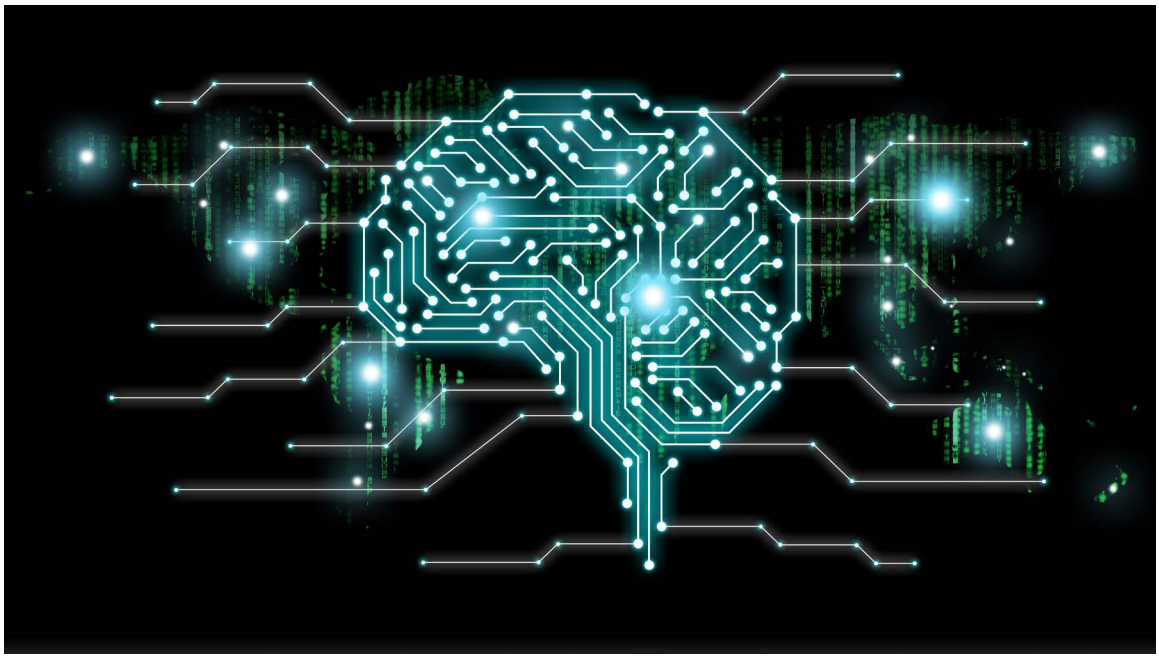
EECS and the Department of Urban Studies and Planning launched another new major, Urban Science and Planning with Computer Science (Course 11-6), in fall 2018.

This undergraduate major, the first of its kind in the United States, combines urban planning and policy-making (including ethics and justice) with statistics, data science, geospatial analysis, visualization, computer science, robotics, and machine learning. It enrolled three students for AY2019 and 13 for AY2020; at this writing, no degrees have been granted.

Course 6-9: Combining Computation and Cognition

In collaboration with the Department of Brain and Cognitive Sciences, EECS will begin offering a new joint undergraduate degree program, Computation and Cognition (Course 6-9), in fall 2019. This program is designed to educate a new cadre of graduates who are uniquely qualified to address challenges and opportunities at the intersection of electrical engineering, computer science, and brain and cognitive sciences, particularly in terms of advancing our understanding of how biological neural circuits function to produce flexible intelligent behaviors and how such behaviors can be replicated in machines and used to improve interfaces with the brain.

These questions are among the greatest scientific and engineering challenges of our time, and transformative advances will require a better understanding of the neural mechanisms of the human mind and brain as well as a better understanding of the computational structures and methodologies that inform the construction of machines that learn. To that end, the new program will foster the use of technology in the study of brain and neurophysiological processes and combine insights from behavior and cognition in brain and cognitive sciences with artificial intelligence and machine learning in electrical engineering and computer science. The major enrolled 40 students in fall 2019.



Minor in Computer Science

Knowledge of computer science is becoming more important in other fields, including the physical sciences, the humanities, and economics. It is clear from the significant increase in computer science enrollments in recent years that students majoring in fields outside of electrical engineering and computer science feel the need to learn computer science. Introduced by EECS in fall 2016, the computer science minor provides a structured, simple, and flexible program for students who want to major in other fields but become proficient in computer science. An update to the minor effective in spring 2020 will allow students more flexibility while still retaining the breadth, depth, and simplicity of the original version.

During the 2019 academic year, 38 students were certified as having completed the computer science minor. Another 65 have declared the minor but not yet completed the requirements. These students are majors in 16 different departments; roughly 67% are seniors, 30% are juniors, and 3% are sophomores.

Contributions to MITx

During the past year, EECS offered a variety of classes through the MITx online portal. Among the most popular were 6.00.1x Introduction to Computer Science and Programming Using Python and 6.00.2x Introduction to Computational Thinking and Data Science, which ran as self-study classes this year. A list of subjects follows, with the enrollment and completion numbers for each:

- 6.00.1x Introduction to Computer Science and Programming Using Python—155,165 registered, 10,511 explored, and 4,606 completed
- 6.00.2x Introduction to Computational Thinking and Data Science—16,042 registered, 1,165 explored, and 656 completed
- 6.431x Probability: The Science of Uncertainty and Data—76,597 registered, 4,746 explored, and 1,349 completed
- 6.86x Machine Learning with Python: From Linear Models to Deep—39,897 registered and 369 explored
- 6.002.1x Circuits and Electronics 1: Basic Circuit Analysis—94,795 registered, 8,434 explored, and 1,086 completed
- 6.002.2x Circuits and Electronics 2: Amplification, Speed, and Delay—24,523 registered, 1,985 explored, and 393 completed
- 6.002.3x Circuits and Electronics 3: Applications—23,598 registered, 1,236 explored, and 273 completed

At this writing, the summer 2019 offerings of 6.431x and 6.86x are still in progress, so the "completed" total does not reflect those sessions. The numbers for the 6.002 modules reflect the total number of learners since the class began in the summer of 2016.

Departmental Exchange Programs

EECS has two departmental exchange programs: one with ETH Zürich and one with Imperial College London. Students in these programs spend one or both semesters of their junior year abroad, taking subjects that will transfer for core or restricted-elective subjects in EECS. In AY2019, two students studied abroad at ETH and four studied abroad at Imperial. In the upcoming year, four will study abroad at ETH and five will study at Imperial.

Undergraduate Student Advisory Group

The department reconvened its Undergraduate Student Advisory Group in EECS (USAGE) in fall 2018. This group consists of 37 diverse students from across the department. In AY2019, they were instrumental in advising EECS leadership on the state of the department and helping the Undergraduate Office plan new initiatives.

Accreditation

The department is up for re-accreditation by the Accreditation Board for Engineering and Technology (ABET) for its 6-1, 6-2, and 6-3 degree programs in the 2019–2020 cycle. During 2018–2019, a committee of seven faculty and lecturers led by EECS undergraduate officer Katrina LaCurts prepared the ABET self-study report. This report describes the department's continuous improvement process and contains documentation on the curricula for each of the programs as well as how the curricula support ABET's outcomes.

Undergraduate Office Updates

The Undergraduate Office hired two full-time staff members in 2018–2019: a new office administrator (replacing the previous administrator after her retirement) and an undergraduate program manager. The latter role is a new one for the department, focused on strategic planning, program management, outreach, and growth.

Thanks to these new hires, the Undergraduate Office has been able to take on new initiatives including an advisor training program and community-building events for students.

Department Teaching Laboratories

The EECS Department Teaching Laboratories supply faculty, students, and staff with the necessary work space and resources to apply theory from research and classes directly to practical implementations. They also contain one of the major campus makerspaces, providing students from across the Institute with access to facilities for electronics fabrication and testing, mechanical assembly, and three-dimensional (3D) printing, among many other hardware capabilities.

The 2019 academic year saw the continued growth of several new subjects, including 6.08 Introduction to EECS via Interconnected Embedded Systems (as mentioned above) and the popular freshman seminar 6.A01 Mens et Manus: The Joy of MIT. These classes continue to expose undergraduates to techniques and challenges in the design, manufacture, testing, and debugging of physical hardware in addition to traditional problem sets and exams.

More than 30 classes across the EECS spectrum use the teaching laboratories, with most students in those classes using the space several times each week. The 25,378-square-foot space remains open and staffed more than 14 hours per day, six days per week, to serve as a regular classroom location and study area.

During the academic year, EECS often highlights the teaching laboratories through alumni donor and prospective student tours, community outreach efforts, and industry events. The lab area continues to be active through the between-terms Independent Activities Period (IAP) with technical competitions such as MASLAB (Mobile Autonomous Systems), which provides students across the campus with an outlet to develop extensive systems that integrate both hardware and software. The Office of Engineering Outreach Programs offers several workshops and seminars during IAP and over the summer to engage local middle and high school students.

The teaching labs also support students engaged in individual practical work, either informally or through a formal special projects course. In these cases, lab staff work to coordinate safety and other concerns, find space, and establish guidelines for lab use.

Finally, the labs are critical to supporting the demo infrastructure in the department. We support the construction and storage of a large number of in-class demonstrations for classes such as 6.002 Circuits and Electronics, 6.003 Signals and Systems, 6.013 Electromagnetics and Applications, and 6.014 Electromagnetic Fields, Forces, and Motion.

Engineering Design Studio

The Engineering Design Studio (EDS) within the Department Teaching Laboratories remains a campus hub for students to design and fabricate ideas that require professional and high-power equipment. As a machine shop and makerspace tailored toward electrical engineering and computer science education, EDS continues to develop its in-house capabilities with additional 3D printers and milling machines for full printed circuit-board design and manufacturing.

EDS also provides a unique capability in that it can be configured as a classroom for lecture-style classes but can simultaneously host equipment for testing and fabrication so that students can move back and forth seamlessly between practical work and listening to an instruction. This environment serves as an optimal model for practical teaching spaces going forward. To that end, EDS reserves a number of high-quality testing elements that can be brought out and used in the space on request.

EDS continues to host a section of the popular class How to Make (Almost) Anything (offered under the class number 6.943J). This 18-unit course delves into technologies ranging from laser cutting to embedded programming. It meets weekly in the fall with three other class sections across campus and at Harvard, giving School of Engineering students exposure to peers with a variety of academic backgrounds. First-year students are engaged through the previously mentioned Mens et Manus seminar.

Through MIT's Project Manus and the Mobius mobile application, EDS also has its full equipment catalog and capabilities available for any user to explore. EDS has steadily received new visitors each year and continues to expand its reach. EECS faculty member Karl Berggren serves as the department's undergraduate laboratory officer.

Graduate Program

The EECS graduate program offers high-quality academics with a broad range of advanced course offerings. Moreover, our graduate students make leading contributions to an extremely wide range of research activities in all areas of science and nanoscience, health care and medical instrumentation and imaging, energy and energy efficiency, business, manufacturing, robotics, management of big data, and advances in technology. In areas impacted by computer science, implementation of machine learning with data from science, business, social networks, technology, medicine, and environmental sensing and monitoring is under intense investigation. The exciting research opportunities for our graduate students continue to attract outstanding and highly accomplished applicants striving to change the world in collaboration with their student peers and our faculty and research staff supervisors.

The graduate program is milestone based and involves a limited number of requirements. Individuals entering the program will be required to complete 66 units of graduate coursework along with a thesis research proposal and thesis to earn a master of science (SM) degree. Along with an SM degree, doctoral-degree requirements include completion of the technical qualifying evaluation, which consists of four EECS graduate subjects, and the research qualifying examination, which includes completion of a minor program (two coherently linked subjects), a teaching assistantship, and a doctoral thesis with a public thesis defense.

New: The Professional Perspective

The EECS faculty approved an additional graduate degree requirement for a three-year trial starting in June 2019: the Professional Perspective. This requirement is designed to assist graduate students in understanding the multitude of options that will be available to them upon graduation with an advanced degree. The Professional Perspective requires the completion of one unit for SM and MEng degrees and the completion of two units for doctoral degrees. Completing the required units can be accomplished in a variety of ways, including industrial, academic, or government lab internships; attendance at industrial colloquia; participation in specialized training to prepare for an academic career; or participation in the creation of a company.

Admissions, Fellowships, Enrollments, and Graduates

During the 2019 admissions season, we received 3,619 applications from all over the world; that figure represents a 5% increase in applications from 2018. Ultimately, 234 students (roughly 6% of applicants) were admitted into our graduate program. In the fall 2019 semester, 134 new students will join the program, with seven additional students joining in spring 2020.

The 2019 class of graduate students includes 33 women and eight underrepresented minority students. About 53% of the new students will be funded by prestigious fellowships including MIT Presidential Fellowships, departmental fellowships sponsored by EECS alumni, and externally awarded fellowships such as National Science Foundation (NSF) Graduate Research Fellowships, industrially sponsored fellowships, and fellowships received from other countries.

These internally and externally funded fellowships not only are important for financial support but also provide incoming graduate students with flexibility to select the desired research groups and projects to meet their interests and career goals. All students who are admitted into our graduate program are provided full financial support in the form of a fellowship, a research or teaching assistantship, or financial support from EECS. Financial support includes tuition, a monthly living allowance or stipend, and medical insurance for the first year of students' graduate education (their remaining years are typically funded by the research supervisor).

As of June 30, 2019, there were 709 active EECS graduate students, with 152 women students (21% overall); 56% of these students have international citizenship. The graduate student body is 47% electrical engineering (22% women) and 53% computer science (21% women).

Our graduate students receive a wide assortment of fellowship awards. About 190 current students (27%) are supported by fellowships, training grants, and internships. In addition to fellowships awarded at the time of admission (EECS departmental fellowships, Institute fellowships, and MIT Presidential Fellowships), EECS graduate students receive fellowships from the US government, US industry and training grants, and fellowships from foundations and foreign countries. Our graduate students have also won a number of scholarship awards, including the prestigious Hertz Fellowship, the Ford Foundation Fellowship, Alfred P. Sloan Foundation Scholarships, Siebel Scholarships, and two Dimitris N. Chorafas Foundation Prizes.

In addition, EECS graduate students have received highly competitive industrial fellowships from Analog Devices, Facebook, Google, HP, IBM, Microsoft, Qualcomm, Samsung, and Texas Instruments.

In AY2019, EECS graduated students in September, February, and June. A total of 448 advanced degrees were awarded: 239 MEng degrees (up 16% from last year), 126 SM degrees, 82 PhD degrees, and one electrical engineering degree.

Traditional cap toss following the Investiture of Doctoral Hoods, June 2019. Photo by Gretchen Ertl.

Graduate Program Diversity and Outreach

Along with a graduate student body that is diverse in nationality, EECS strives to achieve a graduate student community that is diverse in gender, ethnicity, and race. To make inroads to support the diversity of applicants, the EECS Graduate Office staff and faculty regularly participate in MIT's Institute-wide recruiting efforts. In addition to supporting MIT's Minority Summer Research Program, EECS supports the National GEM Consortium Getting Ready for Advanced Degrees (GRAD) Lab and the CONVERGE graduate preview weekend typically held in the fall. Networking and mentoring seminars for women are offered each fall (with reunions in the spring), and other events are held for individuals who may benefit from weekly group meetings and discussions. Three different networking seminars are currently offered for various groups of incoming graduate students.

Visit Days for Newly Admitted Graduate Students

EECS organizes visit days each spring for all students admitted to our graduate program. The events provide a chance for admitted applicants to envision their lives as graduate students working on research and academics and to view firsthand the many opportunities available at MIT and in the Boston metropolitan area. Most important, the events allow admitted applicants to meet potential research supervisors, visit labs, chat with research groups and potential classmates, and see graduate dormitories and living spaces. In developing the visit days schedule, organizers build in a variety of opportunities for one-to-one interactions.

EECS visit days ran from February 28 to March 3, 2019. The event began Thursday night with a dinner and reception organized by current EECS graduate students. Formal sessions began on Friday morning with a research exchange dubbed "three-minute madness," in which EECS faculty and research staff shared their research goals and philosophy as concisely and quickly as possible—in no more than three minutes. Ultimately, the range of research activities discussed added up to an impressive overview.

One-to-one meetings with faculty and research staff followed, giving admitted applicants their first experience of navigating MIT's "infinite corridor" as they moved office to office meeting prospective research groups. Friday afternoon included several laboratory tours and a reception hosted by faculty and lab directors. Friday night featured several dinners arranged by research group or area, providing more time for interaction and discussion.

On Saturday the EECS graduate officer described the program's academic requirements, and a panel of current graduate students discussed student life and answered visitors' questions. Admitted applicants departed on Sunday morning with key information needed to make important decisions about graduate school selection and research direction.

Graduate Student Organizations

Graduate student organizations include the EECS Graduate Student Association (GSA) and Graduate Women in Course 6 (GW6). Current graduate students are invited to participate in both groups' events. Among other activities, GSA offered an informational

panel on preparing thesis proposals and scheduled informal dinners with EECS faculty guests. Over the summer, the group organized social events including a rock-climbing excursion and a movie night. GSA volunteers also put together a variety of welcoming activities for both the EECS visit days and the new student orientation in August.

GW6 also organizes a variety of social, networking, and intellectual events. During the past year, GW6 invited EECS faculty to join the group's members in a conversation at the Women in Tech breakfast series. In addition, the group collaborated with the EECS Communication Lab to provide instruction on the art of the elevator pitch and other communication skills. Social activities organized and offered by GW6 included a paint night, an outlet mall shopping excursion, a jewelry-making night, and kayaking and hiking trips. Also, for the fifth year, GW6 organized the Graduate Women's Community Dinner in memory of Erin M. Aylward '06. The community dinner is an annual event to promote community and networking among graduate women in EECS.

6-A Master of Engineering Thesis Program

The department's 6-A Master of Engineering Thesis Program, which was in its 101st year during the period covered by this report, is a partnership between MIT and some of the world's most innovative companies. It allows students to work on industry projects while simultaneously completing their MEng theses.

Students typically join the program as juniors and seniors, completing three- and six-month assignments at their companies. Each participant is assigned both a faculty advisor and an industry mentor, and students' work for their companies is used toward their MEng theses. In some cases, the program also covers the full tuition for the MEng degree and pays competitive salaries during students' work assignments. Participating students receive academic credit for assignments and are able to graduate with their class.

More than 2,500 alumni have completed the 6-A program over the years. The program currently has two tiers of industrial partners: core and affiliate partners. Core partners commit to supporting students during both their internship at the company and their final term at MIT. Affiliate partners cover students' expenses only during their internship. Current core and affiliate partners include Analog Devices Inc., Applied Materials, Bose, Cadence, Cambridge Mobile Telematics, Cell Signal Technology, Draper, the Lawrence Livermore National Laboratory, Lockheed Martin, MIT Lincoln Laboratory, and Sumo Logic.

The highly competitive program organizes two orientation sessions during the year, one in September and one in April. Sixty-seven EECS students applied during the fall recruitment and 11 during the spring.

Thirty-four students received offers from various 6-A companies, while nine others were not matched with a 6-A company and 24 withdrew from the matching process for various reasons. Ultimately, 19 students accepted 6-A company offers and were admitted into the program. Of these students, seven were undergraduates on work assignments during the summer term.

Twelve MEng students admitted in 2019 will work on their assignments during the summer and fall 2019 terms. In addition, seven students from the previous year have continued on to their MEng work assignments. In total, the program currently has 11 undergraduates and 16 MEng graduate students. Sixteen 6-A MEng students completed the program and graduated in June 2019.

During the May 2019 EECS spring awards ceremony, the J. Francis Reintjes Excellence in 6-A Industrial Practice Award was presented to outstanding 6-A student Zachary Zumbo. Zumbo completed two MEng work assignments at Cadence in Chelmsford, MA, during which he demonstrated terrific performance and genuinely impressed his mentors and advisors. He has accepted a full-time engineering position at Cadence, where he will be the liaison between the company and 6-A and mentor future 6-A students.

EECS professor Tomás Palacios serves as director of the 6-A program.

Zachary Zumbo receives the Reintjes Award from Professor of Computer Science and Engineering Martin Rinard at the 2019 EECS spring awards ceremony.

Photo by Gretchen Ertl.

Educational and Outreach Initiatives

Rising Stars Workshop for Women Returns to MIT

Rising Stars in EECS returned to MIT in October 2018 after being hosted by other universities in 2016 and 2017. The intensive two-day event brought together 76 of the world's most promising graduate students and postdoctoral researchers who are interested in academic careers.

More than 40 panelists and speakers provided participants with practical information and candid advice on seeking and interviewing for faculty jobs, networking, teaching, speaking, mentoring, funding research, setting up labs, getting tenure, and managing day-to-day life in academia. The event also featured a poster session in which attendees pitched their research to faculty members and networked with each other.

The 2018 participants were selected from a pool of nearly 250 applicants, represented 20 different research areas, and hailed from MIT and more than 20 other US schools, including Carnegie Mellon, Columbia, Georgia Tech, Harvard, Princeton, Stanford, the University of California, and the University of Michigan. Also represented were several

international institutions, including Aarhus University in Denmark, the Max Planck Institute for Software Systems and the University of Stuttgart in Germany, Tel Aviv University in Israel, and the University of Toronto in Canada.

EECS launched the Rising Stars workshop for 38 participants in 2012 with the goal of helping demystify the "black box" of academic hiring and the tenure process. In 2013 the workshop attracted 40 participants, and other schools asked to host future events. In 2014, the University of California hosted the workshop (with MIT as a co-sponsor); in 2015, MIT again hosted the event, attracting 61 participants. Carnegie Mellon University hosted the workshop in 2016; the event moved to Stanford University in 2017. It will be hosted by the University of Illinois in 2019.

Where do Rising Stars alumnae end up? Of the 309 women who participated in Rising Stars workshops between 2012 and 2017, more than 30% held faculty positions as of June 2018, according to EECS research. Slightly more than 20% worked in industry; about the same percentage were in postdoctoral positions. The rest were students or in other academic roles. (Mengjia Yan, a 2018 Rising Stars alumna, will join the EECS faculty in November 2019; four other faculty members—Tamara Broderick, Farnaz Niroui, Negar Reiskarimian, and Vivienne Sze—are alumnae of earlier Rising Stars events.)

EECS department head Asu Ozdaglar chaired the 2018 workshop. Technical co-chairs included Niroui and Sze along with EECS faculty members Stefanie Mueller and Virginia Williams. School of Engineering dean Anantha Chandrakasan, who founded Rising Stars in 2012, served as a workshop advisor.

Rising Stars in EECS, 2018. The workshop returned to MIT in October 2018 after being held at other universities in 2016 and 2017. Photo by Justin Knight.

Communication Lab: Engineers Helping Engineers

Launched as a peer-coaching resource, the EECS Communication Lab served approximately 700 students and postdocs between 2016 and 2019, providing them with more than 1,200 free, one-to-one communication coaching sessions. The Comm Lab's goal is to make a difference for students working on their technical and professional communication skills, preparing them for roles as leaders, collaborators, and teachers in whatever careers they choose. To that end, the lab continues to expand its offerings and outreach beyond its core one-to-one coaching service.

During the 2019 academic year, the Comm Lab led seven workshops and panels focusing on the following areas:

- Preparing for the research qualifying examination
- Evaluating abstract submissions to the MTL annual research conference
- Presenting at the MTL annual research conference
- Writing an MEng thesis proposal
- Creating a compelling poster for Masterworks, the annual celebration of thesis research leading to MEng and SM degrees
- Crafting effective grants in accordance with National Institutes of Health standards
- Creating effective communication strategies

In addition, the lab hosted two workshops led by staff from *Nature*, allowing department members to learn publishing strategies directly from editors.

The lab also offered targeted coaching and practice sessions for students working toward particular event or class deadlines:

- A resumé blitz for the fall Career Fair, serving 43 students and postdocs with 10-minute rapid-fire coaching sessions
- Night-before presentation practice for the off-campus Microsystems Technology Lab annual research conference
- Oral presentation coaching for Center for Integrated Circuits and Systems research reviews in the fall and spring
- Partnerships with EECS faculty in six classes (Tomaso Poggio, Manolis Kellis, Julian Shun, Charles Leiserson, Erik Demaine, and Luca Daniel) to coach students on communication assignments
- Partnerships with faculty to prepare lab group members for conference talks through weekly drafting and practice sessions

Finally, we pursued several outreach initiatives to continue finding ways to grow and optimize our services, as follows:

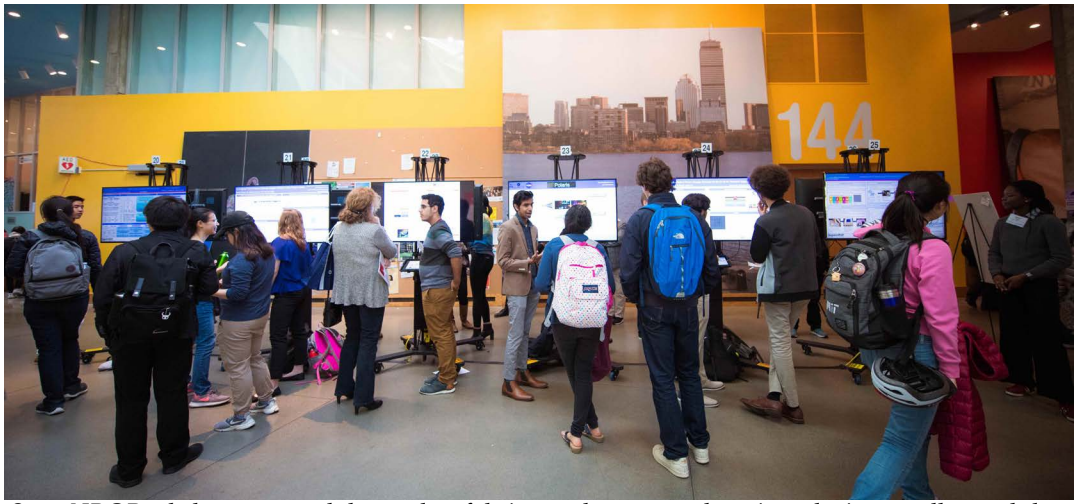
- Launching Comm Lab Quick Takes, a service that provides quick, online-only communication feedback
- Meeting one on one with faculty to better understand their needs and ideas
- Offering outreach to postdoc leadership to increase awareness of our services and identify unmet needs (leading to the development of a new grant-writing workshop to be launched in the coming academic year)
- Interviewing students to learn more about their writing processes and the support they are looking for
- In coordination with the broader School of Engineering Communication Lab ecosystem, executing an educational study to quantify the impact of the lab and identify areas where we can further optimize our coaching practices

SuperUROP at MIT: New Opportunities for Student Researchers

The Advanced Undergraduate Research Opportunities Program, better known as SuperUROP, is designed to provide a more in-depth experience for juniors and seniors who have already completed a traditional UROP project. Through participation in graduate-level research and attendance at weekly guest lectures presented by distinguished speakers, the EECS-hosted program prepares students for work in academia, industry, and start-ups. The 12-credit 6.UAR Seminar in Undergraduate Advanced Research, offered in conjunction with SuperUROP, teaches students technical communication skills.

SuperUROP scholars describe their work at live events such as the December 2018 and April 2019 SuperUROP Showcase poster sessions (the latter session was co-located with Masterworks, the annual EECS celebration of master's thesis research). Many SuperUROP scholars go on to present at professional conferences or publish in top journals in their fields. Each student is eligible to receive a named stipend funded by gifts from industry sources and alumni.

Launched by EECS in 2012, SuperUROP is now open to all School of Engineering students. During 2018–2019, thanks to a generous gift from an anonymous donor, the program was extended for the second year to the School of Humanities, Arts, and Social Sciences. This donation allowed several students to work on projects combining computer science with music, political science, theater, and other areas. Overall, about 130 students completed the intensive program in 2018–2019.



SuperUROP scholars presented the results of their year-long research projects during a well-attended poster session in April 2019. Photo by Gretchen Ertl.

Women's Technology Program

Founded in EECS in 2002, the Women's Technology Program (WTP) marked its 18th year during 2019. WTP's mission is encouraging high school girls with demonstrated math and science talent to pursue engineering and computer science by introducing them to these subjects in hands-on, college-level labs and classes. The program has both an electrical engineering and computer science track and a mechanical engineering track. WTP director Cynthia H. Skier '74, SM '81 (who is based in EECS), manages many of the administrative operations for the two tracks.

During spring 2019, 60 students (40 for WTP-EECS and 20 for WTP-ME) were selected for the four-week program from an applicant pool of 620 high school juniors nationwide.

Because the 2019 WTP classes did not begin until July 1 (after the period covered by this report), detailed information on the summer 2019 program will be provided in the AY2020 report.

Postdoc 6

Postdoc 6 is a departmental initiative that aims to enhance the experience of more than 200 EECS-affiliated postdoctoral researchers and associates. The program's three main offerings are offsite postdoc leadership workshops, occasional half-day workshops, and monthly social hours.

The intensive (two-day, one-night) postdoc leadership workshops are held offsite at MIT's Endicott House two or three times a year. Each fully funded workshop is limited to 16 EECS-affiliated postdocs. The events aim to complement early-career researchers' scientific training by focusing on the human aspects of working in science. Topics covered include setting goals and priorities, developing key communication skills, establishing effective collaborations, and dealing with group dynamics. The workshops also emphasize community building, with facilitators encouraging participants to establish peer groups for further professional development. Feedback collected in post-workshop surveys has been overwhelmingly positive.

EECS schedules occasional half-day workshops on specific topics such as finding faculty jobs, giving talks and presentations, and developing research statements. The program also informs postdocs about available entrepreneurship opportunities such as StartMIT and the Translational Fellows Program.

The program's monthly social hours have become a popular tradition for postdocs in the four participating EECS labs (CSAIL, LIDS, MTL, and RLE). The goal: providing postdocs with an opportunity to connect with each other in a relaxed, supportive setting.

In an intensive two-day offsite session, EECS-affiliated postdocs learn key skills for communication and collaboration.

Faculty Notes

Faculty Promotions

- Full professor: Wojciech Matusik
- Associate professor with tenure: Aleksander Madry, Daniel Sanchez Martin, Virginia Williams
- Associate professor without tenure: Mohammadyeza Alizadeh Attar (Mohammad Alizadeh), Guy Bresler, Tamara A. Broderick, Stefanie Sabrina Jegelka, Luqiao Liu, Suvrit Sra

Faculty on Sabbatical Leave

- Sangeeta N. Bhatia
- Louis D. Braida
- Adam Chlipala
- Jongyoon Han
- Samuel R. Madden
- Silvio Micali
- Robert C. Miller
- Nir N. Shavit
- Armando Solar-Lezama
- Gerald J. Sussman

Faculty on Junior Research Leave

- Guy Bresler
- Tamara A. Broderick
- Michael James Carbin
- Virginia Williams

Faculty on Family Release

- Nickolai Zeldovich (September only)

Faculty on Leave

- Hari Balakrishnan
- David K. Gifford
- Shafrira Goldwasser
- Timothy K. Lu
- Silvio Micali
- Richard Ryan Williams
- Nickolai Zeldovich

Retired Faculty

- William T. Freeman
- Berthold K. P. Horn

The department notes with sadness the passing of Dean Norman Arden.

New Faculty

Nine new faculty members have been hired during the past year:

- Manya Ghobadi (PhD, University of Toronto) joined EECS as an assistant professor in October 2018.
- Negar Reiskarimian (PhD, Columbia University) joined EECS as an assistant professor in May 2019.
- Pulkit Agrawal (PhD, University of California) will join the faculty as an assistant professor in July 2019.
- Jacob D. Andreas (PhD, University of California) will join EECS as an assistant professor in July 2019.
- William D. Oliver (RLE associate director) will join the faculty as an associate professor without tenure in July 2019.
- Mengjia Yan (PhD, University of Illinois) will join the faculty as an assistant professor in November 2019.
- YuFeng (Kevin) Chen (PhD, Harvard University) will join EECS as an assistant professor in January 2020.
- Jonathan Ragan-Kelley (PhD, MIT) will join EECS as an assistant professor in January 2020.
- Henry Corrigan-Gibbs (PhD, Stanford University) will join EECS as an assistant professor in July 2020.

Career Development Chair Appointments

- Song Han was appointed as the Robert J. Shillman (1974) Career Development Assistant Professor in EECS.
- Phillip John Isola was named the Bonnie and Marty (1964) Tenenbaum Career Development Assistant Professor.
- Tim Kraska was appointed as the ITT Career Development Associate Professor in Computer Technology.
- Farnaz Niroui was appointed as the E.E. Landsman (1958) Career Development Assistant Professor.
- Arvind Satyanarayan was appointed as the NBX Career Development Assistant Professor.
- Julian Shun was named the Douglas Ross (1954) Career Development Assistant Professor of Software Technology.

Faculty Chair Appointments

- Polina Golland was named the Henry Ellis Warren (1894) Professor.
- Piotr Indyk was appointed as the Thomas D. and Virginia W. Cabot Professor.
- Asuman E. Ozdaglar was named the School of Engineering Distinguished Professor of Engineering.
- Pablo A. Parrilo was appointed as the Joseph F. and Nancy P. Keithley Professor in Electrical Engineering.
- David Alexander Sontag was appointed as the Von Helmholtz Associate Professor of Medical Engineering.

Awards and Honors

Faculty Awards and Honors

EECS faculty received a number of awards and honors over the past year, as follows.

- Anant Agarwal was presented the Yidan Prize for Education Development Laureate.
- Mohammed Alizadeh was awarded a Microsoft Faculty Research Fellowship.
- Dimitri Antoniadis was elected to the American Academy of Arts and Sciences.
- Regina Barzilay was named one of the Top 100 AI Leaders in Drug Discovery and Advanced Healthcare by Deep Knowledge Analytics.
- Tim Berners-Lee was named the Boldness in Business Person of the Year by *Financial Times*.

- Dimitri Bertsekas and John Tsitsiklis were awarded the 2018 INFORMS (Institute for Operations Research and the Management Sciences) John von Neumann Theory Prize.
- Tamara A. Broderick won the Junior Bose Award and an International Conference on AI and Statistics Notable Paper Award.
- Michael Carbin was presented the Best Paper Award at the International Conference on Learning Representations.
- Vincent W. S. Chan won the Best Paper Award at the IEEE (Institute of Electrical and Electronics Engineers) International Conference on Communications and was named president-elect of the IEEE Communications Society.
- Anantha Chandrakasan was elected to the American Academy of Arts and Sciences.
- Konstantinos Daskalakis won the Bodossaki Foundation Scientific Prize and the ACM Grace Murray Hopper Award.
- Jesús A. del Alamo was named a fellow of the Materials Research Society.
- Erik Demaine won an MIT Teaching with Digital Technology Award and was selected as a MacVicar Fellow.
- Srinivas Devadas was presented a Distinguished Alumnus Award by ITT Madras.
- Dirk Englund was awarded an MIT Professor Amar G. Bose Research Grant.
- Ruonan Han was presented the 2019 Outstanding Researcher Award by the Intel Corporate Research Council.
- Song Han was named to *MIT Technology Review*'s Technology Innovators Under 35 list.
- Thomas Heldt was named an IEEE Engineering in Medicine and Biology Distinguished Lecturer.
- Tommi Jaakkola was named among the Top 100 AI Leaders in Drug Discovery and Advanced Healthcare by Deep Knowledge Analytics.
- David R. Karger was elected to the American Academy of Arts and Sciences.
- Dina Katabi was a Carnegie Corporation of New York Great Immigrants honoree.
- Manolis Kellis was a Mendel Lecturers Committee speaker and was named one of the Top 100 AI Leaders in Drug Discovery and Advanced Healthcare by Deep Knowledge Analytics.
- Luqiao Liu was awarded a Young Investigator Program grant by the Air Force Office of Scientific Research.
- Nancy Lynch was presented the Outstanding Technical Achievement Award by the IEEE Technical Committee on Distributed Processing.
- Thomas Magnanti was the recipient of Singapore's National Day Award.
- Muriel Médard was elected as a fellow of the National Academy of Inventors.

- Robert T. Morris was elected as a fellow of the National Academy of Engineers.
- Stefanie Mueller received an NSF CAREER Award.
- Alan Oppenheim was presented an MIT Creative Advising Activity Award.
- L. Rafael Reif was elected as a fellow of the National Academy of Inventors.
- Devavrat Shah was presented the Test of Time Award by ACM SIGMETRICS (Special Interest Group for the Computer Systems Performance Evaluation Community).
- Julian Shun received a US Department of Energy Early Career Award and an NSF CAREER Award.
- Suvrit Sra received an NSF CAREER Award.
- Vivienne Sze was presented an MIT Harold E. Edgerton Faculty Achievement Award.
- Peter Szolovits was named one of the Top 100 AI Leaders in Drug Discovery and Advanced Healthcare by Deep Knowledge Analytics.
- Russell L. Tedrake was presented the Inaugural Paper of the Year Award by the *International Journal of Robotics.*
- Christopher J. Terman received the MIT Gordon Y. Billard Award (for special services of outstanding merit).
- John N. Tsitsiklis won the IEEE Control Systems Award, received an honorary degree from the Athens University of Economics and Business, and was presented the INFORMS Saul Gass Expository Writing Award.
- Caroline Uhler won the Institute for Data, Systems, and Society Joseph A. Martore Award for Exceptional Contributions to Education and was the recipient of the Simons Investigator Award (Mathematical Modeling of Living Systems category) from the Simons Foundation.
- Vinod Vaikuntanathan was presented the MIT Harold E. Edgerton Faculty Achievement Award.
- Jacob White received the MIT Bose Award for Excellence in Teaching.
- Alan Willsky was presented the IEEE Jack S. Kilby Signal Processing Medal.
- Gregory W. Wornell won the IEEE Leon K. Kirchmayer Graduate Teaching Award.
- Nickolai Zeldovich was presented the ACM SIGOPS (Special Interest Group on Operating Systems) Mark Weiser Award.

Departmental Awards

Students, faculty, staff, and special guests came together for EECS Celebrates, the department's annual awards ceremony and reception, on May 18, 2019. The department presented nearly 60 awards during the event.

A highlight of the 2019 celebration was the presentation of the second Seth J. Teller Award for Excellence, Inclusion, and Diversity. Named for the late EECS professor, the award honors members of the MIT community who embody those three values through work, research, or educational innovation. The 2019 winners were Bruke Mesfin Kifle, an EECS senior, and Ronitt Rubinfeld, professor of computer science and engineering. Both were honored for serving as mentors and undertaking other activities to improve diversity and inclusion.

Faculty Awards

- Frank Quick Faculty Research and Innovation Fellowship: Konstantinos Daskalakis
- Thornton Family Faculty Research and Innovation Fellowships: Luca Daniel and Jing Kong
- Louis D. Smullin ('39) Award for Excellence in Teaching: Ana Bell
- Jerome H. Saltzer Award for Excellence in Teaching: Duane Boning
- Burgess (1952) & Elizabeth Jamieson Prizes for Excellence in Teaching Thomas Heldt and Peter Szolovits
- Ruth and Joel Spira Awards for Excellence in Teaching: Adam Chlipala and Max Shulaker
- EECS Outstanding Educator Award: Joseph D. Steinmeyer
- EECS Digital Innovation Award: Adam Hartz
- Kolokotrones Education Award: Zachary Abel
- IEEE/ACM Best Advisor Award: Joel Voldman
- HKN Best Instructor Award: Leslie Kaelbling

Special Recognition

- Department Head Special Recognition Awards: David Lewis (EECS technical instructor) and Jessica Boles (EECS PhD student)
- Richard J. Caloggero Award: Kathy McCoy (administrator for EECS graduate recruitment)

Student Service and Teaching Awards

- Paul L. Penfield Student Service Award: Mandy Korpusik
- Undergraduate Teaching Assistant Awards: Alex Chen and Caleb Noble
- Frederick C. Hennie III Teaching Awards: Maryam Archie, Paolo Gentili, Czarino Lao, and Stephanie Ren
- Harold Hazen Teaching Award: Apoorva Murarka
- Carlton E. Tucker Teaching Award: Olivia Brode-Roger

Student Awards

- Jeremy Gerstle UROP Awards: Nicholas Bonaker (Nomon: A Single Switch Interface for Assistive Technology; Tamara Broderick, supervisor), Luke Shimanuki (Hardness of 3-D Motion Planning Under Obstacle Uncertainty; Tomas Lozano-Perez, supervisor)
- Morais (1986) and Rosenblum (1986) UROP Award: Aradhana Adhikari (Photo Chromeleon: Re-Programmable Multi-Color Textures Using Photochromic Dyes; Stefanie Mueller, supervisor)
- Anna Pogosyants UROP Award: June (Thuy-Duong) Vuong (Graph Pattern Detection: Hardness for All Induced Patterns and Faster Non-Induced Cycles; Vinod Vaikuntanathan and Virginia Williams, supervisors)
- Licklider UROP Award: Endrias Kahssay (Theoretically Efficient and Practical Parallel In-Place Radix Sorting; Julian Shun, supervisor)
- Robert M. Fano UROP Award: Anelise P. Newman (FourEyes: An Analysis of User Interfaces for Large-Scale Crowdsourcing of Visual Attention Data; Aude Oliva and Zoya Bylinskii, supervisors)
- 2017–2018 SuperUROP Awards: Xinyi Chen (A Unified Programming Model for Optimizing Ordered Graph Algorithms; Saman Amarasinghe, supervisor), Moin Nadeem (FAKTA: An Automatic End-to-End Fact-Checking System; James Glass and Mitra Mohtarami, supervisors), Yunyi Zhu (CurveBoards in 3-D Breadboards for Prototyping Function in the Context of Physical Form; Stefanie Mueller, supervisor)
- George C. Newton Undergraduate Laboratory Prize (6.111): Ashley Kim and Mark Theng (Encrypted Communications Over Ethernet)
- Northern Telecom/BNR Project Award: Best 6.111 Project: Keshav Gupta and Fan Francis Wang (Auditory Localization)
- David A. Chanen Writing Award (for Writing in 6.033): Jason Paulos (System Critique: Eraser)
- Morris Joseph Levin Awards for Masterworks Thesis Presentation: Logan Engstrom (Robustness; Aleksander Madry, supervisor), James Mawdsley (Terahertz Frequency Synthesis in CMOS for a Chip-Scale Molecular Clock; Ruonan Han, supervisor)
- David Adler Electrical Engineering MEng Thesis Awards: Weston Braun (A High-Frequency Variable Load Inverter Architecture; David Perreault, supervisor), James Mawdsley (Terahertz Frequency Synthesis in CMOS for a Chip-Scale Molecular Clock; Ruonan Han, supervisor)
- Charles & Jennifer Johnson MEng Computer Science Thesis Awards: Kenneth Friedman (WYSIWYFab: Integrating 3-D Modeling and Slicing; Stefanie Mueller, advisor), Andrew Ilyas (On Practical Robustness of Machine Learning; Konstantinos Daskalakis, advisor)
- Francis Reintjes Excellence in 6-A Industrial Partnership Award: Zachary Zumbo (Genetic Optimization Applied to Via and Route Strategy; Jacob White, supervisor)

Department Leadership

EECS department leadership during AY2019 included Asuman Ozdaglar, department head; Saman P. Amarasinghe and Joel Voldman, associate department heads; Elfar Adalsteinsson, Dennis M. Freeman, Robert C. Miller (through September 1, 2018), and Antonio Torralba (through September 1, 2018), co–education officers; Katrina L. LaCurts, undergraduate officer; Leslie A. Kolodziejski, graduate officer; and Karl K. Berggren, undergraduate laboratory officer.

Asuman Ozdaglar
Head
School of Engineering Distinguished Professor of Engineering