MITMECHE

MechEConnects

Spring/Summer 2017

MechEConnects
News from the MIT Department of Mechanical Engineering
Spring/Summer 2017 | ► meche.mit.edu

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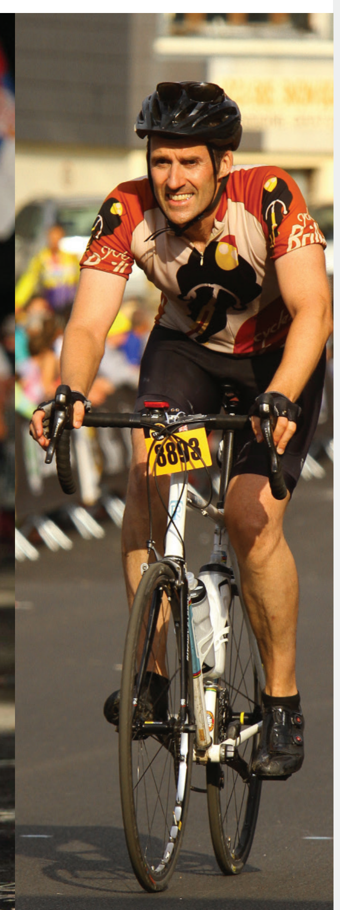
Junior and varsity athlete Olivia Struckman. Credit: Dave Silverman
Professor Alexander Slocum competing in the Ironman World Championship.
Professor Thomas Peacock completes Stage 19 of the Tour de France during the 2015 L'Etape du Tour.



Massachusetts Institute of Technology

About MechE

One of the six founding courses of study at MIT, mechanical engineering embodies the motto "mens et manus" – mind and hand. Disciplinary depth and breadth, together with hands-on discovery and physical realization, characterize our nationally and internationally recognized leadership in research, education, and innovation.

Newsletter Staff

Mary Beth O'Leary
Managing Editor & Staff Writer

Professor Thomas Peacock
Faculty Advisor

John Freidah
Director of Photography

B. Harris Crist
Webmaster

Wing Ngan
Designer

Contact MechE

Department of Mechanical Engineering
Massachusetts Institute of Technology
77 Massachusetts Avenue, Room 3-174
Cambridge, MA 02139

Mary Beth O'Leary, Communications Officer
olearymb@mit.edu

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MITMECHE

The love of sports extends beyond our courts, fields, and swimming pools. It drives the research done by many of our students and faculty.

Dear Alumni, Students, Faculty, and Friends,

Sports are a great equalizer. They bring people from every country and background together. Since our students and faculty come from all over the world, it's no wonder that so many are athletes and sports enthusiasts themselves.

The love of sports extends beyond our courts, fields, and swimming pools. It drives the research done by many of our students and faculty. From squash to sailing and everything in between, research on how to improve athletic performance is being conducted across a myriad of sports here in the Department of Mechanical Engineering.

This exciting research is not done in a vacuum. Thanks to the newly minted MIT 3-Sigma Sports (formerly the STE@M Sports Technology Group), students and faculty can connect with leading industry partners. The annual Sports Technology Summit held in May connects researchers with partners like Adidas and the Milwaukee Brewers. These connections help bring sports technology research out of the lab and into the playing field.

In this issue, we hear from faculty members, students, and alumni about how they apply the knowledge they've gained in classrooms and labs to their favorite sports. Their personal passions have inspired them to identify ways to improve athletic performance and create solutions for problems that can plague athletes. Members of the MechE community have developed a 3-D camera to correct an athlete's form as they lift weights, an aerodynamic bicycle built for speed, and an algorithm to make sense of the thousands of data points generated in each baseball game. If you stop to speak with any student or faculty member about their sports technology research, their passion is infectious.

We hope you enjoy this issue of MechE Connects. As always, thank you for your ongoing support and friendship.

Sincerely,

Gang Chen

Gang Chen, Carl Richard Soderberg Professor of Power Engineering and Department Head

Pushing the Limits of Athletic Performance

Story by Mary Beth O'Leary

A multiflash photo of a baseball batter from the iconic collection of Harold "Doc" Edgerton, inventor, and MIT professor. Credit: © 2010 MIT. Courtesy of MIT Museum.

The panic in the pit of your stomach as you fly over your handle bars is all too familiar to any mountain biker. Most cyclists dust themselves off and carry on riding, perhaps with more caution. But Professor Anette (Peko) Hosoi, Associate Department Head for Operations, is not like most bikers. She straightens her helmet, stands her bike up, and immediately begins examining its mechanics.

Hosoi is at New Hampshire's Highland Mountain Bike Park. Accessible only by ski lift, the park presents bikers with white-knuckle turns and stomach curling bumps. "I kept thinking 'this would be the most fun thing ever – if I could just stop flying off my bike.'" After assessing her cross-country bike, she determines the geometry is all wrong. If she is going to return to Highland Mountain, she will need a proper mountain bike.

As teacher of 2.001, Mechanics & Materials I, Hosoi has access to dozens of eager engineering students. She adds a new assignment to the syllabus: determine which bike on the market has the "truss, deformation, and yield" that make it optimal for mountain biking.

"I realized this was a fantastic way to teach mechanics," she adds. "It got me wondering what other sports we could use to teach engineering." With that, Hosoi founded the Sports Technology Group, now known as MIT 3-Sigma Sports (formerly STE@M).

MIT 3-Sigma Sports aims to solve the biggest problems across sports. The program connects students and faculty with alumni and industry partners who work together to improve athletic performance by using engineering to enhance endurance, speed, accuracy, and agility in sports. Some of the research projects stem from the needs of industry partners, while others are inspired by students and faculty's personal passion and experience with sports.

Graduate students and former varsity athletes Sarah Fay and Jacob Rothman have both found ways to bridge their personal passions with their academic pursuits. Fay, who played squash and field hockey undergrad at MIT, is working to identify the optimal weight for squash rackets by modelling the swing of a racket based on a person's height and weight. Rothman, who played on MIT's baseball team as an undergrad, is co-founder of Perch, a company that uses 3-D cameras to assess the velocity of a weightlifter's movements and provide instant feedback on how to improve form and minimize the risk of injury.

Fay and Rothman are not alone applying the work done in the lab to athletics. Many MechE faculty are conducting cutting-edge research at the forefront of sports technology. Here are just a few sports that MechE faculty are helping to improve:

Above: Professor Anette "Peko" Hosoi, founder and co-director of MIT 3-Sigma Sports.
Below: Hosoi biking at Highland Mountain Bike Park in Northfield, New Hampshire on May 13, 2017.
Credit: John Freidah

Running

Harnessing the power of the stride

Smartphones have revolutionized long distance running – providing everything from route planning, to heart-rate monitoring, to audio entertainment. But the batteries in these devices don't always last as long as the run, sometimes leaving runners in a difficult position.

Professor Sang-Gook Kim and his students have designed an energy harvesting shoe to convert each stride into power. Air bladders embedded in the sole of the shoe convert the foot's impact into airflow along the runner's gait. Both the outflow and inflow from the airbladders are directed at a dual microturbine enclosure which generates electricity that can be used to power the runner's device of choice.

The results produces 90mW of power for walking at 3 mph and a staggering 900mW when jumping. This means that 6 hours of walking can generate enough power to charge an iPhone battery 50%. "You can do a lot with that power," says Kim. "Joggers won't get lost and can get help quickly in emergencies."

The next step for Kim will be working with a top manufacturer on designing a shoe that can incorporate this energy harvesting technology. One immediate application could be to design running shoes with varying levels of elasticity. "The idea is to control the stiffness of the shoe like a sleep-number bed," adds Kim. This technology can do more than just improve the lives of runners and joggers, he notes. Military boots could be outfitted with this device to provide power to troops on the ground.

Cricket

Using a robotic arm to test the umpire's decisions

In cricket, if a ball makes slight contact with a bat and is caught in the field before it touches the ground, the batsman is out. Contact between the bat and the ball can be extremely difficult to detect, especially when the ball grazes the bat at 90 mph, so umpires rely on Decision Review System (DRS) technology. DRS, which depends on sophisticated edge-detection and ball-tracking technologies, is used to confirm whether a batsman is out. When the International Cricket Council (ICC) sought to test the accuracy of DRS, they turned to Professor Sanjay Sarma.

A life-long sports fan, Sarma was tasked with assessing the edge-detection and ball-tracking technologies used in DRS. "Our goal was to create a gold standard to calibrate the technology against," says Sarma, who also serves as Vice President for Open Learning. To test edge-detecting, Sarma, along with alum Jaco Pretorius and PhD student Stephen Ho, built a mechanical arm with a ball secured at the end. As the arm spun at high knots, a bat outfitted with sensors was moved into position to repeatedly replicate fine contact with the ball. Meanwhile to test ball-tracking, they built a frame with a laser field that could detect a ball's exact coordinates. The data generated from both the sensors on the bat and the laser field were then used to calibrate the technologies currently used in DRS.

The project brought the MIT team to the UK, where they visited Lord's Cricket Ground, home of cricket's most revered trophy, the Ashes urn. "I have met many Nobel Laureates, but a childhood dream I was able to fulfill was to have dinner at Lord's Cricket Ground," adds Sarma with a smile.

The ICC is using the data collected by Sarma and his team to calibrate DRS technologies and to enhance officiating.

Golf

How an Emmy inspired a new coaching tool

Engineering and Emmy Awards rarely go hand-in-hand – unless you're Principle Research Scientist Brian Anthony, who won an Emmy for his work on Swing Vision for CBS prior to coming back to MIT. Swing Vision uses two cameras – one recording 2,000 frames per second and the other recording 12,500 frames per second. The slower video is used by on-air commentators to analyze a golfer's swing, while the fast video gathers stats about the velocity, launch angle, and backspin of the club and ball for each of their shots.

Anthony is now using his background in video instrumentation to develop event detection and similarity algorithms that can be used for manufacturing process control, medical diagnostics — and sports. Videos of a gold standard athletic move – the perfect plié or right hook for example – are compared to a new video of the move. "By comparing the two videos, you can make decisions based on the time-space path that one video follows after another," he explains.

The algorithm then provides guided instructions for how the subject can best emulate the gold standard. Anthony hopes this technology could one day become a new coaching tool. "The idea is to one day make a product in which you could compare a little leaguer's swing to a standard appropriate for that individual – maybe, Cal Ripken, and tell him how to mimic Cal's moves," explains Anthony.

So what is the next frontier in sports technology?

Hosoi and the students in course 2.98, Sports Technology: Engineering & Innovation, are working on an array of projects that will help inform the future of sports. These projects range from data analysis to biomechanics and materials.

In May, students and faculty across several departments presented their research at the 2017 Sports Technology Summit. In the rapt audience were various industry partners such as Adidas, the Milwaukee Brewers, the U.S. Olympic Committee, and the San Antonio Spurs. They all have a vested interest in supporting advances in sports technology. The research presented at the Summit may just hold the key to securing their next championship or designing a game-changing product.

"The Summit provides companies with a snapshot of the breadth of work going on across departments," explains Christina Chase, Co-Director of MIT 3-Sigma Sports and co-instructor of class 2.98. "It also showcases our students' work, which helps facilitate collaborations, and in some cases recruitment."

The sports technology research being conducted at MechE is crucial for the advancement of human endurance and performance in sports. When there is a problem plaguing a particular sport, the students and faculty in the MechE community are ready to roll up their sleeves, lace up their running shoes or pick up a bat, and solve it.

The program connects students and faculty with various alumni and industry partners who work together to improve athletic performance by using engineering to enhance endurance, speed, accuracy, and agility in sports.

Student Spotlight:

David Hesslink, SB '17

The Winningest Pitcher in MIT History Takes His Passion to the Major Leagues

Like many kids, senior David Hesslink collected baseball cards when he was younger. Among his most prized cards was that of pitcher Randy Johnson who, like Hesslink, is one of the rare players to swing right-handed but pitch left-handed. As fate would have it, after graduating this June Hesslink will join the very franchise his favorite player pitched for when he starts work in the baseball operations office for the Seattle Mariners.

"I came to campus with no idea of what I wanted to do with my life," Hesslink says. "The only thing I knew for sure was I loved playing baseball." That started to change when he took 2.086, Numerical Computation, as a sophomore. A question on a homework assignment sparked an idea for a project. Working with post-doc Will Cousins, he developed a baseball simulator that accurately predicted the run total from past major league seasons.

The algorithm Hesslink wrote accounted for everything – from batting averages to stolen base success rate. "My poor computer was whirring away, simulating millions of baseball games," he adds.

Cousins soon invited Hesslink to join him on another project as a UROP (Undergraduate Research Opportunity Program). Together they worked with the Houston Astros on developing a pitch clustering algorithm in which the velocity, vertical movement, and horizontal movement for every style of pitch was tracked on a 3D map for each pitcher. "When you plot these things in 3D, you get clouds of points that are separate for curveballs, fastballs, sliders, etc.," explains Hesslink. This pitch clustering algorithm helped the Astros track and evaluate pitchers across the minor leagues.

The summer before his senior year brought Hesslink to Florida, where he was the Analytics Intern for the Tampa Bay Rays. He teamed up yet again with Cousins, who now works in research and development for the Rays, and they undertook a new project to invent a shifting algorithm that determined where the Rays should position their outfielders based on the pitcher and player at bat. It's no surprise to Cousins that Hesslink has landed a job in the major leagues. "David has tremendous intelligence and a relentless work ethic," Cousins says. "He leaves a positive impression on everyone he interacts with."

While Hesslink was putting his computational prowess to both work in the lab and the MLB, he was achieving similar results on the pitcher's mound for MIT's baseball team. At a game against the United States Coast Guard Academy in New London, Connecticut this March, Hesslink broke the record to become the pitcher with the most wins in MIT history. "The best part of that day for me was emerging from the dugout to see my roommate and friends in the stands. They had driven two hours to surprise me."

His undergraduate work on algorithms for the Astros and Rays, coupled with his experience as a student-athlete, has poised Hesslink for a successful career in major league baseball. "It started with one problem on one homework assignment in 2.086, and then bloomed into what hopefully will be a full career," Hesslink reflects.

Hesslink pitching against the Stevens Institute of Technology in March 2016. Credit: Larry Heller

Alumni Profile:

Jim Christian, MS '14

Building a Social Network for Trails and Slopes

The peace and quiet that envelope a lone hiker on a leaf-riddled trail or a rock climber perched on the top of a cliff seem a world away from the noise of a social media feed. But MechE alum Jim Christian had an idea to tap into the superabundance of social-media data to benefit athletes and outdoor adventurers. He, along with MIT Sloan alum Brint Markle, created a device that could help determine avalanche risk. Their device has led to a network in which people can upload and share critical real-time information about the conditions – including avalanche risk – on a particular slope or mountain.

"We want to crowdsource trip data and safety information for the outdoors," explains Christian. Their motivation inspired a free app, Mountain Hub, where outdoor adventurers can share information to benefit others.

Mountain Hub's inception began far from muddy trails and snow-capped mountains. Safely within the halls of MIT, Christian was charged with designing a product that solves a real-life problem for course 2.739, Product Design and Development. Inspired by Markle's brush with a dangerous avalanche in Switzerland, Christian and his fellow students designed a probe with sensors to measure the structure of snow. The device could be used to quickly identify weak-layers in the snowpack – critical features in assessing avalanche risk.

Traditionally, the industry method for avalanche risk assessment starts with digging a hole, analyzing the snow pack in that hole, and determining if there are any weak layers. Digging and assessing a snowpit can take close to an hour and provides just one data point. The scope Christian and his classmates constructed could gather a lot more data about the snowpack in just a few seconds, and it could assess an entire mountain slope in the time it takes to dig just one hole.

"Jim and his team identified an important opportunity for a new product," says Weber-Shaughness Professor Warren Seering, who co-taught 2.739. "They all put a great deal of energy into the development process."

Chris Davenport testing the Avatech SP1 on Mt St Elias in Alaska. Credit: Chris Davenport

Christian and Markle walked out of the class with a proof of concept prototype for measuring snowpack, and along with MechE student Sam Whittemore they co-founded Avatech, a company focused primarily on avalanche risk assessment. Avatech's first product was the SP1 — a five-foot long probe with pressure sensors that could collect 5,000 measurements per second. The SP1 instantly generates a graph showing snow layer hardness, which snow safety teams can use to identify weak layers. This information is vital for avalanche prevention.

It quickly became clear, however, that the data generated from this device couldn't exist in a vacuum. The information needed to be shared with those who would most benefit from it. Christian, Markle, and their team set out to build a network that would enable skiers or climbers to upload, share, and read real-time information about the slope or mountain they were on. The scope of the network became far greater than just snowpack assessment. Customers wanted to share information about bike paths, hiking trails, and an assortment of outdoor activities.

"Most mountain athletes do multiple activities all year round," says Christian. There is an opportunity for information sharing across these various activities. "What a rock climber has to say about hazards on a trail is relevant to hikers and mountain bikers in the same area."

With this transition from scientific measurement tools to a social networking app, Christian and Markle rebranded their company as Mountain Hub. With technologies like a live map, terrain visualizations, and trip reporting, the app aims to diminish the danger associated with solitary or remote sports like hiking, mountain biking, rock climbing, and skiing.

Christian hopes Mountain Hub will become a platform for people to share their experiences, access real-time conditions, and plan new adventures. "We are spearheading a culture of contribution and sharing in the outdoors," explains Christian. "We want to build a real-time network that has daily engaging content so that the first thing someone does before they hit the trail is open up our app."

We are spearheading a culture of contribution and sharing in the outdoors.

Talking Shop:

Professor Emeritus David Gordon Wilson

Designer, Inventor, and Author of "The Bike Bible" Discusses His Lifelong Love of the Bicycle

For Professor Emeritus David Gordon Wilson, there is only one way to get to work – on his beloved bike. Cycling has been his preferred mode of transportation since he first rode on two wheels at the age of nine in his native England. This passion for the bicycle helped inspire his decision to pursue a career in engineering.

Over the course of six decades, Wilson's career has been peppered with many achievements, including inventing the progressive fee-plus-rebate policy in 1973 and designing jet engines. But wherever his career has taken him, his hobby of cycling has followed. Author of *Bicycling Science*, known as the premiere authority on bicycle design and MIT Press's best selling book, he was recently invited to work on a fourth edition.

When did your passion for the bicycle turn into an academic pursuit?

In 1967 I organized an international competition, in collaboration with the journal *Engineering*, for the best design in human-powered land transport. To my amazement seventy-eight people from sixty-four countries entered and it was a great success. At the time I was passionate about getting people interested in different types of bikes, particularly recumbent bicycles. So as the competition carried on, I worked on my own designs for a recumbent bicycle.

What made you interested in designing recumbent bicycles over traditional upright bicycles?

Well, recumbents are faster and safer than regular bikes. Cycling in a reclined position also helps distribute weight more evenly, giving better and safer braking with no danger of going over the handlebars. In the 1970s I started designing recumbents after Fred Wilkie asked for designs. This culminated in the Wilson-Wilkie Recumbent in 1975. Our bike became extremely popular in Europe and got some great visibility when it was featured by Mobil for its "Imagination Series."

Wilson on the world-record breaking Avatar 2000, which he co-designed. Credit: Richard Howard/ People Magazine

One of the recumbent bicycles you designed broke the world record for speed. How did you go about designing a recumbent for speed?

It was important to make the bicycle more aerodynamic to achieve top speeds. In the late 70s, the FOMAC Corporation built the Avatar 1000 and Avatar 2000 recumbent bicycles to my designs. The Avatar 2000 was then streamlined in 1982 with a lightweight fairing called Bluebell to make the bike more aerodynamic. That same year, ridden by an Australian lawyer, it broke the world record at the International Human Powered Vehicle Association trials by traveling 51.9 mph. That record has increased greatly in recent years using the flat Highway 305 at an altitude 4,511 feet in Battle Mountain, Nevada: in 2013 team from the Netherlands achieved 83.1 mph.

What do you think has been the biggest advance in bicycle design since publishing the first edition of *Bicycling Science* in 1974?

Advances in brake and transmission designs have really improved cycling. Gears have a far-wider range than the old three-speeds and ten-speeds had. My wife actually rode 4,000 miles across the country last summer. She also works for The Visiting Nurses and cycles to her patients, often carrying large loads using a 14-speed hub gear that has a gear range over 500%. Another development that has made a big difference in modern bikes is the use of carbon fiber. It makes the structure lighter and stiffer than the steel, aluminum, or titanium used for most bikes. One of my students, David Kindler, made the first fiber wheel for bicycles.

> It's crucial to make safe, light-weight bicycles, especially in sports.

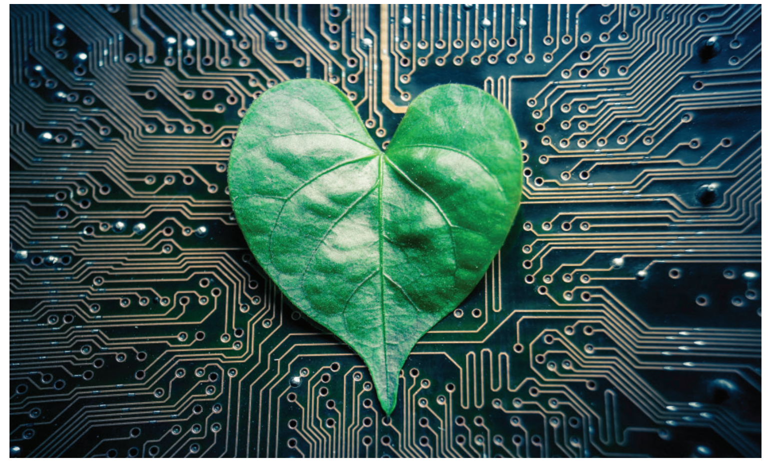
What do you see as the next big thing in bicycle design?

Somebody sent me a wonderful video about the launch of a self-driving bicycle. Of course they sent it on April 1 so it ended up being an April Fool's Joke. What I would really like to see is for companies to make bikes safer. If any element of the design fails – for example a fork or chain stay breaks – then the cyclist is put in danger. It's crucial to make safe, light-weight bicycles, especially in sports. The Dutch have taken the leadership in producing enclosed or semi-enclosed cycles called "velomobiles," giving enhanced safety and weather protection.

Do you see a place for recumbent bicycles in professional cycling?

Absolutely! Something I've recommended is for the Tour de France to have recumbents start prior to the regular upright bicycles. It would be very exciting to add this element, since recumbents are not only faster but safer, so you wouldn't see the domino-style pile-ups that often occur in the Tour de France.

News & Awards



"Tree-on-a-chip" mimics the pumping mechanism of trees and plants.

Seniors Victoria Gregory and Gabe Alba with their product, the Coffee Cookie. Credit: Dana Smith Photography

Departmental and Research News

• The Department of Mechanical Engineering ranks number 1 in the *US News & World Reports* annual rankings as well as QS World University Rankings for 2017.

• Associate Professor Xuanhe Zhao and his team designed a new "living material" — a tough, stretchy, biocompatible sheet of hydrogel injected with live cells that are genetically programmed to light up in the presence of certain chemicals. The study was published in the *Proceedings of the National Academy of Sciences*.

New "living material" lights up in the presence of certain chemicals.

• Professor Anette "Peko" Hosoi and collaborators designed a microfluidic device called a "tree-on-a-chip," which mimics the pumping mechanism of trees and plants. The research was published in *Nature Plants*.

• Seniors Gabe Alba and Victoria Gregory launched a product, first conceived in course 2.009, called Coffee Cookie – a circular, battery-operated drink warmer.

• A new system developed by Associate Professor Gareth McKinley and Professor Kripa Varanasi could make it possible to control the way water moves over a surface, using only light. The system was reported in the journal *Nature Communications*.

• In a recent *Science* study, Professor Evelyn Wang and colleagues develop a new technology that could provide a novel way of obtaining clean, fresh water almost anywhere on Earth, by drawing water directly from moisture in the air even in the driest of locations.

Faculty Promotions

• Cullen Buie, John Hart, and Xuanhe Zhao were promoted to Associate Professor with tenure.

• Pierre Lermusiaux and Evelyn Wang were promoted to Full Professor.

• Amos Winter was promoted to Associate Professor.

Faculty Awards

• Assistant Professor Amos Winter has been awarded the 2016-2017 Harold E. Edgerton Faculty Achievement Award, reserved for junior members of the MIT faculty who have demonstrated outstanding abilities in teaching, research, and service. Additionally, he received an NSF CAREER Award for research on passive prosthetic leg dynamics.

• Assistant Professor Alexie Kolpak received an NSF CAREER Award for her research on oxide electrocatalysts in aqueous environments.

• Professor Alexander Slocum was elected to the National Academy of Engineering for contributions to precision machine design and manufacturing across multiple industries and leadership in engineering education.

• Professor Ioannis Yannas was elected to the National Academy of Engineering for co-developing the first commercially reproducible artificial skin that facilitates new growth, saving the lives of thousands of burn victims.

• Associate Professor Kripa Varanasi, along with colleagues at University College London and Kansas University, has been awarded a Bill and Melinda Gates Foundation Grand Challenge grant for innovation in global vaccine manufacturing.

• Professor David Parks was awarded the Daniel C. Drucker Medal by the American Society of Mechanical Engineers for seminal contributions to the formulation of constitutive theories and computational procedures for large inelastic deformation and failure of metals and polymers.

• Professor Evelyn Wang's research on solar cells was chosen as one of MIT Technology Review's 10 Breakthrough Technologies for 2017.

• Department Head, Professor Gang Chen, was awarded the Eringen Medal by the Society of Engineering Science for his seminal contributions to the understanding of nanoscale transport and energy conversion phenomena, and their applications in energy storage and conversion, and thermal management.

Professor Ernesto Blanco with a model of his invention, the stair-climbing wheelchair, during the 2011 MIT 150 kickoff celebration at the MIT Museum. Credit: Dominick Reuter

• Associate Professor Maria Yang was selected as a 2017 MacVicar Faculty Fellow for exceptional undergraduate teaching, mentoring, and educational innovation.

Student Awards

• Natasha Wright received the Lemelson-MIT Student Prize for her work improving drinking-water quality and understanding household water-usage habits in rural India.

• Seniors Grace Li, Jessica (Jialin) Shi, Charlene Xia and their team won the Lemelson-MIT Student Prize for creating a real-time text to Braille converter.

• Katy Olesnavage has been awarded the Lemelson-MIT Student Prize for her new design method for a low-cost, high-performance passive prosthetic foot.

• PhD Candidate Maher Damak won a 2016 World Technology Award for his work on reducing runoff of agricultural pesticides by making sprays "stickier."

• Kristen Railey was awarded as one of "Tomorrow's Engineering Leaders: The 20 Twenties" by Aviation Week.

• Maher Damak and Karim Khalil, along with Associate Professor Kripa Varanasi, received the MIT Clean Energy prize for their start-up Infinite Cooling.

• Graduate student John Lewandowski made Forbes' 2017 30 Under 30 list for founding the Disease Diagnostic Group, which screens patients for malaria in just five seconds with a reusable handheld device.

Obituary

• Ernesto E. Blanco, a renowned inventor, mechanical designer, and beloved former professor in MechE, passed away on March 21 in Murrieta, California. He was 94 years old. Over the span of a half-century, Blanco designed a number of groundbreaking devices that aided the handicapped — including the first stair-climbing wheelchair and an improved Braille typewriter.

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Massachusetts Institute of Technology
Department of Mechanical Engineering
77 Massachusetts Avenue, Room 3-173
Cambridge, MA 02139

2.007 Final Robot Competition

On May 11, 2017 students competed in the annual 2.007 Final Robot Competition with the "Star Wars" inspired theme "May the Torque Be With You." Sophomore Tom Frejowski won the competition and was carried by Professor Sangbae Kim and Professor Amos Winter after the final match.

Credit: Tony Pulsone