In January 2018, Madeleine Oudin joined Tufts as an assistant professor and the first cancer biologist hired in the Department of Biomedical Engineering.

**Tufts Now: What attracted you to Tufts?**

Madeleine Oudin: When it came time to start my own lab, I really wanted to be close to engineers and at a university that values the interdisciplinary aspects of science, and I found that at Tufts.

**Your postdoctoral research includes looking at what micro-environmental factors in cells and tissues lead a cancerous tumor to spread or metastasize. How did you get to this line of inquiry?**

I was on my way toward a Ph.D. in neuroscience when I heard a presentation on cancer cell migration—how cancer cells

**Bringing different techniques to bear on what we know about tumor biology gives us a powerful tool to tackle cancer, and ultimately inform treatment.**

Continued on page 3
New sponsored research grants and centers of collaboration on cancer and neurodegenerative diseases have propelled our research footprint into areas of significance and exploration for medical advancements. In addition, new opportunities abound for our alumni to re-engage as mentors, and via courses as well.

We are also fortunate to continue to see our past students progressing both personally and along their career paths when we reconnect via our yearly alumni gathering on the Friday before graduation. While we are appreciative of the continued growth and impact of our programs, we will continue to push forward on new initiatives. For example, this year we embark on a major effort to revise our curriculum to reflect growing changes and demands in the field, while further strengthening our efforts to prepare our students for the changing world.

As always, we are thankful for the continued support provided by our dedicated, stellar staff, the engagement of our alumni in many facets of our programs, and the continued efforts of our faculty and students to propel our department forward. The coming year looks to be even more exciting! Please join us, and participate as you can to continue to build the best possible BME program.

David Kaplan  
Professor and Chair  
Stern Family Professor of Engineering

**Notables...**

At the $100K New Ventures Competition, a student team behind VASERA Male Contraceptives received the Stephen and Geraldine Ricci Interdisciplinary Prize. Sophia Atik and Elizabeth Bender, E18, presented their pitch for an injectable silk-based hydrogel technology that provides effective contraception for one year.  

Two staff members in the department were recognized for ten years of service: research administrator Luke Baccari and administrative assistant Milva Ricci.  

Ross Cullen Bretherton, E18, received a Graduate Research Fellowship Program (GRFP) Fellowship from the National Science Foundation (NSF) for his studies as a graduate student at the University of Washington in Seattle.  

Professor Sergio Fantini worked on a new interdisciplinary project to provide scientific and engineering foundations for developing autonomous systems that work effectively with humans, funded in part by the Air Force Office of Scientific Research (AFOSR).  

Roger Gu, E20, won an NCAA Division III championship swimming title in the 50 freestyle.  

Bilal Haider, a Ph.D. candidate in biomedical engineering, received a National Defense Science and Engineering Graduate Fellowship.  

As part of the 2018 Summer Scholars program, Lily Hayes, A19, and Claire Dunn, A20, studied with Assistant Professor Madeleine Oudin; Han Nguyen, E20, studied with Assistant Professor Xiaocheng Jiang; and Isabel Smokelin, E19, studied with Professor Irene Georgakoudi.  

Professor Fiorenzo Omenetto is leading the Laboratory for Living Devices project, part of the Tufts Research and Scholarship Strategic Plan. This research team includes Professor David Kaplan and Assistant Professor Bree Aldridge, and will focus on building a living devices lab based on naturally-derived building blocks for advanced technology.  

At the 2018 Graduate Awards Ceremony, Kristen Tgavalekos, EG18, of Biomedical Engineering received the School of Engineering (SOE) Award for Outstanding Graduate Contributor to Engineering Education.  

Nishanth Krishnamurthy, EG18, was given the SOE Award for Commitment to the Practice of Engineering. The Biomedical Engineering and Chemical Engineering Society (BEaCHES) received two awards: the Robert P. Guertin Student Leadership Award and the award for Outstanding Graduate Student Organization.  

Associate Professor Qiaoqing Xu will serve as the conference co-chair for the 17th International Nanomedicine and Drug Delivery Symposium, with MIT Professor Daniel Anderson.  

**BME Alumni Dinner**

Please mark your calendars for the eighth annual BME alumni dinner on Friday, May 17, 2019 at the Intercontinental Hotel in Boston. Look for emails from BME_Alumni@tufts.edu and check for upcoming details on our alumni page.
On the Front Lines of the Cancer War

Continued from page 1

spread and ultimately take over the function of vital organs. I thought that was a great way to apply my knowledge of neuroscience to something that was more clinically relevant, and more impactful. A lot of drugs work for a while, and then the tumor develops resistance to them. How do tumor cells metastasize and become drug resistant? If we could figure that out, it would be an incredible breakthrough.

**How do biologists partner with engineers to help each other’s research?**

I have questions about biology, and engineers have the practical and innovative technologies that allow us to get closer to answering those questions. At MIT, I repurposed a drug delivery device—which is about the size of a grain of rice—originally designed to release about twenty different drugs inside a tumor, to release cues that are known to attract tumor cells. I coupled that with imaging technology to be able to visualize the tumor’s response to these cues that we were artificially manipulating with these devices developed by engineers.

At Tufts, we’re connected with the incredibly exciting research into tissue properties and tissue engineering done here—that’s a good fit with my interest in tumor cell tissue environments. Tufts also has strong imaging capabilities. I have access to several high-end imaging platforms right next to me in the Science and Engineering Complex. The excellent work already being done in optics and imaging will allow us to image tissue properties in a way that opens up new and better ways to understand how the tumor environment works. Bringing these different technologies to bear on what we know about tumor biology gives us a powerful tool to tackle cancer, and ultimately inform treatment.

**At MIT you helped develop a workshop to teach middle and high schoolers about cancer and the kind of research done to try and tackle it, which you held at the Girl Scouts of America science fair and at the Cambridge Science Festival. Do you have similar plans for Tufts?**

Yes, I’d like to develop something similar here. I hope that as a junior faculty member I can continue to help young girls and undergrads be inspired by the possibilities that are open to them in research.

*This is an abridged Q&A that originally appeared in Tufts Now, written by Laura Ferguson. To read the full interview, visit go.tufts.edu/OudinArticle.*

**WHAT’S NEW AT INSCiDE**

**Initiative for Neural Science, Disease and Engineering (INSciDE@Tufts)**

INSciDE@Tufts continues to address fundamental questions about brain biology and mechanisms of neurodegenerative disease and psychiatric disorders, using bioengineered 3D brain-like tissue models. This past year, INSciDE scientists published on the development of 3D human neural networks from induced pluripotent stem cells (iPSCs). Stem cells derived from both healthy individuals as well as Alzheimer’s and Parkinson’s disease patients were used to populate the model, which would allow for the future exploration of cell interactions, disease progression, and response to treatment.

To further this and other work, INSciDE established a collaborative partnership with the New York Stem Cell Foundation (NYSCF) Research Institute, leveraging its expertise in iPSC biology, including the differentiation and characterization of key brain cell types, to decipher mechanisms of Parkinson’s disease using patient-derived samples. This effort, in addition to collaborations with other Tufts departments (e.g., Biology, Chemical and Biological Engineering, Chemistry, Molecular Biology and Microbiology, Neuroscience) and external collaborators (e.g., Harvard Medical School/Massachusetts General Hospital, UC Irvine, UPenn) demonstrate the broader impact of interdisciplinary research at INSciDE. Team members continue to participate in outreach activities including STEM professional panels, undergraduate neuro network events, and laboratory experience for high school students via the Tufts BME Research Scholars (TUBERS) program. To learn more, donate or collaborate, please visit go.tufts.edu/INSciDE.

**QUICK HITS**

**Professor Mark Cronin-Golomb** was appointed guest editor of a special issue on nonlinear optics for biomedical applications for the journal *Micromachines*.

**Research from Assistant Professor Xiaocheng Jiang’s lab** was featured in the *Journal of Materials Chemistry B*.

**Assistant Professor Brian Timko** was named to the inaugural class of Young Innovators in NanoBiotech, established by the journal *Nano Research*.

**Associate Professor Qiaobing Xu** received a grant from the National Institutes of Health to support the discovery of enzymes for cancer research.
New Materials Move in Response to Light

In a paper published in *Proceedings of the National Academy of Sciences*, Tufts researchers from the *Silk Lab* and the Department of Biomedical Engineering detailed the development of magnetic elastomeric composites that move in different ways when exposed to light. Learn more at go.tufts.edu/lightresponse.

Regeneration Science Takes a Leap Forward

Professor *David Kaplan* and doctoral student *Annie Golding* were among the Tufts researchers who found that the delivery of progesterone via a silk hydrogel device could induce the regeneration of limbs in otherwise non-regenerative frogs. Learn more about the research, published in *Cell Reports*, at go.tufts.edu/regeneration.

**Bacterial Cables**

Members of the *Jiang Lab* created core/shell type conductive “bacterial cables” with programmable electrical properties. These living electronic components represent unique platforms for interrogating biological electron transfer. Learn more about the research, published in *Nano Letters*, at bit.ly/2VZRtyZ.

**Coherent Cerebral Hemodynamics**

A recent study led by the *Diffuse Optical Imaging of Tissue (DOIT) Lab*, published in *PLOS ONE*, reports the frequency dependence of the relative amplitude and phase of oscillatory cerebral hemodynamics and systemic arterial blood pressure. Learn more at bit.ly/2veYnVf.

**Novel Protein Delivery Method**

The *Xu Lab* synthesized three types of lipidoids with differing tail structures and analyzed their ability to deliver genome editing and His-tagged proteins. The research was featured on the cover of *Advanced Healthcare Materials*. Learn more at go.tufts.edu/proteindelivery.

**Functioning Human Neural Networks in 3D**

A team led by Tufts biomedical engineers developed three-dimensional human tissue culture models that mimic the structural and functional features of the brain. Learn more about the research, published in *ACS Biomaterials Science and Engineering*, at go.tufts.edu/neuralmodels.

**Spotlight: The Future of Food with Natalie Rubio**

Quality, nutritious meat cultured from cells in a lab could provide a more sustainable source of meat for people across the globe. Third-year Ph.D. candidate *Natalie Rubio* is one of a select group of scientists worldwide working to develop cultured meat.

Currently a New Harvest Research Fellow pursuing a Ph.D. in cellular agriculture in Professor and Chair and Stern Family Professor of Engineering *David Kaplan*’s lab, Rubio focuses on the creation and exploration of scaffolds. While scaffolds are often applied to the study of regenerative medicine, she is testing whether chitosan, a protein found in the cell walls of mushrooms, makes a suitable scaffold to effectively grow different cuts of meat.

The introduction of a scaffold would allow for cuts of meat to be grown in a lab, like chicken breast or steak, which will be crucial if cultured meat is to become a culturally accepted source of food. This year, Rubio’s research was featured in an *Edible Boston* story on women working at the forefront of food, science, and technology, and she was a featured speaker at Taste of Science’s annual Boston festival. Read more at bit.ly/2VVM2kE.

**Incident light (from right) causes an elastomer film to deflect in a magnetic field.**

**Regeneration Science Takes a Leap Forward**

Professor *David Kaplan* and doctoral student *Annie Golding* were among the Tufts researchers who found that the delivery of progesterone via a silk hydrogel device could induce the regeneration of limbs in otherwise non-regenerative frogs. Learn more about the research, published in *Cell Reports*, at go.tufts.edu/regeneration.
CONGRATULATIONS TO OUR 2018 GRADUATES

Bachelor of Science in Biomedical Engineering

David Alvarez
Gladys Argueta
Xiloj
Sophia Atik
Nicholas Atkeson
Elizabeth Bender
Alexander Berk
Md Reshad Bin Harun
Ross Bretherton
Thomas DePalma
Christopher Flynn
Jackson Fulk-Logon
Michael Gannin
Xinzhi Guo
Nadia Hallaj
Nickolas Hartman

Alexander Ho
Tyler Kulcsar
Isaac Lasko
Steven Lin
Schuyler Link
Angelo Massaro
Roza Ogurlu
Taseen Rahman
Adam Rayfield
Tyler Shapiro
Edmund Takata
Leon Taquet
Megan Tse
Hannah Voelker
Amanda Weeks
Katherine Xu
Xi Yu

Doctoral Recipients

Ayhan Atmanli
Transcriptional and functional heterogeneity during cardiac cellular differentiation
Advisor: Lauren Black III

Lauren Baugh
The development of novel model systems and imaging techniques to advance the understanding of calcific aortic valve disease
Advisor: Lauren Black III

Nishanth Krishnamurthy
Using near-infrared spectroscopy to study static and dynamic hemoglobin contrast associated with breast cancer
Advisor: Sergio Fantini

Dimitra Pouli
Nonlinear label free optical imaging for morpho-functional cellular and tissue diagnosis
Advisor: Irene Georgakoudi

Aswin Sundarakrishnan
Engineering in vitro models for studying pulmonary fibrosis and infectious disease
Advisor: David Kaplan

Kristen Tgavalekos
Near-infrared spectroscopy and mathematical modeling for the characterization of human cerebral hemodynamics in the microvasculature
Advisor: Sergio Fantini

Master of Science

Sarah Armstrong
Mbllicent Lin
Gita Kiae

Keep in Touch

1. E-mail BME_Alumni@tufts.edu with your news, stories, and updated contact information. If you’re not receiving e-mails from us, please let us know!
2. Join our graduate and undergraduate LinkedIn groups.
3. Visit the Tufts Online Community: tuftsalumni.org/olc
4. Our Alumni Group is looking for volunteers to help plan and host networking events and activities, and to mentor current students. For more information, contact Nick Bayhi at nick.bayhi@gmail.com or Yuki Ito at yito16@gmail.com.

Clockwise, from left: Members of the BME undergraduate class of 2018 with faculty, Nishanth Krishnamurthy receives his Ph.D. hood from Professor Sergio Fantini, and newly-minted Ph.D. Dimitra Pouli is hooded by Professor Irene Georgakoudi.

Look for recognition of 2019 graduates in next year’s newsletter!
This year, the Tufts BMES executive board focused on developing new prospective events and opportunities for students to network and socialize. If you are interested in learning more, or want to get involved with BMES, email bmestufts@gmail.com or visit sites.tufts.edu/BMES.

The department was well represented at this year’s Biomedical Engineering Society Annual Meeting, held October 17–20 in Atlanta, Georgia. Professors Black, Jiang, Kaplan, Oudin, Timko, and Xu attended, with a number of graduate students and postdoctoral scholars. Looking forward to another strong Tufts contingent in Philadelphia next fall!

Platform Presentations

Jonathan Grasman (PI: Kaplan): 3D Tissue System to Evaluate the Formation and Repair of Neural Networks

Elena Manousiouthakis (PI: Kaplan): In Vitro 3D Human Innervated Tissue Model of the Intestine to Study Substrate P

Breanna Duffy (PI: Black): Anisotropic Hybrid Silk-Cardiac Extracellular Matrix Scaffolds for an In Vitro Human Myocardial Tissue Model of Pathologic Remodeling

Vineeth Raghuram (PIs: Timko and Fried): ON vs. OFF Sustained Alpha Retinal Ganglion Cells in the Mouse Have Different Axon Initial Segments


Nicole Raia (PI: Kaplan): An Ex Vivo Pregnant-Like Tissue Model to Assess Injectable Hydrogel for Preventing Preterm Birth

Poster Presentations

Olurotimi Bolonduro (PI: Timko): A 3D Bioprinter for Vascularized Tissue Constructs


Zachary Glass (PI: Xu): Cas9 gRNA Barcoding for High Throughput Screening of Synthetic Lipid Nanoparticle Libraries

Matthew Watson (PIs: Black and Kemmerling): The Effects of Pulsatile Shear on Cardiomyocyte Proliferation via Endothelial Neuregulin Signaling

Terrence Roh (PI: Kaplan): 3D Bioengineered Model of Inflammatory Bowel Disease

Sarah Lightfoot Vidal (PI: Kaplan): 3D Biomaterial Matrix to Support Long Term, Full Thickness, Immuno-Competent Human Skin Equivalents with Nervous System Components

Mark Daley (PI: Black): Cardiac ECM Developmental Age and Cyclic Stretch Synergistically Improve Twitch Force in Engineered Cardiac Tissues

Assistant Professor Madeleine Oudin: Physical and Biochemical Gradients in the Tumor Microenvironment Cooperate to Drive Local Invasion and Metastasis

Meghan McGill (PI: Kaplan): Resorbable Silk Splints for the Treatment of Severe Pediatric Tracheomalacia

Wenyi Li (PIs: Omenetto and Kaplan): Coding Cell Micropatterns through Peptide Inkjet Printing for Arbitrary Biomineralized Architectures

Zaira Martin Moldes (PIs: Buehler and Kaplan): Design and Characterization of Silk Functionalized Biomaterial for Bone Regeneration

Bilal Haider (PI: Timko): Conducting Polymer Coatings for Improved Neural Adhesion and Measurements in 3D Tissue Models

Yamin Li (PI: Xu): The Structure-Activity Relationship Study of Synthetic Combinatorial Lipidoids Library for In Vivo CRISPR/Cas9 Delivery

Ahmed Gado (PI: Georgakoudi): Autofluorescence Excitation-Emission Matrices for Quantifying Calcified Deposits

Harry Paul (PI: Kaplan): 3D Bioengineered Model of Intestinal Immunity to Modulate Pathogen Transcytosis

NEW FACES

Srivalleesha Mallidi

Srivalleesha (Valli) Mallidi joined the Department of Biomedical Engineering as an assistant professor in 2019. Her research focuses on ultrasound imaging, photoacoustic imaging, multi-modality imaging, and image-guided therapeutics. Her graduate work on molecular specific photoacoustic imaging to understand nano-molecular interactions is published in journals such as Nanoletters and is highly cited. She received a bachelor’s degree in electronics and communications engineering from Andhra University in Visakhapatnam, India. She received her doctorate and master’s degree in biomedical engineering from the University of Texas at Austin and completed a postdoctoral fellowship at the Wellman Center for Photomedicine.

This year, the Tufts BMES executive board focused on developing new prospective events and opportunities for students to network and socialize. If you are interested in learning more, or want to get involved with BMES, email bmestufts@gmail.com or visit sites.tufts.edu/BMES.
Service and Community

BME faculty, students, and staff continued to be highly involved in our local communities this year. Assistant Professor Madeleine Oudin’s lab ran two activities at the Freedom Connexion Science Club for Girls in Somerville, aided by postdoctoral scholar Morgan Hawker and Isabel Smokelin, E19. The lab also hosted a cancer detection workshop with the Center for Engineering Education and Outreach and visiting high school students from Denmark, and teamed up with Professor Irene Georgakoudi’s lab on Tufts Community day to run cell and optic activity stations with help from Emily Peirent, E19, Eleana Manousiouthakis, E19, and Ph.D. candidate Bilal Haider.

Postdoctoral fellow Samantha Louise Payne judged projects at Somerville High School’s annual Science Fair and Assistant Professor Madeleine Oudin was a judge at the Massachusetts Region IV Science Fair, while Assistant Professor Brian Timko’s lab led an electronics activity at the Innovator Symposium at Acera School in Winchester. Professor Mark Cronin-Golomb and Assistant Professor Brian Timko were sponsored by Tufts alumni for participation in the Steamtown Marathon in northeast Pennsylvania, as part of the development effort for endowing the BME Senior Prize.

Research Scholars—TUBERS

This past summer was the seventh year of the Tufts University Biomedical Engineering Research Scholars Program (TUBERS), where local high school students work in Tufts labs over the summer. Twenty-five rising juniors or seniors were invited to the Science and Technology Center for six weeks to gain hands-on laboratory experience. This year we tried a new format in Professor David Kaplan’s lab, where postdocs and graduate students presented modules related to tissue engineering with hands-on lab work and students were able to spend the last two weeks working on a project with a mentor. The success of this new model is leading to some department-wide changes for the coming summer. Stay tuned!

While the local Boston area was well represented by the students, we also hosted a number of students from other U.S. states and a few international students. We are always seeking to expand the program, so if you have any suggestions for schools that might have interested students, please contact Associate Professor Lauren Black at lauren.black@tufts.edu.

BME Retreat

The 2018 BME retreat took place at Breed Memorial Hall on the Tufts campus on October 26, 2018. Eighty faculty, staff, graduate students, and postdocs attended for a day-long research retreat, featuring lab oral presentations and graduate student poster presentations.
Professor of the Practice Steve Jacques was honored by the Journal of Biomedical Optics as a pioneer in the field. In December 2018, the journal featured a special section recognizing his contributions to biomedical optics and how he has helped to shape the field.