Fall/Winter 2017
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MIT Chemical Engineering Alumni News

X Currents

Designing polymers with novel features

Professor Bradley Olsen '03 designs polymers, including injectable hydrogels (pictured), with novel features and applications.

Massachusetts
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Technology

XCurrents

MIT Chemical Engineering Alumni News

About ChemE

Education
To offer academic programs that prepare students to master physical, chemical, and biological processes, engineering design, and synthesis skills; creatively shape and solve complex problems, such as translating molecular information into new products and processes; and exercise leadership in industry, academia, and government in terms of technological, economic, and social issues.

Research
To provide a vibrant interdisciplinary research program that attracts the best young people; creatively shapes engineering science and design through interfaces with chemistry, biology, and materials science; and contributes to solving the technological needs of the global economy and human society.

Social responsibility
To promote active and vigorous leadership by our people in shaping the scientific and technological context of debates around social, political, economic, and environmental issues facing the country and the world.

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We want to hear from you!

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Acknowledgments

From the Department Head

You, our friends and alumni, are such an important and integral part of the MIT Chemical Engineering community, and I welcome this opportunity to share with you the new and exciting things happening in the Department. We could not accomplish all that we do without your support.

This edition highlights the work of Professor Bradley Olsen '03, an undergraduate alumnus who is quickly becoming a force in the polymer science and materials communities. Even as a sophomore back in 2001, he had an incredible curiosity and passion for scientific investigation that continues today. Brad's research bridges the fields of biochemistry and polymer design by incorporating proteins into self-assembling block copolymers. As I mentioned when he was named one of C&EN's Talented 12 in 2015, he can design materials to take on every challenge, from new sustainable plastics to helping human health.

Brad's work reflects much of what is happening in the Department now. Our faculty, staff and students use their inquisitiveness and drive to create the future of chemical engineering today. Michael Strano has used his investigations of carbon nanotubes to create plants that can tell you when they need water. Tonghan Gu, a graduate student in the Hatton lab, found a way to fight child malnutrition by stabilizing emulsions at the nanoscale. Chris Love's lab has developed a portable single-cell RNA sequencing device that fits on a small tabletop and could aid a plethora of applications, including cancer research and the study of immune cells. Hadley Sikes is integrating molecular technologies for diagnosing malaria and other infectious diseases in resource-limited areas. And this is just a fraction of the innovations happening here as I write to you.

Just as important as today's research is our work to help prepare future chemical engineers for their own roles in defining and enriching our future world. Our faculty have been thinking carefully about the chemical engineering curriculum of the future, and Kristala Prather has taken a leadership role in a special task force to look at our class requirements. We've introduced a special Undergraduate Seminar Series, where MIT ChemE alumni return to share their real-world experiences and show MIT students the abundance of opportunities in our field. Also, we've created an opportunity for MIT undergraduates to have early, hands-on chemical engineering experiences. The designer of this new class was none other than Brad Olsen again! His new freshman course 10.00, *Molecule Builders*, addresses students' growing interest in engineering design and experience using a "maker space." Students learn not only basic engineering principles and state-of-the-art ChemE methods, but also safety practices for managing reactions, synthesizing biological components, and manipulating substances at the molecular level. Learning the discipline's safety culture is part of the larger lesson Brad hopes to bring across. He says, "We want students exposed not just to doing chemical engineering design, but to what chemical engineers really do in their different occupations and workplaces."

As we continue to work toward addressing today's and tomorrow's challenges, I encourage you to check out our new website, *cheme.mit.edu*, to see all the latest news and events going on. We are very interested to know what is going on with you as well – please drop us a line with updates at chemealum@mit.edu.

I look forward to hearing from you.
Sincerely,

Paula T. Hammond
Department Head

Greetings from the MIT Practice School!

As we enter the Practice School's 102nd year of existence, I marvel at how things have changed, and how they've stayed the same. We are still the only academic program of our kind, a true example of MIT's tenet of "Mens et Manus."

This past Spring, our students worked on projects focused on energy and pharmaceuticals, honing their skills at not only thermodynamics and transport phenomena, but also teamwork and professional communication, which are just as important to being a successful chemical engineer. The Spring 2017 stations included MedImmune LLC, where our students worked on solutions to generate blood clots and designed and implemented a self-regulating control system for a continuous purification process; Australia's Woodside Energy, where they examined "slumping," a colloquial term for process temperatures suddenly dropping; and Saint Gobain, a French energy company, where they evaluated the process of forming a pressure adhesive tape as well as investigating the performance of a composite material used in the housing industry. Teams also continued working with carbon black at Cabot and spent time at Merck Ireland, helping with several pharmaceutical projects.

As you may recall, we celebrated the Practice School's centennial in the fall of 2016. It was a great event, and my subsequent conversations and meetings with alumni and friends are helping to guide our priorities and plans for the modern Practice School. Without the strong support of our alumni and friends, the Practice School could not continue its sustained tradition of solving today's industrial problems while preparing the future generation of chemical engineers.

I'd like to share a recent example of this for which we are grateful: the Department has created the Maurice (1939) and Janet Granville Fund, a new endowment to benefit the Practice School. The endowment was established by Maurice "Butch" Granville SM '39. Mr. Granville received his undergraduate degree from UT Austin before coming to MIT to participate in the Practice School, following in the footsteps of family members who had come before him. He participated in stations at the Eastern Manufacturing Company and Hercules Powder Company under the supervision of Walt Whitman, who was an influential early mentor to him. Mr. Granville cites his experiences at these stations as giving him valuable lessons in working as a team and organizing complex projects. Following graduation, Mr. Granville went on to serve in the Petroleum Administration for War and traveled extensively within the U.S. helping to develop additional aviation gas supplies for WWII. He eventually joined Texaco, rising to the position of C.E.O., which he held for from 1970-1980.

Maurice "Butch" Granville SM '39

Mr. Granville has a long history of service to MIT, including service on the MIT Corporation, the Chemical Engineering Visiting Committee, and the New York Alumni Club Board. My colleague Heather Upshaw spent some time with him recently and, looking back on his time at MIT and subsequent service, he reflected, "I believe that my time at MIT really had a huge influence on my professional career thereafter. The fact that the MIT Chemical Engineering Practice School is still in existence and thriving certainly reflects upon how valuable the experience was for myself and continues to be for students both now and in the future."

Practice School students at MedImmune pose with Station Director Claude Lupis (far left).

We are deeply grateful to Mr. Granville for his generosity, which will help ensure the vitality of this core program for the century to come. It is exciting to see how the Practice School can make a lasting impact to our students, as well as our industrial partners. I look forward to sharing more Practice School news with you in the spring.

Sincerely,

T. A. Hatton
Director
David H. Koch School of Chemical Engineering Practice

Bob Langer ScD ’74 : One vaccine injection could carry many doses

Microparticles created by new 3-D fabrication method developed by the Langer Lab could release drugs or vaccines long after injection.

Anne Trafton, MIT News Office

MIT engineers have invented a new 3-D fabrication method that can generate a novel type of drug-carrying particle that could allow multiple doses of a drug or vaccine to be delivered over an extended time period with just one injection. The new microparticles resemble tiny coffee cups that can be filled with a drug or vaccine and then sealed with a lid. The particles are made of a biocompatible, FDA-approved polymer that can be designed to degrade at specific times, spilling out the contents of the “cup.”

“We are very excited about this work because, for the first time, we can create a library of tiny, encased vaccine particles, each programmed to release at a precise, predictable time, so that people could potentially receive a single injection that, in effect, would have multiple boosters already built into it. This could have a significant impact on patients everywhere, especially in the developing world where patient compliance is particularly poor,” says Robert Langer, the David H. Koch Institute Professor at MIT.

Sealed cups

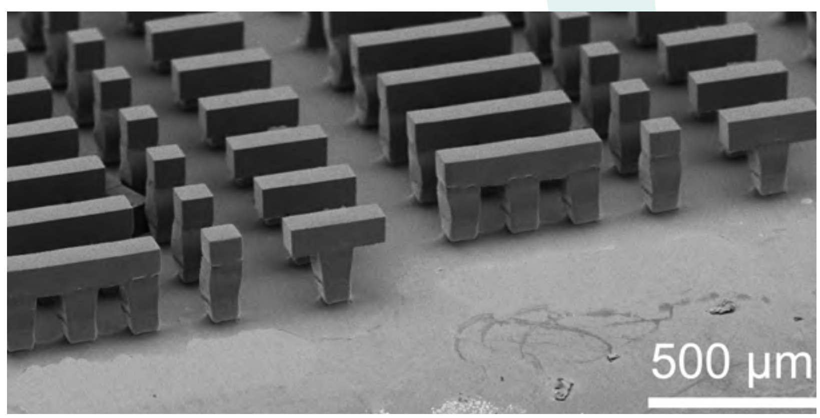
Langer’s lab began working on the new drug delivery particles as part of a project funded by the Bill and Melinda Gates Foundation, which was seeking a way to deliver multiple doses of a vaccine over a specified period of time with just one injection. That could allow babies in developing nations, who might not see a doctor very often, to get one injection after birth that would deliver all of the vaccines they would need during the first one or two years of life.

Langer has previously developed polymer particles with drugs embedded throughout the particle, allowing them to be gradually released over time. However, for this project, the researchers wanted to come up with a way to deliver short bursts of a drug at specific time intervals, to mimic the way a series of vaccines would be given.

To achieve their goal, they set out to develop a sealable polymer cup made from PLGA, a biocompatible polymer that has already been approved for use in medical devices such as implants, sutures, and prosthetic devices. PLGA can also be designed to degrade at different rates, allowing for the fabrication of multiple particles that release their contents at different times.

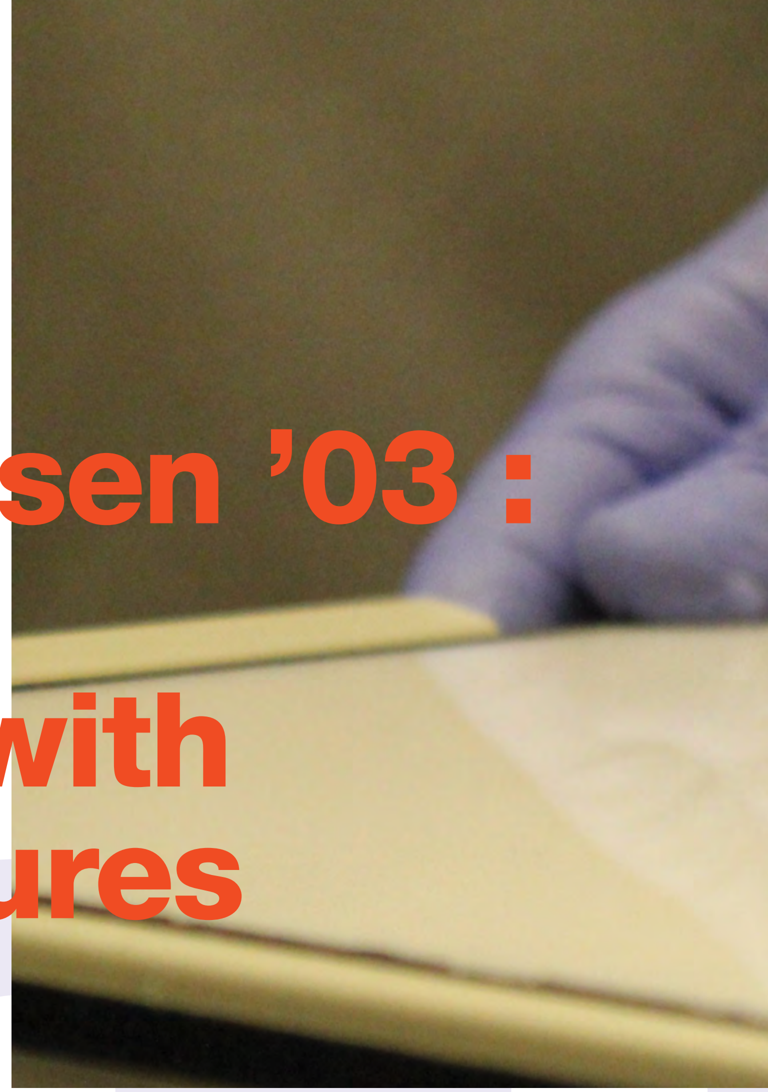
Conventional 3-D printing techniques proved unsuitable for the material and size that the researchers wanted, so they had to invent a new way to fabricate the cups, drawing inspiration from computer chip manufacturing.

Using photolithography, they created silicon molds for the cups and the lids. Large arrays of about 2,000 molds are fit onto a glass slide, and these molds are used to shape the PLGA cups (cubes with edge lengths of a few hundred microns) and lids. Once the array of polymer cups has been formed, the researchers employed a custom-built, automated dispensing system to fill each cup with a drug or vaccine. After the cups are filled, the lids are aligned and lowered onto each cup, and the system is heated slightly until the cup and lid fuse together, sealing the drug inside. X



Microparticles created by a new 3-D fabrication method developed by the Langer Lab could release drugs or vaccines long after injection.

For more information, go to cheme.mit.edu/faculty



Bradley Olsen '03 : Designing polymers with novel features

Undergraduate alumnus and current MIT Chemical Engineering professor seeks to develop and understand materials that behave in radically new ways.

Anne Trafton, MIT News Office

Tiny sensors made of antibodies, protein nanospheres that can clean up toxic spills, and gels that could be injected into a wound to initiate healing are just a few of the innovations emerging from Bradley Olsen's lab at MIT.

Olsen's research is based on exploring the physical properties of new types of polymers, and taking advantage of those properties to design novel materials that could have many useful applications.

"My group is really interested in two things: designing materials to address important challenges, and understanding the fundamental science that's necessary for materials design," says Olsen, an associate professor who recently earned tenure in MIT's Department of Chemical Engineering. His lab, which includes 15 to 20 students and postdocs, pursues these approaches mainly in the field of protein-polymer chemistry, a relatively new discipline that involves incorporating proteins into polymer materials. He credits those students with many of the key discoveries that have yielded these novel materials.

“It’s a group effort,” he says. “I think the talent and wisdom of the team far exceeds anything I could do individually.”

Block by block

As a graduate student at the University of California at Berkeley, Olsen began working on synthesizing a special kind of polymers known as block copolymers. These materials consist of alternating blocks of two different kinds of monomers, which are the building blocks for synthetic polymers such as plastics and rubber.

Olsen studied how these kinds of polymers could be used to control the nanostructure of semiconducting polymers. Then, as a postdoc at Caltech, he worked on developing injectable hydrogels, which could potentially be used for wound healing and stopping blood flow.

At MIT, Olsen has continued to develop block copolymers for a wide range of applications. In one area of research, he is designing materials where one block is a polymer and the other is a protein such as an enzyme or an antibody. These materials could then be formed into extremely sensitive biosensors.

Protein-polymer hybrids also could be useful new materials that mimic the properties of nylons or polyurethanes, which are petroleum-derived materials that are found in hard plastics, coatings, insulation, and many other products. These new hybrids could potentially be produced in “biorefineries,” using sustainable sources of renewable biomass and making a positive impact on the environment. **X**

For more information, go to
cheme.mit.edu/faculty

Faculty Highlights

Arup Chakraborty elected to the National Academy of Medicine

Chakraborty, the Robert T. Haslam Professor of Chemical Engineering and founding director of MIT's Institute for Medical Engineering and Science (IMES), has been elected to the National Academy of Medicine (NAM) in recognition of his distinguished contributions to medicine and health.

Chakraborty, a professor of physics, chemistry, and biological engineering, was one of 70 new members and 10 international members announced recently at the annual meeting of the academy. Membership in the NAM is considered one of the highest honors in the fields of health and medicine and recognizes individuals who have demonstrated outstanding professional achievements and commitment to service.

Robert Langer ScD '74 wins 2017 Kabiller Prize in Nanoscience and Nanomedicine

Institute Professor Robert S. Langer is the recipient of the $250,000 Kabiller Prize in Nanoscience and Nanomedicine for 2017. The most cited engineer in history and the holder of 1,284 issued and pending patents, Langer is being honored for the extraordinary impact of his interdisciplinary work in the design and development of novel nanocarriers for improved small molecule drug delivery. Also being recognized is his work on controlled delivery systems for genetically engineered therapeutic proteins, DNA and RNA as well as his strong leadership.

"Bob Langer is a pioneer in the fields of nanomedicine and chemical engineering, and he has influenced so many others through his spirit, creative energy and practical insights," said Kabiller, a co-founder of AQR Capital Management, a global investment management firm in Greenwich, Connecticut. "While great science is necessary to be successful, it is not sufficient. Leadership, working together and inspiring others are also essential for solving complex problems and helping humankind."

The Kabiller Prize is the largest monetary award in the world for outstanding achievement in the field of nanotechnology and its application to medicine and biology.

Paula Hammond to receive the 2018 ACS National Award in Applied Polymer Science

The annual ACS Award in Applied Polymer Science This award recognizes and encourages the achievements of scientists who are active in the fields of polymer and polymer materials research. The recipient is selected primarily on the basis of scientific contributions made to the technology of plastics, coatings, polymer composites, adhesives, and related fields during the 10-year period preceding the date of selection. Previous Professor Robert Langer also won this award in 1992.

Fikile Brushett and Heather Kulik named 2017 "Influential Researchers" by *Industrial & Engineering Chemistry Research*

Industrial & Engineering Chemistry Research announced its 2017 Class of Influential Researchers in August of 2017. Its global team of 14 editors identified this inaugural class of influential, early career (less than ten years or so in their independent career) researchers on the basis of the quality and impact of their research. Among the invited articles for the celebratory issue were Brushett's "Toward an Inexpensive Aqueous Polysulfide–Polyiodide Redox Flow Battery" and Kulik's "Leveraging Cheminformatics Strategies for Inorganic Discovery: Application to Redox Potential Design."

Bradley Olsen '03 to receive the American Physical Society's 2018 Dillon Medal

Bradley Olsen '03, Paul M. Cook Career Development Professor of Chemical Engineering, was awarded the 2018 John H. Dillon Medal for his work "significantly expanding our understanding of the physics of polymers, including the self-assembly of block copolymers incorporating a fully folded protein, the influence of polymer shape on diffusion; for engineering novel gels; and for updating the theory of the modulus of a network."

Olsen's previous honors include an Alfred P. Sloan Research Fellowship, the DuPont Young Professor Award and the Allan P. Colburn Award; he was named a Kavli Foundation Emerging Leader in Chemistry in 2017.

Fikile Brushett named one of C&EN's "Talented Twelve"

Professor Fikile Brushett has been selected as one of 2017's "Talented 12" by *Chemical and Engineering News (C&EN)*, the weekly magazine of the American Chemical Society. Brushett is recognized for his innovative approach to economical and sustainable energy storage and the magazine calls him the "Baron of Batteries."

To find its annual Talented 12, *C&EN* called on a panel of industry advisers, *C&EN's* advisory board, and Talented 12 alumni to nominate prospects aged 42 or younger who are pushing the boundaries in their fields. They also accepted nominations from readers through an online form. Finally, they researched and evaluated the more than 150 candidates amassed during this process to zero in on the 12 most "path-paving" individuals.

Hadley Sikes named an NAE "Innovative Young Engineering" for 2017

Professor Hadley Sikes was named as one of the nation's brightest young engineers, having been selected to take part in the National Academy of Engineering's (NAE) 23rd annual U.S. Frontiers of Engineering (USFOE) symposium. Engineers ages 30 to 45 who are performing exceptional engineering research and technical work in a variety of disciplines came together for the 2 1/2 day event September 25-27, 2017. The participants -- from industry, academia, and government -- were nominated by fellow engineers or organizations.

Will Tisdale wins the 2017 AIChE NSEF Young Investigator Award

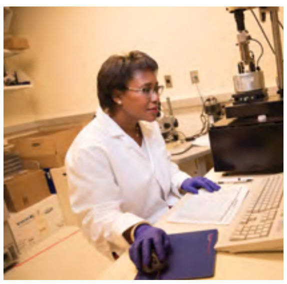
Will Tisdale, the Charles and Hilda Roddey Career Development Associate Professor, has been recognized by AIChE for his research. This award honors outstanding interdisciplinary research in nanoscience and nanotechnology by engineers or scientists in the early stages of their professional careers (within 10 years of completion of highest degree).

Research Highlights

For more information on these and other stories, go to cheme.mit.edu/news/.

Hammond's bio-inspired approach to RNA delivery

By delivering strands of genetic material known as messenger RNA (mRNA) into cells, researchers can induce the cells to produce any protein encoded by the mRNA. This technique holds great potential for administering vaccines or treating diseases such as cancer, but achieving efficient delivery of mRNA has proven challenging. The Hammond lab, inspired by the way that cells translate their own mRNA into proteins, has designed a synthetic delivery system that is four times more effective than delivering mRNA on its own.

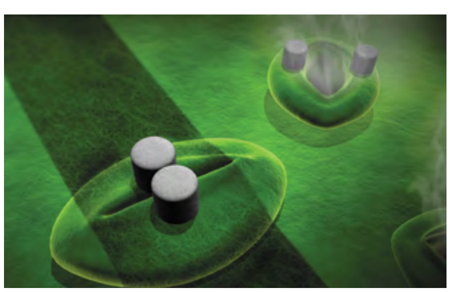


"If we want to be able to deliver mRNA, then we need a mechanism to be more effective at it because everything that's been used so far gives you a very small fraction of what would be the optimal efficiency," says professor Paula Hammond.

Strano's sensors applied to plant leaves warn of water shortage

MIT engineers have created sensors that can be printed onto plant leaves and reveal when the plants are experiencing a water shortage. This kind of technology could not only save neglected houseplants but, more importantly, give farmers an early warning when their crops are in danger, says Michael Strano, the Carbon P. Dubbs Professor of Chemical Engineering at MIT and the senior author of the new study. Strano has already begun working with a large agricultural producer to develop these sensors for use on crops, and he believes that the technology could also be useful to gardeners and urban farmers. It may also help researchers develop new ways to engineer drought-resistant plants, he says.

Artist's impression of the sensor comprising conductive ink printed across a stoma with two micropillars



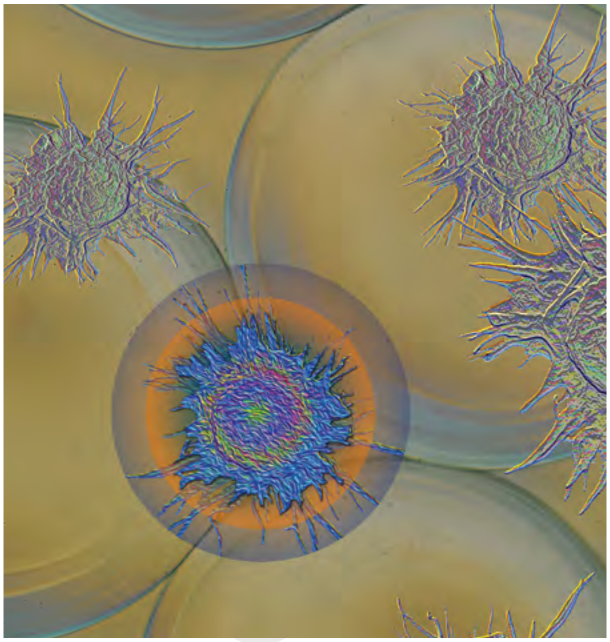
Hatton Lab fights child malnutrition with nanoscience

Tonghan Gu, an MIT Tata Fellow and a PhD candidate in the Hatton Lab, works with ready-to-use therapeutic food (RUTF), a high-calorie, nutrient-dense paste that is the most widely-used outpatient treatment for severe acute malnutrition. While RUTF has seen success in many African countries, it has failed to get the same foothold in India due to issues with palatability, reliability of water supply, and cost. However, patent-pending research from Gu and Hatton describes a new RUTF formula that uses local ingredients to increase palatability for Indian children, can be powdered and spray-dried to make transportation and storage easy, and is affordable in the poor communities where severe acute malnutrition is most prevalent. The new formula is made possible by advances in stabilizing emulsions at the nano-scale. Now, Hatton says, "the goal is to see this approach used throughout India."

MIT ChemE graduate student Tonghan Gu (right) works with technicians at a facility in Vasai, India, to produce a batch of ready-to-use therapeutic food in powdered form. The formula he has developed uses local ingredients to make it more appealing to children.

Anderson Lab study points a way to better implants

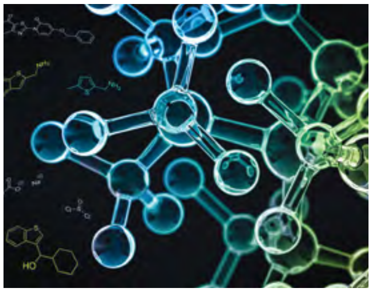
Medical devices implanted in the body for drug delivery, sensing, or tissue regeneration usually come under fire from the host's immune system. Defense cells work to isolate material they consider foreign to the body, building up a wall of dense scar tissue around the devices, which eventually become unable to perform their functions. Researchers at MIT and Boston Children's Hospital have identified a signaling molecule that is key to this process of "fibrosis," and they have shown that blocking the molecule prevents the scar tissue from forming. The findings could help scientists extend the lifespan of many types of implantable medical devices. "This gives us a better understanding of the biology behind fibrosis and potentially a way to modulate that response to prevent the formation of scar tissue around implants," says Professor Daniel Anderson, a member of MIT's Koch Institute for Integrative Cancer Research and Institute for Medical Engineering and Science (IMES), an affiliate at Boston Children's Hospital, and the senior author of the study.



The immune system often builds up a wall of dense scar tissue around implanted medical devices, a process known as fibrosis. The cell shown in blue represents a macrophage that has been blocked from initiating fibrosis.

Jensen and Green Labs create computer system to predict products of chemical reactions

When organic chemists identify a useful chemical compound — a new drug, for instance — it's up to chemical engineers to determine how to mass-produce it. Historically, determining the most efficient and cost-effective way to produce a given molecule has been as much art as science. But MIT researchers are trying to put this process on a more secure empirical footing, with a computer system that's trained on thousands of examples of experimental reactions and that learns to predict what a reaction's major products will be. Like all machine-learning systems, theirs presents its results in terms of probabilities. In tests, the system was able to predict a reaction's major product 72 percent of the time; 87 percent of the time, it ranked the major product among its three most likely results. "There's clearly a lot understood about reactions today," says Klavs Jensen, the Warren K. Lewis Professor of Chemical Engineering at MIT, "but it's a highly evolved, acquired skill to look at a molecule and decide how you're going to synthesize it from starting materials."



A new computer system predicts the products of chemical reactions. "The vision is that you'll be able to walk up to a system and say, 'I want to make this molecule.' The software will tell you the route you should make it from, and the machine will make it," says professor Klavs Jensen.

Love Lab creates tool to make single-cell RNA sequencing widely available

Sequencing messenger RNA molecules from individual cells offers a glimpse into the lives of those cells, revealing what they're doing at a particular time. However, the equipment required to do this kind of analysis is cumbersome and not widely available. MIT researchers have now developed a portable technology that can rapidly prepare the RNA of many cells for sequencing simultaneously, which they believe will enable more widespread use of this approach. The new technology, known as Seq-Well, could allow scientists to more easily identify different cell types found in tissue samples, helping them to study how immune cells fight infection and how cancer cells respond to treatment, among other applications. X

MIT researchers have developed a portable technology, known as Seq-Well, that can rapidly prepare the RNA of many cells for sequencing simultaneously.

Thank you for your support!

This honor roll is a special salute to those who have given over $100 to the MIT Chemical Engineering Department for the period of July 1, 2016, through June 30, 2017. Thank you to everyone who has supported us throughout the year. Every effort has been made to ensure the accuracy of this list.

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Mariah N. Mandt
Michael P. Manning
Geoffrey Margolis
Guy T. Marion
Kishore V. Mariwala
Jordi Mata-Fink
Michael W. McGlynn
James D. McMillan
Marco A. Mena
Edward W. Merrill
Stephen L. Michaels
Jacques H. Michel

Richard G. Miekka
Theodoros G. Mihopoulos
Glen A. Miles
Clare L. Milton
Wang-Tsee T. Mo
Geoffrey D. Moeser
Vivek Mohindra
William C. Mohr
Wm D. Mohr
Charles W. Monroe
Timothy L. Montgomery
Albert L. Moore
Joe F. Moore
Eric M. Morrel
Joan T. Muellerleile
Radha Nayak
Shih-Tung Ngiam
Benjamin F. Nicholson
William J. Nicholson
James J. Noble
Peter D. Noymer
Catherine L. O'Connor
Bernat Olle
Charles H. Oppenheimer
Lillian M. Oppenheimer
Atsushi E. Osawa
Marlon A. Osbourne
David J. Ostlund
Ravinder K. Oswal
Chia-ling Pai
Nicole A. Palmer
Tuomas A. Paloposki
Athanassios Z. Panagiotopoulos
Donald W. Peaceman
Gail Pennell
Steven D. Perry
Scott D. Phillips
David M. Piho
Anna Pisania
Baris E. Polat
Michael J. Pomianek
Paul M. Premo
Cordelia M. Price
John J. Prior
William F. Pritchard
Harry F. Quarls
Waqar R. Qureshi
William P. Raiford
Dilip Rajagopalan
Julie A. Rakestraw
Scott L. Rakestraw
Carlos A. Ramirez
Alonso R. Ramos Vaca
Xing Ran
Michael J. Rappel
Bethany J. Redding
Carlonda R. Reilly

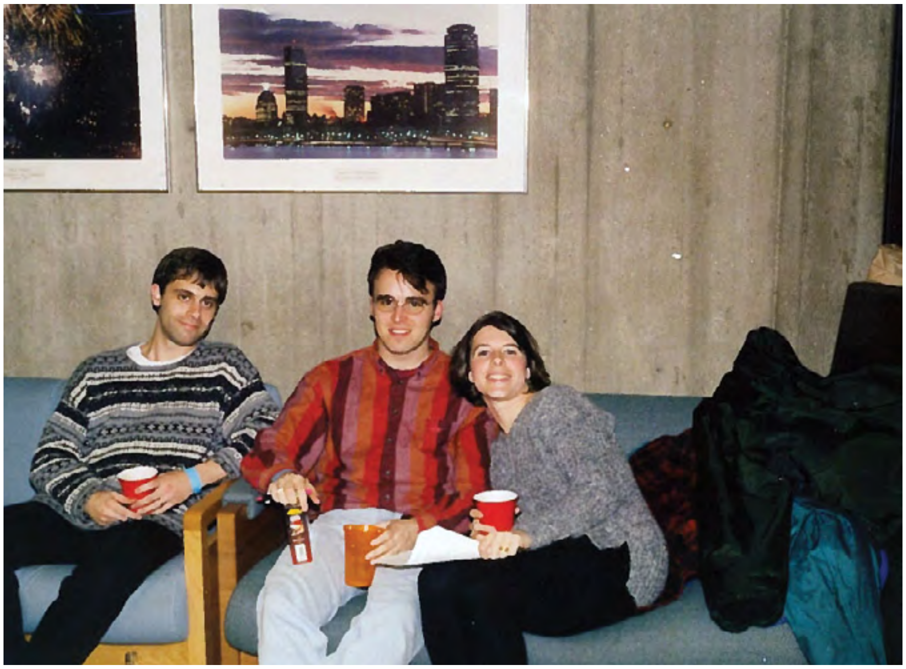
Todd M. Renshaw
James W. Rice
Bradford D. Ricketson
Auguste E. Rimpel
Carlos M. Rinaldi
Kimberly E. Ritrievi
Sandra J. Roadcap
John H. Roberts
Brian D. Robeson
Joseph E. Rogers
Thatcher W. Root
Philippe Rose
Stephen H. Rose
Ronald E. Rosensweig
Murray W. Rosenthal
Richard S. Rosera
Morley E. Russell
Gregory C. Rutledge
Lisa M. Ryan
Albert Sacco
Hiroshi H. Saito
Jeffrey B. Sakaguchi
Todd R. Salamon
Dominick A. Sama
Behrooz Satvat
Deborah E. Savage
Hanno K. Schmidt-Gothan
William J. Schmitt
Dean A. Schneider
Chris E. Schwier
Arthur D. Schwope
Steven F. Sciamanna
Thomas F. Seamans
Michael A. Serio
Philip G. Sikes
Charles A. Siletti
Ronald A. Sills
Harsono S. Simka
Marvin I. Singer
Elizabeth Sluder
Frank G. Smith
Maureen Stancik Boyce
Raymond S. Stata
Leonard I. Stiel
Thibaud S. Stoll
Bayard T. Storey
Pieter Stroeve
Wenyang Sun
William H. Sun
Dennis V. Swanson
Arthur C. Sze
William Taggart
Seck-Eng Tan
Nora Tang
Michael P. Thien
Jean Tilly
Peter A. Tomlinson

Lester Tong
Sonja L. Tong
Marilyn Torres
Seth A. Townsend
Olev Trass
Sergio C. Trindade
Margaret C. Tsai
Antonio Tuells Juan
Jaime A. Valencia-Chavez
Gheorghios Varsamis
Patrick J. Vayn
Michele C. Verticchio
Preetinder S. Virk
Chitra Viswanathan
David E. Voit
Eva C. Wan
Stephen S. Wan
Beatrice Wang
Kenneth W. Wang
Mark Y. Wang
Sally Wang
Wechung M. Wang
Yana Wang
Zhihong Wang
Robert A. Ware
Douglass J. Warner
Alfred E. Wechsler
Christopher P. Wedig
James C. Wei
Lawson E. Whitesides
Thor M. Wilbanks
Richard J. Wilcox
John A. Wilkens
Lucile S. Wilkens
Brian G. Willis
Graham A. Woerner
Patrick S. Wong
Helen H. Woo
Mary J. Wornat
Walter F. Worth
Alexandra A. Wright
Wesley Wright
Michelle H. Wu
Jirong Xiao
Vikramaditya G. Yadav
Hiroshi Yagi
Charles R. Youngson
Eric Yuen
Lei Zhang
Xinjin Zhao
Yizu Zhu
Allyn J. Ziegenhagen
Andrew L. Zydney

Blast from the Past

The holiday season is ripe with nostalgia. Do you see yourself or others in these images of Course X Holiday Parties of the past?

Do you have photos you'd like to share?
Email chemealum@mit.edu.



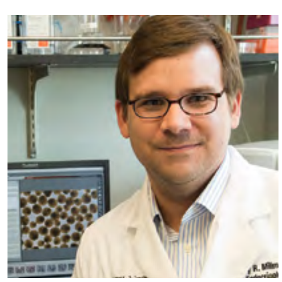
Alumni Highlights

Allan Hoffman ’53 MS ’55 ScD ’57 received the 2017 Acta Biomaterialia Gold Medal Award, which recognizes demonstrated leadership in the field of Science and Engineering of Biomaterials. Awardees are recognized world leaders in the field of biomaterials, whose accomplishments in discovery and translation to practice are surpassing and well known in the field.

The Acta Biomaterialia Gold Medal Award consists of a gold medal, an inscribed certificate, and a cash prize of $10,000.

Michael Laska MS ’97 PhD ’01 has been named Casebia Therapeutics’s VP of CMC Development and Manufacturing. In its announcement, Casebia stated that Laska was “a demonstrated leader in manufacturing process development. Laska built his career guiding biological drug candidates from research through clinical development into commercial production. He joins Casebia from Moderna Therapeutics, where he served as Head of Process Development. Prior to Moderna, Laska spent more than a decade at Merck, rising through different management positions, before becoming Director of External BioProcess Development. In this role, he managed all external research and development in support of Merck’s clinical vaccine and biologic candidates. As Vice President of CMC Development and Manufacturing, Laska will establish and guide the development of manufacturing processes for Casebia’s multiple gene-editing product programs.”

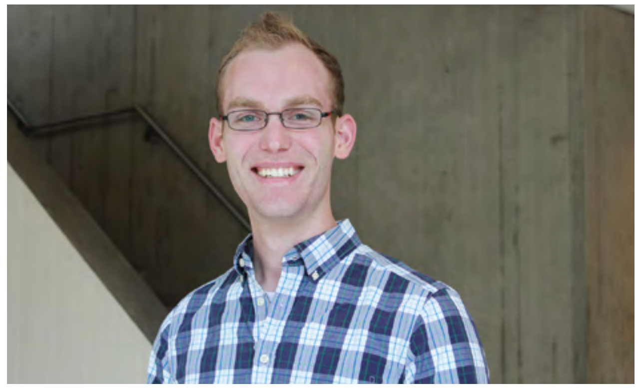
Ruth Misener ’07, from the Department of Computing at Imperial College London, was the overall winner out of a group of five engineers who were shortlisted for the Royal Academy of Engineering’s Engineers Trust Young Engineer of the Year competition. The awards are presented to early career researchers whose achievements are recognized as outstanding, having a major impact in their respective fields. Misener was also named as one of AIChE’s 2017 35 under 35. As a lecturer and researcher in the Dept. of Computing at Imperial College London, Misener leads an interdisciplinary team of process systems engineers, computer scientists, and mathematicians. Her research group develops numerical optimization algorithms and computational software for bioprocess optimization under uncertainty and petrochemical process design and operation. She plans to continue in this realm, and aims to “develop industrially relevant decision-making methodologies for optimizing chemical and biological processes.”



Jeffrey Millman PhD ’11 has been named one of AIChE’s 2017 35 under 35. An assistant professor of medicine and biomedical engineering at Washington Univ. School of Medicine in St. Louis, Millman is “genuinely excited to wake up and go to work every morning.” He credits this verve to his students and trainees who “show me something new — important scientific observations that I, and likely no one else, have ever seen before.”

Millman's research lab uses stem cells in diabetes and regenerative medicine research. He is proud of the work he and his research team are doing in generating insulin-producing tissues in bioreactors, saying, "transplantation of these engineered tissues will one day replace the need for insulin injections in diabetes patients." Millman has embraced the apprehension that comes with trying something new, like cutting-edge research, advising others to do the same and "move forward, confident that your failures will lead to growth and success."

Milena Pagan '11 has opened her own bagel shop in Providence, RI, which has earned critical acclaim since opening in August of 2017. The owner of Rebelle Artisan Bagels tells the *Providence Journal* that she "began her bagel journey less than a year ago when she left CVS after a three-year stint that brought her to Rhode Island from the hallowed Cambridge halls. Her first batch of bagels, made in her kitchen, were 'horrible.' But she got into not just baker mode but science, and read up on everything flour and water… She says, 'You'd be amazed to see how many people put bread under a microscope.'"



Carl Schoellhammer PhD '15's SuonoBio one of The Engine's first startup investments. Announced October 2016, The Engine combines funding and an open network of technical facilities to provide stable financial support and access to costly resources. It focuses on startups developing "tough" technologies — breakthrough ideas that require time to commercialize — in a range of sectors including robotics, manufacturing and materials, health, biotechnology, and energy. Suono Bio's drug delivery platform uses ultrasound waves to rapidly deliver drugs, proteins, vaccines, and other molecules directly into the gastrointestinal tract to treat inflammatory bowel disease and other disorders that are difficult to treat. When a fluid is exposed to ultrasound waves, tiny bubbles form that then implode to create microjets that penetrate and push the drugs into tissue. The drugs absorb about 22 times faster than the traditional treatment method using enemas, where drugs must be kept in the colon for eight to 12 hours. X

Preventing severe blood loss on the battlefield or in the clinic

PhD student Reginald Avery is developing an injectable material that patches ruptured blood vessels.

By Dara Farhadi

In a tiny room in the sub-basement of MIT's Building 66 sits a customized, super-resolution microscope that makes it possible to see nanoscale features of a red blood cell. Here, Reginald Avery, a fifth-year graduate student, can be found conducting research with quiet discipline, occasionally fidgeting with his silver watch.

He spends most of his days either at the microscope, taking high-resolution images of blood clots forming over time, or at the computer, reading literature about super-resolution microscopy. Without windows to approximate the time of day, Avery's watch comes in handy. Not surprisingly for those who know him, it's set to military time.

Avery describes his father as a hard-working inspector general for the U.S. Army Test and Evaluation Command. Avery and his fraternal twin brother, Jeff, a graduate student in computer science at Purdue University, were born in Germany and lived for a portion of their childhoods on military bases in Hawaii and Alabama. Eventually the family moved to Maryland and entered civilian life, but Avery's experiences on a military base never left him. At MIT he's been conducting research on a biomaterial that could stop wounded soldiers from dying from shock due to severe blood loss.

At MIT graduate student Reginald Avery has been conducting research on a biomaterial that could stop wounded soldiers from dying from shock due to severe blood loss. "I wanted to do something related to the military because I grew up around that environment," he says. "The people, the uniformed soldiers, and the well-controlled atmosphere created a good environment to grow up in, and I wanted to still contribute in some way to that community."

"I wanted to do something related to the military because I grew up around that environment," he says. "The people, the uniformed soldiers, and the well-controlled atmosphere created a good environment to grow up in, and I wanted to still contribute in some way to that community."

Blocking blood loss

When Avery first joined the lab of Associate Professor Bradley Olsen in the Department of Chemical Engineering, his focus was on optimizing and testing a material that could be topically applied to wounded soldiers.

The biomaterial is a hydrogel — a material consisting largely of water — with a viscosity similar to toothpaste. Gelatin proteins and inorganic silica nanoparticles are incorporated into the material and function as a substrate that helps to accelerate coagulation rates and reduce clotting times.

The current standard for patching blood vessels is imperfect. Surgeons typically use metallic coils, special plastic beads, or compounds also found in super glue. Each technology has limitations that the nanocomposite hydrogel attempts to address.

"The old techniques don't take advantage of tissue engineering. It can be difficult for a surgeon to deliver metallic coils and beads to the targeted site, and blood may sometimes still find a path through and result in re-bleeding. It's also expensive, and some techniques have a finite time period to place the material where it needs to be," Avery says. "We wanted to use a hydrogel that could completely fill a vessel and not allow any leakage to occur through that injury site."

For the past six months Avery has concentrated on uncovering the physical mechanism by which the nanocomposite material interacts with blood. A super-resolution microscope can achieve a resolution of 250 nanometers; a single red blood cell, for a comparison, is about 8,000 nanometers wide. Avery says the ability to visualize how the physiological molecules and proteins interact with the nanocomposite and other surgical tools may also help him design a better material. Obtaining a comprehensive view of the process, however, can be time-consuming.

"It's taking snapshots every 10 or 20 seconds for approximately 30 minutes, and putting all of those pictures together," he says. "What I want to do is visualize these gels and clots forming over time." X

In Memoriam

Jerry Meldon PhD ’73

Jerry Meldon, an associate professor of chemical engineering and a Tufts faculty member since 1978, died on Tuesday, July 18, 2017, when he drowned while swimming in a lake in North Carolina. He was 69.

Jianmin Qu, dean of Tufts’s School of Engineering, said Meldon was “a great asset to the university and had a profound impact on the students he taught throughout his 40-year career at Tufts. He will be greatly missed by many students, colleagues, alumni and staff.”

Meldon, who received the Henry and Madeline Fischer Award for engineering teacher of the year in 2010, was remembered by colleagues and former students as a brilliant instructor who knew his subject matter inside and out. Professor Kyongbum Lee, the chair of Tufts’s Department of Chemical and Biological Engineering, said Meldon was one of the few faculty members who could teach the whole discipline. “He sort of did it all,” he said.

At faculty meetings, Meldon would often advocate for giving students a strong foundation in chemical engineering basics before they could branch off into newer disciplines. Some of those courses, such as thermodynamics or fluid dynamics and heat transfer, were among the most challenging undergraduate courses at the school. But he was also empathetic, Lee said. “He used to go out of his way to give his students chances to do well.”

Beth Frasso, who worked with Meldon for 12 years as a department administrator, said Meldon always made time for students and was interested in their careers. “He would try to help people make contacts—I know that was important to him,” she said. She recalled him as a great storyteller, whether he was sharing tales of colorful colleagues or reminiscing about his days as a post doc in the physiology department at Odense University in Denmark. “Every now and then he would go to the Danish Pastry House and bring us a kringle,” Frasso said. “Many people liked his dry sense of humor. Students often remarked upon it and I know I appreciated it very much.”

Nyasha Madziva was a student in the math course Meldon taught for chemical engineers. “He taught it in a super-intelligent way,” Madziva said. “Some of it got over your head sometimes, but he was funny in his approach and very thorough. I got back confidence in my math ability.” So much so that she asked Meldon to be her advisor for her master’s thesis, which she completed in May. In all, Meldon advised 47 master’s and doctoral students at Tufts.

Meldon received his bachelor’s degree in chemical engineering from Cooper Union and his doctorate from the MIT. He served on the advisory board of the Global Development and Environment Institute at Tufts.

He leaves his wife, Robin, and his children, James, Seth and Perri.

Summarized from the July 20, 2017, article in *Tufts Now*. X

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In Practice, a history of the Practice School through the eyes of its participants

"As alumni, you know better than anyone the singular rigors, wonders, and lessons of life offered by the Practice School. With this book, we share a cross section of those experiences. Whether students are working with carbon black at Cabot, re-engineering Golden Grahams cereal at General Mills, or analyzing the surface qualities of an antacid pill at Merck, they are contributing to the success of their team and host company, while learning skills one can only earn through such a dynamic and intensive experience."

T. Alan Hatton, in his foreword to *In Practice*

"Success in Practice School is learning something new, even if it's learning why something won't work."

Ramin Haghgooie SM '03, PhD '06, on page 53

In Practice is a culmination of 100 years of the Practice School told through the experiences of three generations of Practice School students, directors, sponsors and alumni. For a brief time, copies of the book will be free for alumni of the Department. For more information and to secure your copy, contact Beth Tuths at *btuths@mit.edu*.