

Department of Biology

Academic year 2018 was exciting and productive for the [Department of Biology](#). The department is considered one of the best biological science departments in the world. Our superb faculty members are leaders in biological research and education, and our students are among the best. Some of the news regarding our faculty, research, and educational programs is highlighted below.

Faculty Count, Promotions, and Departures

During AY2018, the Department of Biology had 58 faculty members: 44 full professors, six associate professors, and eight assistant professors. Research homes are distributed among Building 68, the Broad Institute, the Koch Institute for Integrative Cancer Research, the Picower Institute for Learning and Memory, and the Whitehead Institute for Biomedical Research.

In addition to 58 primary faculty members, there were five faculty members with secondary appointments in Biology. These joint faculty members provide important connections to other departments, including Brain and Cognitive Sciences, Biological Engineering, and Civil and Environmental Engineering.

Iain Cheeseman was promoted to full professor and Adam Martin to associate professor with tenure. We welcomed Joseph Davis, Rebecca Lamason, Sebastian Lourido, and Stefani Spranger as new assistant professors. Professor Wendy Gilbert moved to Yale University. Professor Leona Samson (Biology/Biological Engineering) retired. Professor Gerald Fink (Whitehead Institute) retired as well but will continue part time as a professor without tenure (retired).

Faculty Awards

Department of Biology faculty members are widely recognized for their contributions to the field. Among our core faculty are three Nobel Laureates, 25 members of the National Academy of Sciences, 20 members of the American Academy of Arts and Sciences, 12 fellows of the American Association for the Advancement of Science (AAAS), four recipients of the National Science Foundation National Medal of Science, and 14 Howard Hughes Medical Institute investigators. The following are some of the many awards and recognitions conferred on Department of Biology faculty members during AY2018:

- Angelika Amon was elected to the American Academy of Arts and Sciences.
- Stephen Bell was elected to the National Academy of Sciences.
- Laurie Boyer gave the Medicine by Design Distinguished Lecture and Cardiovascular Rising Star Distinguished Lecture in 2017.
- Eliezer Calo Velazquez was appointed to the Irwin and Helen Sizer Career Development Chair.
- Gerald Fink was chosen for the 2018 James R. Killian Jr. Faculty Achievement Award.
- Becky Lamason was appointed to the Robert A. Swanson Career Development Chair.

- Gene-Wei Li received the Pew Biomedical Scholar Award and the Smith Family Award for Excellence in Biomedical Research.
- Harvey Lodish received the American Society for Cell Biology WICB (Women in Cell Biology) Sandra K. Masur Senior Leadership Award.
- Aviv Regev was presented with the Memorial Sloan Kettering Cancer Center Paul Marks Prize for Cancer Research and the International Society for Computational Biology Innovator Award.
- David Sabatini received the 2018 Switzer Prize, the 2017 Dickson Prize in Medicine, and the 2017 Lurie Prize in Biomedical Sciences.
- Philip Sharp received the Distinguished Award for Extraordinary Scientific Innovation and Exceptional Leadership in Cancer Research and Biomedical Science from the American Association for Cancer Research.
- Stefani Spranger was appointed to the Howard S. and Linda B. Stern Career Development Chair.
- Michael Yaffe received the MIT Teaching with Digital Technology Award.
- Omer Yilmaz was appointed to the Eisen and Chang Career Development Chair and received the AAAS Martin and Rose Wachtel Cancer Research Award.

Research Highlights

Our faculty members continue to make major research contributions to the life sciences. Research areas include decoding of genetic information within cells, the structure and function of the cellular machineries needed for normal growth and propagation, how normal cellular processes work and what goes wrong in disease (cancer, neurodegeneration, infection), how cells differentiate to adopt new fates and functions, how microbes function and interact with each other and larger organisms to promote health or cause disease, how cells process and respond to external and internal signals, how evolution shaped fundamental biological processes, and the factors that control aging and regeneration.

Rather than offer research highlights of all of our faculty members, we use this forum to emphasize those who completed the promotion process during a given year.

Iain Cheeseman's lab analyzes the molecular basis for kinetochore function and studies chromosome segregation during mitosis. The Cheeseman lab uses a combination of proteomics, biochemistry, cell biology, and functional approaches to examine kinetochore composition, structure, organization, and function.

Adam Martin's research is focused on how cells and tissues change shape during embryonic development, giving rise to different body parts. Methods include visualizing these changes to determine how mechanical forces drive massive tissue movements in the fruit fly, *Drosophila melanogaster*. In addition, Martin's lab studies the regulation of tissue integrity, investigating the processes that regulate the epithelial-to-mesenchymal transition.

Education

According to AY2018 fifth-week enrollment data, 67 undergraduates registered as biology majors, and nine registered as double majors. Seventy-three undergraduates registered as majors in computer science and molecular biology and 23 in the new area of chemistry and biology.

There were 220 graduate students registered in the biology graduate program, 29 in the interdepartmental microbiology graduate program, and 10 in the Joint Program in Biological Oceanography with the Woods Hole Oceanographic Institution (WHOI).

In AY2018, bachelor of science degrees were awarded to 23 biology majors, 20 computer science and molecular biology majors, five chemistry and biology majors, and seven students who held double majors.

PhD degrees were awarded to 27 biology students and two students in the joint program with WHOI. We also awarded two SM degrees in biology.

We are proud of our long-standing focus on excellence in both undergraduate and graduate education. Our faculty, regardless of rank, are committed to playing an active role in teaching, advising, and mentoring our students. The department encourages and supports continued reviews and development of new and existing courses to keep up with the rapid pace of discovery in life sciences and to adapt to our students' needs and capabilities.

Online Education Initiatives

Our MITx biology team, made up of individuals with pedagogical training as well as a specific skill set for creating digital learning materials, collaborates with our faculty to develop and implement digital learning materials. This includes creating innovative massive open online courses (MOOCs) on the edX platform that are available to learners around the world for free with a paid certificate option; it also includes developing materials specifically for use on campus via MITx, an iteration of the edX platform. The team is led by Mary Ellen Wiltrout, PhD, lecturer in digital learning in Biology.

Within the context of the overall goals of our online education initiative, the team refines existing courses and develops new ones. In total, our MITx on edX biology courses have had impressive reach, with nearly 284,000 learners registered, more than 183,000 course views, and over 8,500 learners earning a certificate (successfully completing the course). In addition to the five existing MOOCs that continue to run, the team is currently developing two new courses. In December 2017, the MITx Faculty Advisory Committee selected 705.x Biochemistry: Biomolecules, Methods, and Mechanisms, submitted by Professor Michael Yaffe and Mary Ellen Wiltrout for an [MITx project grant](#). In June 2018, the Faculty Advisory Committee awarded Professor Frank Solomon and Wiltrout an [MITx express exploration grant](#) for the Neat Experiments in Biology project. This grant will allow them to work with faculty throughout the Institute to develop a collection of videos presenting key experiments in biology ranging from foundational investigations to recent, exciting advances and the scientific processes that made them possible.

The MITx biology team and faculty continue to integrate digital learning materials created for MOOCs into the curriculum on campus to benefit MIT students and teaching staff. Over the last year and a half, we have deployed a version of the comprehensive competency exam developed for certification in MITx 7.00x Introduction to Biology – The Secret of Life MOOC as an online advanced standing exam for the General Institute Requirements (GIRs). This change allows students to know their passing status the day they take the exam, saves staff time in grading hundreds of handwritten exams, and ensures test-taking integrity through randomization and other means.

On campus, we continue to expand our blended learning initiatives (digital combined with in-person teaching and learning) by integrating MITx sites into subjects and hosting digital learning materials as assignments or additional resources. The faculty continues to use MITx sites in a variety of ways in the Introduction to Biology, 7.28/7.58 Molecular Biology, 7.06 Cell Biology, and 7.05 Biochemistry subjects. Even when new faculty teach a subject (e.g., as with Molecular Biology during Professor Steve Bell's sabbatical this past spring), they use the MITx site with MOOC content.

In December 2017, the Reimagine Education conference selected the Teaching MIT Students to Think Like Cell Biologists: A Visual Approach project for the Hybrid Learning category short list. This project represents the blended learning efforts in the Cell Biology subject over the last several years. The project was one of 1,041 submissions across 17 categories, of which just 140 were short listed for a talk at the conference. With its MITx grant, the biology team increased the digital learning resources supporting the curriculum taught by Professor Michael Yaffe in the Biochemistry subject.

Student Awards

We take great pride in the success and productivity of our students, several of whom received awards in academic year 2018.

MIT Awards

Class of 2018

- Samantha Amey-Gonzalez, MISTI (MIT International Science and Technology Initiatives) Ambassador Award, which recognizes an MIT student who exemplifies MISTI's mission and has served as an outstanding MISTI representative abroad and at MIT
- Helen Abadiotakis, Molly Brennan, and Abbey Diener, Advanced Certificate of Engineering Leadership recognizing successful completion of the requirements for the two-year Bernard M. Gordon-MIT Engineering Leadership Program
- Mary Clare Beytagh, Rhodes Scholarship for scholarly achievement, character, commitment to the public good, and leadership potential; Peter and Sharon Fiekowsky Award for outstanding contributions to the ESG (Experimental Study Group) community; Peter and Sharon Fiekowsky Award for distinguished teaching at ESG; and Peter S. Donaldson Prize for Excellence in Literary Studies, which recognizes a literature major who excels academically and is an engaging participant in the literary community at MIT

- Marjorie Buss, Roger de Friez Hunneman Prize for outstanding scholarship and research and Chemical Engineering Department Special Service Award
- Camilo Espinosa, Merck Index Award for outstanding academic achievement and Royal Society of Chemistry Certificate of Excellence for outstanding scholarship
- Kristina Lopez, S. Klein Prize for Technical Writing
- Danielle Finney, Boit Manuscript Prize (essay first prize)
- Mercedes Ondik, Chemistry Research Award for outstanding contributions in the area of research
- Kayla Young, Mens et Manus Award, which recognizes a senior who has shown a passion and affinity for diversity and inclusion work
- Brian Zhong, Wing and Lourdes Fong Memorial Prize for the chemical engineering senior of Chinese descent with the highest cumulative grade point average, Chemistry Research Award for outstanding contributions in the area of research, and Chemistry Department Special Service Award for outstanding contributions in the area of service to the department

Ten biology majors from the class of 2018 were elected to Phi Beta Kappa: Mohammed AlDajani, Erika Arias, Mary Clare Beytagh, Marjorie Buss, Christina Dalzell, Jennifer Li, Puwanat Sangkhapreecha, Claire Simpson, Brian Zhong, and Kimia Ziadkhanpour.

Class of 2019

- Min Woo Bae, American Chemical Society Analytical Chemistry Award
- Meena Chakraborty and Anna Sappington, Barry Goldwater Scholarship for a junior or senior who exhibits outstanding potential and intends to pursue a career in mathematics, the natural sciences, or engineering disciplines that contribute significantly to US technological advances
- Helena Ma, Priscilla King Gray Award for a graduate or undergraduate student who is exceptionally dedicated to community engagement and making a difference at MIT and beyond
- Theresa Machemer, Boit Manuscript Prize (fiction honorable mention)
- Janice Ong, Boit Manuscript Prize (essay second prize)
- Zach Schmitz, Chemical Engineering Department Special Service Award
- Taylor Sorenson, Certificate of Engineering Leadership recognizing successful completion of the requirements for the one-year Bernard M. Gordon-MIT Engineering Leadership Program
- Sarah Stern, Outstanding Associate Advisor Award for an upperclass student who has demonstrated exceptional dedication to mentoring freshmen in an advising group or residential community
- Chung-Yueh Lin and Clare Wieland, Hans Lukas Teuber Award for Outstanding Academics in Brain and Cognitive Sciences
- Sherry Zhou, Outstanding Sophomore Achievement Award

Class of 2020

- Venkatesh Sivaraman, Gregory Tucker Memorial Prize for exceptional ability in composition, performance, or music-historical studies and overall contributions to the Music and Theater Arts Section
- Harrion Wang, Freshman Chemistry Award

Department of Biology Awards

- Amanda Cao, Salvador E. Luria Prize for scholarship and research of publication quality
- Meenakshi Chakraborty, Susan Hockfield Prize in Life Sciences for a third-year MIT undergraduate student in any area of the life sciences who has demonstrated both exceptional performance and promise for graduate study and research
- Abbey Diener, Gene Brown Prize for academic scholarship and demonstrated excellence as a teaching assistant
- Chun-Ting Liu, Merck Prize for outstanding research and academic performance in biophysical or bioinformatics science
- Grace Liu, Gene Brown-Merck Teaching Award for outstanding dedication and commitment to teaching
- Grace Phelps and Arish Shah, Teresa Keng Graduate Teaching Prize for outstanding dedication and commitment to teaching
- Sarah Stern, Whitehead Prize, which recognizes outstanding promise for a career in biological research through academic scholarship as well as contributions to research and the MIT community
- Kimia Ziadkhanpour, Ned Holt Prize for demonstrated excellence in scholarship as well as service to the MIT community

Undergraduate Research Symposium

Nine students spoke during the Undergraduate Research Symposium at the invitation of their research faculty mentors: Mary Clare Beytagh, Meenakshi Chakraborty, Emily Damato, Celeste Dang, Kimberly Feng, Madeleine Kline, Stacie Lin, Alexandra Stanton, and Sarah Stern.

Diversity and Outreach Initiatives

A strategic objective of the Department of Biology is to increase the pipeline of underrepresented minority (URM) and disadvantaged students pursuing research careers. A primary, but not the sole, focus of our efforts is to increase URM enrollment in our own graduate programs. To this end, we engage in a variety of outreach activities, including participation in national conferences for minority scientists and undergraduate students; visits to college and universities with large URM populations to establish regular and direct contact with students, faculty, and program directors

at these institutions; MIT campus visits with students interested in graduate school in the biological sciences; and opportunities for faculty from primarily URM-serving institutions to perform sabbatical research at MIT or to visit and present their research.

Mandana Sassanfar, our diversity and outreach coordinator, represented the department at graduate school fairs at the University of Massachusetts Boston and the University of Maryland, Baltimore County. She also attended the Annual Biomedical Research Conference for Minority Students and the annual meetings of the Society for Advancement of Chicanos/Hispanics and Native Americans in Science and AAAS. In addition, she visited a number of diversity-focused programs and biology departments at minority-serving institutions such as Howard University, Hunter College, the University of Puerto Rico, Barry University, Florida International University, and the University of California, Los Angeles.

We continue to be an active participant in the MIT Summer Research Program (MSRP Bio), designed to encourage URM and underprivileged students to pursue careers in the sciences. Students spend 10 weeks conducting full-time supervised research and participate in classes and other activities designed to prepare them for graduate studies in biomedical sciences. Since its founding, more than 275 students have participated in MSRP Bio. Over 80% have gone on to enroll in PhD or MD/PhD programs at top schools across the country. Since 2010, dozens have enrolled in graduate programs at MIT. In 2017, Eliezer Calo became the first MSRP Bio alumnus to join the Biology Department as a member of the faculty. The 24 participants in the current cycle represent the most diverse group we have had in the program's history.

In January 2018, we hosted the annual weeklong Quantitative Methods Workshop for students and faculty from historically black colleges and universities and minority-serving institutions. The intensive, fast-paced workshop exposes participants to the quantitative and computational tools required to analyze large biological data sets or model biological phenomena. Participants met with a number of Biology faculty to learn about their research and the process for applying to graduate schools. Many of the students who participate in this workshop subsequently apply for our summer program (MSRP Bio).

We also continue to organize high school outreach programs. Over a two-day period in March, we hosted class field trips for more than 150 students from high schools in the Boston area and New Hampshire. These students attended lectures, toured facilities, and participated in hands-on activities and computer labs led by graduate students. In July, we co-hosted the annual summer workshop for Massachusetts high school science teachers with the Department of Brain and Cognitive Sciences. During this five-day workshop, teachers participate in hands-on lab activities (focused this year on neuroscience) and design new curricular material for science classes.

In summer 2018 we continued the Leah Knox Scholars Program, a two-year initiative offering hands-on lab experience and mentorship to low-income high school students of color. Students participate in a five-week lab experience. Rising juniors receive training in biology lab skills, and rising seniors do summer internships throughout Boston's world-class research labs. Participating students meet with MIT undergraduates, graduate students, and faculty members and receive counseling about the college admissions process.

Development

Fiscal year 2018 was very successful in terms of gifts and broadening of our base of donors, but we still have significant goals and needs. Our priorities include attracting the best graduate students, attracting and retaining top faculty members, building the pipeline of young students participating in biological research, and remaining flexible to enable new initiatives and research directions. Discretionary funds and support for our graduate program remain our top two areas of emphasis.

Graduate students are at the core of the research and educational mission of the department, and adequate funding for our graduate program is one of our most important challenges. With the help of MIT alumnus, former faculty member, and Visiting Committee member Paul Schimmel, we continue to approach alumni and non-alumni friends of the department to ask for their help. To date, these efforts have resulted in dozens of gifts—expendable, endowed, and testamentary—with a current market value of \$29.5 million, of which \$3.4 million is in hand. FY2018 expendable gifts increased three-fold over the prior year, reaching a total of \$130,000. We continue to focus on fundraising to support our graduate students.

The MSRP Bio program continues to play a major role in developing highly talented and motivated students who go on to pursue graduate training. Moreover, MSRP Bio has become a powerful recruiting tool for the Biology graduate program and an important means of fostering diversity at the Institute. Following the initial endowed gift from Mike Gould and Sara Moss, the program has continued to receive generous supplemental support, including expendable gifts of \$75,000 in FY2017 and \$50,000 in FY2018.

One of our short-term initiatives was our proactive approach to the September 2017 Puerto Rican hurricane disaster. We successfully raised funds from the Sloan Foundation and, with a waiver of tuition granted by the provost, brought two undergraduate students to MIT during the spring term.

MIT will join the ranks of major universities offering cryo-EM (electron microscopy) capabilities with the fall 2018 opening of the MIT.nano facility. In FY2017, we secured external gifts totaling \$7.5 million for the purchase of two cryo-electron microscopes along with commitments from MIT's School of Science, Department of Chemistry, and vice president for research to support the start-up of our cryo-EM facility. This is a major step forward, but we still need considerable resources to support the people and materials to maintain a complete and cutting-edge facility. We continue to explore individual, foundational, and industrial sources of support and remain hopeful that we may yet identify a viable prospect to endow this new facility.

Raising funds for discretionary purposes is vital to the department's ability to carry out its mission, remain flexible, and adapt to change. Critical to our continued success is the ability to offer competitive faculty start-up packages, provide bridge support when faculty experience temporary gaps in research funding, and support new initiatives (e.g., cryo-EM) and new areas of research. This message continues to resonate with donors. FY2018 expendable gifts to our discretionary fund totaled \$60,000, double that of the prior year, with a 25% increase in first-time donors. We are focused on increasing the numbers of donors and soliciting larger gifts to support some of our specific and long-term needs.

Named Lectures

The department sponsored the following endowed lectures during AY2018:

Salvador E. Luria Lecture: David Baltimore, California Institute of Technology

Randy Chipperfield Lecture: Erin O'Shea, Howard Hughes Medical Institute

Alexander Rich Lecture: David Julius, University of California, San Francisco

Charles "Ned" E. Holt Memorial Lecture: Venkatraman Ramakrishnan, Medical Research Council Laboratory of Molecular Biology, Cambridge, England

Paul F. Glenn Distinguished Lecture: Shelley Berger, University of Pennsylvania

Sackler Lecture: Yigong Shi, Tsinghua University, Beijing

Francis O. Schmitt Memorial Lecture: Leslie Vosshall, The Rockefeller University

John (Jack) Buchanan Lecture: Emily Balskus, Harvard University

Malvin and Eleanor Mayer Lecture: Ronald Evans, The Salk Institute

Alan D. Grossman

Head

Praecis Professor of Biology