Dean, School of Science

School of Science faculty members seek to answer fundamental questions about nature ranging in scope from the microscopic, where a neuroscientist might isolate the electrical activity of a single neuron, to the telescopic, where an astrophysicist might scan hundreds of thousands of stars to find Earth-like planets in their orbits. Their research will bring us a better understanding of the nature of our universe and help us address major challenges to improving and sustaining our quality of life, such as developing viable resources of renewable energy or unraveling the complex mechanics of Alzheimer's disease and other diseases of the aging brain.

These profound and important questions often require collaborations across departments or schools. At the School of Science, such boundaries do not prevent people from working together; our faculty cross such boundaries as easily as they walk across the invisible boundaries between buildings on our interconnected campus. Collaborations across School and department lines are facilitated by affiliations with MIT's numerous laboratories, centers, and institutes, such as the Institute for Data, Systems, and Society (IDSS), as well as through participation in interdisciplinary initiatives such as the Aging Brain Initiative or the Transiting Exoplanet Survey Satellite (TESS).

Our faculty's commitment to teaching and mentorship, like their research, is not constrained by lines between schools or departments. School of Science faculty teach General Institute Requirement subjects in biology, chemistry, mathematics, and physics that provide the conceptual foundation of every undergraduate student's education at MIT. The School faculty solidify cross-disciplinary connections through participation in graduate programs established in collaboration with the School of Engineering, including the programs in biophysics, microbiology, and molecular and cellular neuroscience. The faculty's participation in the Undergraduate Research Opportunities Program, established in 1969 by physics professor Margaret MacVicar, enables students to work across departmental and disciplinary boundaries and gain hands-on experience in basic research. Through their contributions to EdX, our faculty's commitment to excellence in education has reached beyond the walls of MIT's classrooms and laboratories to students around the world.

Initiatives and Programs

Aging Brain Initiative

Spearheaded by Li-Huei Tsai, director of the Picower Institute for Learning and Memory, and Dean Michael Sipser, the Aging Brain Initiative was established to support interdisciplinary research on Alzheimer's disease and other diseases of the aging brain. Its aim is to focus a broad range of research talent on a single goal: improving quality of life through fundamental research into how the brain ages in health and in decline. Although the number of Americans with Alzheimer's disease is predicted to increase from 5.2 million today to 13.8 million by 2050, there is neither a cure for Alzheimer's disease nor an effective means of slowing its progress. Until we know more about what causes brain functions to change with age, we will be no closer to a cure or a disease-modifying therapy. The Aging Brain Initiative seeks to address this gap in knowledge through collaborative efforts by researchers in the areas of the neurosciences, bioengineering, biology, computer science, artificial intelligence, medicine, and health policy.

Center for Brains, Minds and Machines

The Center for Brains, Minds and Machines, a multi-institutional collaboration headquartered at MIT, aims to create a new field—the science and engineering of intelligence—by bringing together computer scientists, cognitive scientists, and neuroscientists to work in close collaboration. Led by Professor Tomaso Poggio of the Department of Brain and Cognitive Sciences (BCS), the vision of this multi-institutional collaboration is to develop a deep understanding of intelligence and the ability to engineer it, to train the next generation of scientists and engineers in this emerging new field, and to catalyze continuing progress in and cross-fertilization among computer science, mathematics and statistics, robotics, neuroscience, and cognitive science.

Institute for Data, Systems, and Society

Launched in 2015 with participation from all five MIT schools, the Institute for Data, Systems, and Society brings together researchers working in the mathematical, behavioral, and empirical sciences to capitalize on their shared interest in tackling complex societal problems. Led by Professor Munther Dahleh of the Department of Electrical Engineering and Computer Science, IDSS offers a range of cross-disciplinary academic programs, using tools and methodologies in statistics, information and decision systems, and social sciences to address challenges and opportunities in complex systems. IDSS research encompasses a variety of domains, including finance, social networks, urbanization, energy systems, and health analytics.

Transiting Exoplanet Survey Satellite

The first MIT-led National Aeronautics and Space Administration (NASA) mission, the Transiting Exoplanet Survey Satellite, will monitor more than 200,000 stars in search of exoplanets capable of supporting life. Faculty members in the Departments of Aeronautics and Astronautics, Physics, and Earth, Atmospheric and Planetary Sciences (EAPS) will participate in the project, with support from Lincoln Laboratory staff. George Ricker, a principal investigator at the MIT Kavli Institute, leads the project, with a projected launch date in 2018.

TESS will use an array of wide-field cameras to survey the entire sky, looking for the transient dimming of stars that indicates that planets are passing in front of them. The satellite will employ a number of innovations, such as an offset, highly eccentric orbit that oscillates close enough for high data-downlink rates and far enough away to avoid Earth's harmful radiation belts. Once TESS is in orbit, the all-sky survey will be carried out by cameras designed at Lincoln Laboratory containing novel CCD (charge-coupled device) detectors (also developed and fabricated at Lincoln Laboratory) with high signal-handling capacity and photometric accuracy and speed. The TESS mission will provide extraordinary opportunities for MIT to raise its international profile in space science, expand its educational and research mission, and enhance its strength in developing space exploration missions.

Education

MIT is exceptional among major research institutions for its dedication to undergraduate education. Unlike most leading schools of science, MIT places great emphasis on hiring and promoting young faculty members and using undergraduate teaching as important criterion for promotion and tenure. It is not uncommon for Nobel Prize winners and others among our best researchers to teach freshman subjects. Committed to providing undergraduates with a strong science base for studies in their majors, the School and its departments participate in and support a variety of programs designed to create more active, student-centered learning environments inside the classroom. For instance, the Department of Physics participates in both the d'Arbeloff Interactive Mathematics Project and the Technology-Enabled Active Learning program, which integrate technology into coursework to help students engage with concepts. Likewise, the Undergraduate Research-Inspired Experimental Chemistry Alternatives curriculum integrates cutting-edge research with core chemistry concepts.

Interdisciplinary Graduate Programs

Over the past several years, the School of Science has been working to expand educational and training opportunities for graduate students, collaborating with the School of Engineering to create innovative graduate programs in fields in which MIT shows great strength. These programs allow MIT to attract the most talented students in their respective fields and to build cross-disciplinary connections among the Institute's faculty members, departments, and schools.

Biophysics

The biophysics program trains graduate students in the application of the physical sciences and engineering to fundamental biological questions at the molecular, cellular, and systems levels. The program exemplifies the Institute-wide goal of reducing boundaries between disciplines, spanning the Schools of Science and Engineering, including the Departments of Biological Engineering, Biology, Brain and Cognitive Sciences, Chemical Engineering, Chemistry, Civil and Environmental Engineering, Electrical Engineering and Computer Science, Materials Science and Engineering, Mechanical Engineering, Nuclear Science and Engineering, and Physics, along with the Harvard-MIT Program in Health Sciences and Technology.

Microbiology

The microbiology program is an interdisciplinary doctoral program in microbial science and engineering with more than 50 faculty members from several departments in the Schools of Science and Engineering. Students receive training in a wide range of approaches to microbiology, including biochemistry, biotechnology, cell and molecular biology, chemical and biological engineering, computational biology, ecology, environmental biology, evolutionary biology, genetics, genomics, geobiology, immunology, pathogenesis, structural biology, synthetic biology, systems biology, and virology. The program integrates educational resources across participating departments, builds connections among faculty with shared interests, and creates an educational and research community for training students in the study of microbial systems.

Molecular and Cellular Neuroscience

The molecular and cellular neuroscience doctoral program carries out cutting-edge neuroscience research and education across multiple subdisciplines, providing critical bridges from the molecular and cellular neuroscience field to neuroengineering, systems neuroscience, genomics, optogenetics, and neurochemistry. The program provides elective offerings in key cross-discipline subjects, such as neuroengineering, biochemistry, genetics, systems neuroscience, neuroimaging, cell biology, neural networks, quantitative biology, and neuronal dynamics, that complement less formal program aspects and bring faculty and students together with different levels of expertise and technology in studying the brain. The program graduates trainees with unique abilities to solve complex problems in basic neuroscience and neuropsychiatric disease.

EdX

To support MIT's goals to establish leadership in online education through our involvement with EdX and our own MITx initiative, School of Science departments continue to add to MITx curricula. This year, MITx began offering a more rigorous competency exam certificate for the popular course 7.00 Introduction to Biology—The Secret of Life in order to provide a more thorough and robust means of evaluating online learners and a more meaningful certificate for participants who excel. Additionally, Tracy Slatyer, the Jerrold R. Zacharias Career Development Assistant Professor in the Department of Physics, was selected for a 2017 MIT Teaching with Digital Technology Award for her incorporation of MITx materials into her courses 8.033 Relativity and 8.323 Relativistic Quantum Field Theory.

Teaching Prizes for Graduate and Undergraduate Education

To reward individual faculty members for supporting the Institute's mission to foster strong teaching, the School recognizes student-nominated professors with School of Science Prizes in Undergraduate and Graduate Teaching. This year Michale Fee, the Glen V. and Phyllis F. Dorflinger Professor of Neuroscience, was awarded the prize for undergraduate education for his subject 9.40 Introduction to Neural Computation. Associate Professor of Chemistry Elizabeth Nolan was awarded the graduate education prize for her subjects 5.061 Principles of Bioinorganic Chemistry and 5.08 Biological Chemistry II.

Research

Angelika Amon, the Kathleen and Curtis Marble Professor of Cancer Research, identified a mechanism that the immune system uses to eliminate aneuploid cells, that is, cells that have too many or too few chromosomes after a round of mitosis. Almost immediately after gaining or losing chromosomes, cells send out signals that recruit immune cells called natural killer cells, which destroy the abnormal cells. Amon found that the cells themselves cannot detect whether their chromosomes have incorrectly segregated but that, as they continue to divide, the chromosome imbalance causes increasingly significant disruption to DNA replication until the cells are incapable of dividing. Once in a senescent state, they begin attracting natural killer cells by producing inflammation-inducing molecules. Amon's findings raise the possibility of harnessing this system to kill cancer cells, which are able to proliferate even though most of them are aneuploid (90% of solid tumors and 75% of blood cancers). In future studies, the Amon lab hopes to determine how aneuploid cells attract natural killer cells and whether other immune cells are involved in the process, as well as how aneuploid tumor cells avoid immune clearance and whether this process can be reactivated in cancer patients.

Bonnie Berger, the Simons Professor of Mathematics, worked with researchers at Indiana University and MIT's Computer Science and Artificial Intelligence Laboratory to develop a new system that permits database queries for genome-wide association studies while reducing the chances of privacy compromises to almost zero. Berger's new system implements a technique called "differential privacy," which adds a small amount of random variation to the results of database searches to confuse algorithms that are designed to extract private information from the results of several tailored, sequential searches. The new system focuses on databases of single-nucleotide polymorphisms (SNPs), which are important for genome-wide association studies. The amount of variation or "noise" introduced by the system depends on how secure the database needs to be, how many contributors there are to the database, and how many SNPs the database contains. The more people whose data an SNP database contains, the less noise required, since it is easier to get lost in a crowd. The more SNPs in the database, the more flexibility an attacker has in constructing searches, requiring more noise to protect individuals' data. Although the system introduces a small amount of inaccuracy to the results it returns, it could make biomedical research much more efficient by allowing instantly searchable yet secure online databases. In order to protect sensitive information, databases are currently stored in repositories that require researchers to go through a lengthy process to gain access to them.

Data from the NASA New Horizons team, which includes **Richard Binzel**, professor of planetary sciences and Margaret MacVicar Faculty Fellow (along with other MIT researchers), show that Pluto's most prominent surface feature, a heart-shaped region named Tombaugh Regio, may harbor a large, viscous liquid ocean just below its surface. The team's findings may resolve a long-standing puzzle: for decades, astronomers have observed that Tombaugh Regio aligns almost exactly opposite from the dwarf planet's moon, Charon, in a locked orientation that has lacked a convincing explanation. The mass of a subsurface ocean would help explain this gravitational anomaly.

LED lights flickering at a specific frequency can substantially reduce the beta amyloid plaques seen in Alzheimer's disease in the visual cortex of mice, according to a study conducted by **Ed Boyden**, associate professor of biological engineering and brain and cognitive sciences; **Li-Huei Tsai**, the Picower Professor of Neuroscience and director of the Picower Institute; and lead author **Emery Brown**, the Edward Hood Taplin Professor of Medical Engineering and Computational Neurosciences. The treatment appears to work by inducing brain waves known as gamma oscillations, which help the brain suppress beta amyloid production and invigorate cells responsible for destroying the plaques. The study showed that an hour of exposure to the 40-hertz LED enhanced gamma oscillations and reduced beta amyloid levels by half in the visual cortex of mice in the early stages of Alzheimer's, with proteins returning to their original levels within 24 hours. For mice with more advanced accumulations of amyloid plaques, treatments of one hour per day for seven days resulted in markedly reduced plaques and free-floating amyloid. The Tsai lab is now studying whether light can drive gamma oscillations in brain regions beyond the visual cortex, and preliminary data suggest that this is possible. Also, Tsai and her group are investigating whether the reduction in amyloid plaques has any effects on the behavioral symptoms of their Alzheimer's mouse models and whether their technique could affect other neurological disorders that involve impaired gamma oscillations.

Institute Professor **Sallie "Penny" Chisholm** discovered that the marine bacteria *Prochlorococcus*, one of the tiniest and most abundant organisms on Earth, evolve new kinds of metabolites called lanthipeptides more abundantly and rapidly than any other known organism. Chisholm, in collaboration with researchers from the University of Illinois, found that while most bacteria synthesize only one or two versions of lanthipeptides, each localized variety of *Prochlorococcus* can synthesize several lanthipeptides—up to 29 in one case—and produce a set of them wholly distinct from other varieties. The team further discovered that evolution in *Prochlorococcus* does not proceed incrementally, as in other organisms, but in vast wholesale changes enabled by the division of lanthipeptide genes into two parts: one well conserved and the other highly variable. This mode of evolution has not been previously observed in nature, although similar studies have not been performed for other organisms. The findings have the potential to change our understanding of how evolution happens, and further research may offer insight into how to design and build new chemicals.

Julien de Wit, a postdoctoral associate in the Department of Earth, Atmospheric and Planetary Sciences, along with an international team including astronomers from MIT and the University of Liège in Belgium, has announced the discovery of seven Earth-sized planets orbiting a nearby star just 39 light years from Earth. Using NASA's Spitzer Space Telescope for observations, researchers found that all seven planets appear to be rocky, and any one of them may harbor liquid water since they are all within the habitable zone, where temperatures are within a range suitable for sustaining liquid water on a planet's surface. The discovery marks a new record, as the planets make up the largest known number of habitable-zone planets orbiting a single star outside our solar system. The planets are the best targets found so far to search for signs of life. Because they are all transiting the same star, each planet can be studied in great depth. Currently, de Wit is leading atmospheric reconnaissance with the Hubble Space Telescope, while Mary Knapp, an MIT graduate student, co-leads the search for signs of planetary magnetic fields in radio. Both projects are part of a worldwide reconnaissance effort that spans the electromagnetic spectrum from ultraviolet to radio.

John Gabrieli, the Grover M. Hermann Professor in Health Sciences and Technology and Cognitive Neuroscience, showed that a distinctive neural signature found in the brains of people with dyslexia may explain why they have difficulty learning to read. Gabrieli discovered that the brain displays less neural adaptation (the ability to acclimate to repeated input) in people with dyslexia than in those without the condition. Magnetic resonance imaging (MRI) scans of subjects without dyslexia showed neural adaptation in relevant brain regions after hearing a list of words said by the same speakers but not by different speakers. Subjects with dyslexia showed much less neural adaptation to hearing words said by the same speaker. The same pattern held true for other kinds of repeated input, such as objects or faces, even though are no documented difficulties for object or face recognition among people with dyslexia. These results suggest that the reduced neural adaptation associated with dyslexia is not limited to regions of the brain involved in reading and, moreover, that the effects of reduced neural adaptation surface only in reading because the activity entails uniquely difficult cognitive demands. Since this study focused on first and second graders who are learning to read and young adults with longer histories of reading instruction, Gabrieli will turn his attention to younger children to see if differences are apparent before reading instruction begins. He will also use other types of brain measurements such as magnetoencephalography to follow the time course of neural adaptation more closely.

Wolfgang Ketterle, the John D. MacArthur Professor of Physics and director of the MIT-Harvard Center for Ultracold Atoms, has created a new form of matter, a supersolid, that combines the properties of solids with those of superfluids. Using lasers to manipulate a superfluid gas known as a Bose-Einstein condensate (BEC), Ketterle and his MIT team were able to coax the condensate into a quantum phase of matter that has a rigid structure like a solid yet can flow without viscosity like a superfluid. The team used a combination of laser cooling and evaporative cooling methods (originally co-developed by Ketterle) to cool atoms of sodium to nanokelvin temperatures, resulting in a BEC and, subsequently, a supersolid. Ketterle co-discovered BECs, an achievement for which he was recognized with the 2001 Nobel Prize in physics. Currently, the supersolid exists only at extremely low temperatures under ultra-high-vacuum conditions. The team plans to carry out further experiments on supersolids and spin-orbit coupling, characterizing and understanding the properties of the new form of matter they created. Studies of this apparently contradictory phase of matter could yield deeper insights into superfluids and superconductors, which are important for improvements in technologies such as superconducting magnets and sensors, as well as efficient energy transport.

On January 4, the Laser Interferometer Gravitational-Wave Observatory (LIGO), operated jointly by the California Institute of Technology and MIT, detected its third gravitational wave since it first went online in 2015. The detection was made when LIGO began its second observing run in November 2016 after going offline in order to enhance the observatory's lasers, electronics, and optics. Catalogued as GW170104, the most recently observed event took place about 3 billion light years from Earth, measuring about twice as far as the black hole collision that produced LIGO's first-ever gravitational wave detection. Like the first two detections, the third event is the result of a binary black hole merger—with the black holes estimated to be about 31 times and 19 times as massive as the sun. The signal lasted less than two tenths of a second, during which scientists calculate that the black holes circled each other about six times before merging into one 49-solar-mass black hole. Unlike the first two detections, LIGO scientists found that at least one of the black holes may have been "anti-aligned" with the orbital angular momentum (the direction in which the black holes were orbiting each other). If more anti-aligned systems are detected, such evidence may support a formation scenario known as "dynamical capture," in which black holes evolve separately in a cosmic environment cluttered with stellar objects. In such an environment, black holes with various spins can eventually pair up in binary systems simply through gravitational "dynamic" attraction rather than evolving together according to the model termed "common envelope evolution."

Elizabeth Nolan, associate professor in the Department of Chemistry, has developed a new strategy for immunization against microbes that invade the gastrointestinal tract, including *Salmonella*, which causes more foodborne illness in the United States than any other bacteria. This approach could offer an alternative to antibiotics, which, if used too frequently, can contribute to drug resistance and can cause side effects because they also kill beneficial bacteria. Together with researchers from the University of California, Irvine, Nolan targeted a class of molecules called siderophores that *Salmonella* and other bacteria secrete to scavenge iron, which is essential to many cellular functions. Since siderophores are too small to induce an immune response from the host organism, Nolan attached a molecule that does induce a response (cholera toxin subunit B) to a siderophore and immunized mice twice, two weeks apart. The mice formed antibodies against siderophores, had reduced numbers of *Salmonella* in their gut, and did not experience the weight loss seen in unimmunized mice. Also, the mice had a bigger population of the beneficial bacteria *Lactobacillus*. In the future, Nolan will work to isolate and analyze the antibodies produced by mice in this study and develop immunization strategies against siderophores made by other organisms.

Morss Professor of Applied Mathematics **Peter Shor**, along with other researchers at MIT and IBM's Thomas J. Watson Research Center, showed that simple systems of quantum particles exhibit exponentially more entanglement than was previously believed. This means that quantum computers or other quantum information devices powerful enough to be of practical use could be closer than we thought. Previously, researchers believed that in a certain class of simple quantum systems, the degree of entanglement was, at best, proportional to the logarithm of the number of qubits. Shor and his group found that the entanglement scales as the square root of the system size, which means that a 10,000-qubit quantum computer could exhibit about 10 times as much entanglement as previously thought, with the difference increasing exponentially as more qubits are added.

Professor of Physics **Marin Soljačić** and a team of scientists at MIT developed an optical chip that may vastly improve the speed and efficiency of deep learning computer systems. Relying on light instead of electricity, the new chip can carry out matrix multiplication almost instantly with, in principle, zero energy, whereas these computations in conventional CPU (central processing unit) or GPU (graphics processing unit) chips are energy intensive. The new "programmable nanophotonic processor" uses multiple light beams directed in such a way that their waves interact with each other, producing interference patterns that convey the result of the intended operation. An array of waveguides are interconnected in a manner that can be modified as needed, programming that set of beams for a specific computation. To demonstrate the concept, the team set the programmable nanophotonic processor to implement a neural network that recognizes four basic vowel sounds. Even with this rudimentary system, they were able to achieve a 77% accuracy level, as compared with about 90% for conventional systems, and they expect no substantial obstacles to scaling up the system for greater accuracy.

Susan Solomon, the Lee and Geraldine Martin Professor of Environmental Studies, reported that warming from short-lived greenhouse gases such as methane, chlorofluorocarbons, or hydrofluorocarbons can cause sea levels to rise for hundreds of years after the pollutants have been cleared from the atmosphere. Solomon, in collaboration with a team of researchers from MIT and Simon Fraser University, explored a number of climate scenarios using an Earth systems model of intermediate complexity, a computationally efficient climate model that simulates ocean and atmospheric circulation to project climate changes over decades, centuries, and millennia. With the model, the researchers calculated both the average global temperature and sea-level rise in response to anthropogenic emissions of carbon dioxide, methane, chlorofluorocarbons, and hydrofluorocarbons. Along with revealing long-lasting effects from short-lived greenhouse gases, the study confirmed other predictions pertaining to carbon dioxide, showing that even if carbon dioxide emissions ceased in 2050, up to 50% of the gas would remain in the atmosphere more than 750 years afterward. Additionally, sea levels would continue to rise, measuring twice the level of 2050 estimates for 100 years and four times that value for another 500 years. The study also determined that if the Montreal Protocol had not been ratified in 1989, sea levels would rise an additional six inches by 2050.

Roger Summons, professor in the Department of Earth, Atmospheric and Planetary Sciences, together with **Gregory Fournier**, the Cecil and Ida Green Assistant Professor of Geobiology, and other MIT researchers, found that eukaryotes—the domain of life comprising animals, plants, and protists—were present on Earth as early as 2.33 billion years ago, around the time when oxygen became a permanent fixture in the atmosphere. This new time stamp for ancient life significantly predates the earliest sign of eukaryotes found in the fossil record: macroscopic fossils 1.56 billion years old that scientists widely agree are the remains of multicellular algae-like organisms. The rise of eukaryotes is a pivotal event in the development of life as we know it on Earth, and when it happened is a matter of vigorous, long-standing debate. The estimate was obtained not by examining rocks for fossil evidence but by using a technique called "molecular clock analysis." This approach involves first sifting through DNA databases to trace the evolution of sequences that code for the biosynthesis of sterol, a class of molecules found in all eukaryotes. Then, using ages derived from the fossil animal and plant relatives, these sequences can be tied backward in time to the earliest point at which they must have been expressed in ancestral eukaryotes. Molecular clock analysis has been used for many years, but to study events from millions, not billions, of years ago.

Yogesh Surendranath, the Paul M. Cook Career Development Assistant Professor in the Department of Chemistry, developed a new catalyst material that provides key insight into the design requirements for producing liquid fuels from carbon dioxide (CO2), the leading component of greenhouse gas emissions. Surendranath's tunable catalyst, made of a highly porous silver electrode material, allows for a selective, specific conversion pathway. Whereas most efforts to tune the selectivity of silver catalysts for carbon monoxide (CO) production have focused on changing the surface active site chemistry, the new catalyst's selectivity is modified by tuning the dimensions of the material's pores. The porous material can be made by depositing tiny polystyrene beads on a conductive electrode substrate, electrodepositing silver on the surface, and then dissolving away the beads, leaving pores whose size is determined by that of the original beads. The findings suggest a route toward using the world's existing infrastructure for fuel storage and distribution without adding net greenhouse emissions to the atmosphere. While the new catalyst takes the process only through its first stage, converting CO2 to CO, there are already established methods for converting CO and hydrogen to a variety of liquid fuels and other products.

Awards and Honors

Faculty Awards and Honors

Every year, academic and professional organizations honor numerous School of Science faculty members for their innovative research, as well as their service to the community. Because this past year was no exception, the individual reports from the School's departments, labs, and centers will document these awards more completely. Several notable honors and awards deserve additional mention here.

Stephen P. Bell, professor of biology; Christopher Cummins, the Henry Dreyfus Professor of Chemistry; and Nergis Mavalvala, the Curtis and Kathleen Marble Professor of Astrophysics, were elected to the National Academy of Sciences.

Edward S. Boyden, associate professor of biological engineering and brain and cognitive sciences; Matthew Vander Heiden, associate professor of biology; and Feng Zhang, associate professor of biological engineering and brain and cognitive sciences, were named inaugural Faculty Scholars by the Howard Hughes Medical Institute and the Bill and Melinda Gates Foundation.

Ibrahim Cissé, the Class of 1922 Career Development Assistant Professor, and Gene-Wei Li, assistant professor of biology, were named 2017 Pew Scholars in the Biomedical Sciences.

Christopher Cummins, the Henry Dreyfus Professor of Chemistry, was awarded the 2017 Linus Pauling Medal by the American Chemical Society in recognition of his synthetic and mechanistic studies of early-transition metal complexes.

The American Physical Society named William Detmold, assistant professor of physics, and Martin Zwierlein, professor of physics, as fellows. Also, the society presented the Medal for Exceptional Achievement in Research to Daniel Kleppner, Lester Wolfe Professor of Physics emeritus; the Henry Primakoff Award for Early-Career Particle Physics to Tracy Slatyer, the Jerrold R. Zacharias Career Development Assistant Professor of Physics; and the Oliver E. Buckley Condensed Matter Physics Prize to Xiao-Gang Wen, the Cecil and Ida Green Professor of Physics.

Semyon Dyatlov, an assistant professor of mathematics; Nikta Fakhri and Kerstin Perez, assistant professors of physics; and Aaron Pixton, the Class of 1957 Career Development Assistant Professor, were named 2017 Sloan Research Fellows.

Raffaele Ferrari, the Cecil and Ida Green Professor in Earth and Planetary Sciences, was selected to receive the 2016 Robert L. and Bettie P. Cody Award in Ocean Sciences in recognition of his work toward understanding the nature and rates of oceanic mixing and their consequences for general circulation.

Wolfgang Ketterle, the John D. MacArthur Professor of Physics, and Elly Nedivi, professor of brain and cognitive sciences and biology, were elected as fellows of the American Association for the Advancement of Science.

Stephen J. Lippard, the Arthur Amos Noyes Professor of Chemistry, was named co-winner of the 2016 Robert A. Welch Award in Chemistry for his pioneering work in the field of bioinorganic chemistry, as well as his role as a teacher and mentor.

The Brain and Behavior Research Foundation named Earl K. Miller, the Picower Professor of Neuroscience, the recipient of the 2016 Goldman-Rakic Prize for Outstanding Achievement in Cognitive Neuroscience. The foundation also presented the 2016 Freedman Prize for Basic Exceptional Research to Kay M. Tye, the Whitehead Career Development Assistant Professor of Brain and Cognitive Sciences. In addition, Tye received the 2016 Young Investigator Award from the Society for Neuroscience.

Richard Schrock won the 2017–2018 MIT Killian Award for his foundational work in the field of inorganic and organometallic chemistry.

Li-Huei Tsai, the Picower Professor of Neuroscience at MIT, was named the recipient of the Society for Neuroscience Mika Salpeter Lifetime Achievement Award. This award recognizes an individual with distinguished achievements in neuroscience who actively promotes the advancement of women in neuroscience.

Rainer Weiss, professor of physics emeritus, was a co-winner of the 2017 Princess of Asturias Award for Technical and Scientific Research, along with California Institute of Technology physicists Kip S. Thorne and Barry C. Barish and the LIGO Scientific Collaboration. The team was recognized for direct detection of gravitational waves.

The following professors were elected to the American Academy of Arts and Sciences: Angelika Amon, the Kathleen and Curtis Marble Professor of Cancer Research; Edward S. Boyden, associate professor of biological engineering and brain and cognitive sciences; Kerry A. Emanuel, the Cecil and Ida Green Professor of Atmospheric Science; Nergis Mavalvala, the Curtis and Kathleen Marble Professor of Astrophysics; Earl K. Miller, the Picower Professor of Neuroscience; Mary C. Potter, professor of psychology emerita; and Paul L. Schechter, William A.M. Burden Professor of Astrophysics emeritus.

School of Science Rewards and Recognition

The School of Science Rewards and Recognition program continues to acknowledge the dedication and hard work of the people who fill our departments, labs, and centers and whose efforts are the source of our prestige. The School continues its Spot Awards, which recognize employees "on the spot" for going beyond the requirements of their normal duties.

Since the Infinite Mile Award program was established in 2001, the School of Science has presented the awards to more than 300 of its members based on the nominations of grateful colleagues. This year's winners were Paul Acosta (Laboratory for Nuclear Science), Tyler Brezler (Chemistry), Cesar Duarte (Mathematics), Becky Ecung (Mathematics), Christin Glorioso (Biology), Diviya Sinha (Biology), Magdalah Wesh (Biology), and Nina Wu (Physics).

The Infinite Kilometer, which is designated for postdoctoral researchers and research scientists, was added in 2012 to recognize the contributions of these individuals to both our scientific endeavors and the MIT community as mentors and advisors to students and colleagues. This year's winners were Jan Bernauer (Laboratory for Nuclear Science), Edward Brignole (Biology), Ivica Friscic (Laboratory for Nuclear Science), Jinsoo Seo (Picower Institute), Daniel Winklehner (Physics), and Zhihong Xue (Biology).

Personnel

Appointments and Promotions

Michael Follows (EAPS), Laura Schulz (BCS), and Robert Simcoe (Physics) were promoted to the rank of full professor.

Mircea Dincă (Chemistry), Liang Fu (Physics), Jeffrey Gore (Physics), Jeremiah Johnson (Chemistry), Brad Pentelute (Chemistry), Jesse Thaler (Physics), and Matthew Vander Heiden (Biology) were granted tenure.

William Detmold (Physics), Anna Frebel (Physics), Aram Harrow (Physics), David McGee (EAPS), Ankur Moitra (Mathematics), Matthew Shoulders (Chemistry), and Michael Williams (Physics) were promoted to the rank of associate professor without tenure.

Elchanan Mossel joined the Department of Mathematics as a full professor, and Alexander Radosevich joined the Department of Chemistry as an associate professor.

Andrew Babbin (EAPS), Eliezer Calo (Biology), Riccardo Comin (Physics), Timothy Cronin (EAPS), Andrew Lawrie (Mathematics), Max Metlitski (Physics), Matěj Peč (EAPS), Kerstin Perez (Physics), Salvatore Vitale (Physics), and Bin Zhang (Chemistry) joined the School of Science faculty as assistant professors.

Faculty Lunch Programs

Tenure-track faculty lunch meetings are intended to help junior faculty members meet their peers in different departments and to provide a forum for discussion of important issues. This year's meetings included faculty presentations on graphite-conjugated catalysis, quantum computing, molecular semiconductors, and the role of maternal immunity in neurodevelopmental disorders.

School of Science Learn@Lunch Series

To provide administrative staff the support they need to do their jobs as effectively as possible, the School of Science holds a monthly lunch series for staff members on a variety of subjects. This year, Physics Department head Peter Fisher spoke about work-life balance and Biology Department head Alan Grossman gave a talk on his experiences with organ donation.

School of Science Peer Connections

The Peer Connections Program pairs new School of Science staff with mentors who will help them navigate job responsibilities, MIT policies and procedures, and Institute organization and culture. The program provides opportunities for both mentors and new employees to expand their skill sets, increase their confidence, and make connections with School of Science community members outside of their home department, lab, or center.

Michael Sipser
Dean
Donner Professor of Mathematics