Department of Mechanical Engineering

The Department of Mechanical Engineering (MechE) embodies the Massachusetts Institute of Technology's motto, mens et manus (mind and hand), as well as "heart," by combining analysis and hands-on discovery with a commitment to making the world a better place. By leveraging our strengths, we aspire to solve some of the biggest challenges facing our world—and to train the next generation of mechanical engineers to develop creative products and solutions.

We conduct cutting-edge research at the frontiers of mechanical engineering. Faculty often specialize in more than one discipline, ensuring a fluidity of research that promotes cross-disciplinary discovery.

The department's research is organized across seven collaborative disciplines:

Mechanics

Design, Manufacturing, and Product Development

Controls, Instrumentation, and Robotics

Energy Science and Engineering

Ocean Science and Engineering

Bioengineering

Micro-and-Nano Engineering

These core disciplines shape our world-class introductory and advanced undergraduate and graduate-level programs. MechE has a culture of curiosity that combines a rigorous education with hands-on experience. The department educates future leaders in mechanical engineering who can model, design, innovate, and solve the "grand challenge" problems facing our society. Our students and faculty advance science and technology by discovering solutions, designing products, and engineering workflows that help make the world a better place.

Every year, MechE attracts and enrolls top-notch mechanical engineering students. Both the undergraduate and graduate programs continue to thrive, with 553 undergraduate students and 564 graduate students enrolled during academic year 2018. The department's research programs incorporate a growing postdoctoral population of approximately 80 fellows and associates.

This year's report provides an overview of departmental news from AY2018. The report includes a short synopsis of the visiting committee meeting and strategic plan execution, new initiatives, and updates on faculty (new hires, promotions, changes in departmental leadership, and retirements). It also presents selected research highlights across the department; an overview of start-ups and products originating in the MechE community; education highlights, with brief overviews of the undergraduate and graduate programs; awards and recognitions that provide a small sampling of the diversity, breadth, and depth of achievements of the entire community; a summary of various communication activities; and an overview of space renovations that were completed on campus.

Goals, Objectives, Priorities

Visiting Committee Meeting

In April 2018, members of the MIT Department of Mechanical Engineering Visiting Committee convened on campus for their biennial meeting to assess the current state of the department and provide recommendations on its direction.

- The Visiting Committee found Mechanical Engineeringto be a strong department. Due in large part to the leadership of Gang Chen, department head and Carl Richard Soderberg Professor of Power Engineering, the scope of the department continues to grow.
- The research and education conducted in design, manufacturing, and energy are among the department's greatest strengths.
- The Visiting Committee found the breadth and diversity of the junior faculty presentations to be impressive.
- There was a good deal of excitement and enthusiasm around undergraduate education involving hands-on and project-based classes.
- Maker culture is prevalent throughout the department. There is also strong support for entrepreneurial activities at all levels—from undergraduate students to faculty members.

During the meeting, Evelyn Wang, associate department head for operations and Gail E. Kendall Professor, presented MechE's strategic plan to the Visiting Committee. In addition to reviewing priorities and initiatives, Wang presented an external-facing pamphlet that will be made available to prospective industry partners, sponsors, and donors. The Visiting Committee was pleased with its content and design.

Strategic Plan

Throughout the academic year, the Strategic Planning Committee's co-chairs, Pierre Lermusiaux and Evelyn Wang, synthesized the information gathered during the previous year by the committee and oversaw the development of an external-facing pamphlet intended to inform interested audiences about the department's educational and research priorities. It includes the following information:

- Who we are: a synopsis of the department's mission, commitment to diversity, and research areas, as well as a description of the MechE Alliance.
- What we do: detailed information on the four grand challenges, which include design and manufacturing innovation, health of the planet, global energy sustainability, and robotics, autonomy, and intelligent systems.
- How we teach: a description of the department's educational philosophy and strategy for training the mechanical engineer of the 21st century by providing an education that is comprehensive, hands-on, career-focused, and flexible.

In line with these strategic priorities, progress has been made on a number of initiatives.

New Initiatives

Alliance Program

The MechE Alliance Program was launched in fall 2017 as a way to build a community of students, alumni, and industry partners around shared knowledge and meaningful relationships. In September 2017, the MechE Alliance launched its website. The initial focus of the program was on facilitating mentorship opportunities between students and alumni and hosting events for the alumni community. These events included:

- "Speed mentoring" events in December 2017, January 2018, and April 2018
- An alumni panel titled "Life After MechE" featuring Barbara Botros SM '08, PhD '11, deputy component integrated product team leader, Pratt & Whitney; Anurag Bajpayee SM '08, PD '12, PhD '12, co-founder and chief executive officer of Gradiant Corporation; Mary Delichatsios, SM '72, PhD '76, formerly of FM Global; Daniel Theobald '95, SM '98, president and chief technology officer at Vecna Technologies
- Mixer event for the MechE alumni community at MIT Reunion in June 2018

After these events, the alliance grew to 472 members—254 alumni, 110 graduate students, and 108 undergraduate students. To ensure the MechE Alliance continues to grow and host activities that foster collaboration and community, the department hired Theresa Werth as program manager in June 2018. Joe Rife stepped down from his role as director of the MechE Alliance in March 2018.

Consolidating Courses

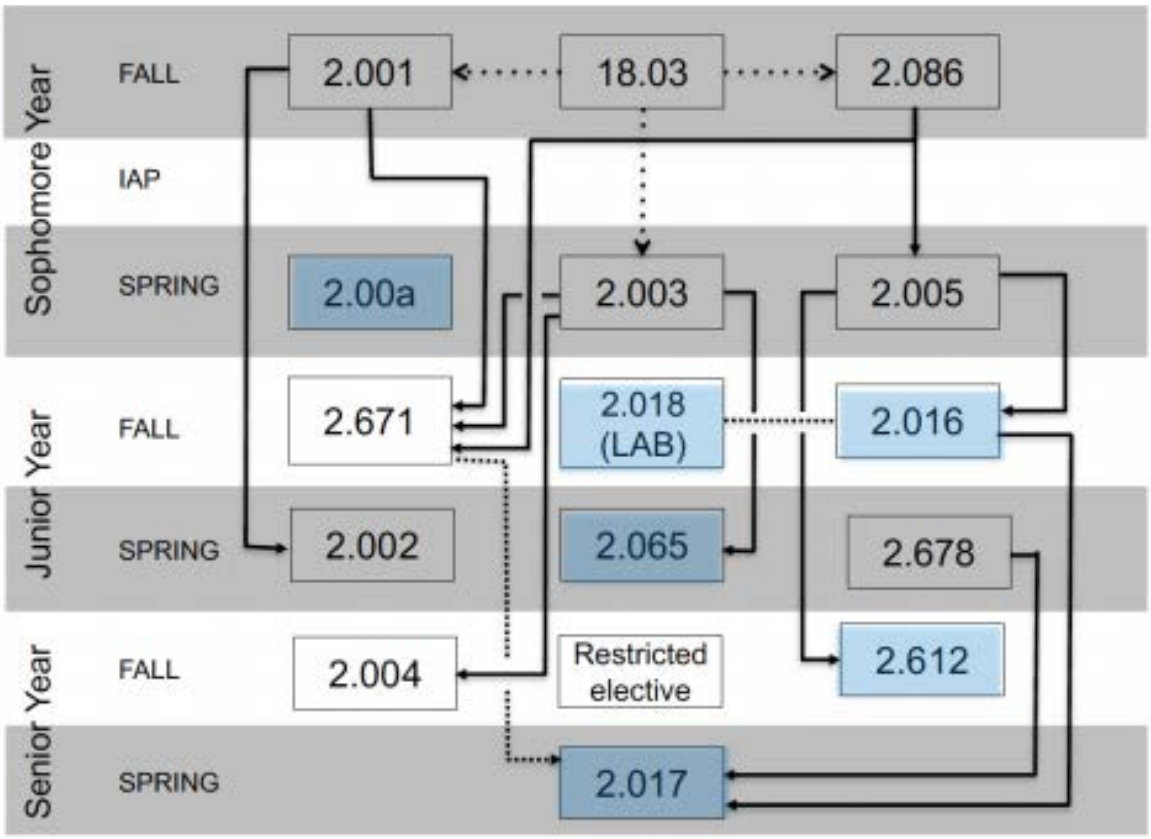
Following the Strategic Planning Committee's suggestion to consolidate foundation core classes across Course 2 and Course 2-A in order to increase the efficiency and effectiveness of teaching, several ad hoc subcommittees were appointed to review the curriculum. They focused on the areas of dynamics and control, thermal-fluids, and mathematics. They recommended developing an integrated course structure with some revisions to content. The goal wass to implement the changes in the next year, with the last offering of six-unit core subjects in spring 2019. Below is a summary of the subcommittees' recommendations.

Recommendations for Course Consolidation

Area	Course 2 requirement	Course 2-A requirement	Recommended 2-A requirement
Dynamics and Control	2.003 + 2.004	2.03* + 2.04A* or 2.04B*	2.003 (revised, 2.003 & 2.004 lab)
Thermal-fluids	2.005 + 2.006	2.05* + 2.051* + 2.06*	2.005 (revised)
Mathematics	2.086 + 18.03	2.086 + 2.087*	2.086 + 18.03

* 2.03, 2.04A, 2.04B, 2.05, 2.051, 2.06, and 2.087 are six-unit subjects.

Revamping of Course 2-OE Curriculum



The Course 2-OE program builds on the traditional Course 2 curriculum, adding a specialization in ocean engineering. The program includes engineering aspects of the ocean sciences, ocean exploration, and use of the oceans for transportation, defense, and extracting resources. The Strategic Planning Committee found that Course 2-OE could be improved by including more ocean engineering in the curriculum and exposing students to ocean engineering as early as sophomore year. Specific recommendations included:

- Decouple 2.016 Hydrodynamics and 2.06 Fluid Dynamics, allowing more advanced hydrodynamics
- Revise 2.017 Design of Electromechanical Robotic Systems as a 2-OE capstone subject
- Add a second-year ocean engineering design class (2.00A Fundamentals of Engineering Design: Explore Space, Sea and Earth)
- Add hydrodynamics laboratory (2.018)
- Add electronics requirement (2.678 Electronics for Mechanical Systems)

Mechanisms for Collective Funding

The Strategic Planning Committee recommended the development of various mechanisms for collective funding opportunities for the department. In June 2017, MechE hosted a half-day retreat that focused on various initiatives across the Institute, including the Tata Center, the Abdul Latif Jameel Water and Food Systems Laboratory,

the Sloan Automotive Laboratory's consortia, industrial consortia, the National Sea Grant College Program, the MIT Energy Initiative, and Lincoln Laboratory. The emphasis of the retreat was on sharing knowledge and brainstorming ideas to encourage more funding.

Topics covered included collective funding opportunities for engineering, energy, undersea research, bioengineering, humanitarian and disaster relief, advanced technology, unmanned aerial vehicles, and small satellites. Particular emphasis was placed on the potential collaboration between MechE and Lincoln Laboratory to help promote additional access to seed funding.

Workshop on Joint Opportunities for Mechanical Engineering and Artificial Intelligence

On January 31, 2018, the department hosted a faculty workshop, "Learning Machines: Joint Opportunities for MechE and AI," recognizing the emerging importance of artificial intelligence (AI) in recent years. Professor George Barbastathis organized the event. The workshop was timely, given the announcement of the launch of the MIT Quest for Intelligence the following day. Speakers included experts from other MIT departments, IBM, and Northeastern University, as well as 10 MIT MechE faculty members. Speakers and topics included:

- Patrick Winston, MIT Electrical Engineering and Computer Science: "Deep Learning Demystified"
- Lisa Amini, IBM Research, Cambridge, MA
- Jin Xiaoning, Northeastern University: "Big Data Analytics for Smart Manufacturing Systems"
- Paul Sclavounos, MechE: "Artificial Intelligence Machine Learning in Marine Hydrodynamics"
- A. John Hart, MechE: "Artificially Intelligent Manufacturing"
- Sanjay Sarma, MechE: "Embedded Machine Learning for Arc Fault Detectors"
- John Leonard, MechE: "Artificial Intelligence Challenges for Self-Driving Cars"
- Alberto Rodriguez, MechE: "Team MIT–Princeton's approach to the 2017 Amazon Robotics Challenge"
- Jeehwan Kim, MechE: "New Design of Artificial Synapses for Compact Artificial Intelligence Hardware"
- Pierre Lermusieaux, MechE: "Bayesian and Deep Machine Learning of Models"
- Themis Sapsis, MechE: "Two to Tango: Data-Driven, Equation-Assisted Prediction Schemes for Complex Dynamical Systems"
- George Barbastathis, MechE: "On the Use of Machine Learning to Solve Inverse Problems"

Faculty Promotions

Associate Professor to Full Professor

Domitilla del Vecchio was promoted from associate professor to full professor. She is a leading international figure in quantitative approaches to synthetic biology and has made breakthrough contributions to the field. Her seminal work introducing the concept of retroactivity has had a major impact on systems and synthetic biology. She discovered that, in a genetic circuit, the concentrations of any two proteins that are not linked by regulatory interactions are constrained on a line, which she named the "isocost line," and has constructed a new model describing the dynamics of gene regulatory networks. She started a new research program to understand and control the reprogramming of cell fate, and identified a blueprint for the synthetic genetic feedback controller. Del Vecchio is also a dedicated teacher. She introduced a new course in biomolecular feedback systems that has become a core course in the bioengineering department's undergraduate synthetic biology certificate. She has served extensively within MIT, chairing the undergraduate Dynamics and Control Curriculum Revision Committee, co-leading the education effort of the department Strategic Planning Committee, and serving on the Institute for Data Systems and Society Faculty Search Committee as well as the MechE Faculty Search Committee. She served on the editorial board of the American Chemical Society's *Synthetic Biology* and *IEEE Transactions on Network Science and Engineering*, *IEEE Life Science*, *mSystems* (American Society for Microbiology), and *Cell Systems* (Cell Press). She also joined the Technical Committee on Systems Biology in the Control Systems Society and has engaged actively in organizing invited sessions in systems and synthetic biology at the Institute of Electrical and Electronics Engineers (IEEE) Conference on Decision and Control. She has been recognized with a National Science Foundation (NSF) CAREER Award and with the prestigious Donald Eckman Award from the American Automatic Control Council.

Nicholas Xuanlai Fang has been promoted from associate professor to full professor. Fang is internationally recognized for his pioneering and innovative work in metamaterials research. He established himself early on as a leader in optical three-dimensional printing and has developed a leading innovative program in a broad range of areas related to optical and acoustic metamaterials' fundamentals, microfabrication and nanofabrication, and applications. Since his promotion, he has continued to explore new directions with fundamental studies of light confinement, tunable and active acoustic materials, the fabrication of lightweight ultra-stiff and negative thermal expansion lattices, and the applications of metamaterials to light conversion, tissue engineering, and clean energy. Fang has served extensively within MIT and his professional societies. At MIT since 2014, he mentored the student team of the Graduate Association of Mechanical Engineers to organize the annual Mechanical Engineering Research Exhibition. He served on the Edgerton Award Selection Committee, chaired the Microsystems Technology Laboratories equipment acquisition committee, and served as a freshmen advisor. He has been recognized with a number of prestigious awards, including the NSF CAREER Award, the *MIT Technology Review* TR35 award, the Pi Tau Sigma Gold Medal from the American Society of Mechanical Engineers (ASME) , and the Chao and Trigger Young Manufacturing Engineer Award. He is a fellow of the International Society for Nanomanufacturing. In 2011, he was awarded the Ernest Abbe Medal by the International Commission of Optics for his achievements in the field of electromagnetic metamaterials. He is a dedicated teacher and outstanding mentor.

Associate Professor without Tenure to Associate Professor with Tenure

Associate Professor **Kenneth Kamrin** has received tenure. He is a leader in the modeling of dense granular flows and has made breakthrough advances in the development of continuum constitutive models for granular media. He has developed numerical techniques to address challenges in simulating granular materials. Recently, he identified certain applications where simplified constitutive models can provide accurate results, leading to reduced-order techniques with significantly reduced computation time. These insights are essential to readily address a vast range of important engineering problems involving granular media. Kamrin is an excellent teacher and has brought new pedagogical materials to undergraduate classrooms. He co-developed the first concurrently online class offered to MIT students, including online proctoring, office hours, and a searchable video index. He has also actively engaged in service and leadership activities in the broader engineering mechanics community. He is a founding organizer of the NEW.Mech workshop, which brings together New England's mechanics community. Kamrin received the NSF CAREER Award in 2013, the ASME Eshelby Mechanics Award for Young Faculty in 2015, the ASME *Journal of Applied Mechanics* Award in 2016, and the MIT Ruth and Joel Spira Award for Excellence in Teaching in 2016.

Assistant Professor to Associate Professor without Tenure

Jeehwan Kim, Class of '47 Career Development Professor, has been promoted to associate professor without tenure. Kim has made pioneering contributions to the manufacturing and growth of non-silicon semiconductors. At IBM, he invented a layer resolved transfer process to precisely control the transfer of two-dimensional materials, monolayer by monolayer. After joining MIT, his group proved that this process can prepare wrinkle-free, single-crystalline, single-domain graphene with high mobility. Furthermore, he demonstrated that the presence of a monolayer graphene is thin enough to allow a single-crystalline thin film growth on the graphene by registering the lattice structure of the single-crystalline substrate, and that the film can be peeled off for the reuse of the substrate. This remote-epitaxy technology has game-changing potential as it enables low-cost fabrication of a wide range of semiconductor thin films. Kim is an enthusiastic educator and has established a strong teaching record since joining MechE's faculty. In 2016 he received the IBM Faculty Award, in 2015 he received the Lymphangioleiomyomatosis (LAM) Research Foundation Award, and in 2012 he was an IBM Master Inventor with more than 80 granted patents.

Alexie Kolpak was promoted to associate professor without tenure. Kolpak's research advances first-principles simulation tools and employs them to study atomic and electronic structures of realistic interfaces and assess their impacts on renewable energy technologies. She discovered a new mechanism for oxidation evolution reaction at oxide interfaces. Kolpak also advanced tools for simulation of complex interfaces, including environmental effects, through developing neural network codes to enable simulating the large numbers of atoms necessary to reproduce realistic interfaces. She developed open-source machine learning codes to predict bandgaps and exchange-correlation energy more accurately. Kolpak is a caring advisor and mentor. She received the NSF CAREER Award in 2017.

Departmental and School Leadership

Associate Dean of Engineering—Anette (Peko) Hosoi. Anette (Peko) Hosoi, Neil and Jane Pappalardo Professor of Mechanical Engineering, was named associate dean of MIT's School of Engineering. Formerly the associate department head for operations in MechE, Hosoi began her new role on September 1, 2017. As associate dean, Hosoi will contribute to the School's mission broadly, particularly in educational initiatives and strategic planning and implementation.

Evelyn Wang—Department Head. Evelyn Wang, the Gail E. Kendall (1978) Professor and director of MIT's Device Research Laboratory, has been named head of MechE, effective July 1, 2018. She will replace Gang Chen, the Carl Richard Soderberg Professor in Power Engineering, who has been department head since July 1, 2013. An internationally recognized leader in phase change heat transfer on nanostructure surfaces, Wang's research focuses on high-efficiency energy and water systems. Currently the associate department head for operations in MechE, Wang has served as co-chair of the department's Strategic Planning Committee and the MechE–Lincoln Laboratory Task Force. She has taught and mentored hundreds of Course 2 students.

Rohit Karnik—Associate Department Head for Education. Associate Professor Rohit Karnik has been named the new associate department head for education at MechE. He will begin his new role on July 1, 2018. Over the past two years, Karnik has taken an active role in shaping the educational experience at MechE. As the undergraduate officer, he has overseen the operations of the department's undergraduate office and chaired the Undergraduate Programs Committee. This position has afforded Karnik the opportunity to evaluate and refine the department's course offerings each year and work closely with undergraduate students to provide the best education. Karnik's dedication to his students has been recognized with the Keenan Award for Innovation in Education and the Ruth and Joel Spira Award for Teaching Excellence. He has also served on the Graduate Admissions Committee and various faculty search committees. Karnik will succeed Professor John Brisson, who previously served as associate department head for education.

Pierre Lermusiaux—Associate Department Head for Operations. Pierre Lermusiaux has been named the new associate department head for operations, effective July 1, 2018. Lermusiaux has been instrumental in developing and implementing MechE's strategic plan over the past several years. In 2015, he joined Evelyn Wang as co-chair of the department's Strategic Planning Committee. Along with Wang, he was responsible for interviewing key stakeholders across the department, determining priority "grand challenge" research areas, and researching new educational models. The resulting strategic plan will inform the future of MechE for years to come. Lermusiaux's talent as an educator has been recognized with the Ruth and Joel Spira Award for Teaching Excellence. He has been the chair of the Graduate Admissions Committee since 2014 and is also active in several MIT-Woods Hole Oceanographic Institution Joint Program committees.

Chairs, Professorships, and New Hires

Haruhiko (Harry) Asada. Professor Haruhiko (Harry) Asada was named a 2018 Singapore Research Professor.

Tonio Buonassisi. Associate Professor Tonio Buonassisi was named a 2018 Singapore Research Professor.

John Lienhard. Professor John Lienhard was reappointed as the Abdul Latif Jameel Professor of Water and Food.

Nicholas Makris. Professor Nicholas Makris was named the William I. Koch Professor.

Wim van Rees. Assistant Professor Wim van Rees was appointed to the American Bureau of Shipping Career Development Professorship. Rees is new to the department. His work couples the most advanced computational fluid dynamics and structural mechanics available with modern optimization and machine learning algorithms to design ocean propulsion and energy harvesting systems.

Ellen Roche. Assistant Professor Ellen Roche was appointed as the Hermann L. F. von Helmholtz Career Development Professor. Roche is new to the department; she joined MechE from Harvard University. Her research focuses on applying novel manufacturing technologies to translational medical devices and developing devices along the translational path from concept to clinic.

Sanjay Sarma. Professor Sanjay Sarma, vice president for open learning, was reappointed as the Fred Fort Flowers ’41 and Daniel Fort Flowers ’41 Professor of Mechanical Engineering.

Dick Yue. Professor Dick Yue was reappointed as the Philip J. Solondz (1948) Professor of Engineering.

Faculty Retirement

Roger Kamm, Cecil and Ida Green Distinguished Professor, announced his retirement. Kamm received a PhD from MIT in 1977 and joined MechE as an assistant professor in 1978. He served as associate department head from 2005 to 2008, and helped form the Biological Engineering Department, in which he holds a dual appointment. He has been director of the NSF Science and Technology Center on Emergent Behaviors of Integrated Cellular Systems for the past eight years. Professor Kamm has been a leader in bringing the field of mechanics together with biology and chemistry. His work has explored the ways in which single molecules transmit force through macromolecular networks and the resulting change in molecular binding or enzymatic activity. Recognition for his contributions is reflected in Kamm’s election as a fellow of the American Institute for Medical and Biological Engineering, ASME, the Biomedical Engineering Society, the American Association for the Advancement of Science, the International Academy of Medical and Biological Engineering, and the National Academy of Medicine. He also received the ASME Lissner Medal for lifetime achievements in 2010 and was the inaugural recipient of the ASME Nerem Medal for education and mentorship in 2018.

Research Highlights

The department’s faculty members are innovators and problem solvers. Researchers are focused on major global challenges including the health of our planet, design and

manufacturing, global energy sustainability, and robotics, autonomy, and intelligent systems. Snapshots of the varied and diverse research conducted in the department follow.

Tonio Buonassisi
The worldwide quest by researchers to find better, more efficient materials for tomorrow's solar panels is usually slow and painstaking. Researchers typically must produce laboratory samples—which are often composed of multiple layers of different materials bonded together—for extensive testing. Now, a team led by Tonio Buonassisi has come up with a way to bypass such expensive and time-consuming fabrication and testing, allowing rapid screening of far more variations than would be practical through the traditional approach.

Gang Chen
Plastics are excellent insulators, meaning they can efficiently trap heat—a quality that can be an advantage in something like a coffee-cup sleeve. But this insulating property is less desirable in products such as plastic casings for laptops and mobile phones, which can overheat, in part because the coverings trap the heat that the devices produce. Now a team of engineers at MIT led by Gang Chen has developed a polymer thermal conductor—a plastic material that, however counterintuitively, works as a heat conductor, dissipating heat rather than insulating it. The new polymers, which are lightweight and flexible, can conduct 10 times as much heat as most commercially used polymers.

Ming Guo
The stiffness or elasticity of a cell can reveal much about whether the cell is healthy or diseased. Cancer cells, for instance, are known to be softer than normal, while asthma-affected cells can be rather stiff. MIT engineers led by Ming Guo, the Brit (1961) and Alex (1949) d'Arbeloff Career Development Professor, have devised a way to assess a cell's mechanical properties simply by observation. The researchers use standard confocal microscopy to zero in on the constant, jiggling motions of a cell's particles—telltale movements that can be used to decipher a cell's stiffness. Unlike optical tweezers, the team's technique is noninvasive, running little risk of altering or damaging a cell while probing its contents.

Anastasios John Hart
MIT engineers led by Associate Professor Anastasios John Hart have developed a new desktop 3D printer that performs up to 10 times faster than existing commercial counterparts. Whereas the most common printers may fabricate a few Lego-sized bricks in one hour, the new design can print similarly sized objects in just a few minutes. The key to the team's nimble design lies in the printer's compact printhead, which incorporates two new speed-enhancing components: a screw mechanism that feeds polymer material through a nozzle at high force, and a laser built into the printhead that rapidly heats and melts the material, enabling it to flow faster through the nozzle.

Jeehwan Kim
Associate Professor Jeehwan Kim and his team have designed an artificial synapse in such a way that they can precisely control the strength of an electric current flowing across it, similar to the way ions flow between neurons. The team has built a small chip with artificial synapses made from silicon germanium. In simulations, the researchers

found that the chip and its synapses could be used to recognize samples of handwriting with 95% accuracy. The design published in the journal *Nature Materials*, is a major step toward building portable, low-power neuromorphic chips for use in pattern recognition and other learning tasks.

Matthias Kolle
Compression therapy is a standard form of treatment for patients who suffer from venous ulcers and other conditions in which veins struggle to return blood from the lower extremities. Compression stockings and bandages, wrapped tightly around the affected limb, can help to stimulate blood flow. But there is currently no clear way to gauge whether a bandage is applying an optimal pressure for a given condition. Now, engineers led by Assistant Professor Matthias Kolle have developed pressure-sensing photonic fibers that they have woven into a typical compression bandage. As the bandage is stretched, the fibers change color. Using a color chart, a caregiver can stretch a bandage until it matches the color for a desired pressure before wrapping it around a patient's leg.

Pierre Lermusiaux
Observing the world's oceans is increasingly a mission assigned to autonomous underwater vehicles (AUVs)—marine robots that are designed to drift, drive, or glide through the ocean without any real-time input from human operators. MIT engineers led by Professor Pierre Lermusiaux have now developed systems of mathematical equations that forecast the most informative data to collect for a given observing mission and the best way to reach the sampling sites. With their method, the researchers can predict the degree to which one variable, such as the speed of ocean currents at a certain location, reveals information about some other variable, such as temperature at some other location—a quantity called "mutual information." If the degree of mutual information between two variables is high, an AUV can be programmed to go to certain locations to measure one variable, to gain information about the other.

Gareth McKinley
MIT scientists including Gareth McKinley, School of Engineering Professor of Teaching Innovation, have now explained why under certain conditions a droplet of liquid should not coalesce with the liquid surface below. If the droplet is very cold, and the bath sufficiently hot, then the droplet should "levitate" on the bath's surface as a result of the flows induced by the temperature difference. The team's results, published in the *Journal of Fluid Mechanics*, offer a detailed, mathematical understanding of drop coalescence, which can be observed in everyday phenomena, from milk poured in coffee to raindrops skittering across puddles and sprays created in surf zones.

Ellen Roche
After a patient has a heart attack, a cascade of events leading to heart failure begins. Damage to the area in the heart where a blood vessel was blocked leads to scar tissue. In response to scarring, the heart will remodel to compensate. This process often ends in ventricular or valve failure. A team of researchers, including Assistant Professor Ellen Roche, is hoping to halt the progression from heart attack to heart failure with a small device called "Therepi." The device contains a reservoir that attaches directly to the damaged heart tissue. A refill line connects the reservoir to a port on or under the patient's skin where therapies can be injected either by the patient or a health care professional.

Themistoklis Sapsis
Many extreme events—from a rogue wave that rises up from calm waters, to an instability inside a gas turbine, to the sudden extinction of a previously hardy wildlife species—seem to occur without warning. Now Associate Professor Themistoklis Sapsis has devised a framework for identifying key patterns that precede an extreme event. The framework can be applied to a wide range of complicated, multidimensional systems to pick out the warning signs that are most likely to occur in the real world.

Sanjay Sarma
A team of researchers led by Professor Sanjay Sarma has developed software that can tell if a car's tires need air, spark plugs are bad, or an air filter needs replacing. The smartphone app combines the various diagnostic systems the team developed and could save the average driver $125 a year and improve a driver's overall gas mileage by a few percentage points. For trucks, the savings could run to $600 a year, not counting the benefits of avoiding breakdowns that could result in lost income.

Yang Shao-Horn
A new approach to analyzing and designing new ion conductors—a key component of rechargeable batteries—could accelerate the development of high-energy lithium batteries and possibly other energy storage and delivery devices such as fuel cells, researchers say. The new approach developed by Yang Shao-Horn, W. M. Keck Professor of Energy, relies on understanding the way vibrations move through the crystal lattice of lithium ion conductors and correlating that with the way they inhibit ion migration. This provides a way to discover new materials with enhanced ion mobility, allowing rapid charging and discharging. At the same time, the method can be used to reduce the material's reactivity with the battery's electrodes, which can shorten its useful life. These two characteristics—better ion mobility and low reactivity—have tended to be mutually exclusive.

Kripa Varanasi
Devised by Associate Professor Kripa Varanasi's research team, a new system could provide a low-cost source of drinking water for parched cities around the world while also cutting power plant operating costs. About 39% of all the fresh water withdrawn from rivers, lakes, and reservoirs in the US is earmarked for the cooling needs of electric power plants that use fossil fuels or nuclear power, and much of that water ends up floating away in clouds of vapor. But the new MIT system could potentially save a substantial fraction of that lost water—and could even become a significant source of clean, safe drinking water for coastal cities where seawater is used to cool local power plants.

Amos Winter
Prosthetic limb technology has advanced by leaps and bounds, giving amputees a range of bionic options, including artificial knees controlled by microchips, sensor-laden feet driven by artificial intelligence, and robotic hands that a user can manipulate with her mind. But such high-tech designs can cost tens of thousands of dollars, making them unattainable for many amputees, particularly in developing countries. Now MIT engineers led by Amos Winter, the Ratan N. Tata Career Development Professor, have developed a simple, low-cost, passive prosthetic foot that they can tailor to an individual. Given a user's body weight and size, the researchers can tune the shape

and stiffness of the prosthetic foot such that the user's walk is similar to an able-bodied gait. They estimate that the foot, if manufactured on a wide scale, could cost an order of magnitude less than existing products.

Xuanhe Zhao
MIT engineers led by Associate Professor Xuanhe Zhao have created soft, 3D-printed structures whose movements can be controlled with a wave of a magnet, much like marionettes without the strings. The menagerie of structures that can be magnetically manipulated includes a smooth ring that wrinkles up, a long tube that squeezes shut, a sheet that folds itself, and a spider-like "grabber" that can crawl, roll, jump, and snap together fast enough to catch a passing ball. It can even be directed to wrap itself around a small pill and carry it across a table. The researchers fabricated each structure from a new type of 3D-printable ink that they infused with tiny magnetic particles. The group's technique may be used to fabricate magnetically controlled biomedical devices.

Start-up and Product Highlights

Mechanical Engineering faculty, students, and alumni have founded many innovative start-ups and launched a number of game-changing products. Below is an overview of the various start-ups and products launched by a member of the MechE community which have been highlighted on MIT News over the past year:

- *Veggie Grill:* MechE alumnus T. K. Pillan '90 created Veggie Grill, a completely plant-based, fast-casual eatery that is now the largest vegan and vegetarian restaurant company in the US.
- *Playful Learning Lab*: Playful Learning Lab, founded by ocean engineering alumna AnnMarie Thomas '01, is collaborating with rock band OK Go to create hands-on engineering experiences for students from preschool through high school.
- *Terzo Millenio*: Associate Professor John Hart will investigate new carbon fiber and composite materials that could enable the complete body of Lamborghini's Terzo Millenio to be used as a battery system.
- *Cheetah III*: Professor Sangbae Kim is now developing a third generation of his robotic cheetah that is commercially viable and can operate in emergency response environments.
- *PipeGuard Robotics*: A small robotic device developed by Professor Kamal Youcef-Toumi and graduate student You Wu can inspect water or gas pipes from the inside to find leaks long before they become catastrophic.
- *Top Flight Technologies*: A start-up founded by MechE alumnus Long Phan SM '99, PhD '12, has commercialized hybrid gas-to-electric drones that offer more range, payload size, and power over battery-powered drones.
- *Portal Instruments*: Based on research by Ian Hunter, George N. Hatsopoulos Professor in Thermodynamics, the start-up Portal Instruments will collaborate with Takeda Pharmaceuticals to produce a smart, needle-free drug injection device.

Departmental News

Throughout the year, a number of updates highlighting the latest departmental news were published in MIT News. These updates included a number of departmental efforts and innovations.

- Closing the Gender Gap in Mechanical Engineering: The department's efforts to achieve gender parity over the past few decades were chronicled in a research study (presented at the 2017 annual conference of the American Society for Engineering Education) and an MIT News article. Particular attention was paid to the various initiatives that helped the department be composed of 49.5% women in fall 2016.
- Centers for Mechanical Engineering Research and Education Announced: MIT and the Southern University of Science and Technology will launch two centers in Cambridge, MA, and Shenzhen, China, that aim to foster research collaborations and inspire new approaches to engineering education.

Lup Wai Chew (left) explains his research in Wind Enhancement in Urban Areas to alum Luis De Jesus at the 4th annual Mechanical Engineering Research Exhibition. Photo: John Freidah.

- MIT Launches MITx MicroMasters in Principles of Manufacturing: The MITx MicroMasters program in principles of manufacturing brings an advanced manufacturing curriculum to the MITx platform for the first time and enables learners worldwide to advance their careers by mastering the fundamental skills needed for global manufacturing excellence and competitiveness. Many courses are taught by MechE instructors.
- Smart Manufacturing Program Boosts Productivity in Factories: The MIT Smart Manufacturing Leadership Program, developed in collaboration with MIT Professional Education, featured several webinars and a pair of four-day, on-campus sessions held in September 2017 and January 2018. MIT's faculty director of the program was Brian W. Anthony, director of programs and outreach for MIT.nano and a principal research scientist in the Department of Mechanical Engineering and the Institute for Medical Engineering and Science. He and his students worked on the development of manufacturing-related educational methods, materials, and machines.

- NEET Initiative: The New Engineering Education Transformation (NEET) initiative is rethinking engineering education by offering students two pilot cross-departmental threads: Living Machines and Autonomous Machines.

Event Highlights

MechE hosts a number of seminal events throughout the year. Below are highlights from some of the larger, more high-profile events from academic year 2018.

Mechanical Engineering Research Exhibition

Mechanical engineering sophomore Elizabeth Pedlow shows off the robot she built in class 2.007 at the final robot competition in May 2018. Photo: Tony Pulsone.

In its fourth year, the Mechanical Engineering Research Exhibition, which is hosted by the department and the Graduate Association of Mechanical Engineers, gives mechanical engineering graduate students, Undergraduate Research Opportunities Program participants, and postdocs a chance to present their work to alumni, faculty, and fellow students. Projects range from low-cost braille label makers to solar thermophotovoltaic systems and an in vitro intestinal organ model.

2.009 Final Class Presentations

Students of 2.009 Product Engineering Processes spent a semester developing and designing a product prototype centered around this year's theme: "Super!" Products ranged from the fun (a game blind and sighted people can play together) to the life saving (a real-time system for search and rescue teams) to the life changing (a wearable device that minimizes the effects of tremors in Parkinson's disease patients).

Months of thinking, modeling, and testing culminated in the final presentations. Eight teams of students presented to a full-capacity crowd in MIT's Kresge Auditorium, receiving a rock-star welcome. Brandishing pompoms in every color of the rainbow, the crowd of 1,200 cheered as 140 students revealed their prototypes. The 2.009 final presentation has become a celebrated event each year at MIT. For the past 22 years, professor of mechanical engineering David Wallace, MacVicar Faculty Fellow, has been at the helm of the class, which serves as a capstone for seniors. He leads a triple-digit team of dedicated teaching assistants, course instructors, and support staff to ensure students leave this class with an understanding of how products are created and launched.

Maker Break

More than 700 students and makers joined in the first annual showcase of fabrication and crafts across the Institute. Makers of all skill levels were encouraged to try their hands at any of the 18 making stations, including 3D scanning, jewelry making, vinyl cutting, candle making, and origami. The event was organized by Project Manus, led by professor of mechanical engineering Martin Culpepper.

2.007 Final Robot Competition

On June 15, 2018, Zhenghe Xu, dean of engineering at SUSTech (seated left) and Anantha Chandrakasan, dean of engineering at MIT (seated right), signed an agreement to establish the Centers for Mechanical Engineering Research and Education at MIT and SUSTech. Standing behind them are Shiyi Chen, president of SUSTech (left), Weizhong Wang, Party Secretary CPC Shenzhen Municipal Committee (center), and Richard Lester, associate provost at MIT (right). Photo: Allegra Boverman.

On May 10, 2018, the Johnson Ice Rink was transformed into a world of pure imagination. Students taking 2.007 Design and Manufacturing I showcased their own imaginative designs in the class' final robot competition. This year's Willy Wonka–themed competition featured a colorful game board based on the famous Chocolate Room and two equally colorful emcees: course instructors Sangbae Kim, donning a purple velvet coat as Willy Wonka, and Amos Winter, dressed as Charlie Bucket (complete with golden ticket).

Thirty-two student finalists showed just how calculated their imaginations could be in five sudden-death rounds throughout the event. In each round, two students went head-to-head to gain the most points. Their robots navigated two massive game boards to achieve certain tasks such as lifting gummy bears, pushing gobstoppers into a river of chocolate, and freeing Oompa Loompas from pipes. In one task, students were scored on the basis of how much kinetic energy they could put into a spinning mushroom.

The game board was designed to get students familiar with basic mechanical engineering principles. In building their robots, students gained an understanding of concepts such as traction, gripper design, sensor integration, autonomy, and optimized motor power.

Education Highlights

Undergraduate Enrollment, AY2013–AY2017

	AY2013	AY2014	AY2015	AY2016	AY2017
Sophomores course 2	84	87	85	88	66
Sophomores course 2-A	98	86	85	99	103
Sophomores course 2-OE	3	4	7	1	2
Sophomores subtotal	**185**	**177**	**177**	**188**	**173**
Juniors course 2	80	94	89	83	97
Juniors course 2-A	61	102	102	92	90
Juniors course 2-OE	6	4	3	3	2
Juniors subtotal	**147**	**200**	**194**	**177**	**189**
Seniors course 2	87	73	92	81	78
Seniors course 2-A	68	66	104	89	94
Seniors course 2-OE	4	8	5	6	3
Seniors subtotal	**159**	**147**	**201**	**176**	**175**
5th-year students course 2	8	11	4	3	8
5th-year students course 2-A	7	12	7	7	8
5th-year students course 2-OE	0	1	3	0	0
5th-year students subtotal	15	24	14	10	16
Total	**506**	**548**	**586**	**551**	**553**

Graduate Enrollment, AY2013–AY2017

	AY2013	AY2014	AY2015	AY2016	AY2017
Master's	232	230	193	213	221
Doctoral	299	310	312	309	302
MEng	15	18	12	15	11
MechE	0	0	0	0	1
Eng (naval)	33	33	34	30	28
Total	**579**	**591**	**551**	**567**	**564**

Honors and Recognition

The Mechanical Engineering Department, faculty, and students are all recognized for their accomplishments through a number of awards and honors each year. Here is a small sampling.

Rankings

In their annual rankings for 2018, QS World University Rankings rated MIT's Department of Mechanical Engineering the number one mechanical engineering program in the world.

Faculty Awards

Lallit Anand

William Prager Medal: Lallit Anand, Warren and Towneley Rohsenow Professor of Mechanical Engineering, was awarded the 2018 William Prager Medal by the Society of Engineering Science for outstanding research contributions to large deformation plasticity theory. These contributions are becoming part of the core knowledge of the field and are having a significant impact on its development.

National Academy of Engineering: Professor Anand was elected to the National Academy of Engineering for contributions to the development of plasticity for engineering technology, involving theory, experiment, and computation.

Harry Asada

$2 Million Grant to Develop Robotic Educational Tool, "Teach-Bot": Massachusetts Governor Charlie Baker awarded Harry Asada, Ford Professor of Engineering, a $2 million grant to develop "Teach-Bot"—an interactive robot that educates and trains manufacturing workers on robotics.

Cullen Buie

MIT Committed to Caring Award: Associate Professor and holder of the Esther and Harold E. Edgerton Career Development Chair Cullen Buie was honored with an MIT Committed to Caring Award for making an impact in the lives of graduate students.

Kytopen (Backed by The Engine): Kytopen, co-founded by Professor Buie, is among the first seven start-ups backed by The Engine, a venture launched by MIT that will support "tough tech" companies. The Kytopen team has developed a new wave of genetic engineering, delivering DNA to bacterial cells up to 10,000 times faster than current state-of-the-art methods.

National Institutes of Health Director's Transformative Research Award: Cullen Buie received a National Institutes of Health Director's Transformative Research Award.

Gang Chen

American Academy of Arts and Sciences: Professor Gang Chen was elected to the American Academy of Arts and Sciences, one of the nation's oldest and most prestigious honorary societies.

Ahmed F. Ghoniem

Combustion Institute Fellow: Ahmed F. Ghoniem, Ronald C. Crane (1972) Professor, was named a fellow of the Combustion Institute for pioneering research in turbulent combustion, combustion dynamics and active control, and oxy-combustion.

Stephen Graves

National Academy of Engineering: Stephen Graves, Abraham J. Siegel Professor of Management Science and professor of engineering systems and mechanical engineering, was elected to the National Academy of Engineering for contributions to the modeling and analysis of manufacturing systems and supply chains.

Neville Hogan

Academic Career Achievement Award: Neville Hogan, Sun Jae Professor of Mechanical Engineering, has received the 2018 Institute of Electrical and Electronics Engineers (IEEE) Engineering in Medicine and Biology Society Academic Career Achievement Award for exceptional contributions of leadership, education, and mentorship in the fields of biological robotics, neural control of movement, and human-machine interfaces.

Ian Hunter

National Academy of Inventors Fellow: Professor Ian Hunter has been named to the 2017 class of fellows of the National Academy of Inventors (NAI). Election to NAI fellow status is a professional accolade bestowed to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society.

Lynette Jones

Institute of Electrical and Electronics Engineers Fellow: Senior Research Scientist Lynette Jones has been named an IEEE Fellow in recognition for her contributions to tactile and thermal displays.

Roger Kamm

Robert M. Nerem Education and Mentorship Medal: The American Society for Mechanical Engineers has awarded Roger Kamm, Cecil and Ida Green Distinguished Professor, the first-ever Robert M. Nerem Education and Mentorship Medal for demonstrating a sustained level of outstanding achievement in education and mentoring of trainees.

John Lienhard

Global Water Leader: John Lienhard, Abdul Latif Jameel Professor of Water, has been ranked the fourth most influential global water leader by *Water and Wastewater International* for his many contributions to water purification and desalination.

Bureau of Reclamation "More Water, Less Concentrate" Prize: Professor Lienhard's research has been selected by the US Bureau of Reclamation for its "More Water, Less Concentrate" prize. He proposes the use of concentrate from existing reverse osmosis plants that are acidified and then further concentrated using batch reverse osmosis.

MIT Committed to Caring Award: Lienhard was honored with an MIT Committed to Caring Award for making an impact on the lives of graduate students.

Warren Seering

MIT Committed to Caring Award: Warren Seering, Weber-Shaughness Professor, was honored with an MIT Committed to Caring Award for making an impact on the lives of graduate students.

Yang Shao-Horn

Faraday Medal: Professor Yang Shao-Horn has been named the first female recipient of the Royal Society of Chemistry's Faraday Medal in recognition of her outstanding original contributions and innovation in electrochemistry.

National Academy of Engineering: Professor Yang Shao-Horn has been elected to the National Academy of Engineering for contributions to design principles for catalytic activity for oxygen electrocatalysis for electrochemical energy.

International Society of Electrochemistry Fellow: Professor Yang Shao-Horn has been named a fellow of the International Society of Electrochemistry.

Alexander Slocum

Ruth and Joel Spira Outstanding Design Educator Award: Alexander Slocum, Walter M. May and A. Hazel May Professor, was given the 2018 Ruth and Joel Spira Outstanding Design Educator Award by ASME. The award goes to a person who exemplifies the best in furthering engineering design education through vision, interactions with students and industry, scholarship, and impact on the next generation of engineers, and a person whose action serves as a role model for other educators to emulate.

David Trumper

MIT Committed to Caring Award: Professor David Trumper was honored with an MIT Committed to Caring Award for making an impact on the lives of graduate students.

Kripa Varanasi

Infinite Cooling: Infinite Cooling, a start-up from Associate Professor Kripa Varanasi that reduces water consumption at power plants, won the 2017 Cleantech University Prize, the grand prize at the 2018 Rice Business Plan Competition, and grand prize at the MIT $100K Entrepreneurship Competition.

Frank E. Perkins Award for Excellence in Graduate Advising: Professor Varanasi was awarded the Frank E. Perkins Award for Excellence in Graduate Advising for serving as an excellent advisor and mentor for graduate students.

2018 ASME Gustus Larson Memorial Award: The American Society of Mechanical Engineers awarded Kripa Varanasi the Gustus Larson Memorial Award for outstanding achievement in mechanical engineering within 10 to 20 years following graduation with a baccalaureate (bachelor's) degree in mechanical engineering or a related field.

David Wallace

ASME Ben C. Sparks Medal: Professor David Wallace, MacVicar Faculty Fellow, received ASME's Ben C. Sparks Medal for outstanding contributions that have transformed the way undergraduates across disciplines and cultures think about and practice mechanical engineering design.

Evelyn Wang

***Foreign Policy*'s Global Rethinkers:** Professor Evelyn Wang was named one of *Foreign Policy*'s "Global Rethinkers" in 2017 "for outsmarting the world's water crisis."

MIT Committed to Caring Award: Professor Wang was honored with an MIT Committed to Caring Award for making an impact on the lives of graduate students.

Amos Winter

New Voices in Sciences, Engineering, and Medicine: The National Academies of Sciences, Engineering, and Medicine named Associate Professor Amos Winter a member of the inaugural cohort of the New Voices in Sciences, Engineering, and Medicine—a group of early-career leaders who will discuss key emerging challenges in science, engineering, and medicine.

Kamal Youcef-Toumi

MIT Committed to Caring Award: Professor Kamal Youcef-Toumi was honored with an MIT Committed to Caring Award for making an impact on the lives of graduate students

Student Awards

Rhodes Scholar

Senior Matthew Chun received the prestigious Rhodes Scholarship. As a Rhodes Scholar, Chun will begin postgraduate studies at Oxford University with the goal of advising organizations that bring life-improving technologies to countries around the world.

Marshall Scholar

Senior Nick Schwartz has been awarded the prestigious Marshall Scholarship. As a Marshall Scholar, he plans to pursue a master's degree in physics with extended research at Imperial College London.

Schwarzman Scholar

Joshua Charles Woodard was awarded a 2018 Schwarzman Scholarship and will study at Tshingua University in the fall.

Knight-Hennessy Scholar

Senior Jani Adcock has received one of the first-ever Knight-Hennessy Scholarships. The fellowship funds graduate school at Stanford University.

MIT $100K Entrepreneurship Competition—Grand Prize

Graduate students Maher Damak and Karim Khalil, along with Associate Professor Kripa Varanasi, won the grand prize at the MIT $100K Entrepreneurship Competition.

Lemelson-MIT Award

Graduate student Maher Damak won the 2018 Lemelson-MIT Student Prize in the graduate "Eat It!" category for his work on making pesticides stickier to reduce runoff that contaminates the environment.

MIT Federal Credit Union People Helping People Award

Senior Nick Schwartz was honored for his service to the community with the MIT Federal Credit Union's 2018 People Helping People Award.

MIT IDEAS Global Challenge

A number of mechanical engineering students won prize money at the MIT IDEAS (Innovation, Development, Enterprise, Action, and Service) Global Challenge, which rewards student teams that come up with inventions that improve people's lives worldwide. Winners included undergraduates Sarah Tress, Shannon McCoy, and Smita Bhattacharjee for their invention Loop; graduate students Scott Nill and Larissa Nietner for their invention STEMgem; undergraduates Max Kessler and Sarah Moseson for their team's TravelerPack; and undergraduate Moiz Imam, whose team's Umbulizer took home the grand prize.

MIT Solve

Several MechE students and alumni were chosen as Solver teams by MIT Solve. These included graduate student Kristen Railey for her nonprofit Girls Who Build, which organizes creative engineering workshops for high school girls; PhD candidate You Wu, whose company, Pipeguard, develops robots that find leaks in pipes; and alumna Amrita Saigal '10, founder of Saathi, which develops sanitary pads that are good for women's bodies and the environment.

Laya and Jerome B. Wiesner Student Art Award

Senior Julia Rue received a Laya and Jerome B. Wiesner Student Art Award for outstanding achievement in and contributions to the arts at MIT.

Communications

The MechE media team continued to share MechE's stories in compelling ways across a variety of channels this past year.

MechE Connects

This year's issues of MechE Connects, the biannual newsletter for the Department of Mechanical Engineering, demonstrated the breadth and diversity of the research generated by MechE's students, faculty, and alumni. The winter 2018 issue focused on the interface of mechanical engineering and the medical field. The summer 2018 issue centered on the various artificial intelligence and machine learning technologies developed by the MechE community.

MIT News Stories

Twenty-six articles, written by Communications Officer Mary Beth O'Leary, were published in MIT News. Nine of these were the Spotlight of the Day on MIT's main website. A number of these spotlights had a corresponding video produced by Multimedia Specialist John Freidah. MIT News stories included those listed in the table.

- Using Sensors and Social Networks to Make Slopes Safer, July 10, 2017
- David Gordon Wilson's Lifelong Love of the Bicycle , July 25, 2017
- MIT Spotlight: Pushing the Limits of Athletic Performance, July 16, 2017
- MIT Spotlight: Closing the Gender Gap in Mechanical Engineering, July 27, 2017
- Evelyn Wang Joins Leadership Team in MechE, September 1, 2017
- MIT Spotlight: On a Mission to Measure, September 8, 2017
- Presentation Practice: Hurricanes to Prosthetics , September 27, 2017
- Professor Harry Asada Awarded a $2 Million Grant to Develop Robotic Educational Tool, "Teach-Bot", November 2, 2017
- Four from MIT Are Named 2018 IEEE Fellows, December 7, 2017
- Students Launch Products That Help Users Harness Their Superpowers, December 13, 2017
- MIT Spotlight: Unlocking Marine Mysteries with Artificial Intelligence, December 14, 2017
- Using Mechanical Forces to Improve Wound Healing, December 21, 2017

- MIT Spotlight: Turning Any Room Into An Operating Room, January 8, 2018
- MIT Spotlight: Going for the Gold, January 29, 2018
- Understanding and Treating Disease, January 30, 2018
- MIT Spotlight: Just What the Doctor Ordered, February 5, 2018
- Featured Video: Solving a Rubik's Cube in Record Time, March 16, 2018
- 3Q: John Heywood on the Future of the Internal Combustion Engine, April 17, 2018
- MIT Spotlight: Ken Kamrin—Going with the Flow, May 13, 2018
- Students Demonstrate "Calculated Imagination" in Robot Competition, May 14, 2018
- Revolutionizing Everyday Products with Artificial Intelligence, May 30, 2018
- On a Mission to Build the Uncrashable Car, June 6, 2018
- A New Way to Mend a Broken Heart, June 6, 2018
- MIT Spotlight: Teaching Robots How to Move Objects , June 12, 2018
- MIT and SUSTech announce Centers for Mechanical Engineering Research and Education at MIT and SUSTech, June 19, 2018
- The Race to Build the Navy's Next Fleet of Ships, June 25, 2018

MechE Video

Video production continues to be a priority for MechE's communication team. This year, the department released eight videos on its YouTube channel. Most of these videos were original content, produced by Multimedia Specialist John Freidah, with a few research videos originating from MechE labs. The table offers an overview of the videos published this year.

YouTube Videos Produced in AY2018

Title	Category	YouTube Views
MIT Minute: Life as a Teaching Tool	Faculty profile	4,926
Go Forth and Measure at MIT	Class profile	9,933
Using AI to Explore Oceans	Class profile	6,279
Energy Harvesting Combat Boot with GPS	Research highlight	1,704
How to Float Your Coffee Creamer	Research highlight	2,025
Engineering Medical Devices at MIT	Class profile	6,367
MIT Robot Breaks Rubik's Cube Record	Departmental news	110,296
The Nature of Sand	Faculty profile	5,210
Total		**146,740**

These videos are also posted natively on Facebook and are often repurposed by the main MIT channels on Facebook and YouTube.

Social Media

MechE's social audience reach increased throughout the 2017–2018 academic year. Channel-specific strategies were employed to ensure that key demographics were targeted on the channel they most often use. Additionally, a LinkedIn company page was launched to help increase engagement with the alumni community and attract potential new hires. It garnered 427 followers as of June 30, 2018. MechE's Facebook fan base crossed the 30,000 mark increasing from 27,955 to 31,908 followers (1.4% increase), while its Twitter following surpassed 5,000 from 3,714 to 5,247 (41% increase). The starkest increase was on Instagram, where the number of followers more than doubled from 1,047 to 2,427 (132% increase).

Website Traffic

The MechE homepage is constantly updated with engaging content, including articles about groundbreaking research, students and faculty profiles, start-up and product news, and award highlights. The website received 2,707,457 pageviews by 356,330 users in AY2018.

Space Renovations

Machine Shop (35-125)

A partition wall in the Machine Shop was installed so the space can now be sectioned off to create a dedicated teaching area.

IT Area (3-455)

Renovation of 3-454, which is the MechE information technology area, has been completed. Upgrades include a large work area, storage, and power and network ports. These improvements will enable the IT staff to repair and set up new computers more easily and quickly.

Building 31 Conference Rooms (31-135 and 31-139)

Building 31 conference rooms were built. The rooms are equipped with 65-inch monitors and can seat 10 people each. In addition, a conference room on the fourth floor of Building 3 was renovated this year. The audiovisual equipment has been upgraded with a new laser projector, speakers, and a new motorized screen.

Conclusion

MIT's Department of Mechanical Engineering continues to be a global leader in mechanical engineering research and education. A commitment to making the world a better place is at the core of everything we do. As educators, we strive to train mechanical engineers who can think critically, develop creative solutions, and remain flexible in the face of abrupt change. In the coming year, we will continue to develop new educational initiatives and models that better prepare mechanical engineers of the 21st century.

Our students benefit from the diverse expertise of our faculty, many of whom are recognized as global leaders in their areas of study. We have a unique opportunity as a department to address the grand challenges our society faces including the health of our planet, global energy sustainability, design and manufacturing innovation, robotics, autonomy, and information systems, among many others. The department will focus on developing mechanisms and initiatives that support the collaborations needed to increase our global impact.

In AY2019, there will be a transition in the department's leadership as Professor Evelyn Wang succeeds Professor Gang Chen as department head on July 1, 2018. Wang will be joined by Professor Pierre Lermusiaux, who will succeed her as associate department head for operations, and Professor Rohit Karnik, who will succeed Professor John Brisson as associate department head for education. They will be supported by Joanne Mathias, PhD, who recently joined the department as administrative officer. The new leadership team will continue to push boundaries and work to ensure that the department remains at the forefront of mechanical engineering.

Gang Chen
Head
Carl Richard Soderberg Professor of Power Engineering

Evelyn Wang
Associate Head for Operations
Gail E. Kendall Professor