DARTMOUTH
Engineer
FALL 2019
THAYER SCHOOL OF ENGINEERING

"THE FOREFRONT OF A REVOLUTION"

—NEW THAYER DEAN **ALEXIS ABRAMSON** ON DELIVERING AN EDUCATIONAL EXPERIENCE THAT WILL IMPACT FUTURE GENERATIONS OF ENGINEERS

inside

First Look

BIRD'S-EYE VIEW

A 210-foot crane towers over the construction of the new West End building that will soon house engineering, computer sciences, and the Magnuson Center for Entrepreneurship. The building is slated to open in late 2021.

Drone photograghy by Jared Benedict and Zack Bennis

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ARCTIC EXPEDITION

Professor Donald Perovich and a team of Dartmouth researchers have joined others from around the world on the largest polar expedition in history to better understand the scale of climate change and what it means for our planet. **PAGE 4**

ESTHER HORVATH

DEPARTMENTS

COVER:
Photograph by Rob Strong

THE Great Hall

NEWS FROM AROUND THAYER SCHOOL

CLIMATE OBSERVATORY

Adrift in the Arctic

MOSAIC TEAM
A global team of researchers will live on an icebreaker vessel for an entire year to gather data about the changing Arctic climate and its impact.

PROFESSOR DONALD PEROVICH AND A TEAM of Dartmouth researchers have joined others from around the world on the largest polar expedition in history to better understand the scale of climate change and what it means for our planet.

The Multidisciplinary-drifting Observatory for the Study of Arctic Climate (MOSAiC) expedition set sail from Tromsø, Norway in September and marks the first time a global team of researchers will live on an icebreaker vessel for an entire year to gather data about the changing Arctic climate and its impact.

"The threats posed to the planet from global climate change are real—and they are coming on fast," says Perovich, professor of engineering at Thayer and the expedition's co-lead for sea ice research. "This study will be historic not only for its scale, but for its ability to allow us to understand the causes and consequences of changes in the Arctic."

Along with Perovich, Thayer graduate students Ian Raphael '18 and David Clemens-Sewall '14, plus Christopher Polashenski '07 Th'07 Th'11, an adjunct assistant professor at Thayer and a research geophysicist at the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory, will be part of the global expedition.

Throughout the upcoming year, the four Thayer researchers and rotating crews of 300 researchers will call the German research icebreaker *Polarstern* home base. Each will take part in alternating legs of the expedition—with each leg expected to last two to three months. In a remote part of the Siberian Arctic, the *Polarstern* is expected to power down and wait for water to freeze around the vessel. Once entrapped, it will drift with the floe as it tracks across the Arctic.

All told, the $155-million expedition, led by the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, will involve a total of 600 international participants from 17 different countries. In addition to the *Polarstern*, an international fleet of four icebreakers, helicopters, and fixed-wing aircraft support the mission. The sea-based teams will be supported on land by researchers from Austria and South Korea.

Raphael is currently aboard the *Polarstern* for the expedition's first leg, and he described the MOSAiC mission as essential to understanding what's at stake for our planet.

"Our climate models are informed in an enormous way by field data," Raphael says. "MOSAiC is so critical because the sheer volume of data that we will collect simply isn't feasible any other way."

Perovich, Clemens-Sewall, and Polashenski will sail on later legs of the expedition. Raphael, who is expected to complete the first leg in December, will rejoin the *Polarstern* for a second time in August 2020 for MOSAiC's final leg.

The mission, which has been 10 years in the making, "could not come at a more important time," Perovich says. "The impacts of climate change are amplified in the Arctic, so this could be our best shot to explore the region while there is still time to assess and respond to change." *—David Hirsch*

Q&A

Danielle Castley

Engineering PhD Innovation Program candidate Danielle Castley, who won the American University of Sharjah New Venture Challenge award in February for her work in radiation-shielding materials, talks about why she came to Thayer and her research in nuclear energy.

What attracted you to engineering at Dartmouth?

I like the idea of having the opportunity to develop a strategy for commercializing my technology as a student. I am not just writing a thesis that will sit on a shelf; I'm doing work that will advance industry. The PhD Innovation Program has allowed me to do that. It's also given me the opportunity to take classes in corporate fi ance, learn about IP rights and protecting my intellectual property, and develop the strategy for commercializing my material. Seeing what works and what doesn't work and having the opportunity to bounce ideas off Dr. Eric Fossum and other professors about the best way to go about developing the product and technology has been key.

Why did you decide to work in the nuclear energy field?

I'm concerned about the environment and global warming. Nuclear power has the lowest life cycle carbon emissions of any energy production method besides wind. It's scalable and reliable, and I want to create materials to improve safety as well as adjust public perception of the nuclear industry.

Can you tell us more about your research?

My goal is to develop a neutron shielding material that's lightweight enough to transport in nuclear fuel casks, but can also operate at higher temperatures than existing polymer-based materials. It needs to retain certain thermal properties—such as thermal expansion and the coeffici t of thermal conductivity—but also handle the high burn-up fuel heat loads that the U.S. Department of Energy wants nuclear power plants to comply with. With a higher temperature neutron shielding material, we can increase the lifetime of reactor components, improve the safety of managing spent nuclear fuel, and improve the effici cy and safety of the reactor overall.

What's next for you?

What's next, I hope, is fin shing my thesis and testing the manufacturing process on a larger scale so that we can prepare to see the material deployed in the nuclear industry or even in aerospace engineering, where neutron shielding is also a concern.

—Interview by Kathryn Lapierre

"I want to adjust public perception of the nuclear industry."

OPPOSITE PAGE: STEFAN HENDRICKS. THIS PAGE: KATHRYN LAPIERRE

WELCOME

New Faculty

JIWON LEE joined Thayer in July as the Ralph and Marjorie Crump Assistant Professor of Engineering. His research focuses on the impact of antibody repertoires on autoimmunity, infectious diseases, and cancer, and the application in developing the next generation of vaccines and immunotherapy. Previously, he was a postdoctoral fellow with a joint assignment at Harvard Medical School and the University of Texas at Austin. He earned his BA in molecular and cell biology at the University of California, Berkeley, an MEng in chemical and biomedical engineering from Cornell University, and a PhD in chemical engineering from the University of Texas at Austin.

WILLIAM SCHEIDELER joined Thayer in July as an assistant professor of engineering. His research focuses on developing new materials and nanomanufacturing methods for high-performance printed and flexible devices, including low-power sensors and energy harvesting for hybrid electronics. Prior to joining Dartmouth, he was a postdoctoral scholar in the materials science and engineering department at Stanford. He earned his BSE degrees in electrical and biomedical engineering from Duke University and a PhD in electrical engineering from University of California, Berkeley.

COLIN MEYER joined Thayer in September as an assistant professor of engineering and a faculty member in the Ice, Climate, and Energy academic cluster at Dartmouth. An applied mathematician who studies how glaciers and ice sheets respond to changes in climate, he is also involved in research in fluid dynamics, snow and ice mechanics, and glaciology. Prior to joining Dartmouth, he was a postdoctoral scholar at the University of Oregon. He earned his BS in civil and environmental engineering from the University of California, Berkeley, a master of advanced study for completion of Part III of the Mathematical Tripos from the University of Cambridge, and a PhD in applied mathematics from Harvard University.

HELPING HANDS
Abby Brazil '21, Mallory Byrd '19 Th'20, Marisa Magsarili '19 Th'20, Ben Saccone '20, and Kevin Yang '20 install a new hydroelectric system on a remote Alaskan Island.

STUDENT PROJECT

Alaskan Field Trip

PROFESSOR DOUGLAS VAN CITTERS, along with a group of Thayer undergraduates, traveled to a remote Alaskan island in June to install a hydroelectric system for the Inian Islands Institute. The institute, an ecological field school founded by four Stanford PhD graduates, for years had relied on a diesel generator for power. Recently, however, the institute decided to switch to a greener energy source—a micro-hydroelectric system.

Through a connection made by Professor Laura Ray, who served as interim dean for the past year, Thayer offered to send a team of students to do the actual installation.

The students had one week to complete the job.

"It's one thing to design something at your desk, manufacture it, and change the design and repeat the process if necessary—it's a totally different thing to make design changes onsite, in real time, with no equipment, no computer, and no plumber nearby," Van Citters says. "It took every minute of the seven days to get the system installed. Everything takes longer than expected, and for all of your planning, things will fall apart."

Abby Brazil '21, Mallory Byrd '19 Th'20, Marisa Magsarili '19 Th'20, Ben Saccone '20, and Kevin Yang '20, who accompanied Van Citters on the trip, grappled with many unexpected challenges. At one point, because water pressure had built up in one of the 1,200-foot pipes on the property, the students dealt with an explosion that flooded the generator, batteries, and inverter, cutting the power and water for the whole site.

"When you are out on a remote island and resources are limited, you are more aware of the amount of resources being used and the waste being produced," says Magsarili. "Working on the Inian Islands was a strong reminder about what organisms and ecosystems we are aiming to preserve when installing these renewable energy systems."

—James Bressor

LEADERSHIP

New Board Members

LUIS PAZ-GALINDO '93 TH'94, elected this spring to the Thayer Board of Advisors, is a founding partner of Blue Road Capital, a private equity firm focusing on investments in the agricultural sector. Previously, he was a managing director at Ospraie Advisors, LP, where he managed the Ospraie Special Opportunities Fund, which focused on private equity investments in agriculture and energy. He began his career at JP Morgan in mergers and acquisitions and later served as a principal with JP Morgan Partners in the São Paulo, Brazil, and New York City offices. He earned his AB in philosophy and engineering sciences from Dartmouth, a BE from Thayer, an MS in technology and policy, and a PhD in technology, management, and policy with an emphasis in energy economics from the Massachusetts Institute of Technology.

TODD COOK '93 TH'94, elected this spring to the Thayer Board of Advisors, is a co-managing partner of Bain Capital Double Impact, a fund that invests in companies that deliver competitive financial returns and positive social and environmental impact. Previously, he worked for 20 years on Bain Capital's North American private equity team, where he was most recently a managing director focusing on investments in industrial and energy companies. He started his career as a consultant at Bain & Co. He serves on the board of Cradles to Crayons, Rural Sourcing Inc., and By Chloe and Living Earth, and has served on the boards of Dollarama, Dunkin Brands Group, Michaels Cos., Blackhawk Specialty Tools, TI Fluid Systems, and American Trailer Works. He earned his AB in engineering sciences and economics from Dartmouth, a BE from Thayer, and an MBA from Stanford's Graduate School of Business, where he was an Arjay Miller Scholar.

Solutions for a Global Challenge

The Dartmouth Humanitarian Engineering team of **Alexandria Chen '20, Joshua de la Cruz '22, Anna Dodson '20, Jack Sadoff '21, Suraj Srivats '22**, and **John Weingart '22** represented the United States at the National Academy of Engineering's 2019 Global Grand Challenges Summit in London in September. The team was chosen for its work on the Compost Tea Project, which aims to deliver sustainable organic fertilizing solutions to low-income urban farmers who face soil nutrient deficiency, but lack the space, time, and finances needed to implement traditional composting systems. "We picked this project to help low-income urban farmers in Quito, Ecuador, improve soil quality through utilizing a cheaper, more effective, and sustainable composting system," says project leader Chen. "We identified Quito because we are working with a partner NGO there called ConQuito and they have thousands of small orchards scattered across the city which would benefit from our device."

OPPOSITE PAGE: KEVIN YANG. THIS PAGE: COURTESY OF ALEXANDRIA CHEN

HONORED **Professor Fridon Shubitidze** was awarded the Georgia Medal of Honor for "his personal contribution in the development of science and in the creation of modern technologies." Georgia-born Shubitidze earned the honor in part for his efforts to establish collaboration between Georgian colleagues and his electromagnetic sensing group at Dartmouth.

AWARDED **Chris Miller '20** has earned the John G. Kemeny Computing Prize for his "Group Assignment Tool," created as part of a research project with **Professor Petra Bonfert-Taylor**. The tool, which is being integrated into the College's web-based learning system, is designed to help instructors form well-functioning student teams in their project-based classes.

PUBLISHED In his new book, *eIoT: The Development of the Energy Internet of Things in Energy Infrastructure* (Springer), **Professor Amro Farid** explores the collision between the sustainable energy transition and the Internet of Things. He explains how emerging applications have the potential to transform today's energy grid into one that is much more responsive.

AWARDED Engineering student **Camilo Toruno '20** received the Mazilu Engineering Research Fellowship to support his work with **Professor Rahul Sarpeshkar** on biological cellular chemical production for sustainability. "We are using a fascinating mixture of analog circuit theory, evolutionary techniques, and metabolic engineering—something that, to our knowledge, hasn't been done before," he says.

WON Materials science PhD candidate **Eldred Lee Th'17 Th'21** has earned a graduate fellowship with the U.S. Department of Energy's National Nuclear Security Administration. He will work with Los Alamos National Laboratory scientists on research "relevant to stewardship of the nation's nuclear stockpile."

AWARDED Engineering research scientist **Evan Thomas** has earned the Basu United States Early Career Award for Research in Sun-Earth Systems Science by the American Geophysical Union. His research focuses on understanding the ionosphere-magnetosphere system using ground-based observations of various plasma properties.

I Want One of Those!

AWARD-WINNER

PINGS FOR POSITIVE CHANGE

In an effort to affect social change on campus and beyond, a team of students invented Pings for Positive Change, a wearable device to gather data and track alerts relevant to sexual misconduct. A wi-fi chip calculates the wearer's location based on surrounding routers and three levels of pings cover a range of situations. One press of the button logs the user's location, sends a follow-up text asking to anonymously share situational details, and sends the user emergency medical and counseling resources. Two presses accomplishes those three steps and also sends a text to three of the user's pre-determined friends, alerting them to the user's situation and location. Three presses is an SOS sequence—indicating a crisis situation—that contacts campus security. Inventors Yefri Figueroa '21, Mikaela O'Brien '21, Logan Sankey '20, Nolan Sankey '21, and James Turner '21 won the winter term Phillip R. Jackson Award for best overall performance in ENGS 21: Introduction to Engineering. Their teaching assistant was Zach Berzolla '19.

—Kathryn Lapierre

PINGS FOR CHANGE
Team members show the wearable device to gather data and track alerts relevant to sexual misconduct.

ENERGY RESEARCH
The collaboration supports research on energy resiliency for extremely cold regions and will build on its long-established cold-regions research work, such as this 2018 Institute of Arctic Studies expedition to Greenland.

ARCTIC COLLABORATION

Developing New Energy Systems

THAYER SCHOOL OF ENGINEERING IS collaborating with Dartmouth's Arthur L. Irving Institute for Energy and Society and the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL) to assess ways to improve energy services, delivery, storage, and mobility for military bases in the Arctic. Engineering professors Amro Farid, Jifeng Liu, and Weiyang (Fiona) Li—who are co-investigators of the project with principal investigator and Irving Institute Director Elizabeth Wilson—will work at the cutting edge of energy research to extend the Army's mission capabilities by up to 30 percent while testing new technologies that will lead to the next generation of energy-delivery and storage systems for extremely cold regions.

The overall project comprises three subprojects, which will be executed simultaneously and led by Thayer faculty.

Led by Farid, the "Arctic Resilient Intelligent Integrated Energy System" project will develop a multi-modal energy management system that optimizes the supply, demand, and storage of energy for an Arctic military base operation.

Led by Liu, the "Porous Thermoelectric Cells for Waste Heat Recovery in Arctic Stations and Habitats" project will develop lightweight porous thermoelectric materials and thermoelectric cells to recover waste heat from power generators in the Arctic region, converting the wasted thermal energy directly to electricity. Joining Liu in his work are Professors Ulrike Wegst, Jason Stauth, and Charles Sullivan.

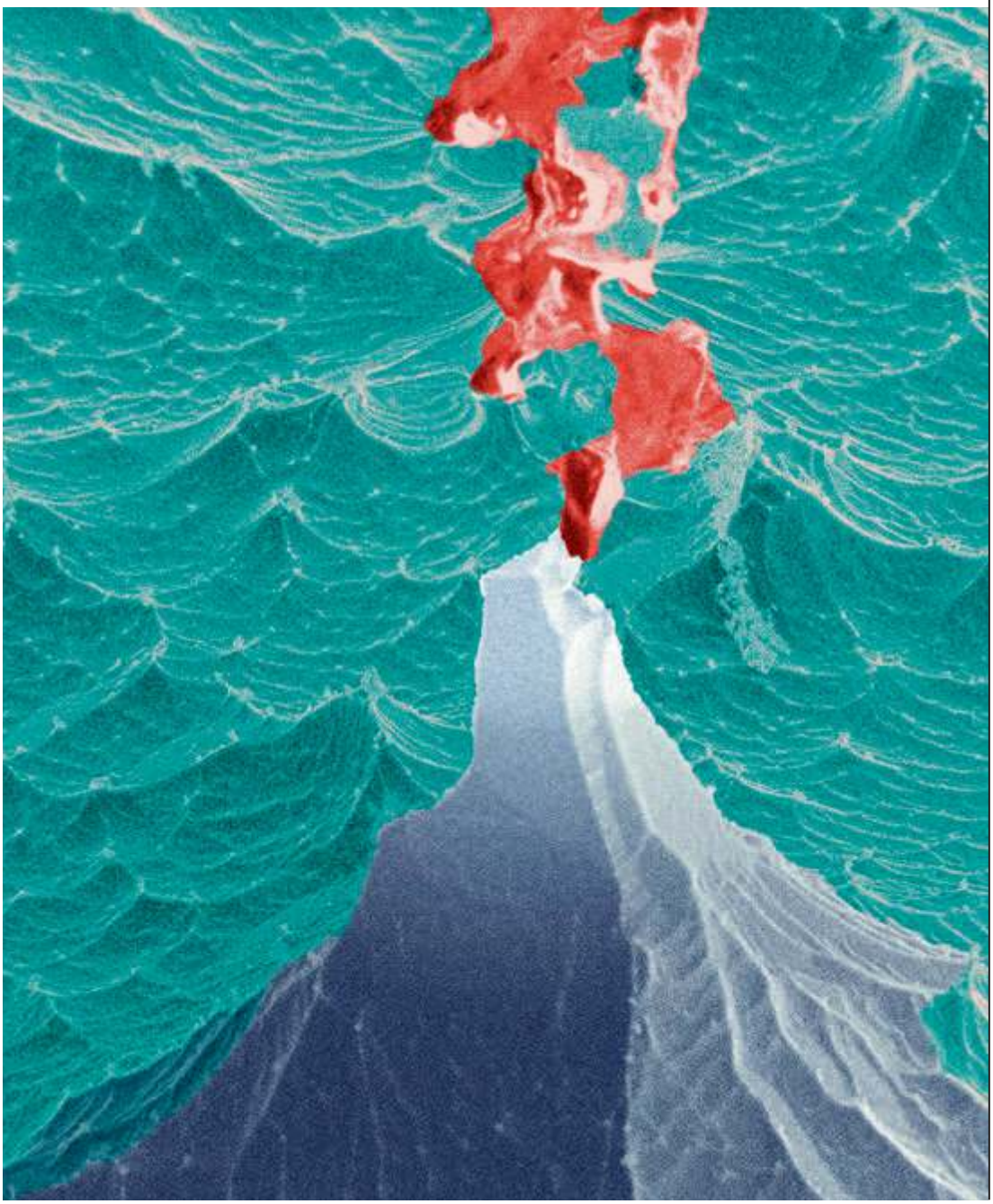
Led by Li, the "Energy Storage Solutions for Extremely Cold Environments: Development of Novel High-Energy Lithium Batteries" project will address the challenges posed by the extreme cold to the electrochemical reactions of batteries, which makes it difficult for the batteries to deliver the stored energy. Joining Li in the research are Ian Baker and Katherine Mirica, a chemistry professor.

—Bill Platt

Kudos

Science as Art

With *Erupting Volcano on the Ocean*, PhD student **Kaiyang Yin Th'12** transformed information into art—and earned second prize at the annual Materials Research Society "Science as Art" competition. Inspired by the iconic Hokusai print *The Great Wave off Kanagawa*, Yin made her volcano by imaging a textured ice surface. "This image was a total accident," says Yin, whose research focuses on porous materials created by a freezing process. "We—me and **Cory Cline Th'21**, who is also a PhD student at Thayer—were hoping to find a flat ice surface instead of a textured one under a scanning electron microscope with a cold stage. I was disappointed, but all of a sudden I saw frost, which became the smoke in the image, growing from the tip of those 'mountains.'"



OPPOSITE PAGE: TOP, ROBERT GILL; BOTTOM, KATHRYN LAPIERRE. THIS PAGE: KAIYANG YIN

PUBLISHED Engineering sciences major **Alexandra Stasior '20** profiles 25 current College students as coauthor of *Getting Into Dartmouth: Successful Applicants' Essays, Resumes, and Interviews* (self-published). As she writes in her profile: "I finally chose Dartmouth over MIT because I could study engineering and still get a liberal arts education."

NAMED **Professors Keith Paulsen Th'84 Th'86** and **Brian Pogue** have been named senior members of the National Academy of Inventors. Paulsen, who was elected to the NAI's inaugural class earlier this year, was recognized for his efforts to foster a spirit of innovation while educating and mentoring the next generation of inventors. Paulsen is scientific director of the Advanced Imaging Center and the Center for Surgical Innovation at Dartmouth-Hitchcock Medical Center. Pogue was elected for his "success in patents, licensing, and commercialization" and for producing "technologies that have brought, or aspire to bring, real impact on the welfare of society." Pogue is the MacLean Professor of Engineering and the president and co-founder of DoseOptics, a company that has created technology for real-time imaging of radiotherapy in cancer patients.

HONORED Clairways—a maker of lung monitoring technology that was founded by Thayer PhD student **Justice Amoh '13 Th'13**, **Jeffrey Bemowski Tu'18**, and **Professor Kofi Odame**—won the grand prize at the 2019 Dartmouth Entrepreneurs Forum. Also during the forum, the Dartmouth Technology Innovation and Commercialization Award was given to two professors: **Laura Ray**, who teaches thermodynamics and engineering design and founded two medical technology companies; and **B. Stuart Trembly**, who founded Avedro, an ophthalmic device company focused on corneal cross-linking and refractive correction that recently went public with an IPO priced at $70 million.

HONORED Engineering student-athletes **David Emanuels '19** and **Jack Traynor '19** were lauded by the College's athletics department for their extracurricular and scholastic achievements. Linebackers Emanuels and Traynor were leaders on a defense that ranked second in the country in fewest points allowed while maintaining GPAs above 3.6.

CLASS OF 2019
Celebrations broke out after Investiture ceremonies.

INVESTITURE BY THE NUMBERS

22
Doctor of Philosophy

6
Master of Science

59
Master of Engineering Management

116
Bachelor of Engineering

116
Bachelor of Arts in Engineering Sciences

INVESTITURE

Class of 2019

THAYER SCHOOL'S 2019 INVESTITURE on June 8 honored 203 recipients of BE and graduate degrees. The Robert Fletcher Award, named for Thayer's first dean, was presented to astrophysicist and National Science Foundation Director France Córdova. The next day, Dartmouth awarded 116 AB degrees in engineering sciences.

"Perhaps the timeliest message I can leave with you is this reminder of the opportunity and responsibility you now bear," Córdova told the Thayer graduates. "Because our lovely, fragile planet—and the very real people it serves—need you now more than ever. We need your optimism and enthusiasm. We need new voices representing every background. We need your willingness to think outside of traditional paradigms and to form new and unconventional partnerships."

"Be a source, not a sink."
—RYAN CHAPMAN TH'19

Student speaker Ryan Chapman Th'19 encouraged classmates to "take a penny, leave a penny. We took a penny. Now it's on us to return the favor. In conversation, leave a penny by being present. When stressed, leave a penny by remaining patient. When our schedules are full and someone needs help, leave a penny by finding time. And when the world seems full of anger and hate, leave a penny by showing compassion and love. Let me rephrase to something the engineers will more easily understand: Be a source, not a sink."

In closing, after touching on the nature vs. nurture debate, Interim Dean Laura Ray remarked, "I can say with confidence that your Thayer education has nurtured a passion for actively engaging your engineering gifts to improve the human condition."

—Catha Mayor Lamm

OPPOSITE PAGE AND THIS PAGE, LEFT: MARK WASHBURN. THIS PAGE: RIGHT, PATRICIO SARZOSA

LAB REPORT

Toys and Real-Life Whales Inspire Biohybrid Robot

DRAWING INSPIRATION FROM BIOLOGY AND THE TOY SHELF, Dartmouth engineering Professor Zi Chen's team and researchers at the City University of Hong Kong have developed a swimming robot with a light-controlled cellular engine that can perform highly-targeted drug delivery.

Researchers combined cardiac tissue engineering, a 3D-printed wing structure and a light-sensitive gel to produce the soft robot with start-stop capability. The switchable device transforms its shape when exposed to skin-penetrating near-infrared light, causing it to drive and brake through fluid environments like the human blood stream.

The transformable device dramatically improves the usefulness of robots designed to work inside the human body and other unconventional work environments.

The research team at City University of Hong Kong produced the original robot design and performed the experimental tests. The Dartmouth team performed mechanical and numerical analysis on the device and suggested changes to design elements like size and shape.

"With this technology we can create soft transformable robots with unprecedented maneuverability," said Chen, an assistant professor of engineering at Thayer. "Our inspiration came from transformable toys that have different configurations and functionality. The result is no toy, it may literally change people's lives."

The robot's high sensitivity to near-infrared light creates a response rate that allows an almost immediate transformation of wing shape, allowing it to be highly maneuverable. In the study, researchers used the "unprecedented controllability and responsiveness" of the floating-plane robot as a cargo carrier to conduct targeted drug delivery against cancer cells.

"We literally dropped drug bombs on cancer cells," said Chen. "The realization of the transformable concept paves a pathway for potential development of next-generation intelligent biohybrid robotic systems."

—David Hirsch

THE NEW FACE OF LEADER

DEAN ALEXIS ABRAMSON WANTS TO TURN IDEAS INTO REALITY.

BY KATHRYN LAPIERRE

THIS FALL, Thayer School of Engineering at Dartmouth welcomed Alexis Abramson, a mechanical engineer and a leader in sustainable energy technology, as its 13th dean. Abramson, a Cleveland native whose career spans academia to the nonprofit sector to policy development, joins Thayer at a time of growth and opportunity. As Dartmouth builds a new, $200-million facility to house engineering, computer science, and entrepreneurship, Abramson will oversee the next phases of Thayer's expansion to double Thayer's faculty and number of PhD graduates. Abramson recently spoke to *Dartmouth Engineer* about how her career and

PHOTOGRAPH BY ROB STRONG


SHIP

life experiences so far have helped prepare her for the role, what it's like to be a woman in a largely male-dominated field, and how she plans on keeping Thayer at the forefront of engineering education, innovation, and research.

What drew you to Thayer and to Dartmouth?

I truly believe we are at an inflection point in engineering education. I chose to accept the role of dean at Thayer because Dartmouth is at the forefront of a revolution that's necessary and critical for the future of our world. With all that's going on in society, it's extremely important that engineers are taught to tackle problems using a systems-based approach, with education that's grounded strongly in the liberal arts, so that engineers can invent and discover at the intersection of the human-made world and the human experience. Thayer delivers a "human-centered" approach to engineering education like no other—and I am excited to join an institution where we're leading the way.

Of course, what also drew me here is this incredible community—from the faculty and staff to our students and alumni and the Dartmouth community at large. Our faculty are scholars equally passionate about research, teaching, and mentorship, with a dedication to students unmatched at most large research institutions. We live and breathe collaboration and problem-based engineering that you see only sprinklings of at other institutions, but it's part of our DNA here. To be part of that and to be a part of Thayer's future growth is very exciting.

How have your career and your life experiences, so far, prepared you for this new role?

I have always been drawn to complexities of where two ideas or worlds intersect, and that's led me to a number of different roles. I am somewhat of a traditional academic in the sense that I was a faculty member at Case Western Reserve University for 16 years, advising, teaching, and doing research. I've also had an opportunity to work in the nonprofit world in tech-based economic development in northeast Ohio, trying to figure out how to better catalyze commercialization, and spent time as a director of the Great Lakes Energy Institute, working in energy sustainability research. More recently, I was a technical advisor for Breakthrough Energy Ventures, a firm started by Bill Gates and others to invest in companies with a significant potential to mitigate climate change.

> "ENGINEERING IN AN ACADEMIC SETTING IS A UNIQUE OPPORTUNITY TO TACKLE SOCIETY'S CHALLENGES IN AN EXCITING, DYNAMIC, AND FORWARD-THINKING ENVIRONMENT."

And, I've learned a lot of lessons along the way. The most important lesson I've learned is that the best solutions never come from a single person. The right kind of team ultimately leads to amazing solutions, and you need to know how to work collaboratively in an effective manner to move great ideas forward. Another important lesson I learned is the value of ownership—everyone, working toward a common goal, needs to fully know their role and responsibility and see the path to their own success in support of the organization's overall strategy. Lastly, we all need metrics. We need to have metrics so that we're all working toward a common and measurable goal, with markers along the way that let us know what worked and what didn't.

What inspired you to become an engineer?

Growing up, my family was not engineering-inclined, but I got a lot of encouragement, especially from my family and teachers, to be the best version of myself I could be. And, I happened to be good at math and science.

I remember the day in first grade when I realized, for the first time, that some people thought boys were better at math and science than girls—I couldn't believe it. I had been so sheltered that up until that point, I had actually thought maybe girls were better than boys at that sort of stuff. That experience had a profound impact on me. I remember thinking at the time, "Well, if someone is going to say I'm not good at this, I'm going to prove them wrong." It was a huge motivator.

I also had a wonderful calculus teacher in high school who provided a lot of encouragement, and a physics teacher who pulled me aside and told me, "Gosh, you have a lot of potential here." Other than family, few people had formally done that before, so it instilled a level of confidence in me to pursue engineering in college. Without that kind of support from key people, which we all need in our lives, I'm not sure I would be where I am today.

You are only the second woman to hold the title of "Dean" at Thayer. What is the significance of that for you? What are some experiences that have helped shape the kind of leader you'll be here?

The significance is not lost on me. We live in a world where this is still uncommon, and reminding the world—especially our children—that women are not only valuable contributors, but also decision-makers and leaders in STEM is extremely critical for the future of science and engineering.

I certainly have encountered various chal-

lenges as a woman in a male-dominated field—I won't name them all here—but it has meant that I have had to try that much harder to prove myself a bit more throughout my career. That has required me to be more introspective about my own strengths and weaknesses and push myself to be a better engineer. It's required me to take more time to understand other people and where they're coming from. And, it has allowed me to better connect with a more diverse community and consider multiple perspectives in doing my work.

What do you enjoy most about being an engineer?

I think most engineers would say that they love being an engineer because there's often a definitive answer to the problems they are trying to solve. In life, we encounter so many questions that have no answers, and an engineer's job is to search for concrete answers and provide solutions that can have a great impact on the world. It doesn't happen every day, but when it does, it's an amazing feeling. That potential for impact pushes us forward to continue the work we do as engineers. For me, as an engineer, there's a level of comfort and a lot of joy in that.

What's even more incredible is to teach engineering to young people and work with faculty who help push these discoveries forward. We all benefit from engineering—we drive cars to school, we use our iPhones—but how many of us understand how these thing work? To work with young people and open their eyes, to bring them to that "aha" moment, and to show them how they can impact society with their human-made inventions in new ways—there's really no feeling like it.

Being dean takes this experience to the next level. Engineering in an academic setting is a unique opportunity to tackle society's challenges in a new way and in an exciting, dynamic, and forward-thinking environment. We are working collaboratively to design and deliver an educational experience that will impact generations of future engineers and society at large. It's something most people in the world just don't have the chance to do, and I'm honored I have the opportunity to do that.

JUST THE FACTS

ALEXIS ABRAMSON

13th Dean
Thayer School of Engineering at Dartmouth

PRIOR ROLES

Milton and Tamar Maltz Professor of Energy Innovation

Case Western Reserve University

Technical Advisor

Breakthrough Energy Ventures

Director of Great Lakes Energy Institute

Case Western Reserve University

Interim Chair, Electrical Engineering and Computer Science

Case Western Reserve University

Chief Scientist and Manager, Emerging Technologies Team

Building Technologies Office
U.S. Department of Energy

EDUCATION

BS
Mechanical Engineering
Tufts University

MS
Mechanical Engineering
Tufts University

PhD
Mechanical Engineering
University of California, Berkeley

What are some of your near-term goals and what is your long-term vision for Thayer?

In the short term, I expect to spend a lot of time listening and learning, as well as set up opportunities for others to listen and learn together. I believe very strongly in working collaboratively toward a vision that everyone can believe in—and that can't happen without a lot of dialogue, not just with me, but among all the stakeholders in the process.

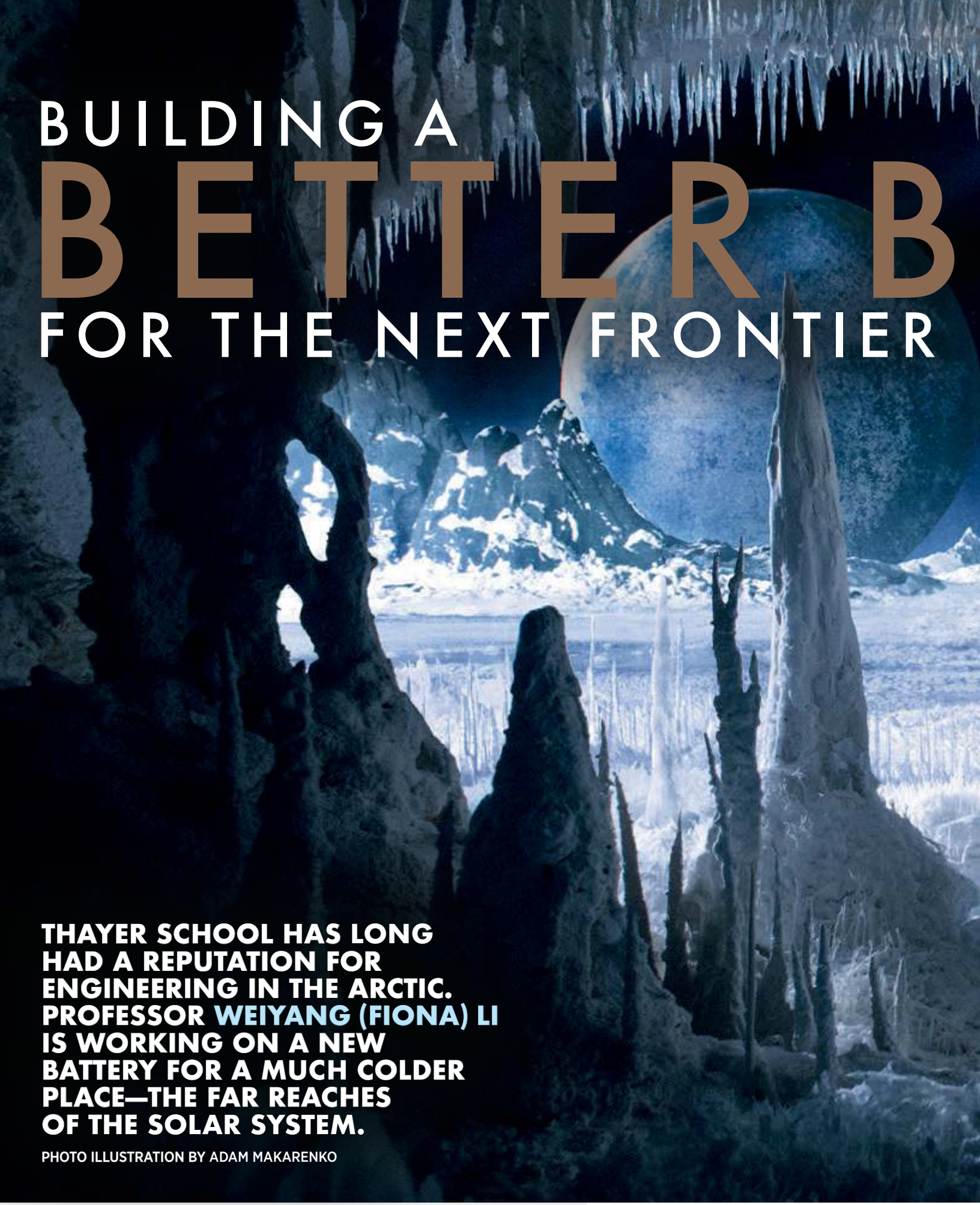
At the moment, I can point to three long-term goals. One of my ongoing goals is to raise Thayer's profile and the external visibility of the school. Thayer is already an incredible engineering school, but we have room to take ourselves to the next level and should be sharing our story with the world. There are a lot of different ways we can do that, and I look forward to engaging my colleagues in determining the best path forward.

Second, as we double our physical footprint and grow as a school, I want to make sure that we grow intentionally and strategically—to attract top scholars in the areas where we want to lead, and do so with a faculty that reflects the diversity of our society.

Lastly, I want to help increase more cross-campus collaboration and external partnerships. There's already a lot of that going on at Thayer, and I want to find ways to support and encourage additional partnerships across campus, with universities, with corporations, with alumni, and with other members of the Upper Valley community. While we want to sustain the specialness of being in Hanover, I also believe that stronger connections with the external world can further enrich our experiences, lead to greater educational opportunities, and encourage unique discoveries in the lab.

There is nothing more exciting and challenging to me than taking ideas from our academic community and turning them into reality. I see a future ahead where we can have enormous impact, not only at our own institution, but on the world. I really look forward to working with the Dartmouth community to do exactly that.

KATHRYN LAPIERRE is the senior editor of *Dartmouth Engineer*.



BUILDING A BETTER B FOR THE NEXT FRONTIER

THAYER SCHOOL HAS LONG HAD A REPUTATION FOR ENGINEERING IN THE ARCTIC. PROFESSOR WEIYANG (FIONA) LI IS WORKING ON A NEW BATTERY FOR A MUCH COLDER PLACE—THE FAR REACHES OF THE SOLAR SYSTEM.

PHOTO ILLUSTRATION BY ADAM MAKARENKO

ATTERY

BY LEE MICHAELIDES

Low ion mobility—anyone who has encountered the frigid winters up north has experienced it.

It's what happens when batteries get extremely cold. Low ion mobility—or the slow-down of electrochemical activity inside a battery—is the reason your car has trouble starting on a cold morning and why a cell phone suddenly powers down during a frosty winter walk.

Professor Weiyang (Fiona) Li, whose research focuses on renewable energy and energy storage systems, understands this phenomenon well. Her ongoing efforts to develop longer-lasting, high-effici cy batteries for extremely cold temperatures has the potential for huge impact—not just in how we power our lives here on Earth, but also for the far reaches of outer space.

Li is one of 11 early-career faculty selected by NASA last year to develop innovative, early-stage technology to support the needs of the nation's space program. "The Space Technology Research Grant Early Career Faculty Awards are one of our favorite ways at NASA to use the innovative minds in academia to help solve our high-priority technology challenges," says Jim Reuter, acting associate administrator for NASA's Space Technology Mission Directorate in Washington, D.C. "I'm excited to see how they advance these technologies."

Now in the second year of a three-year, $600,000 grant, Li is exploring new battery chemistries that provide energy for future spacecraft travel to the surface of Mars or the edges of the solar systems in sub-zero temperatures.

While temperatures in space dip far below those in the coldest parts of Earth—up to hundreds of degrees Celsius below zero—for the purposes of the grant, NASA requires an energy storage system that can function at negative 40 to 80 degrees Celsius.

"We proposed a new sodium-based battery that we hope will work well under low temperatures," says Li. "How do we improve kinetics under such extreme temperatures? That's the puzzle we have to solve."

WHILE NASA DOES NOT EXPECT A MARS ROVER-READY battery to come out of Li's lab, she hopes to demonstrate by the end of the project how a sodium-based energy storage system can work on a small scale.

"Because this is a completely new system, there won't be a full prototype, but there will be a small battery assembly from our lab that we test at very low temperature," Li says. "We start with small coin-cells, like you can buy at the supermarket, to see if they function in extremely cold temperatures," says Li.

For the ongoing tests, Li installed in her lab an environmental chamber that can drop to negative 85 degrees Celsius. If her research is successful, the next step will be building a larger, higher-capacity, sodium-ion battery.

"For the future, we need to scale this up," Li says. "A bigger size will present a lot of challenges. For now, NASA is more interested in the material development and a fundamental kinetic study of the chemistry."

Why sodium? When you are looking for a solution that's "dirt cheap," you start with what's already abundant in dirt, Li says. Compared to lithium, sodium is a far more accessible and plentiful element in the earth, and has a specifi capacity 12 times higher than lithium.

In addition, the cost of lithium is more prohibitive, especially on a large scale. During the past two years, lithium prices have jumped from $5,000 to $14,000 per ton. The cost of sodium: about $150 per ton. And in some studies, sodium was shown to have superior performance in cold environments.

Even with these benefits, sodium-based batteries still face hurdles—such as the growth of sodium dendrites inside the battery. Dendrites are sharp, needle-like chemical structures that grow from the anode and can puncture the separation between the anode and cathode. When the dendrite touches the cathode, it causes a short circuit that can cause the battery to overheat, explode, or catch fi e. Dendrites are why some current generations of lithium batteries—which power everything from Tesla cars to laptops and cell phones—have burst into flames.

One promising path toward solving the dendrite problem involves coating anodes with nano-scaled layers of graphene. The results from the lab have been encouraging.

"We believe this could be a viable route toward high-energy, sodium-based battery systems, and can also provide valuable insights into lithium batteries," Li says.

LI'S WORK ALSO HAS FAR-REACHING IMPLICATIONS FOR cold regions closer to home. With climate crises,

NOW IN THE SECOND YEAR OF A THREE-YEAR, $600,000 GRANT, LI IS EXPLORING NEW BATTERY CHEMISTRIES THAT PROVIDE ENERGY FOR FUTURE SPACECRAFT TRAVEL TO THE SURFACE OF MARS OR THE EDGES OF THE SOLAR SYSTEMS IN SUB-ZERO TEMPERATURES.

particularly in the Artic, where scientists have observed the most alarming impact of global heating, there is an urgent need for renewable energy and sustainable energy storage solutions to minimize further catastrophic impact.

While energy from renewable sources such as wind and solar remain some of the most Earth-friendly solutions to curbing greenhouse gas emissions, the energy generated still requires viable battery and energy storage systems to effectively deliver and power vehicles, homes, or appliances.

Rechargeable batteries capable of withstanding extreme temperatures and other conditions are key to facilitating technology to implement renewable energy use on a more a sustainable and scalable level.

At Dartmouth, Li, along with Assistant Professor of Chemistry Katherine Mirica, Associate Professor of Engineering Amro Farid, and Sherman Fairchild Professor of Engineering Ian Baker, have teamed up with the Arthur Irving Institute for Energy and Society at Dartmouth and researchers at the U.S. Army Corps of Engineers' Cold Regions Research and Engineering Laboratory to develop energy storage solutions for extremely cold environments.

Funded by the U.S. Department of Defense, this project will initially look at and propose novel, high-energy lithium battery solutions for the military units based in the Arctic and other cold regions. The goal is to extend the Army's mission capabilities by up to 30 percent while providing the next generation of energy-effici t delivery and energy storage systems.

The outcomes of this project also have far-reaching applications beyond the military. The solutions have the potential to provide communities in the Arctic and polar regions currently contending with the catastrophic effects of global warming with renewable energy storage solutions and energy-effici t power delivery systems.

Li arrived at Thayer School in 2015 as a research scientist, before joining the faculty as an assistant professor in January 2016. More recently, she was named the inaugural chair of the William P. Harris Career Development Assistant Professorship, a distinction reserved for promising faculty in their early careers.

She earned her bachelor of science and master of science degrees in chemistry from Nankai University in China and a doctorate in biomedical engineering from Washington University in St. Louis, Mo. Prior to her work at Dartmouth, she spent four years as a postdoctoral fellow at Stanford, working on energy storage and battery systems in the university's materials sciences department. She holds three Chinese and one American patent.

Li was attracted to Thayer's unique approach to cross-departmental learning and research and its strength in bioengineering.

"I appreciate the interdisciplinary collaboration, and I was also really attracted to how biomedical engineering and energy and chemistry could work together closely in the same space," she says.

The intersection of biomedical engineering and her work with batteries points to another future avenue of research for her lab—improving the batteries used in implantable devices.

"There is a lot of uncertainty about the future," Li says. "What is certain is that we are working hard to make sure we can develop batteries and energy storage systems that help deliver energy to some of the coldest parts of Earth and even to space. It's a very exciting to part of the solution."

LEE MICHAELIDES is a contributing editor to *Dartmouth Engineer*.

THIS PAGE: ROBERT GILL

COLD TRUTHS

Professor Li and her team are working with the Irving Institute and CRREL to develop rechargeable batteries capable of withstanding extreme temperatures which are key to facilitating technology to implement renewable energy use on a more a sustainable and scalable level.

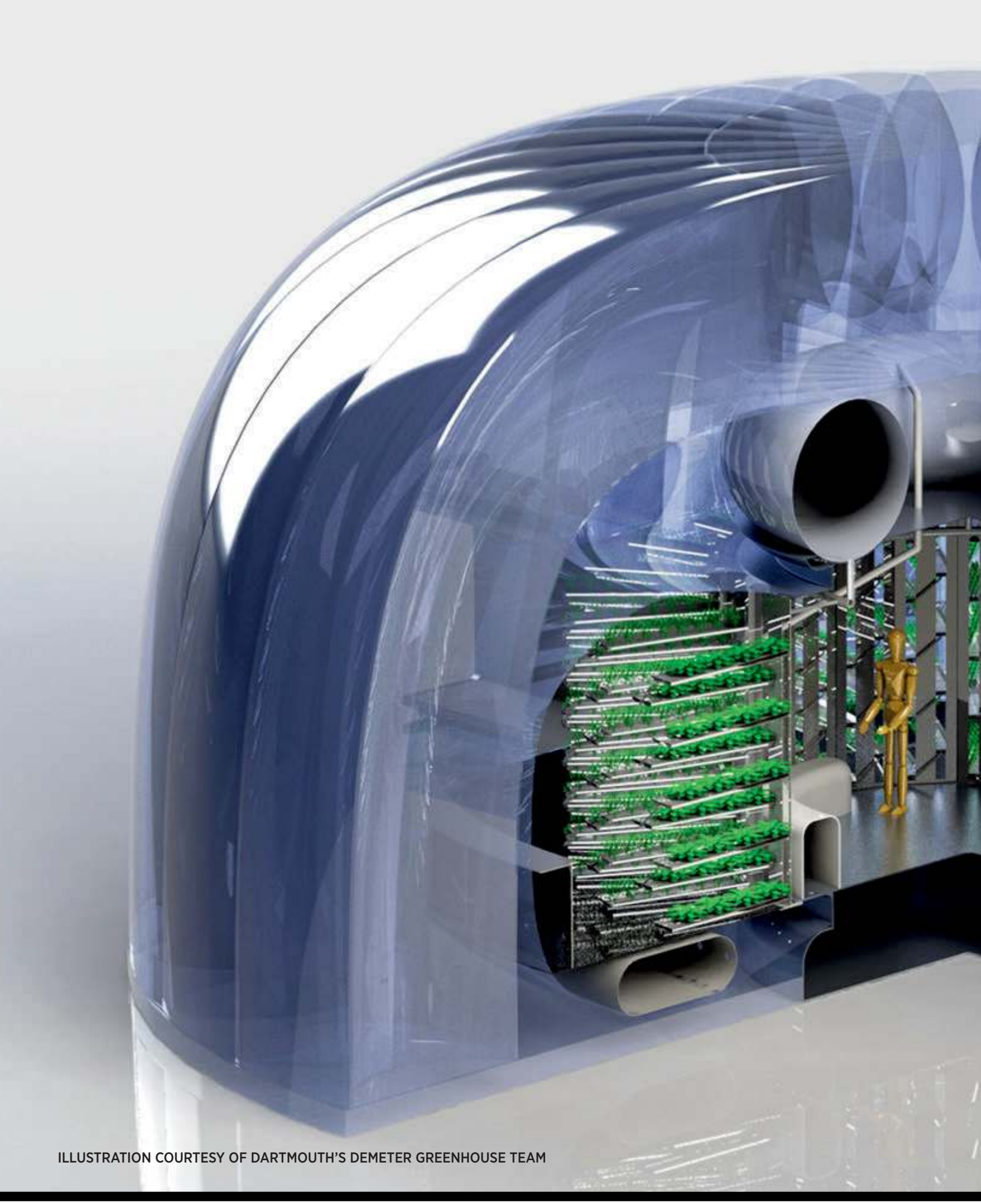


ILLUSTRATION COURTESY OF DARTMOUTH'S DEMETER GREENHOUSE TEAM

ON A MISSION TO

MARS

How did students, with no background in rocket science or aerospace design, end up winning NASA's BIG Idea Challenge? By leaning on a Dartmouth engineer's greatest assets: design-thinking and collaboration.

BY EUN LEE KOH

It all started with an email she would typically ignore.

In the summer of 2018, Professor of Engineering Laura Ray received an announcement from NASA seeking proposals for its annual BIG Idea Challenge. The challenge? Design a greenhouse for Mars that can grow food and sustain a colony of astronauts on a 600-day surface mission to the red planet.

She had received solicitations like this before, but something about this challenge made her look twice.

"Now, we normally wouldn't take this on, but I thought, 'This could be perfect for our capstone design class,'" said Ray, who was then serving as interim dean and as a faculty advisor for ENGS 89/90, Thayer School's engineering design capstone courses that pair student teams with real-world industry-sponsored projects. "This wasn't just about engineering, but also food science and nutrition, the conditions on Mars, and bringing together environmental engineering, energy, mechanical and electrical engineering, and complex systems. This was the kind of challenge made for our students."

FAST FORWARD A YEAR LATER, THE DARTMOUTH TEAM'S MARS greenhouse DEMETER, which (spoiler alert) went on to win the BIG Idea Challenge in April, now serves as the basis for NASA's advanced concept of operations for a greenhouse that could be tested in lunar and cislunar operations for further development.

Finalized in October through the Game Changing Development program at NASA, the newly developed greenhouse concept, dubbed CYBELE, largely draws from the Dartmouth team's winning proposal and is now part of NASA's early efforts to establish a long-term human presence on Mars.

BACK IN THE FALL OF 2018, AS ENGS 89 BEGAN, RAY COLLABORATED with her fellow faculty advisors Professors John Collier, Benoit Cushman-Roisin, and Lee Lynd to pull together a team of students with diverse training and skillsets. Led by Alexa Escalona '18 Th'19 and Zoe Rivas '18 Th'19, the team comprised of David Dick Th'19, Grace Genszler Th'19, Thomas Hodsden '18 Th'19, Peter Mahoney '19 Th'19, Morgan McGonagle '18 Th'19, and Christopher Yu '19 Th'19.

Despite the students' initial enthusiasm for the project, the team members knew their work was cut out for them.

The team began the project knowing nothing about farming and agriculture on Earth, much less an extraterrestrial environment. As children, some had aspired to become astronauts, but none had taken actual courses in aerospace engineering. (Dartmouth does not have an aerospace engineering program.)

Even the most basic questions—what crops to grow or how to grow plants in a greenhouse—introduced a unique set of challenges on Mars. The Martian soil, they learned, was filled with perchlorates deadly to the human thyroid. The atmosphere was bombarded by radiation.

In addition, the team need to figure out how to package the greenhouse, transport it through space, then deploy it—all without human intervention.

"Anything you do on Mars has to be done in a very tightly controlled environment—you can't just let in fresh air, you can't waste water, energy is very precious," said Molly Anderson, Game Changing Development principal technologist for next-generation life support at NASA's Johnson Space Center in Houston. "You have to do it in ways that are mass-efficient, energy-efficient, cost-efficient, and integrated tightly with the habitat that the crew is living in."

With these hurdles to overcome, the team leaned on their greatest skills as Dartmouth engineers: design-thinking and collaboration.

"Design-thinking is what truly helped us," Escalona said. "We're so used to using that type of thinking at Dartmouth. We always tackled every problem from a needs-based approach and iterated and iterated until we got it right."

"We took a ground-up approach," Hodsden said. "We began with the calories and nutrients the human astronauts would need to be happy and healthy so far from home. Then, we considered a number of different growing systems that would be the best fit for the greenhouse. Once we decided on a hydroponic approach for the greenhouse, we designed a structure to contain it, then figured out how it could be packaged to meet the size constraints and shipped from Earth."

The students were also unafraid to ask for help, and quickly adapted to working outside of their specific engineering disciplines. They conducted independent research, visited the Dartmouth Organic Farm to learn more about farming, and solicited guidance from life sciences faculty on crop cultivation and nutrition. Max Fagin Th'11, Thayer alumnus and senior aerospace engineer, who served as an additional advisor to the project, guided them on aerospace engineering and design.

AT THE START, THE TEAM STARTED WITH 90 DIFFERENT VARIETIES of crop species. Through research, they winnowed it down to eight—kale, soy, sweet potato, potato, broccoli, strawberry, wheat, and chufa—hardy crops that also provide the necessary nutrition for human survival.

They prototyped multiple structures and layouts, before deciding on the torus-shaped dome, and iterated on a number of different ways to package the greenhouse, before deciding on folding, collapsible membranes.

"We teach students to be good problem solvers and encourage them to be unintimidated by the fact that that their background doesn't match the problem," Collier said.

"As students here, we're used to not being boxed into one specific type of engineering," Rivas said. "My background and training is as an environmental engineer, but to work on a project of this magnitude, I had to step outside of that. We might not have had the opportunity to work on and contribute to all the different parts of this project, if we were only trying to stay in our corners."

"The project was very interdisciplinary," said Hodsden, a mechanical engineer. "I was able to channel some of my background in CAD design for this project, but it involved a lot of systems engineering and a lot of biology. It helped to have a team with such diverse backgrounds. We could all kind of occupy a different role in the project, but also have the opportunity to step into new roles as we identified new challenges."

In April, the team traveled to NASA's Langley Research Center in Virginia to present their greenhouse concept to a panel of NASA scientists. Named DEMETER after the Greek goddess of harvest, the greenhouse had the potential to grow the food crops in a rotating, nutrient-filled, hydroponic system that provides enough nourishment for a four-person crew on a 20-month mission to Mars. In addition, to support the health and well-being of astronauts, their design included a running track around the perimeter of the greenhouse and a relaxation area.

The team edged out four other university team finalists from MIT, University of California, Davis; University of Colorado, Boulder, with Harvard, Cornell, and University of Hawaii, Manoa; and the University of Michigan with Pennsylvania State University, Purdue University, and the University of Wisconsin, Platteville.

Escalona, who earned a summer internship at NASA upon the team's win in April, had the opportunity to further the Dartmouth team's work through the Game Changing Development program. Escalona was part of the team that drafted the advance concept of operations document for CYBELE, in collaboration with other interns and under the mentorship of NASA scientists.

"It is incredibly humbling to know that all the work we put into this project could someday become part of something so monumental as a future human mission to Mars," Escalona said. "This was literally a dream, to be part of something so much bigger than myself."

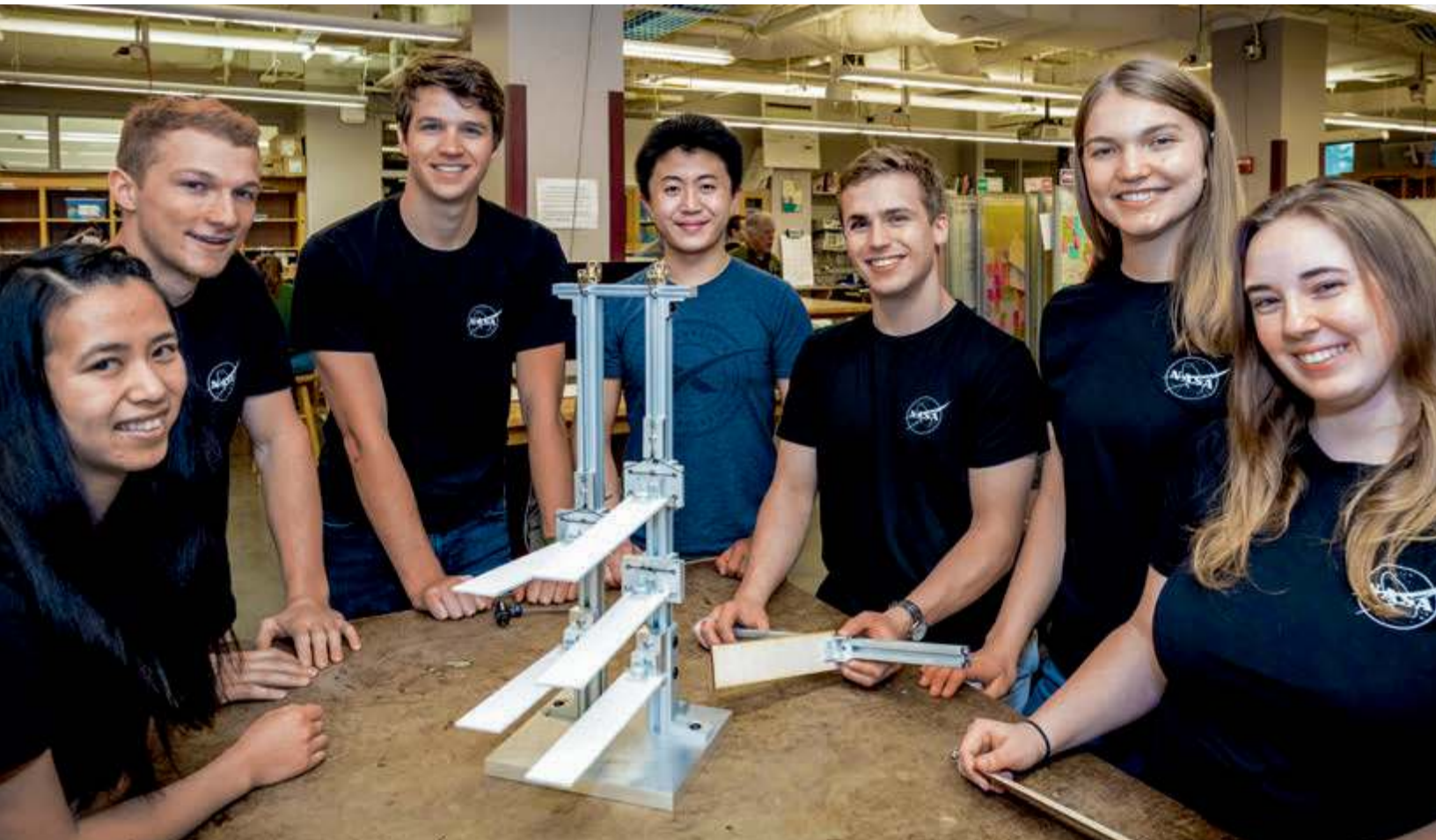
EUN LEE KOH is editor of *Dartmouth Engineer*.

OPPOSITE PAGE: LARS BLACKMORE

LEFT: A close-up of the greenhouse's folding membranes.

TOP RIGHT: The team grew strawberries using hydroponic solution and a set-up that closely mimicked the condition on Mars.

BOTTOM: The winning Dartmouth team, Grace Genszler Th'19, David Dick Th'19, Peter Mahoney '19 Th'19, Christopher Yu '19 Th'19, Thomas Hodsden '18 Th'19, Zoe Rivas '18 Th'19, and Alexa Escalona '18 Th'19. (Not pictured: Morgan McGonagle '18 Th'19)



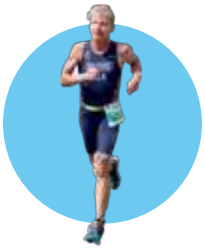
Alumni News

FROM AROUND THE WORLD

spotlights

Ironwoman

Donna Smyers '79 Th'88, triathlon world champion and physical therapist, has been inducted into the USA Triathlon Hall of Fame in honor of her three decades of success and contributions to the sport. She has twice been named USA Triathlon Masters Triathlete of the Year and won four USA Triathlon national championships, two International Triathlon Union world championships, and six Ironman world championships. Back home in Adamant, Vermont, she focuses on problem solving for anyone trying to stay active at Fixer-Upper Physical Therapy. "My specialty is helping athletes of all ages return to their activities through manual therapy, exercise, and education," says Smyers, who earned a master's in materials science at Thayer and then a master's in exercise science at the University of Oklahoma. "Materials science is about stress, strain, fatigue, fracture, plastic fl w, materials aging, and mechanics," she says. "That is exactly what PT is about on the human body, so it applies all the time. I think I look at things much more mechanically than most PTs do."



DONNA'S 3 TIPS TO STAY ACTIVE WITHOUT INJURY

1. **Enjoy it.** "Find something you like, especially with a social component, or sign up for an event to have a goal to work toward."
2. **Go slowly.** "Everything requires a slow phase in, even gardening or stacking wood."
3. **Act your age.** "Avoid fast, reactive, dynamic sports with people half your age. Older people process more slowly and don't bounce like they used to, so plan on that."

Influencer

Brian Nickerson '00 is the man behind the curtain. As the founder of MagicLinks.com, he is tapping into the influence friends, family, and experts can have on customers' decisions. His website allows "influencers" to share the products they love and earn income as their fans shop across any social media platform. To date, the engineering sciences major says, MagicLinks' more than 20,000 influencers have advised more than 150 million shoppers in videos that have been viewed more than 21 billion times. "Brands pay based on sales driven by the MagicLinks community of influencers," he says, pointing to a recent success story: "HP approached MagicLinks to drive awareness and sales of a wide range of back-to-school-related HP products," he says. Although HP would typically focus on tech-focused influencers, MagicLinks recommended YouTube sensation Jen of JENerationDIY, "based on her affi ty with a target demographic with high propensity to purchase technology products," he says. "Here, we helped marketers identify unknown or unserved market segments to drive purchase activity."

▼ Brian Nickerson '00 has influenced more than 150 million shoppers through MagicLinks.com.

Inventor

David Halpert '77 Th'79 of Brownsville, Vermont, reached No. 11 on *The Washington Post*'s list of "Notable Influential Inventions" of the past 180 years for his work on bitmap graphics. As an engineer with Creare in Hanover, Halpert was awarded a patent in 1984 for a method that was further developed into a type of graphics used for computer displays and image storage.

Sylvanus Thayer Fellows

In October, Thayer School's Board of Advisors named **Robert Garman '69 Th'70** and **Jessica Duda '96 Th'97 Gr'99 Th'99** Sylvanus Thayer Fellows in honor of their service to the School. "Thayer is a very unique place," says Garman, "and the intimacy and connectedness that comes with that builds bonds where you figu e it's appropriate to give back."

After his service as a nuclear engineer for the U.S. Naval Nuclear Propulsion Program, Garman had a 25-year career with Exxon, retiring in 2002 as controller of its 150-person biomedical sciences affiliate. Garman is active with the Friends of the Irving Institute and the Dartmouth Society of Engineers and has volunteered on the executive committee of the Thayer Annual Fund since 2001, for the Career Network and Moosilauke Forum, and as an admissions interviewer. He has also supported research in energy through the Energy Challenge and Bengt Sonnerup Fellows initiatives, the latter in honor of his Thayer mentor.

"The highlight during the whole five years was working with Bengt Sonnerup as a computing assistant on his NASA grant in the sum-

On the Job

ASHIE BHANDIWAD TH'13 | FOUNDER OF STEMCHEF

"My idea is to take any scientific element and concoct a recipe that fits the bill." —ASHIE BHANDIWAD

OPPOSITE PAGE: COURTESY OF BRIAN NICKERSON; THIS PAGE: COURTESY OF ASHIE BHANDIWAD

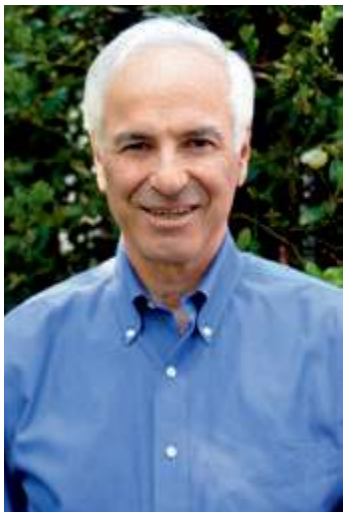
Mix one bioscientist and a curious 3-year-old. Stir in a conversation about STEM education with a former Thayer engineering dean. The result: StemChef, a hands-on program that helps kids ages 7 and up concoct delicious desserts while learning scientific concepts. It's a recipe for success that Bhandiwad is sharing across the San Francisco Bay Area.

Where did you develop the concept of teaching science through cooking?
It started with a conversation four years ago with Joseph Helble, former dean of Thayer School of Engineering who is now Dartmouth's provost, that revolved around how to get more girls interested in STEM at a young age. Around that time, I worked at UC Berkeley and had a really long commute. Dinnertime was the only quality time I would get to spend with my daughter. And, she had every question under the sun. In response, I spent most evenings demonstrating lessons in the kitchen while I made dinner. The foundational knowledge in science that my daughter was forming was unbelievable. I wondered what this strategy of teaching science through cooking could do for future generations. So, two years ago I founded StemChef.

How did you introduce StemChef?
I rolled out summer camps, afterschool enrichment classes, demo classes, and visited schools. The program was received with enormous enthusiasm. Kids get to cook and then eat what they make—what's not to love? And their little brains soak up the scientific concepts and they understand the implications because they apply them in the recipes. I thought it would be great to combine the educational aspect of StemChef and the immersion experience of escape rooms to make this new offering. Children solve puzzles, find clues, tinker with science, and then use the clues and science to make the special dessert to escape the Candy Lab.

How do you lead an "escape"?
Each session accommodates up to 10 participants at a time, and it takes anywhere from 55 to 80 minutes. The Candy Lab is one big room split into separate sections: the lab, the kitchen, the garden, the gallery, the library, and a clue wall. Kids get a box of clues that has them visiting each "room" in a structured way to get more clues. They use their keen perceptive senses, analytical skills, and common sense to crack the puzzles. Independent working is intrinsically built into the experience, but in case they need hints I provide them. It is amazing to see the kids' exhilaration when they solve puzzles and "discover" the science that the clues lead to. The sense of accomplishment they get when they make a tangible recipe from a mere abstract concept is even more gratifying to see.

◀ Jessica Duda '96 Th'97 Gr'99 Th'99 and ▼ Robert Garman '69 Th'70 have been named Sylvanus Thayer Fellows.



mer between my graduation and Thayer," says Garman. "We were developing ways to run on Dartmouth timesharing and output visual results and it helped me realize what I wanted to focus on in the fi h year." He went on to earn a BE with a concentration in electronics and systems, and then an MBA from MIT's Sloan School of Management in 1977.

Duda, who serves as chair of the MEM Corporate Collaboration Council, says Thayer's hands-on approach to learning kept her engaged: "You learned textbook theory in class and you got to build a bridge or a Stirling engine—mine still sits on my parents' bookcase." She earned a BE as a Clare Boothe Luce Fellow and an MEM and MS through a dual-degree program with a focus on biomechanical and biomaterials research and orthopedics that included working on a thesis in John Collier's lab. "I had the opportunity to explore real-world problems with John Collier. He had such a dedicated team of engineers and medical and industry experts that allowed me to see the impact we could have for patients," says Duda, who has built a career around translating technology into medical products for patients, most recently as director of business development at Harvard's Wyss Institute for Biologically Inspired Engineering. In addition to the MEM Corporate Council, which she joined in 2004, Duda has volunteered with the Career Network, Thayer School Alumni Fund, and as an admissions interviewer and has been a member of the Sylvanus Thayer Society for Leadership Giving since 2012.

Visionary

Snake robots, steerable needles, robotic skull surgery—they're sci-fi concepts that **Michael Miga Th'98** has grounded in real-world applications as cofounder of the Vanderbilt Institute for Surgery and Engineering (VISE). His motto: "So, you think I can't do that? Watch me." He adds, "It sounds a little reckless, but it is more about overcoming naysayers on truly ambitious undertakings, such as the creation of our institute," says Miga, who joined the Vanderbilt biomedical engineering faculty in 2000. VISE moved last winter into a 7,000-square-foot suite in the Vanderbilt Medical Center that allows the 10 engineering faculty easy access to more than 40 clinicians, a machine shop, mock operating room, and wet lab. Since the program's start in 2011, it has graduated more than 40 PhD students, secured 26 patents and seven licenses, and deployed $30 million in grants across dozens of cross-disciplinary research efforts. One of the latest is Miga's training program in surgical engineering, "where they can invest a lot of time in understanding the cutting-edge areas of engineering that are impacting the clinic in terms of technology," he says. "Oftentimes we can create technology and have no sense of how it will influence the trajectory of care," he says. "Our students will have this experience to engage with clinicians to shape their ideas and the direction of their research."

Historian

Electronics engineer **Norman Fine '55 Th'56** reveals the most influential invention of World War II in *Blind Bombing: How Microwave Radar Brought the Allies to D-Day and Victory in World War II* (Potomac Books, December 2019). The microwave radar systems emerging from British laboratories in the early 1940s enabled the Allies to overcome two obstacles to winning the war: German U-boats and weather. First, Allied forces were able to detect and destroy the U-boats that had shut down shipping lanes to the British. The radar also overcame the typically overcast European weather, which had grounded up to 80 percent of the bombing missions scheduled from 1941 through 1943. Microwave radar-equipped B-17s—"Mickeys"—led Allied bomber formations, dropping marker flares to highlight airfi lds, manufacturing plants, and oil refi eries. Just six months after the introduction of radar bombing, there were scarcely any German planes in the sky or any fuel to run them and few experienced pilots to fly them. With access to the water and the air, the Allies launched D-Day on June 6, 1944, and began reclaiming the enemy-occupied continent. Fine tells an engaging story, full of details and accounts from some of the people involved in the development and implementation of the new technology. He also draws on his experience in the fi ld—as a Raytheon consultant on the design for a large-screen radar display scope for use by U.S. air traffic controllers and cofounder of a cathode ray tube graphic display manufacturer—to explain in simple terms the most important breakthrough in the ultimate Allied victory.

Ice Trucker

Engineering sciences major **Tracy Kim Horn '02** launched a new business last year, Parfait—a modern version of the ice cream truck—based in Lexington, Mass. She dishes up soft serve and paletas, Mexican-style ice pops made from scratch with mostly local ingredients and all-natural sweeteners (blueberry-ginger and chocolate fudge sweetened with Vermont maple syrup are crowd-pleasers). The adventure began four years ago when she and her 1-year-old twins were at the playground and heard the sound of an ice cream truck. "I was suddenly a kid again—an overly excited one at that," she says. "Except…now I was a parent who cooked everything from scratch for her family, and there was no way we were going to spend

money on food that was made with high-fructose corn syrup, modifi d cellulose, artific al flavors, or Red 40." The former pastry chef drew on her background in restaurant operations and her toolkit from Thayer to take her idea on the road: "My engineering degree came in handy while retrofitting an old USPS mail truck that I got on auction into a board of health-approved mobile food facility," she says. On her horizon: a takeout shop. "It's right on the Minuteman Bikeway, so we're excited to give the active community in the greater Boston area better food options when they're on the go!" Follow her on Instagram @parfaitplease.

Researcher

Biomedical engineering major **James Jung '14 Th'15** is off o study in Krakow, Poland, through a Fulbright scholarship. Jung will study the pathogenesis of psoriasis in the department of immunology at Jagiellonian University while taking classes in immunology, biotechnology, and the history, culture, and language of Poland. His interest in disease mechanisms grew out of witnessing friends and family experience illnesses such as psoriasis, diabetes, and cancer. "At a young age I didn't understand the mechanisms of diseases, but I was curious about them," he says. At Dartmouth, he worked in two research labs and served as a teaching assistant in chemistry and engineering courses. He worked most recently as a predoctoral research associate at the Lebanon, N.H.-based biotech company Adimab, founded by Thayer Professor Tillman Gerngross.

Councilor

Akwugo Nnama '12 Th'13 began her three-year term as a Thayer representative on the Dartmouth Alumni Council in July, replacing **Carrie Fraser '86 Th'87**. Nnama joins current councilor **Pablo Stern '01 Th'01**, a San Francisco-based senior vice president with cloud computing fi m ServiceNow. "The collaboration and community at Thayer is like no other," says Nnama, who recently earned a master's in public administration at Harvard and started working as an energy investment banking associate at JP Morgan in New York City. "Th s is a place where everyone knows your name and is willing to do everything to help you thrive." She will also serve on the council committees for alumni and student engagement, young alumni, and honorary degrees. "I look forward to working with Pablo Stern to ensure we do our best to represent our Thayer alumni community," she says, "as well as communicate effectively on behalf of Dartmouth."

▼ Tracy Kim Horn '02 brings the pops to the greater Boston area with her Parfait food truck.

OPPOSITE PAGE: KATHRYN LAPIERRE (LEFT), COURTESY ROBERT GARMAN (RIGHT); THIS PAGE: COURTESY TRACY KIM HORN

just one question

Q. What was your motto as a Thayer student and what is your motto today?

When I entered Dartmouth I was 17, too young and not ready for the challenges of college, so all through undergrad and Thayer my goal was "Try to catch up." Today, at age 83, I've made many wrong turns through the years, so it's "Do it right the fi st time." **—Ron Read '57 Th'58**

My motto while at Dartmouth: "Become an excellent and well-rounded engineer in the Thayer School tradition." My motto now: "Stay fit, well-informed, and able to successfully deal with modern life while continuing to be close to family, friends, and church members."
—Jerome Allyn '59 Th'60

My motto was "There's always a better way," courtesy of Professor George Taylor. And that has stood me in good stead throughout my career. Professor Taylor taught a class that was an introduction to industrial engineering and his mantra was, "When looking at a process or tool, there's always a better way." It was an approach that fit the fi ld of industrial engineering very well, of course, and that phrase was repeated to the point that we all embraced the idea. In his class we'd deal with a problem, maybe solve it, and then one of us would say the magic words and we'd look at the "solution" and try to fi d a better way. That attitude stuck, and some of my Tuck-Thayer friends, such as **Jim Wooster '59 Tu'60 Th'60**, continue to use it in day-to-day activity, as do I. It became words to live by.
—Ray Becker '59 Tu'60 Th'60

Motto then and now: "Don't put off until tomorrow what can be done today." **—Neil Drobny '62 Th'64**

Then: "Let's party." Now: "Carpe diem." I've come to realize that the days are limited and the construct of immortality sets in. I spend a lot of time on the DREAM project, which I founded in 1995 and now chair, which means I'm involved in policy and day-to-day efforts now. It's an educational foundation in the Dominican Republic that serves 9,000 indigent students in 27 communities. See more at dominicandream.com. **—Michel Zaleski '68 Th'69**

My motto when I was studying was "Learn fast computer engineering" so I could land a job. My motto now is "Build amazing products" so I can delight customers and leave a legacy.
—Vishal Gupta Th'94

Motto then: "Engineer for good, not for evil." Motto now: "Work hard. Play harder." **—Kendra Tupper '02 Th'03**

For my motto at Thayer, it would have to be the classic by George R.R. Martin: "Night gathers, and now my watch begins. It shall not end until my death. I shall take no wife, hold no lands, father no children. I shall wear no crowns and win no glory. I shall live and die at my post. I am the sword in the darkness. I am the watcher on the walls. I am the fi e that burns against cold, the light that brings the dawn, the horn that wakes the sleepers, the shield that guards the realms of men. I pledge my life and honor to the Night's Watch, for this night and all the nights to come." I'm not sure what it is now. Maybe having no motto is a motto in and of itself? **—Jacob McEntire Th'15**

My motto as an undergrad and now: "If you don't fall, you don't learn" (something my dad always says).
—Russell Beckerman '19

I figu ed out my motto junior year—and I use it every day: "The work always gets done." **—Matt Gardner '19**

As a MEM student: "Unless someone is dying, no need to fret. Be reasonable and things will work out." As someone nine months out: "Unless someone is dying, no need to fret. But promotions are nice, so do make sure to hustle." **—Wanfang Wu Th'19**

My motto was and still is: "Always Day 1." **—Junfei Yu Th'19**

thayer notes

| 1940s |

Ken Kelly '47 Th'48: Dartmouth and Thayer started me off on a great working life. I was project manager on large construction projects in Europe and the United States, including an oil terminal in Greece, airfi lds in England, a mountaintop antenna system in Scotland, and skyscrapers in Chicago and New York City. I saw many interesting things on my travels and met many interesting people. It was a very enjoyable career.

| 1950s |

Jerome Allyn '59 Th'60: I am fully retired, age 82, and enjoying life with my wife of 59 years, Frances (Smith '59). We are still living on our 10-acre place in Colchester, Vt. I am staying active by participating in our local church, town chorus, and town historical society. I continue to care for our place by doing all the yardwork on the two acres, including snow shoveling. I am still able to downhill and cross-country ski in the winter and sail in the summer.

| 1960s |

Neil Drobny '62 Th'64: I'm planning to retire from teaching at Ohio State next May and move to Kalamazoo, Mich. We will live on a lake and I will stay engaged academically part-time at Western Michigan University. My work at Michigan is undefi ed, except that it will be with the college of business and relabeled to sustainability.

Bob Sauer '66 Tu'68 Th'68: The article "Journey to Greenland" in the Spring 2019 issue of *Dartmouth Engineer* brought back memories of the summer of 1965 at Camp Century, a U.S. Army research base on the northern Greenland ice cap, less than 800 miles from the North Pole.

The Army Cold Regions Research and Engineering Lab on Lyme Road needed to fill 20 summer jobs in Alaska and Greenland. I spent seven weeks researching the construction properties of snow, during which time I learned the real meaning of "a cold day in July" and experienced isolation from the rest of the world. I also came to understand a real blizzard (we couldn't see a man holding the other end of a six-foot rope) and a real whiteout (an ice fog that makes sky, horizon, and ground indistinguishable, like being inside a milk jug).

Camp Century was built in tunnels in the ice cap—barracks, mess, offi space, latrine, maintenance shop—everything except our experiments. On the other hand, there was plenty of sunlight on the surface, where most of the work on our team's experiments was done. Working through the night was no issue, but even then we needed dark sunglasses.

The rapid escalation of the Vietnam War meant that all the jets available were ferrying troops and supplies to Southeast Asia, so our return trips at the end were on packed C-130s. There were a few other Dartmouth students working at Camp Century that summer, but **Steve Zeller '66** is the only one whose name I recall. The Greenland ice cap is a place like no other, with adventures like no others. I hate to think of the impact of climate change on it.

| 1970s |

Steve Askey '76 Th'77: I changed careers in late 2015 from engineer at an oil company to lead guitarist in a classic rock band, the Cat. 4 Band out of Daytona Beach, Fla. I'm just happy for every day above ground!

| 1990s |

Vishal Gupta Th'94: I am global chief technology officer and senior vice president of technology at Unisys. I partner closely with a team of 1,500-plus engineers in all aspects of more than 20 product releases a year. Th s summer we launched the fi st new product in Unisys in more than 20 years. It is called Cloud Navigator and it helps enable a smooth and secure journey to a multi-cloud world. We also work on a very interesting cyber-security offering called Stealth, which protects some important customers, including airports, banks, and some of the largest federal agencies. And we built an offering called Digistics, which leverages artific al intelligence and information technology to move cargo for nine of the 12 biggest airlines in the world.

| 2000s |

Kendra Tupper '02 Th'03: After serving as the chief sustainability offic for five years for Boulder, Colo., I just joined Google to lead its sustainability operations team. My team is working to minimize the environmental impact—namely energy, water, and waste—of Google's global portfolio of offi sites. I'm still living in Boulder and enjoying all of the typical Boulder things: biking, trail running with my dog, cross-country skiing, and getting really fi ed up about political issues.

Laura Weyl Th'08: Anders Wood Th'08, Margaret Martei Th'08 Th'09, Andrew Herchek Th'08 Th'09, Matthew Wallach Th'08, and I got our growing families together for a weekend mini reunion on Lake Winnipesaukee in June! There were some lasting friendships made in the great halls of Thayer!

| 2010s |

Sharang Biswas '12 Th'13: In May I left my corporate consulting job to refocus on my art career. Since then, I published an article in University of Waterloo's journal, *First-Person Scholar*, on using live-action role-play to build a queer community (fi stpersonscholar.com/queer-larp-community). Also, my game Verdure was named "Most Innovative" at the Indie Game Developers Network's Indie Groundbreaker Awards (astrolingus.itch.io/verdure). I received a grant from the Effing Foundation to work on an anthology of role-playing games that discuss sex and sexuality. I gave my fi st talk at the Games for Change Festival, on using Analogue games to promote sex positivity. And I have two interactive theater performances coming up this year in New York City: Knock Once for Yes with **Nick O'Leary '14** and Basic Principles of Esoterica with **Max Seidman '12** (wonderville.nyc/events/event-template-f7h7a). Additionally, I'm excited to teach an undergraduate course on video game design at Fordham and an MFA course at the International Center of Photography on art and interactivity this fall!

Jacob McEntire Th'15: Recently, I've been getting more into the gaming world. For an example, see the YouTube of me running a game for people from various other podcasts and streams at youtube.com/watch?v=Lnu5OFOHB4c, including some with 10,000-plus regular viewers. It was very exciting!

Matt Abate '17 Th'17: I am pursuing a doctorate in robotics at the Georgia Institute of Technology. I work in the fi ld of control theory, specifi ally, safety for autonomous robotics. I use math (differential equations) to figu e out how to represent the physical world accurately in code. Th s is not easy, as many times the physical properties of robots are poorly understood. For instance, in 2018 a Tesla Model 3 crashed into a semi-trailer and it was later discovered that this was due to a modeling error in the code (in part due to the fact that the code/car misunderstood friction). The analysis we do can broadly be applied to many applications from autonomous cars to manufacturing robots to power grids.

After I am done writing up some theory, typically my work is tested on a scaled model autonomous car—we have not had one crash yet, but there is still room for improvement. I partially attribute my success at Georgia Tech to a research project I worked on at Thayer under Professor Gern-

gross. We were aiming to build an autonomous lawnmower. Knowing what I know now, I think that lawnmower could be made more 'safe.' Additionally, I'm glad I studied mechanical engineering at Thayer; many of the students who work in robotics have electrical engineering backgrounds and struggle a bit with the physics. After my doctorate I hope to enter academia as a professor of engineering. Who knows, maybe I'll end up back at Thayer.

Russell Beckerman '19: I am currently interning at DMC Biotechnologies in Boulder, Colo., working with a Dartmouth '09 in downstream process development before heading into my fi h year for the BE. While here I have also taken one of the most beautiful hikes I've ever done and enjoyed the distinctly Boulder tradition of Tube to Work Day, where we floated four miles to the office with lab gear in tow. (See more at youtube.com/watch?v=tXrdw0z4_rI&t=22s.) Essentially, I am designing and building customized chemical separation, purifi ation, and analytical apparatuses to perform processes on bioreactor products (ion-exclusion chromatography, cryogenic condensation, molecular sensing, etc.).

Now I am using some of these instruments to draw conclusions about how to optimize product development to be low-cost and time-efficient. Th s has involved leveraging my coursework in chemistry and engineering as well as challenging me to adapt and come up with creative solutions. My concentration for the BE is in biotechnology/biochemical engineering.

During this time, I plan on furthering my education by taking ENGS 160: Biotechnology and Biochemical Engineering and ENGS 157: Chemical Process Design, in addition to my 89/90 capstone project. I will also be continuing my thesis research in developing nanoparticles for high-sensitivity liquid biopsy with the Zhang Research Group as a paid research assistant.

Matthew Gardner '19: I'm currently interning at Dassault Systemes in Waltham, Mass., working as a technical customer support intern for SolidWorks. I'm coming back to Thayer to finish the fifth-year BE. I'll have an electrical engineering concentration with an interest in integrating mechanical and electrical systems.

Wanfang Wu Th'19: I just got hired by stent maker Abbott Vascular as a divisional quality engineer. My team monitors the manufacturing processes of quality and process engineers to ensure regulatory compliance.

As an analogy, if we are an online forum, my team is like the admin who addresses gaps in the guidelines that the moderators follow. I'm based outside San Diego, Calif., and because Abbott sells internationally, we get audited by the regulators of all our target markets. On their audits, they review our internal reports on things such as what went wrong and our procedures for operators on the manufacturing fl or.

Junfei Yu '19: I have been working as a fellow at Dartmouth's Cook Engineering Design Center (CEDC) to help bridge industry and engineering.

I source, vet, and acquire cutting-edge technology projects to build up a portfolio for CEDC, and have also built a database of 2,000-plus companies from scratch. As I wouldn't be who I am today and where I am now without a Thayer and Dartmouth education, I believe that it is a great opportunity for me to give back to the Thayer community by coordinating with ENGS 89/ 90, the engineering capstone course, for the rising graduate class.

Second, I am passionate about technology startups and venture capital. Th s fellowship exposed me to more than 2,000 leading industry companies, let me be inspired by their ideas, and fostered my product management skills.

1.


2.


3.


4.

Gallery

1. Four researchers—including standing, from left, Steve Zeller '66 and Bob Sauer '66 Tu'68 Th'68—unfurled the DOC flag at Camp Century.

2. A mini-reunion on Lake Winnipesauke with Laura Well Th'08, Anders Wood Th'08, Margaret Martei Th'08 Th'09, Andrew Herchek Th'08 Th'09, and Matthew Wallach Th'08 included plenty of time in the water.

3. Russell Beckerman '19 enjoyed the Colorado outdoors during a summer internship with DMC Biotechnologies in Boulder.

4. Lead guitarist Steve Askey '76 Th'77, second from left, rocks out with the Cat. 4 Band.

obits

Gordon L. Ross '44 Th'44 Th'47 died on April 4, 2019, in Fort Myers, Fla., surrounded by his family. At Dartmouth he was active in the Dartmouth Outing Club, Dartmouth Society of Engineers, Foley House, Glee Club, Handel Society, and the Marching Band. After earning his bachelor's in civil engineering in 1944, Gordon enlisted in the Navy and served with the Seabees on Guam during WW II. He returned to Hanover to earn his degrees in civil and mechanical engineering from Thayer and then moved to Canton, Ohio, to begin a 39-year career with the Timken Co. engineering department. Gordon was predeceased by his first wife, Elodie, with whom he had Alan, Christopher '71, Laurel, and Peter, who survive him. In 1982 he married Darla, who survives him along with her two children, eight grandchildren, and two great-grandchildren.

John B. Helsell '46 Th'50—a longtime resident of Orcas Island, Wash.—died on May 16, 2018. His Dartmouth studies were interrupted when he enlisted in the 10th Mountain Division and then served as an infantryman in Europe until the end of the war. After graduation, Jack took a job as an engineer at Pacific Car and Foundry in Seattle and married Jan McKillop. In 1967 Jack and Jan began a new career as camp directors, developing Camp Nor'Wester on Lopez Island, Wash. They eventually moved to a piece of undeveloped family property on nearby Orcas Island, where he built a sawmill and then a barn, house, and workshops from timber logged on the land. Lumber from Jack's West Sound Lumber Co. has since been used to build bridges, parks, marinas, and homes across the county. He is survived by Jan, brother Robert '59 Tu'60 Th'60, and children Mary Jane, Susan, and Ellen and their families.

Louis F. Blaisdell '47 Th'48 of Isle au Haut, Maine, died January 14, 2019. "Bud" enlisted in the U.S. Marine Corps in 1941 and then came to Dartmouth through the V-12 program. He earned his BS with Phi Beta Kappa honors and then a degree in civil engineering in 1948 before beginning a successful career in structural engineering. He met Anne Palmer in March of 1944 and they enjoyed 65 years together. Bud was skilled with pencil, brush, color, canvas, and oar at an early age, painting scenes along the shore of the East River and rowing his boat many miles. Bud lived by the water for most of his life, teaching his family to swim, row, build, and sail small boats. He is survived by son John and his partner, Paula; son Robert; daughter Theresa; five grandchildren; and several great-grandchildren. Bud was predeceased by Anne, daughter Anne, and sons Louis Jr. and Frank.

James Smith Rudolph '47 Th'48 died in Sarasota, Fla., on April 15, 2019. Jim enlisted in the Navy at the age of 17 and came to Dartmouth as part of the V-12 program. He earned his AB in engineering sciences and then a doctorate in literature from the Sorbonne in Paris. He and his wife of 47 years, Adrienne, were art dealers and cofounders of Centicore Arts International in Ann Arbor, Mich., and traveled the world. Jim collected Renaissance musical instruments, 18th-century French furniture, contemporary art, vintage wines, and kitchen gadgets. He is survived by Adrienne; her children, Gabrielle and Adam; and his sister, Barbara, and her children, Amy, Stephen, and Eric.

Raymond F. Richard '48 Tu'54 Th'54 of Lebanon, N.H., died at home on April 21, 2019. Ray served in the U.S. Army Air Corps and in the Navy's Sixth Fleet in the Mediterranean as a lieutenant, j.g. He returned to the States to marry Gloria Sepp in June 1952. After graduating from the Tuck-Thayer program in 1954, Ray began a long and varied career in industrial management, starting at General Electric in 1948. His work took him to the United Kingdom, where his management of the Cummins Engine Co. plant at Darlington earned it the Queen's Award for Industry in 1966. After Ray's retirement in 1996, he and Gloria moved to Thetford, Vt., where Ray began a second career as a consultant. He was predeceased by Gloria in 2017. Ray is survived by three sons and their wives, Bruce '76 and Loretta, Dave and Kathy, and Dean and Christine; and grandchildren Jonah, Katie, and Sophie.

John T. Avery '50 Th'51 passed away on February 6, 2019. Jack was born and lived most of his life around Cleveland, Ohio. Jack served a year in the U.S. Navy before attending Dartmouth, where he earned his AB in engineering sciences and his degree in mechanical engineering. In 1952 he joined his father at Avery Engineering and taught Dale Carnegie courses. Jack started Keltner Sales in 1997. He was a Scoutmaster from 1969 to 1974, mayor of Pepper Pike from 1976 to 1991, and a member of the local country club for 70 years. Jack is survived by his wife of 65 years, Joan; son Tom and his wife, Mary; son Bill and his wife, Martha; daughter Ann and her husband, Greg; and grandchildren John, Melissa, Molly, Maggie, Bill Jr., Nick, and Ben.

Robert D. Shannon '51 Th'52 passed away on July 25, 2019, at Edgehill Retirement Community in Stamford, Conn. The longtime Connecticut resident attended Bridgeport Central High School, where he excelled at baseball and basketball, sports he continued to pursue at Dartmouth. After earning his degree in mechanical engineering at Thayer School, Bob returned to Bridgeport and began a long career as a civil engineer with the Clark Construction Co., rising to become its vice president. Bob was held in high esteem for his integrity, honesty, and work ethic by his coworkers, clients, and the many public officials with whom he worked. Bob and his wife, Joan, raised four daughters in Easton, Conn. She predeceased him in 2011. He is survived by daughters Cindy '76, Jo Ann '85, Nancy, and Linda; 10 grandchildren, including Luke '07 and Mark '11; and two great-grandsons.

Douglas H. Keare '56 Tu'57 Th'57 died on January 8, 2019. He completed the Tuck/Thayer program in business and engineering and went on to earn a PhD in economics at Princeton. He and his wife, Ginger, were married in 1959 and traveled around the world. He spent much of his career in international development, first with the Ford Foundation in Malaysia and then the World Bank in Bangladesh in 1970. In 1971 Doug and Ginger moved to Washington, D.C., where they raised their three children. He then worked with the Harvard Institute for International Development and the Lincoln Institute for Land Policy in Boston. He is survived by Ginger; daughter Heather '84 and her husband, Chris; son Doug '86 and his wife, Jill; daughter Stacey and her husband, John; and grandchildren Drew, Lauren '17, Carter, Lindsay '16, Brian '18, Jeff, Haley, Ryan, and Brooke.

Peter Christian Foltz '59 Th'59 of Hershey, Pa., died on November 6, 2018. At Dartmouth he received his degree in engineering sciences, participated in the Marching Band for four years, and was a member of Chi Phi. He was in Navy ROTC and upon graduation spent three years of active duty on destroyers. He then began a long career as a mathematics teacher, first in public schools in Norfolk, Virginia, and then for about 35 years at Hershey Junior College and Harrisburg Area Community College. He earned a master's in mathematics from Rutgers and served as founder and first president of the Pennsylvania Mathematics Association of Two-year Colleges. He continued his Navy career in the reserves, specializing in aeronautical engineering, and retired as a captain. He is survived by Patricia, his wife of 59 years; son Michael and his wife, Jodi; son David; daughter Susan; and grandchildren Steven, Kathryn, Lauren, Amanda, and Elizabeth.

H. Gordon Starkey Jr. '60 Th'61 of New London, N.H., passed away from esophageal cancer on July 13, 2019. A graduate of Phillips Exeter Academy, Gordon graduated from Thayer with a degree in civil engineering and began his career at Hazen & Sawyer Consulting Engineers, where he eventually retired as a partner. There he was a water resources, potable water treatment, and water storage and transmission specialist. His contributions were focused on New York City although he also had projects in Sao Paolo, Brazil; Danville, Va.; and Johnson City, N.Y. He had a major role on the benchmark North East Water Supply Study for

the U.S. Corps of Engineers. Gordon and his wife of 46 years, Marcella, resided in New Canaan, Conn., for 20 years before retiring to New London. Gordon is survived by Marcella and children Megan and Andrew and their families.

Loren A. Jacobson '60 Th'61 of Santa Fe, N.M., passed away on December 26, 2018, following an extended battle with cancer. He attended Dartmouth and the University of California, Berkeley, where he earned a degree in ceramics engineering in 1962. As a second lieutenant in the U.S. Air Force he worked as a ceramics engineer at Wright Patterson Air Force Base. He returned to Berkeley to earn a PhD in metallurgical engineering in 1968. His career highlights included work at the Wright Patterson Aerospace Research Laboratory, where he analyzed Russian military hardware and patented an alloy of gold, tin, and silicon for brazing electronic components; the Air Force Office of Scientifi Research at the Pentagon; and the Lawrence Livermore National Lab. He is survived by his wife, Linda, daughter Barbara '83, sister Margaret, grandson Nathan, niece Megan, nephew Mark, and former wife Joanne.

Brian Forrest Walsh '65 Th'66 died unexpectedly on July 3, 2018, during a bicycle ride along the New Hampshire seacoast. At Dartmouth he was named an All-American lacrosse goalie. He earned his BE at Thayer and his MS at Columbia. Brian was the founder and original CEO of three technology startups: Creare Innovations; Creonics, a robotics company; and Spectra Inc., an ink-jet printer technology company now known as FujiFilm Dimatix. He served the town of Hanover for 15 years on the board of selectmen, where he led efforts to relocate the middle school, helped transition Mary Hitchcock Hospital to its current Dartmouth-Hitchcock Medical Center location, and created a rowing dock at Wilson's Landing to accommodate local crew teams. He is survived by his wife, Linda, and children Leila, Michael, Amy, Emily, and Gretchen and their families, including grandchildren Anderson, Wyatt, Morgan, Carter, Nelson, Alice, and James.

THIS PAGE: GETTY IMAGES

| in memorium |

FRANK ALSCHULER '45 TH'46
— 1924-2019 —

Longtime Chicago architect built community ties.

Chicago Cubs fan Frank Alschuler shares a laugh with President Obama while celebrating the team's 2016 World Series championship.

Providing shelter for others was both a professional and a personal mission for Frank Alschuler. He died September 1, 2019, of cardiovascular disease, having spent half a century building community in his hometown Chicago. As an architect, he helped design multifamily residences; as a volunteer, he advocated for affordable housing and helped those with mental illness transition back into society.

Other than his years at college and in the Navy, Alschuler spent his entire life in Chicago. He came to Dartmouth from the University of Chicago's Lab School and earned a degree in civil engineering from Thayer as a member of the Navy V-12 program. At the end of WW II, Alschuler was posted in Hawaii and Japan, where he helped administer GED exams to servicemen who had not fin shed high school. He went on to earn a master's from the Yale School of Architecture in 1949 and returned to Chicago to begin his career under noted architect Bertrand Goldberg. He then cofounded Alschuler, Wolfson & Associates, where he designed residential buildings, later working for a general contractor, General Building and Maintenance Co., until retirement in his 80s.

Alschuler also turned his talents to creating sanctuary for those released from local psychiatric hospitals. He was a founding board member of Community Counseling Centers of Chicago (C4), a community mental health center serving low-income residents, and served on its board from 1972 until his passing. "Frank figuratively and literally helped build C4 from the ground up," Chris Carroll, C4 president and CEO, told the *Chicago Tribune* in September. He was on the organization's facilities committee and "figu ed out what buildings we should get, and how to renovate them," added his daughter, Mimi.

The city honored Alschuler and his wife of 54 years, Marjorie, for their long service to the community by placing an honorary street sign on their block in 2014. Marjorie died that year. He is survived by Mimi, son Matthew, and two grandchildren.

—Theresa D'Orsi

Collaborations

"We really try to teach science by doing science."

—VICKI MAY

STEM Outreach

Professor Vicki May, in partnership with colleagues across Dartmouth, is leading a collaboration between the College and the Montshire Museum of Science to create new science, technology, engineering, and math (STEM) programs for local middle school students and teachers. It's a five-year, $1.3-million initiative designed to build a STEM network for schools across rural New England.

May was named the 2013 N.H. Professor of the Year for her ability to make science accessible, and as project co-investigator she will draw on her previous efforts to enhance local STEM education. They included GK-12, a program that paired graduate students with middle school teachers, and "Design It! Built It!," a summer engineering workshop that introduced high school students to Computer-Aided Design and the Thayer machine shop.

"I try to incorporate hands-on activities, demonstrations, and projects whenever possible—anything that will get the students engaged in learning," she says. "My goal is to understand how to get K-12 students through college and excited and interested in engineering."

The first educational units will be developed by Dartmouth faculty, Montshire staff, and teachers at four local schools.

Graduate students will help design the units and serve as mentors for the middle school students. The program will be expanded to include teachers and students in eight additional schools during the fourth and fifth years of the project. Once the units are fully developed, they will be posted to a project website for use by any school system. —*Theresa D'Orsi*

KATHRYN LAPIERRE

@USAFootball Aug 15

Either we change the way we coach the game, or we're not going to have a game to coach.

FDM council members @BTeevens and @CALBrown17 of @DartFootball are changing the way football is coached, with the help of @MVPdummy.

@GeiselMDPHD Aug 19

Prof. Sarpeshkar of @Dartmouth and his collaborator, Dr. Kumar, have formed a firm to develop Sarpeshkar's patents.

One of the most fascinating of these is a flexible implant that harnesses glucose in the body and converts it into electrical energy.

@dartmouth Oct 2

Dartmouth engineering professor Eric Fossum and @RITtigers

have received a grant from @NASA to develop technology essential to future astrophysics missions. #DartmouthLeads

David Clemens-Sewall '14 and MS student Ian Raphael '18 prepare for their Artic research expedition to document climate change with Dartmouth Engineering professor Don Perovich.

A computer-aided mechanical engineering design omnidirectional vehicle

triathalon!

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I'm an Engineer and a Powerlifter

"Coming to Dartmouth, I got to learn how to apply all my knowledge of math, science, and physics to systems, and now I really want to pursue biomedical engineering because fitness and physical health has always been an interest of mine."

—Brygitte De La Cruz '21

WATCH DE LA CRUZ AND OTHER STUDENTS IN THAYER'S "I'M AN ENGINEER AND..." VIDEO SERIES AT YOUTUBE.COM/THAYERSCHOOL.