Moving towards electric, wind, and solar power generation and transportation is an essential element of adapting to a new energy future. In Assistant Professor Nav Nidhi Rajput’s lab at Tufts, a research team is using novel methods to understand the properties of materials and predict material activity in different circumstances.

Rajput’s research lives at the intersections of chemical engineering, materials science, and computational science. “[Recently] there is more collaboration between departments to solve problems” that may not fall under a traditional discipline umbrella, she says. In the Rajput Lab, “we are focusing on problems relating to new materials, designing new materials, and predicting new materials.”

The Rajput Lab utilizes computational modeling to understand and predict the properties of materials that could be used in processes relating to energy storage and production.

Continued on page 3
Dear Alumni, Colleagues, and Friends,

I hope that this letter finds you well. I am very pleased to share with you some exciting news from the department. In the fall, the department welcomed its newest faculty member, Assistant Professor Nidhi Rajput. Her research uses first principles modeling and molecular dynamics simulations to gain fundamental insights into synthesis-structure-property relationships of materials. These insights are used to predict properties of fluids and solid-fluid interfaces. I am delighted to have Professor Rajput join our faculty.

I have good news to share regarding the Gregory Botsaris Fund. Earlier this year, we exceeded our fundraising goal of $100,000. I want to thank all of our alumni and friends whose generous gifts made this possible. I would like to acknowledge Y.A. Liu, EG70, for kickstarting the fundraising, and Bob Haber, E79 and EG80, for providing matches to the gifts that took us over the top! The Gregory Botsaris Fund will celebrate Professor Gregory Botsaris’ legacy by ensuring that the Botsaris lectures continue in perpetuity while also recognizing outstanding students and providing critical funding for programs of importance to the department. This spring’s Botsaris lecture was delivered by Dr. Michael P. Thien of Merck & Co., Inc.

I am happy to tell you that the department continues to excel in teaching and research. Our total research expenditure this past year reached a record high, doubling the expenditure from five years ago. Faculty members secured new grants and contracts totaling more than $3 million. A particularly exciting development is the growth in industrial partnerships, reflecting the visibility and real-world impact of research programs in the department. Inside this newsletter, you will find short summaries and highlights of several exciting new research projects.

This newsletter also highlights prestigious awards received by the department’s students, alumni, and faculty. This year, Professor Maria Flytzani-Stephanopoulos, the Robert and Marcy Haber Endowed Professor in Energy Sustainability, and her collaborator Professor Charles Sykes (Chemistry) were recognized by the American Chemical Society with the Catalysis Lectureship for their groundbreaking work on single-atom alloy catalysts. Students and alumni received NSF graduate research fellowships, were named to Forbes 30 Under 30 lists, and spoke at Tufts Commencement ceremonies. These are just a few of the many noteworthy accomplishments by former and present members of the department.

As you can see, the department has much to celebrate. I am very grateful for the dedication of our faculty members, students, and staff as well as generous support from our alumni and friends. Thanks to their efforts, the department continues to thrive as a vibrant community of learning and scholarship. I invite you to read on. Please don’t hesitate to reach out—we love to hear from you.

With warm regards,

Kyongbum Lee
Professor and Chair

Notables...

Husain Adamji, E20, researched “Density Functional Theory-based Study of III-V Semiconductors” as a Summer Scholar with Assistant Professor Prashant Deshlahra. ■

At the 2018 $100k New Ventures Competition, Kelsey-Claire Gallagher and Caitlyn Leo, both E18, were members of a team pitching VASERA Male Contraceptives, which took second place in the MedTech & Life Science track and received the Stephen and Geraldine Ricci Interdisciplinary Prize.

Earl St Sauver, E13, was on the winning team in the Social Impact category for pitching Apollo Agriculture. ZwitterCo, a start-up founded by School of Engineering students and alumni, won first place in the General & High Tech track. Its nanofiltering technique is based on technology developed in Assistant Professor Ayse Asatekin’s lab. ■

Tommy George, E19, was named a Fellow in the National Science Foundation Graduate Research Fellowship Program. ■

Ph.D. student Georgios Giannakakis received the Outstanding Poster Award at the Gordon Research Seminar on Catalysis. ■

Professor Kyongbum Lee, Assistant Professors Ayse Asatekin and Nikhil Nair, Associate Professor Matthew Panzer, and doctoral student Alice Oliveira-Aguilar all received seed grant funding for projects in the 2018-19 year through the Tufts Collaborates program. ■

Associate Professor Matthew Panzer, Assistant Professor Prashant Deshlahra, and Assistant Professor James Van Deventer received grants from the National Science Foundation and the National Institutes of Health. ■

At the 2018 Graduate Awards, Ilin Sadeghi, EG18, received the SOE Award for Outstanding Academic Scholarship. The Biomedical Engineering and Chemical Engineering Society (BEaCHES) also received two awards: the Robert P. Guertin Student Leadership Award and the award for Outstanding Graduate Student Organization. ■
Nav Nidhi Rajput joined the department in the fall of 2018 as an assistant professor. She received her M.S. and Ph.D. degrees in chemical engineering at Louisiana State University, specializing in molecular dynamics studies of ionic liquids (ILs) confined inside nanoporous materials for applications in electrochemistry.

Rajput was a postdoctoral research associate in the Energy Technologies Area Division at Lawrence Berkeley National Laboratory, California, where she worked on developing infrastructure for high-throughput computations for the Joint Center for Energy Storage (JCESR) and Electrolyte Genome, which is a coupled first-principle and classical molecular dynamics code-base for rapid understanding and design of electrolytes.

Rajput’s collaborative spirit extends to how the team disseminates their research results. “All the codes that we are developing or that I’ve developed in the past, we’re making all the code open source so the community can use it and contribute to it,” she says. “For a computational person like me, I think one of the things we can contribute to is sharing our codes so people don’t have to pay. They can use them, and modify them, and contribute more to the framework. I think that’s a very healthy approach going forward.”

For Rajput and her team, collaborating with other researchers is critical to their work. The group is joining forces with the Pacific North West Lab to design molecules for better stability and solubility and with researchers at the Electrolyte Genome Project to develop a code base for the rapid understanding and design of electrolytes.

Her team uses computational modeling to understand and predict the properties of materials that could be used in processes relating to energy storage and production. “We are trying to understand very fundamental physical and chemical properties of materials, in particular electrolytes and electrodes, for energy storage devices using computer simulations,” Rajput says.

Focusing specifically on fluids and solid/fluid interfaces, the team also designs models for assessing the effectiveness of different materials for applications in energy production and consumption.

One example is the development of multivalent batteries, including magnesium ion and aluminum ion batteries. “We have restrictions on the materials” found in widely-used lithium ion batteries, Rajput says, so new solutions are needed to build batteries with better energy density.

Research led by Assistant Professor Ayse Asatekin, John A. and Dorothy M. Adams Faculty Development Assistant Professor, on highly selective membrane filters with applications in chemical purification was featured in a special issue of the journal *ACS Nano* honoring women-led investigations. She was also named an editorial board member of the journal *Membranes*.

Distinguished Professor Maria Flytzani-Stephanopoulos, Robert and Marcy Haber Endowed Professor in Energy Sustainability, received the American Chemical Society Catalysis Lectureship for the Advancement of Catalytic Science, with Professor Charlie Sykes of Tufts’ Chemistry Department. She was the 2018 Hougen Lecturer at the University of Wisconsin-Madison. She also delivered the 2019 Ensor Lecture at Washington State University and the 2019 William Schwarz Lecture at Johns Hopkins University.

Professor Christos Georgakis delivered the AIChE Pharmaceutical Division plenary lecture at the 2018 AIChE Annual Meeting.

Professor and Chair Kyongbum Lee will give an invited lecture at the 2019 Kern Lipid Conference in Vail, Colorado.

Associate Professor Matthew Panzer (pictured) and Assistant Professor Ayse Asatekin are part of a Climate & Energy research team associated with the Tufts University Research and Scholarship Strategic Plan. The team aims to use Tufts’ position as a leader in climate policy and education to develop foundations for further study.

Assistant Professor Prashant Deshalhra delivered the keynote lecture at the 10th Chilean Meeting on Catalysis and Adsorption in Linares, Chile.

Nav Nidhi Rajput joined the department in the fall of 2018 as an assistant professor. She received her M.S. and Ph.D. degrees in chemical engineering at Louisiana State University, specializing in molecular dynamics studies of ionic liquids (ILs) confined inside nanoporous materials for applications in electrochemistry. Rajput was a postdoctoral research associate in the Energy Technologies Area Division at Lawrence Berkeley National Laboratory, California, where she worked on developing infrastructure for high-throughput computations for the Joint Center for Energy Storage (JCESR) and Electrolyte Genome, which is a coupled first-principle and classical molecular dynamics code-base for rapid understanding and design of optimal electrolytes.
Thanks to the generosity of our alumni and friends, we have now exceeded our fundraising goal of $100,000 for the **Gregory D. Botsaris** Fund. We are truly grateful to all of you who supported this effort, which now allows the Department of Chemical and Biological Engineering to permanently honor Professor Emeritus Gregory Botsaris.

The Gregory Botsaris Fund will celebrate Professor Botsaris’ legacy by ensuring that the Botsaris lectures continue in the years ahead while also providing critical funding for programs of importance to the department and recognizing student excellence. In addition to hosting our regularly scheduled biennial Botsaris Endowed Lecture in April, we will be launching our first Botsaris undergraduate summer research scholar program this summer.

Throughout his career at Tufts from 1965 to 2004, Professor Botsaris worked tirelessly to enhance our department. During his chairmanship, we moved to our current home in the Science and Technology Center, substantially expanded our graduate program, and founded the Biotechnology Engineering Center, ushering in bioengineering activities at the School of Engineering. Thank you for helping the department honor his memory.

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**Gregory Botsaris Distinguished Lecture**

In April 2019, Dr. Michael Thien of Merck & Co., Inc. delivered this year’s Gregory Botsaris Lecture in Chemical and Biological Engineering.

In his lecture, Thien encouraged engineering students to realize their potential to impact the biopharmaceutical industry and human health in a meaningful way. He argued that chemical and biological engineers are essential activators tasked with bringing discoveries within the biopharmaceutical industry to commercial scale and economic feasibility.

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**Jeanne and Martin Sussman Endowed Lecture**

In March 2018, Dr. Martin L. Yarmush (pictured), Paul and Mary Monroe Chair and Distinguished Professor of Biomedical Engineering at Rutgers, delivered the 2018 Sussman Lecture. He spoke on translational biomedical engineering, with emphasis placed on scientific and technological gaps that could be filled, and the opportunities for translating the work to the clinical and industrial realms.

The biennial lecture is funded by The Jeanne and Martin Sussman Endowed Fellowship and Lectureship Fund, which also provides an international fellowship for ChBE undergraduates. The fund was established by a generous gift from the estate of Professor Emeritus Martin Sussman, who was a gentleman, an inventor, and a scholar who planted seeds of technical knowledge around the world.
CONGRATULATIONS TO OUR 2018 GRADUATES

Doctoral Recipients (Chemical Engineering)

Anthony D’Angelo
Thesis: Influence of Polymer Scaffold Selection on the Properties of Conventional and Solvate Ionogel Electrolytes
Advisor: Matt Panzer

Meenal Datta
Thesis: Mathematical Model of Oxygen Transport in Tuberculosis Granulomas
Advisor: Jerry Meldon

Jin Guo
Thesis: Multiscale Design and Synthesis of Bioinspired Protein/Mineral Systems
Advisor: David Kaplan

Papatya Kaner
Thesis: Zwitterionic Copolymers for Fouling Resistant and Responsive Membranes
Advisor: Ayse Asatekin

Smitha Krishnan
Thesis: Gut Microbiota Metabolites Modulate Inflammation in Non-Alcoholic Fatty Liver Disease
Advisor: Kyongbum Lee

Jilie Liu
Advisor: Maria Flytzani-Stephanopoulos

Ilin Sadeghi
Thesis: Novel Approaches to Manufacturing Membranes with Controlled Selectivity
Advisor: Ayse Asatekin

Zhenyu Wang
Thesis: Nonlinear Data-Drive Dynamic Models for Process Optimization and Control
Advisor: Christos Georgakis

Master of Science Recipients (Chemical Engineering)

Ahmed Bardooli
Maurice Bukenya
Christopher Drover
Kean Duffey

Master of Science Recipients (Bioengineering)

Shawna Downing
Wenhao Li
William Palmteer
Chuan-Lu Wang
Haotian Zhang

Master of Engineering Recipient (Chemical Engineering)

Jason Thall

Master of Engineering Recipients (Bioengineering)

Kristina Papa
Caroline Petersen
Jonathan Platt
Yinghan Qu
Mary Schwartz

Certificate Recipient (Biotechnology)

Yixiao Jiang

Bachelor of Science Recipients

Melissa Adler
Abdul Hadi Al Hillawi
John Arnold
Grace Aro
Ahmed Bardooli
Timothy Blewett
Braden Chiulli
Elizabeth Cultrara
Sopuruchukwu Ezenwa
Rihab Fahad
Jacob Fiedler
Ari Fitzsimmons
Dana Hemmert
Christopher Keyes

Departmental Award Winners

Grace Aro, E18
Nadia Medina Memorial Prize

Elizabeth Cultrara, E18
Alex Elias Memorial Prize Scholarship

Sopuruchukwu Ezenwa, E18
Donald A. Cowdery Memorial Scholarship

Jeanelly Gonzalez, E20
Audrey Butvay Gruss Science Award

Christopher Keyes, E18
Benjamin B. Brown Scholarship

Jacob Kronenberg, E18
Class of 1947 Victor Prather Prize

Wei Han Lim, E19
Gemma Cifarelli Memorial Scholarship

Brittany Mitro, E18
Class of 1898 Prize

Trang Ngo, E19
Audrey Butvay Gruss Science Award
RESEARCH HIGHLIGHTS

Rapid Growth of Yeast on Xylose

Assistant Professor Nikhil Nair and Venkatesh Gopinayanan, EG18, published in *Nature Communications* on their creation of a genetically modified yeast that can more efficiently consume xylose, enabling the yeast to grow faster and to higher cell densities, raising the prospect of a faster path to designing new synthetic organisms.

“Instead of building a metabolic framework from the ground up, we can reverse engineer existing regulons to enable an organism to thrive on a novel nutrient,” said Nair, the corresponding author on the study. “Adapting native regulons can be a significantly faster path toward the design of new synthetic organisms for industrial applications.” Learn more at go.tufts.edu/yeastxylose.


Protection from Inflammation

A team of researchers identified a mechanism in which “good” bacteria in the gastrointestinal tract can help protect the body from inflammation, in research published in the journal Cell Reports. Their study identified two key metabolites produced by the bacteria in mice that modulate inflammation in the host and could ultimately reduce the severity of non-alcoholic fatty liver disease. Professor Kyongbum Lee was corresponding author on the paper, and Smitha Krishnan, EG18, Maria Choi, E15, and Gautham Sridharan, EG13, were contributing authors. Learn more at go.tufts.edu/gutcheck.


Threads that Detect Gas

Lead author and Ph.D. candidate Rachel Owyeung and Associate Professor Matthew Panzer worked with Professor Sameer Sonkusale (Electrical and Computer Engineering) to develop equipment- and training-free textile detector smart threads. The researchers treated threads with polydimethylsiloxane (PDMS), which creates a flexible, physical seal around the thread and dye, which also repels water and prevents dye from leaching during washing. Crucially, the PDMS is gas permeable. Published in *Scientific Reports*, the research has implications for a wide array of public health, workplace safety, military, and rescue applications. Learn more at go.tufts.edu/gassmartthreads.


New Water Filtration Method

In a research paper published in *ACS Applied Polymer Materials* on World Water Day, Tufts chemical engineers and physicists described how they devised a low-cost membrane capable of rapidly filtering oil from water and oil mixtures without the membrane getting fouled.

“Filtration is a simple, energy-efficient water treatment method, and might be an effective way to clean up these oil spills,” said Assistant Professor Ayse Asatekin, corresponding author of the study. The research team created a material that combined water-repelling chemistry and texture using a technique called electrospinning. Learn more at go.tufts.edu/waterfiltration.


Read more at engineering.tufts.edu/chbe/news.
**ALUMNI UPDATES AND NEWS**

*Anthony D’Angelo*, EG18, is the co-founder of Lithio Storage, a team that won the 2018 MIT Clean Energy Prize.

VASERA Male Contraceptives, a start-up launched by Tufts engineering alumni including *Kelsey-Claire Gallagher* and *Caitlyn Leo*, both E18, won the top honor from an expert panel at the sixth annual Beantown Throwdown competition, hosted by the MIT Enterprise Forum.

*Monte Haymon*, E59, J83P, J85P, former Tufts trustee, and Board of Advisors member, passed away in 2018. Monte and his wife *Jane*, A60, J83P, J85P, established the Monte and Jane Haymon Family Endowed Scholarship Fund in 2006 to assist Tufts undergraduate students with financial need, helped fund undergraduate term scholarships and graduate fellowships, supported Tufts Hillel, and were challenge donors for Tufts’ Giving Tuesday campaign in 2015. The department extends condolences to the Haymon family.

As part of a series on up-and-coming researchers, postdoctoral scholar *Ilm Sadeghi*, EG18, *Papatya Kaner*, EG18, and Assistant Professor *Ayse Asatekin* published findings on ways to control and expand membrane selectivity in *Chemistry of Materials*.

Chemical engineering graduate *Ryan Pandya*, E13, was named to the 2018 Forbes 30 Under 30 list for social entrepreneurs as the co-founder of Perfect Day, which launched in 2014. The company creates animal-free dairy protein.

*Julia Prusaczyk*, E18, joined the St. Louis Cardinals as a baseball development analyst, and spoke to *espnW* for an article on women working in Major League Baseball. Read that article at es.pn/2KeNQQ4.

Alumna *Paula Soteropoulos*, E89, J89, EG90, A20P—now CEO and President of Akcea Therapeutics—was an honored speaker at Commencement in 2018.

*Sherrie Zacharius*, E77, vice president of Technology and Laboratory Operations, retired in March 2019 after 37 years of technical leadership and service to The Aerospace Corporation and its customers.

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Have an alumni update for next year’s newsletter? Email chbe@tufts.edu!
Ph.D. candidate Rachel Owyeung collaborated with colleagues from the Tufts Department of Electrical and Computer Engineering to develop a series of 3D-printed metamaterials with unique microwave or optical properties that go beyond what is possible using conventional optical or electronic materials. The research, published in *Microsystems & Nanoengineering*, took inspiration for a 3D-printed antenna from the geometry of a moth’s eye. Read more at go.tufts.edu/3Dprintedmetamaterials.