

Department of Biology

The [Department of Biology](#) at MIT is considered one of the best biological science departments in the world. Our superb faculty are leaders in biological research and education. Below are some highlights of the past year.

Department Demographics

In academic year 2013–2014, the Department of Biology had 60 primary faculty members working in five research locations: Building 68 (25 faculty), the Whitehead Institute (17), the Koch Institute (14), the Broad Institute (2), and the Picower Institute (2). Joint and adjunct faculty (10 total) provide important connections to other departments, including Brain and Cognitive Sciences, Chemistry, Biological Engineering, and Civil and Environmental Engineering. The department has three living Nobel Prize winners, 31 National Academy of Science members, 14 HHMI (Howard Hughes Medical Institute) Investigators, one HHMI Early Career Investigator, and seven National of Medal of Science winners.

A total of 177 undergraduates registered as biology majors (course 7 and 7A) during the fall 2013 and spring 2014 terms. There were 78 undergraduates registered as 6/7 majors. In spring 2014, 29 freshmen declared biology (Course 7 or 7A) as their major while 26 freshmen declared biology and computer science (Course 6/7).

The bachelor of science degree was awarded to 85 students from September 2013 through June 2014. Of this group, 45 students were in Course 7, 17 in Course 7A, and 23 in Course 6/7.

From July 1, 2013, to June 30, 2014, the department awarded a total of 33 PhD degrees and three SM degrees in biology. One PhD degree was awarded in the Joint Program in Biological Oceanography with the Woods Hole Oceanographic Institute (WHOI). There were 230 graduate students registered in the Biology Department in 2013–2014, and another 23 in the Joint WHOI Program. The incoming class for fall 2014 will have 34 students in the Biology doctoral program, with an additional two students in the Joint Program.

Faculty

We remain committed to finding outstanding faculty candidates, recruiting them to MIT, and providing mentorship and resources to maximize their chances of success. We typically recruit junior faculty, but occasionally, given the right set of circumstances, we will recruit senior faculty.

Appointments, Promotions, Retirements, and in Memoriam

- Laurie Boyer, associate professor with tenure (effective July 1, 2014)
- Iain Cheeseman, associate professor with tenure (effective July 1, 2014)
- Wendy Gilbert, associate professor without tenure (effective July 1, 2013)

- Michael Hemann, associate professor with tenure (effective July 1, 2013)
- Nancy Hopkins, professor emeritus (effective January 1, 2014)
- Gene-Wei Li, assistant professor (effective January 1, 2015)
- Jeroen Saeij, associate professor with tenure (effective July 1, 2014)
- Paul Schimmel, John D. MacArthur professor emeritus (effective April 2014)
- Edward Scolnick, reappointed professor of the practice (effective July 1, 2014)
- Matthew Vander Heiden, associate professor without tenure (effective July 1, 2014)
- Jing-Ke Weng, assistant professor (effective January 1, 2014)
- Omer Yilmaz, assistant professor (effective July 1, 2014)

Boris Magasanik, the Jacques Monod professor emeritus of microbiology, passed away on December 25 at his home in Cambridge. He was 94. Magasanik was recruited by Salvador Luria to join MIT's Department of Biology in 1960, leaving his post as a professor of bacteriology at Harvard Medical School to help the Institute establish a presence in the then-new field of molecular biology. In the succeeding years, Magasanik crossed disciplinary boundaries between metabolic biochemistry, enzyme regulation, microbial genetics and physiology, and molecular biology, becoming a pioneer in the study of gene regulation. From 1967 to 1977, Magasanik was head of the Department of Biology. A memorial was held on June 1, 2014.

Faculty Awards and Honors

David Altshuler was elected to the American Academy of Arts and Sciences. He was chosen by the White House, which honored 13 "Champions of Change" last June for their vision and commitment to promoting open scientific data and publications to grow our economy and improve our world. David also received the Roy O. Greep Award from the Endocrine Society and was elected a fellow of the American College of Physicians.

Angelika Amon received the 2014 Genetics Medal from the American Genetics Society.

Gene Brown was honored by the Biology faculty at a lunch to recognize his 60 years of teaching. A reception was also held in his honor by his co-teachers in 7.05 General Biochemistry, and was attended by graduate and undergraduate students.

Chris Burge acted as vice chair for the 2014 Gordon Research Conference on Post-Transcriptional Gene Regulation.

Sallie (Penny) W. Chisholm was selected as the 2014 recipient of MIT's highest honor for full-time faculty members, the James R. Killian Jr. Faculty Achievement Award, in recognition of her "extraordinary professional accomplishments." She will deliver the Killian Lecture in spring of 2015. She was also selected to receive the Ramon Margalef Prize in Ecology from the government of Catalonia. The prize is one of the most prestigious scientific awards dedicated exclusively to ecological and environmental

sciences. Chisholm will receive the \$100,000 prize from Artur Mas, president of Catalonia, at a ceremony in Barcelona in October.

Martha Constantine-Paton was the keynote lecturer at the Gordon Research Conference on Molecular Mechanisms of Toxicity in August 2013. She was named lecturer for the Lawrence Grossman Lecture at Johns Hopkins Bloomberg School of Public Health in October 2013, and also received a Radcliffe Institute Fellowship for 2014–2015.

Catherine Drennan was renewed as a HHMI investigator in September 2013.

Wendy Gilbert received an American Cancer Society Research Scholar Award.

Alan Grossman was elected to the National Academy of Sciences in 2014.

Piyush Gupta was named the Howard S. and Linda B. Stern Career Development Professor.

Richard Hynes was elected fellow of the American Academy for Cancer Research (AACR) and received a Department of Defense Innovator Award.

Nancy Hopkins received two honorary degrees in May 2014, from the Mount Sinai School of Medicine and from Boston University, where she gave the baccalaureate address.

Tyler Jacks received the 2014 Hope Fund for Cancer Research Award of Excellence. He was elected a fellow of the AACR Academy and was named a member of MGH Cancer Center's 2013 One Hundred. He was also named a Vallee Foundation Visiting Professor in 2014.

Rudolf Jaenisch received the 2014 Otto Warburg Medal from the German Society for Biochemistry and Molecular Biology for "his groundbreaking work in the field of epigenetic regulation of gene expression in mammalian development and disease." He also received the 2013 New York Academy of Medicine Medal.

Chris Kaiser was appointed to the Amgen Professorship.

Terry Orr-Weaver was named a dean's distinguished lecturer at the University of Colorado, Anschutz Medical Campus. She also delivered the 2013 Kaulenas Lecture at the University of Massachusetts, Amherst.

David Page delivered the 2014 Kaulenas Lecture at UMass Amherst, the President's Guest Lecture at the American Academy of Dermatology, and the Rachford Lecture at the University of Cincinnati. In 2013 he delivered the keynote lecture at the Gordon Research Seminar on Fertilization and Activation of Development and the keynote lecture at the Gordon Research Conference on Human Genetics and Genomics.

Aviv Regev was named the 2014 Earl and Thressa Stadtman Scholar by the American Society for Biochemistry and Molecular Biology.

David Sabatini was awarded the 2014 National Academy of Sciences Award in Molecular Biology for his discovery of components and regulators of the mTOR kinase pathway and his elucidation of the important roles of this signaling pathway in nutrient sensing, cell physiology, and cancer.

Robert Sauer received the 2013 Stein and Moore Award for his influential contributions to protein-DNA recognition, folding and structural stability of proteins, protein quality control, and the operation of ATP-fueled protein folding and degradation machines.

Philip Sharp had an award series named in his honor. Stand UP to Cancer (SU2C) began the Philip A. Sharp Innovation in Collaboration Award series to foster collaboration among members of the SU2C scientific community that would enhance the SU2C mission to accelerate the development of new cancer treatments. He also had a building dedicated to him by Biogen Idec. In 2013 Sharp was elected a fellow of the AACR Academy, and he received the Lifetime Achievement in Science Award from the RNA Society.

Leona Samson delivered the keynote lecture at the Molecular Mechanisms of Toxicity Gordon Research Conference in 2013. She was the named lecturer of the Lawrence Grossman Memorial Lecture at Johns Hopkins Bloomberg School of Public Health, and she was awarded a Radcliffe Institute Fellowship for 2014–2015.

Matthew Vander Heiden received the American Association for Cancer Research Gertrude B. Elion Cancer Research Award.

Robert Weinberg was awarded the 2013 Breakthrough Prize in Life Sciences and was named a fellow of the AACR Academy.

Jing-Ke Weng was named a Thomas D. and Virginia W. Cabot Career Development Professor. He also received the 2013 Tansley Medal for Excellence in Plant Science. In 2014, he was named a Pew Scholar in the Biomedical Sciences, and he received the American Society of Plant Biologists Early Career Award.

Research Highlights

Jianzhu Chen's lab group discovered how dengue fever depletes blood platelets by studying mice with human immune cells. The mosquito-borne illness, an infectious tropical disease found in more than 100 countries, has no cure and no vaccine. One reason it has been difficult to develop new drugs for dengue fever is that there have been no good animal models of the disease, which only infects humans.

Iain Cheeseman and postdoctoral researcher Tomomi Kiyomitsu studied how human cells manage to divide into two equally sized daughter cells during mitosis. During the metaphase cell cycle step, a dividing cell uses the motor protein dynein and two signals to perfectly align the cell's mitotic spindle structure in the middle of the cell. The mitotic

spindle is composed of threadlike proteins called microtubules that extend from one of two spindle poles on either side of the cell to the duplicated chromosomes in the cell's center. Other microtubules connecting the spindle poles to the cortex—a protein layer lining the cell's outer membrane—act to pull the spindle poles back and forth within the cell until the spindle and chromosomes align down the cell's center axis.

Michael Hemann and his lab are trying to figure out how tumors develop resistance in hopes of developing new drugs that could overcome it. This study reveals a way to combat these recurrent tumors with a drug that makes them more vulnerable to the antibody treatment. The drug, known as cyclophosphamide, is already approved by the US Food and Drug Administration to treat some cancers. A paper on the study appeared in *Cell*.

Richard Hynes and postdoctoral researcher Alexandra Naba published a study in *eLife* about the discovery that certain proteins in the extracellular matrix structure help cancer cells make their escape. They identified dozens of proteins that surround highly metastatic tumors, but not less-aggressive tumors, and found that four of those proteins are critical to metastasis.

Tyler Jacks and collaborating researchers performed the most comprehensive analysis to date of the changes in mice programmed to develop cancer. The team discovered mutations and other genetic disturbances that arise at certain stages of lung cancer development. The researchers were able to identify tumor cells that broke free to spread to other organs. The findings, described in *Cell*, suggest possible new targets for drugs for small cell lung cancer, a highly lethal form of lung cancer that is associated with tobacco use and is usually treated with chemotherapy drugs that have severe side effects.

Rudolf Jaenisch and his lab group have determined that Niemann-Pick type C1 (NPC1) disease, a lipid storage disorder, is caused by defects not only in cholesterol processing but also in autophagy, a key cellular degradation pathway that malfunctions in many neurodegenerative diseases. Targeting both the cholesterol accumulation and stalled autophagy found in NPC1 with combination therapy could represent a viable treatment strategy.

Professor Jaenisch and his lab group used the gene regulation system CRISPR/Cas to engineer mouse genomes containing reporter and conditional alleles in one step. Animals containing such sophisticated engineered alleles can now be made in a matter of weeks, rather than years, and could be used to model diseases and study gene function.

Jaenisch, along with colleagues from the Del E. Webb Center, published a paper in *Cell* about how gene-environmental interactions can kill nerve cells that make dopamine. Their discoveries include identification of a molecule that protects neurons from pesticide damage. Until now the link between pesticides and Parkinson's disease was based mainly on animal studies and epidemiological research that demonstrated an increased risk of disease among farmers, rural populations, and others exposed to agricultural chemicals.

Professor Jaenisch published research in *Cell Stem Cell* that determined that the transcription factor Nanog, which plays a critical role in the self-renewal of embryonic stem cells, is expressed in a manner similar to other pluripotency markers. This finding contradicts the field's presumptions about this important gene and its role in the differentiation of embryonic stem cells.

Eric Lander, as the founding director of the Broad Institute of MIT and Harvard, announced that the Broad Institute has been issued a patent for a CRISPR-Cas9 system 'that is enabling scientists to modify genes and better understand the biology of living cells and organisms. The Broad Institute applied for the patent in concert with a publication in *Science* that described the use of the CRISPR enzyme, Cas9, for genome editing.

Doug Lauffenburger's lab group has discovered new findings that could lead to drugs that fight back when tumors don't respond to treatment. A new study reveals that much of this resistance develops because a protein called AXL helps cancer cells to circumvent the effects of ErbB inhibitors, allowing them to grow unchecked. The findings suggest that combining drugs that target AXL and ErbB receptors could offer a better way to fight tumors.

Susan Lindquist, using a discovery platform whose components range from yeast cells to human stem cells, has identified a novel Parkinson's disease drug target and a compound capable of repairing neurons derived from Parkinson's patients. The platform — whose effectiveness is described in dual papers published online in *Science* — could accelerate the discovery of drug candidates that address the underlying pathology of Parkinson's and other neurodegenerative diseases. Today, no such drugs exist.

Harvey Lodish's research has identified a protein that is the target of glucocorticoids, the drugs that are used to increase red blood cell production in patients with certain types of anemia, including those resulting from trauma, sepsis, malaria, kidney dialysis, and chemotherapy. The discovery could spur development of drugs capable of increasing this protein's production without causing the severe side effects associated with glucocorticoids.

David Page's research group, in collaboration with Washington University in St. Louis and Baylor College of Medicine, published a study in *Nature* that suggests that because Y-linked genes are active across the body, they may actually be contributing to differences in disease susceptibility and severity observed between men and women.

Peter Reddien and his research group have been studying three-banded panther worms for their ability to regenerate any part of their bodies. These worms are amenable to molecular studies in the lab, making them a valuable addition to a field keen on understanding how mechanisms controlling regeneration have evolved over millennia and how they might be activated in humans. Their new model for studying the worms was published in *Current Biology*, and their research discoveries were published in *eLife*.

David Sabatini and his lab group identified a major mitochondrial pathway that imbues cancer cells with the ability to survive in low-glucose environments. By finding cancer cells with defects in this pathway or with impaired glucose utilization, the scientists can predict which tumor will be sensitive to antidiabetic drugs known to inhibit the pathway in question. Findings were published in *Cell*, *Science*, and *Nature's* online publication.

Leona Samson and her research team have developed a way to test several different DNA repair pathways in one cell. Their research was described in *Proceedings of the National Academy of Sciences*. The test can analyze four types of DNA repair capacity simultaneously in less than 24 hours. Previous tests have been able to evaluate only one system at a time. Tests analyzing cells' ability to fix different kinds of broken DNA could help doctors predict cancer risk.

Phillip Sharp and his colleagues published a paper in *Nature* describing their discovery of a mechanism that allows cells to read their own DNA in the correct direction and prevents them from copying most of the so-called "junk DNA" that makes up long stretches of our genome. The finding helps to explain the existence of many recently discovered types of short strands of RNA whose function is unknown.

Susumu Tonegawa and her research group had papers published in *Nature Neuroscience* and the online publication of *Cell* describing their work linking a specific synchronized oscillation pattern with its correlating behavior. This work may lead to new therapies for patients suffering from Alzheimer's disease and other memory impairments. Their discoveries included two neural circuits in the brain that work together to control the formation of time-linked memories, a critical ability that helps the brain determine when it needs to take action to defend against a potential threat.

Tonegawa's research group published a paper in *Science* detailing a study that showed how false memories can be planted in the brains of mice, leaving neurological traces identical to those of authentic memories. Tonegawa's group also studied how schizophrenia might be linked to abnormal brain waves.

Robert Weinberg's research group identified a transcription factor, ZEB1 that is capable of converting non-aggressive basal-type cancer cells into highly malignant, tumor-forming cancer stem cells. This discovery sheds new light on the aggressiveness of certain breast cancers. The findings were published in *Cell*.

Michael Yaffe and his lab group found that tumor cells with mutated p53 can be made much more vulnerable to chemotherapy by blocking another gene called MK2. The study was published in *Cell*.

Education

We are proud of our longstanding 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 review 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. We take great pride in the success and productivity of our students, a number of whom received awards in 2013–2014.

Undergraduate Program

Class of 2014

Anne Huang of Burlingame, CA, received an Award for Excellence in German Studies—for outstanding performance in the study of German language and culture—from the Department of Foreign Languages and Literatures.

Laura Lu of Potomac, MD, received an Advanced Certificate of Engineering Leadership, which recognizes the successful completion of the requirements of the two-year Bernard M. Gordon–MIT Engineering Leadership Program.

Catherine Koch of Shaker Heights, OH, was named a Marshall Scholar.

Cynthia Chen of Forest Hills, NY, was presented with the Randolph G Wei UROP (Undergraduate Research Opportunities Program) Award for making the most outstanding contribution in undergraduate research at the interface of life sciences and engineering.

Allegra Hawkins from Easton, MD, of the Alpha Phi sorority, and Daniella Yuschenkoff from San Francisco, CA, of the Kappa Alpha Theta sorority, were honored with Senior Legacy awards from the Fraternities, Sororities, and Independent Living Groups.

Katherine Silvestre of Seekonk, MA, received the Chemistry Department's Alpha Chi Sigma award for outstanding achievement in scholarship, research, and service to the department.

Sasilada Sirungruang of Washington, DC, received the Chemistry Department's Merck Index Award for outstanding scholarship, and the IAP (Independent Activities Period) 2014 Four Weeks for America fellowship from the Public Service Center.

Priyanka Saha of Bellevue, WA, was honored with the David Epstein Award in recognition of distinguished service and musical contribution to the MIT Symphony Orchestra.

Daniel Zhang of Newton, MA, received an Emerson Music Fellowship, which provided full funding for lesson instructions during the 2013–2014 academic year.

Sunanda Sharma of Shrewsbury, MA, received an honorable mention for outstanding research from the Department of Brain and Cognitive Sciences.

Sophie Chung of Naperville, IL, received an Emerson Music Scholarship, which provided funding for half-year lesson instructions during the 2013–2014 academic year.

Jake Bograd-Denton of Bedford, MA, received a summer 2013 fellowship from the Public Service Center.

Eight biology majors from the class of 2014 were elected to Phi Beta Kappa: Benjamin Bell of Dallas, TX; Cynthia Chen of Forest Hills, NY; Sungmin Cho of Scottsdale, AZ; Catherine Koch of Shaker Heights, OH; Angela Ma of Carmel, IN; Priyanka Saha of Bellevue, WA; Katherine Silvestre of Seekonk, MA; and Sasilada Sirungruang of Washington, DC.

Class of 2015

Joanne Zhou of Appleton, WI, received a Bridge Builder Award, presented to students for a campaign, initiative, or program that has addressed a campus, local community, or global need.

Halide Bey of Nicosia, Cyprus, was named a Kelly-Douglas Summer Travel Fellow to support projects that enrich our understanding of the Humanities, Arts and Social Sciences at MIT. She was also a winner of the 2013 IDEAS Global Challenge for Ghana: Science in Action.

Andrea Kriz of Ann Arbor, MI, won second prize in the S. Klein Prize for Technical Writing.

Divya Pillai of Oak Brook, IL, was a winner of the Gregory Tucker Memorial Prize in recognition of exceptional musical performance. She was also granted a Music Award for Steadfast Commitment to Chamber Music Performance in the category of voice, and was named an exceptional vocal student under the Ragnar Naess Awards for recognition of exceptional talent and commitment to performance at MIT.

Meghan O'Dell of Bethesda, MD, received an IAP Four Weeks for America fellowship from the Public Service Center.

Guillaume Kugener of Newton, MA, received an IAP 2014 Fellowship from the Public Service Center.

Yiping Xing of New Albany, OH, was a winner of the 2013 IDEAS Global Challenge for Hope in Flight.

Class of 2016

Mariana Agudelo of Roswell, GA, received an Award for Excellence in German Studies for outstanding performance in the study of German language and culture.

Nihala Thannikal of North Andover, MA, received an Expedition Grant for summer 2014 from the Public Service Center.

Class of 2017

Minyi Lee of Bronx, NY, earned an honorable mention for the Dewitt Wallace Prize for Science Writing for the Public.

Undergraduate Research Symposium

Ten students spoke at the Undergraduate Research Symposium in January at the invitation of their research faculty mentors: Amy Fan, Andrea Kriz, Kaitlin Allen, Prakriti Paul, Cynthia Chen, Laura McCulloch, Quynh Nguyen, Rebecca Shi, Robert Williams, and Vivian Liu.

Biology Department Undergraduate Awards

The Gene Brown Prize, for academic scholarship and demonstrated excellence as a teaching assistant, was awarded to Jennifer Plotkin '15, of Beverly Hills, CA, for serving as a TA in 7.016, and to Yiping Xing '15, of New Albany, OH, and Joanne Zhou '15, of Appleton, WI, for their work in 7.02.

The Susan Hockfield Prize in Life Sciences—given to 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—was awarded to Meghan Torrance '15, of Sewickley, PA, for her work in Professor Vander Heiden's lab.

The Ned Holt Prize, for demonstrated excellence in scholarship and service to the MIT community, was awarded to Benjamin Bell '14, of Dallas, TX, for his contributions to MIT and his undergraduate research in Professor Drennan's lab.

The Salvador E. Luria Prize for scholarship and research of publication quality was awarded to Andrea Kriz '15, of Ann Arbor, MI, for her work in Professor Sharp's lab.

The Merck Prize, for outstanding research and academic performance in biophysical or bioinformatics sciences, was awarded to Andrew Chen '15, of Sacramento, CA, for his work in Professor Gore's lab.

The Whitehead Prize, for outstanding promise for a career in biological research through academic scholarship as well as contributions to research and the MIT community, was awarded to Cynthia Chen '14, of Forest Hills, NY, for her work in Professor Lodish's lab and her contributions to the Department of Biology.

Graduate program

From July 1, 2013 to June 30, 2014, the Department awarded a total of 33 PhD degrees and three SM degrees in biology. One PhD degree was awarded in the MIT/Woods Hole Oceanographic Institute (WHOI) Joint Program in Biological Oceanography. There were 230 graduate students registered in the Biology Department in 2013–2014, and another 23 in the Joint WHOI Program. The incoming class for fall 2014 will have 34 students in the biology doctoral program and two students in the Joint Program.

Diversity

The biology department is deeply committed to providing talented underrepresented minorities, students from disadvantaged socioeconomic backgrounds, and persons with disabilities with access to high-quality graduate training. Accordingly, we strive to increase the visibility of our department and graduate training program at undergraduate institutions that serve primarily underrepresented minority and underprivileged students. We are continually expanding our efforts to identify, recruit, and retain underrepresented minorities, but one of the most powerful and effective tools for at MIT has been the MIT Summer Research Program (MSRP), as shown by the numbers detailed below.

MIT Summer Research Program

The MIT Summer Research Program in Biology (MSRPBio) provides undergraduates from other institutions with biology research opportunities at MIT and encourages them to apply to top-tier graduate schools. The program's success is demonstrated by the high percentage of students who are later admitted to top US graduate schools and who receive graduate fellowships.

The department hosted 21 summer students in 2011 and 25 students in 2012; 16 of these students enrolled in PhD programs, including four at MIT and one in the Harvard-MIT Health Sciences and Technology MD/PhD program. Of the 24 students in the summer 2013 program, most were rising juniors, so it is too early to say to which schools they will apply. However, eight of these students are currently in graduate school.

The Biology Department has managed its own summer program since 2004. In the past 10 years we have matriculated 37 students at MIT, 25 of those in biology. At least seven of those received National Science Foundation fellowships in their senior year of college, six have already completed their PhDs, and one finished with a 'master's degree.

The 2013 MSRP was highly competitive: 14 students were selected from a pool of more than 180 applications, and another five were accepted through cost sharing with HHMI.

The 2013 Biology entering graduate class had six MSRP biology alumni, four of whom were underrepresented minorities. Other MSRPBio alumni are pursuing their PhD degrees at top US institutions such as Stanford University; the University of California, Berkeley; the University of California, San Francisco; the California Institute of Technology, the Rockefeller University, Harvard University, the University of Pennsylvania, and Princeton University. We can therefore say that MSRPBio is actively helping build a strong pipeline of underrepresented minority graduate students for the nation as a whole.

The department also hosted two scholars through the Khorana Program, which honors the memory of Har Gobind Khorana, a Nobel laureate and longtime professor in biology at MIT who passed away in November 2011. One of the 2012 Khorana scholars is now a first-year biology graduate student at MIT.

Additional Outreach Activities

Our general efforts to increase diversity in science include the HHMI Special Research Seminar Series and underrepresented faculty sabbatical programs. The HHMI-funded seminar series features research seminars given by minority faculty or faculty from minority-serving institutions. These participants have been selected to speak in this seminar series because of their strong record in teaching and mentoring students from underrepresented minority groups. The invited faculty members meet with faculty and the department head, graduate students, and interested postdocs. They can also explore research collaborations with MIT faculty. This past year, the department hosted speakers from Brown University, Howard University, the University of Puerto Rico, and Florida Agricultural and Mechanical University. On average, each speaker met with four or five biology faculty and with a dozen graduate students and postdocs in small groups.

As part of his MLK visiting professorship, Jason Sello of Brown University's chemistry department worked in the laboratory of Robert Sauer. He was very active in the biology and MIT communities, giving a research seminar in the biology department, teaching a course over IAP, meeting with around 30 MSRPBio summer students, and lecturing on biofuels to participants in the annual HHMI summer workshop for high school biology teachers.

Since 2007, we have hosted an HHMI-funded summer sabbatical program for faculty from minority institutions to help them establish research collaborations with MIT faculty and to develop new curricula for their schools. In the past four years, we have hosted five underrepresented minority faculty members on sabbatical from institutions with a high percentage of underrepresented minority students. These professors also bring their students, who participate in the MSRPBio program while performing research with the sabbatical professor. In 2013, Courtney Robinson of Howard University participated in a mini-sabbatical with one of her graduate students, studying new lab techniques for her classroom teaching at Howard.

The weeklong IAP intensive Quantitative Biology Workshop (QBW) was offered for the fifth consecutive year to a select group of minority-serving institutions. The program has been very popular, with the number of faculty and student participants rising from 31 in its first year to 50 in 2014, from nine institutions (mostly Historically Black Colleges and Universities and Hispanic-Serving Institutions). The workshop introduces participants to important computational and quantitative methods used in modern biology to analyze large experimental datasets, and participants gain important skills that help them succeed in top graduate programs. To date, 28 of the workshop participants also took part in the MSRP program and seven are currently enrolled in PhD programs at MIT (five in biology and two in computational and systems biology). Four of the faculty participants have also participated in the HHMI summer sabbatical program. In January, the QBW was selected to become a short course on MITx, and in June, 7.QBWx was offered for the first time, with 8,031 individuals registered and 392 finishing the course and receiving a certificate.

The workshop drew participants from the University of Puerto Rico at Rio Piedras, the University of Puerto Rico at Mayaguez, Barry University, Hunter College, York College, Howard University, Spelman College, Florida International University, and the University of Maryland Baltimore County. The workshop offered daily lectures and hands-on computer labs to introduce participants to quantitative methods used in generating and analyzing data. Participating faculty included Ernest Fraenkel, Eric Lander, Paul Blainey, Jeff Gore, Amy Keating, Mark Bath, and Chris Burge. Hands-on activities were designed and taught by graduate students and postdoctoral fellows interested in undergraduate teaching.

The B-cubed program, begun in 2010 in collaboration with Novartis, is in its final year. Of the eight students who have completed the program, four were admitted into graduate programs at MIT, UC San Diego, New York University, and John's Hopkins University; two enrolled in MD/PhD programs (Stony Brook University and University of Minnesota); and two entered the workforce.

The department hosts a highly successful high school outreach program that includes a five-day workshop for high school biology teachers from Massachusetts, a six-week summer internship for high school science teachers, and a high school biology field trip to MIT during spring break in March. The 2013 'summer teachers' workshop focused on the use of tissue cultures and cell lines in biomedical research and personalized medicine, with lectures on stem cells, drug discovery, and immunology. During the hands-on lab activities, teachers learned how to culture mouse embryo fibroblasts and insect cells and how to conduct cell proliferation assays and transfections. In March, the department hosted class field trips for more than 200 high school students from five Boston-area high schools over a two-day period. These students attended lectures, toured facilities, and participated in hands-on activities and computer labs led by graduate students.

Since 2007, the department has been sponsoring a lecture series titled "[Conversation with Scientists](#)" in which past and present senior MIT biology faculty discuss the early years of their science lives and how their personal background, family, education, and mentors influenced their lives and career choices. The conversations are videotaped before a live audience of mostly graduate students and postdocs and then posted on the biology website via TechTV. Professor Frank Solomon spoke on June 17, 2014, and Robert Dottin of Hunter College will speak at the end of August.

Digital Learning Team

Eric Lander and Graham Walker developed and taught the MIT introductory biology course offered online through edX, 7.00x Introduction to Biology: "The Secret of Life." The course began March 5, 2013, and ran for 12 weeks. Professor Kaiser was working on 7.03 Genetics, but progress slowed due to the demands of the Provost's position. Other courses in early the stages of development are 7.06 Cell Biology, and a bioinformatics mini-course/module.

Building on lessons learned from developing other courses and educational initiatives, the department has partnered with the Office of Digital Learning to establish a digital learning team that includes two fulltime PhD biologists who have certification in teaching and pedagogical training. They will enable our faculty to develop innovative courses at a level consistent with MIT problem solving and offer customized assessment tools that can be machine graded, and to remain focused on the core mission—innovative teaching and cutting-edge research.

The department also worked to integrate the highly successful HHMI education group with the digital learning team. Led by Professor Walker, the group designs, develops, and disseminates educational tools and resources that enhance student learning of important biology concepts. Last year two of our subjects, 7.014 and 7.03, benefited from customized applications of software from [StarGenetics](#) and [StarBiochem](#).

Development

The department's 2013–2014 development efforts were focused on preparing for a major fundraising campaign for fellowship support that will complement and coincide with MIT's planned campaign announced in May 2014.

Encouraged by members of the Biology Visiting Committee, and under the leadership of Professor Schimmel, the biology campaign will seek to secure the department's graduate program against present and future fluctuations in federal funding. A small core campaign committee recruited by Schimmel and department head Alan Grossman will work to secure both planned and outright gifts for a graduate training initiative. Schimmel hosted an event at his home in California on September 22, 2013, and the next two years will include similar events on the MIT campus and East Coast'. Schimmel has also made a personal commitment to this campaign, which will be the basis for a challenge to other donors.

In October 2013, Vertex Pharmaceuticals renewed its longstanding support for the department's Vertex Scholars Program with a grant of \$85,000 for one PhD student.

On January 21, 2014, Glenn Foundation president and director Mark Collins visited with the Glenn Lab team and attended the Glenn Lecture, and in May a new grant proposal for \$3 million was submitted in support of the ongoing collaboration among professors Leonard Pershing Guarente, Li-Huei Tsai, and Angelika Amon. During his visit, Collins repeatedly stressed the importance of the mission of the foundation to extend human healthy lifespan and "reduce deathspan," as well as supporting "blue-sky research" into the biology of aging. In May, the department hosted an open house, and 10 of 25 invited alumni attended as part of the 2014 Commencement celebrations.

The department also hosts named lectureships as part of the regular biology seminar series. On January 7, the department hosted the Chipperfield Lecture, which honors the memory of Randy Chipperfield, who—before his tragic and untimely death in 1985—was pursuing his doctoral degree in the Biology graduate program. Dr. James Bradner from Dana-Farber Cancer Institute and Harvard Medical School delivered the lecture, titled "Chemical modulation of chromatin structure and function." The event was planned by the Chipperfield Graduate Committee for 2014: (Grace Chen, Zoe Hilbert, Aaron Hosios, and Erik Tillman).

The 5th annual Paul F. Glenn Distinguished Lectureship Series was held on January 21. Bruce Yankner of Harvard Medical School's Department of Genetics gave a talk titled "Systems Biology of the Aging Brain."

The 2014 Salvador E. Luria Lecture in the Life Sciences, honoring the late founder of the MIT Center for Cancer Research, was given by Karen Vousden of the Beatson Institute for Cancer Research (Glasgow, Scotland). Her talk was titled "The Role of the p53 Pathway in Metabolic Adaptation and Survival."

On May 6, Carla J. Shatz of the Bio-X and Department of Biology and Neurobiology at Stanford University gave the Francis O. Schmitt Memorial Lecture on "Surprise at the Synapse: Unexpected Role for MHC Class I in Synapse Pruning and Plasticity."

On April 29, Susan M. Gasser of the Friedrich Miescher Institute for Biomedical Research delivered the International Lecture in the Life Sciences sponsored by Raymond and Beverly Sackler. She spoke on "Roles for Heterochromatin in Development: A Study in *C. elegans*."

On April 8, Sung-Hou Kim of the Department of Chemistry at the University of California at Berkeley delivered the Alexander Rich Lecture titled “On the Predication of Genomic Susceptibility for Cancer.”

Staff

Our staff is integral to the department’s success and infrastructure.

Administrative officer Michelle Coleman left the department in May, after serving almost four years.

Rebecca Chamberlain, from Architecture, will join the department in August 2014 as the new administrative officer.

Nelly Cruz was hired as a technical instructor for the Project Lab to replace Leslie Houghton who left in September 2013.

Mary Mango left the Finance Office after nine years to serve in the Student Activities Office. She was replaced by Kristin Brace, who joins us from Roxbury Community College.

Technical instructor Michelle Mischke left after 17 years. She was replaced by Entela Nako, from Tufts University. Nako received her PhD from Harvard University in 2013.

Lab associate Anthony Morais, of the glass washing facility, retired after 17 years, and Ann Buddhai was promoted from lab aide to lab associate to replace him.

Hilda Harris-Ransom retired after 40 years in the department. She was replaced by Sarah Mann, who joins us from Tufts Medical Center.

Kristin Seabolt, previously of Stanford University, was hired as a new administrative/writing assistant.

Sera Thornton, who recently completed her PhD in the Boyer lab, was hired as a postdoctoral associate to join our digital learning team. Thornton brings significant experience and talent in designing images for biology, which will be useful in developing very visual courses such as developmental and cell biology during the upcoming year.

Alan D. Grossman
Department Head
Praecis Professor of Biology