

## Department of Biology

Academic year 2016–2017 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. Some of the news regarding our faculty, research, and educational programs is highlighted below.

### Faculty Count and Departures

During AY2017, the Department of Biology had 56 faculty members: 44 full professors, eight associate professors, and four 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 56 primary faculty members, there were six faculty members with secondary appointments in Biology. These joint faculty members provide important connections to other departments, including Brain and Cognitive Sciences, Chemistry, Biological Engineering, and Civil and Environmental Engineering.

We are saddened by the loss of Professor Susan Lindquist, who passed away in October 2016. Hidde Ploegh (Whitehead Institute) moved to Children's Hospital in January 2017. Professor William (Chip) Quinn (Biology/Brain and Cognitive Sciences) retired in July 2016.

### Faculty Awards

Department of Biology faculty members are widely recognized for their contributions to the field. Among our core faculty are three Nobel Laureates, 30 members of the National Academy of Sciences, 28 members of the American Academy of Arts and Sciences, 14 fellows of the American Association for the Advancement of Science, four recipients of the National Science Foundation National Medal of Science, and 15 Howard Hughes Medical Institute (HHMI) investigators. The following are some of the many awards and recognitions conferred on Department of Biology faculty members during AY2017:

- Tania Baker gave the 2016 William H. Stein Memorial Lecture at Rockefeller University.
- Laurie Boyer joined the editorial boards of *Development* and *Cell Reports*.
- Gerald Fink delivered the Thomas Roderick Memorial Lecture at the Jackson Laboratory in July 2016.
- Wendy Gilbert was presented the 2017 RNA Society Early Career Award, which recognizes outstanding accomplishments by RNA scientists during their first 10 years as independent investigators.
- Richard O. Hynes was named co-chair of the National Academy of Sciences/ National Academy of Medicine Committee on Human Genome Editing.
- Tyler Jacks was the 2016 Charlton Lecturer at the Tufts University School of Medicine.

- Dennis Kim was named the Ivan R. Cottrell Professor of Immunology.
- Eric Lander was the recipient of the 2016–2017 James R. Killian Jr. Faculty Achievement Award.
- Gene-Wei Li was chosen as a Searle Scholar (2016) and a Sloan Research Fellow (2016) and received the 2017 Smith Family Award for Excellence in Biomedical Research.
- J. Troy Littleton was named the Menicon Professor of Neuroscience.
- Harvey Lodish was the conference chair and keynote speaker at the 2016 Beijing Biomedicine Forum.
- David C. Page delivered the keynote lecture at the Keystone Symposium on Sex and Gender Factors Affecting Metabolic Homeostasis, Diabetes and Obesity. Also, he presented the keynote lecture at the Jane Coffin Childs Fellows Symposium and the Dorcas Cummings Memorial Lecture at the Cold Spring Harbor Symposium on Quantitative Biology.
- Thomas Schwartz was named Boris Magasanik Professor of Biology.
- Matthew Vander Heiden was selected as an HHMI faculty scholar, joined the editorial board of *Trends in Biochemical Sciences*, and became co-editor in chief of *Cancer & Metabolism*.

## 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 complete the promotion process during a given year.

Matthew Vander Heiden successfully completed the tenure review process in 2016–2017. Matt’s research is focused on cancer metabolism, that is, the underlying metabolic pathways that enable cancer cells to grow. His efforts have led to remarkable new insights into cancer metabolism and identified potential “weak links” that might be targets for therapeutic intervention. His work also provides a conceptual framework for understanding why certain cancer therapies are successful with some tumors and unsuccessful with others.

## Education

According to fifth-week enrollment data, 77 undergraduates registered as biology majors, and 16 registered as double majors. Eighty-five undergraduates registered as majors in computer science and molecular biology.

Bachelor of science degrees were awarded to 37 biology majors, 21 computer science and molecular biology majors, and 10 students who held double majors.

There were 250 graduate students registered in the Biology Department, with another 18 in the Joint Program in Biological Oceanography with the Woods Hole Oceanographic Institution (WHOI). The department awarded 31 PhD degrees and four SM degrees. Nine PhD degrees were awarded in the joint program with WHOI.

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 subjects 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 (BIOx) team, made up of individuals who have pedagogical training as well as a specific skill set for creating digital learning materials, continues to enable our faculty to develop digital learning materials. This includes creating innovative massive open online courses (MOOCs) on the edX platform and residential materials using MITx, an iteration of the edX platform.

After the 2013 release (and repetition) of the [MITx course 7.00x Introduction to Biology—The Secret of Life](#), the department released a self-paced version in July 2015. In spring 2016, the BIOx team developed a comprehensive competency exam, built on the principles of education research, as the only path for certification in the 7.00x edX course. This exam, [the first of its kind released on edX](#), applies all technical means to deter and prevent cheating while holding learners to a high degree of excellence to achieve a passing grade. We hope to use parts of this exam for the MIT General Institute Requirements (GIRs) Advanced Standing Examination (a pilot is in the planning stages).

Within the context of the overall goals of our online education initiative, the team continues to refine existing courses as well as develop new ones. The team recently released the final part of the [MITx on edX 7.28x Molecular Biology series, RNA Processing and Translation](#). In total, our MITx on edX biology courses have had impressive reach, with nearly 200,000 people registered, more than 123,000 course views, and over 8,000 people earning a certificate (successfully completing a course).

We have made significant progress in integrating MITx sites into residential courses and outreach to provide MIT students with additional learning resources. MITx sites are used in a variety of ways in the Introduction to Biology, Molecular Biology, Cell Biology, and Biochemistry courses. In the 7.28/7.58 Molecular Biology course, Professor Steve Bell moved to sole use of the MITx site with content from the MOOC. Some of the online questions were included as part of the grade, and the majority of MIT students who

completed the course survey thought that this practice should continue and reported enhanced studying and learning as a result of completing the questions. With these results in mind, the team and Professors Frank Solomon and Adam Martin are currently adding graded online problems to the 7.06 Cell Biology course to motivate students to practice better study habits. Spring 2017 brought an expansion to the use of protein structure tool exercises in the curriculum of 7.05 Biochemistry.

### **Undergraduate Awards**

We take great pride in the success and productivity of our students, a number of whom received awards in 2016–2017.

#### **Class of 2017**

- Melanie Abrams, King Prize for Writing Science Fiction
- Justin Bader, Frederick D. Greene Teaching Award for outstanding contributions in the area of teaching
- Zi-Ning Choo, Wing and Lourdes Fong Memorial Prize for a chemical engineering senior of Chinese descent with the highest cumulative grade point average
- Rhogerry “Gerry” Deshycka, Randolph G. Wei UROP (Undergraduate Research Opportunities Program) Award, which recognizes the undergraduate who has made the most outstanding contributions in undergraduate research at the interface of the life sciences and engineering
- Matthew Iovino, Philip Loew Memorial Award in recognition of creative accomplishments in music
- Yasuko Mano, S. Klein Prize for Technical Writing
- Elan Ness-Cohn, Boit Prize for Engineering Writing
- Rui Song, second-place team award in the StartMIT Fund Competition
- Michelle Tai, Chemical Engineering Individual Accomplishment Award and Chemical Engineering Department Special Service Award

Six biology majors from the class of 2017 were elected to Phi Beta Kappa: Orlando Arevalo, Shivangi Goel, Jason Hyun, Jinseong Kim, Ellena Popova, and Dalia Walzer.

#### **Class of 2018**

- Erika Arias, Global Studies and Languages 2017 Award for Excellence
- Marjorie Buss, Chemical Engineering Department Special Service Award
- Lei Ding, Aasvari Phanse, and Nina Singh, Certificate of Engineering Leadership recognizing successful completion of the requirements for the one-year Bernard M. Gordon-MIT Engineering Leadership Program.
- Camilo Espinosa, S. Klein Prize for Technical Writing

- Bryce Hwang, 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 technological advances

### **Class of 2019**

- Zoya Fan, Award for Excellence in German Studies at MIT
- Jueun Lee, Ragnar and Margaret Naess Award in recognition of exceptional talent and commitment to performance at MIT
- (Jeremy) Chung-Yueh Lin, Hans Lukas Teuber Award for Outstanding Academics in Brain and Cognitive Sciences
- Theresa Machemer, Dewitt Wallace Prize for Science Writing for the Public
- Margaret Manto, Peter J. Eloranta Summer Undergraduate Research Fellowship for interesting and novel research and student-initiated ideas developed outside the normal curriculum

### **Biology Department Awards**

- Rhogerry Deshycka and Chiara Waingarten, John L. Asinari Award for outstanding research in the field of life sciences
- Angela Koh and Ellena Popova, Gene Brown Prize for academic scholarship and demonstrated excellence as a teaching assistant
- Alissandra Hillis, 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
- Celeste Dang and Elizabeth Li, Ned Holt Prize for demonstrated excellence in scholarship as well as service to the MIT community
- Ching Pin Cheng, Salvador E. Luria Prize for scholarship and research of publication quality
- Madeleine Duran and Bryce Hwang, Merck Prize for outstanding research and academic performance in biophysical or bioinformatics sciences
- Rachel Terry, Whitehead Prize recognizing outstanding promise for a career in biological research through academic scholarship as well as contributions to research and the MIT community

### **Undergraduate Research Symposium**

Nine students spoke during the Undergraduate Research Symposium at the invitation of their research faculty mentors: Daphne Superville, Mary Clare Beytagh, Meenakshi Chakraborty, Chittampalli Yashaswini, Rhogerry Deshycka, Surya Tripathi, Jonathan Guzman, Camilo Espinosa, and Alissandra Hillis.

## Diversity 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 colleges 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.

We continue to send faculty and student representatives to the Annual Biomedical Research Conference for Minority students (ABRCMS). Dr. Mandana Sassanfar, our diversity and outreach coordinator, represented the department during graduate school fairs at the University of Massachusetts Boston and the University of Maryland, Baltimore County. She also attended ABRCMS and the annual meetings of the Society for Advancement of Chicanos/Hispanics and Native Americans in Science and the American Association for the Advancement of Science. 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. Summer 2017 was highly competitive : 16 students were selected from a pool of over 206 applications, and another four were accepted through our cost-sharing arrangement with HHMI. MSRP Bio students met as a group and met one on one with a number of biology faculty.

In January 2017, we hosted the annual weeklong Quantitative Methods Workshop for 61 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 school.

The department continues 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.

Our programs emphasize personal contact and long-term regular interactions with faculty who mentor URM students, and this has been an effective recruitment strategy. The department has almost tripled the percentage of URM graduate students from approximately 4% in FY2005 to approximately 11% in FY2017.

## **Development**

Given the essential role our graduate students play in virtually all of the department's work, our Graduate Training Initiative, which aims to raise funds to endow graduate fellowships in the department, remains a priority. With the help of MIT alumnus, former faculty member, and Visiting Committee member Paul Schimmel, we continue to approach department alumni and non-alumni friends to ask their help in enhancing the graduate student experience through student and programmatic support. To date, these efforts have resulted in dozens of gifts—expendable, endowed, and testamentary—with a current market value of nearly \$26 million. Along with our department head, Alan Grossman, and other dedicated volunteers, Paul continues to identify and approach other like-minded individuals, and we remain confident that considerable additional support can be achieved.

In partnership with the Office of Foundation Relations and the Office of Sponsored Programs, we successfully raised \$7.5 million for the purchase of two cryo-electron microscopes. Although this is a major step forward, we still need considerable resources to support the people and materials necessary to launch a complete cryo-electron microscope facility. We are actively exploring potential sources of individual support as well as additional foundational and industrial sources of support. While, in general, contributions from foundation and industrial sponsors are small and carry the added complication of under-recovery of overhead, we remain hopeful that we may yet identify a viable prospect to endow this essential facility.

After learning that our flagship outreach and diversity program, the MIT Summer Research Program in Biology, could no longer depend on funds from HHMI, we began working to endow this program to ensure ongoing funding for 25 to 30 students each summer. In addition to the FY2016 gift we received from Michael Gould, son of the late MIT biology professor Bernard “Bernie” Gould, to create an endowed fund that supports a number of students each summer, we also raised expendable funds from two members of our Visiting Committee. The Gould Fund and the \$175,000 in expendable commitments will go a long way toward ensuring that this critical outreach program continues.

Discretionary funds remain essential, and we strive to increase the amount at the department's disposal. In addition to ensuring that the department is able to adapt to change and taking advantage of new opportunities, these funds are used to enhance graduate training, provide seed money for new faculty, ensure that labs can continue between grants, and help sustain core facilities. We continue to seek potential donors who would be interested in specific discretionary support, including startup and bridge funding for faculty and matching funding to allow us to pursue increased foundation support.

## Named Lectures

The department welcomed the following named speakers during the 2016–2017 academic year:

- Salvador E. Luria Lecture: Phillip Sharp, MIT
- Randy Chipperfield Lecture: Bonnie Bassler, Princeton University
- Alexander Rich Lecture: Jack Szostak, Harvard Medical School
- Charles “Ned” E. Holt Memorial Lecture: David Morgan, University of California, San Francisco
- Paul F. Glenn Lecture Distinguished Lecture: Vera Gorbunova, University of Rochester
- Sackler Lecture: Nikolaus Rajewsky, Max Delbruck Center
- Francis O. Schmitt Memorial Lecture: Karl Deisseroth, Stanford University
- John (Jack) Buchanan Lecture: Judith Frydman, Stanford University
- Malvin and Eleanor Mayer Lecture: Michael Sixt, IST Austria

**Alan D. Grossman**  
**Praecis Professor and Head**  
**Department of Biology**