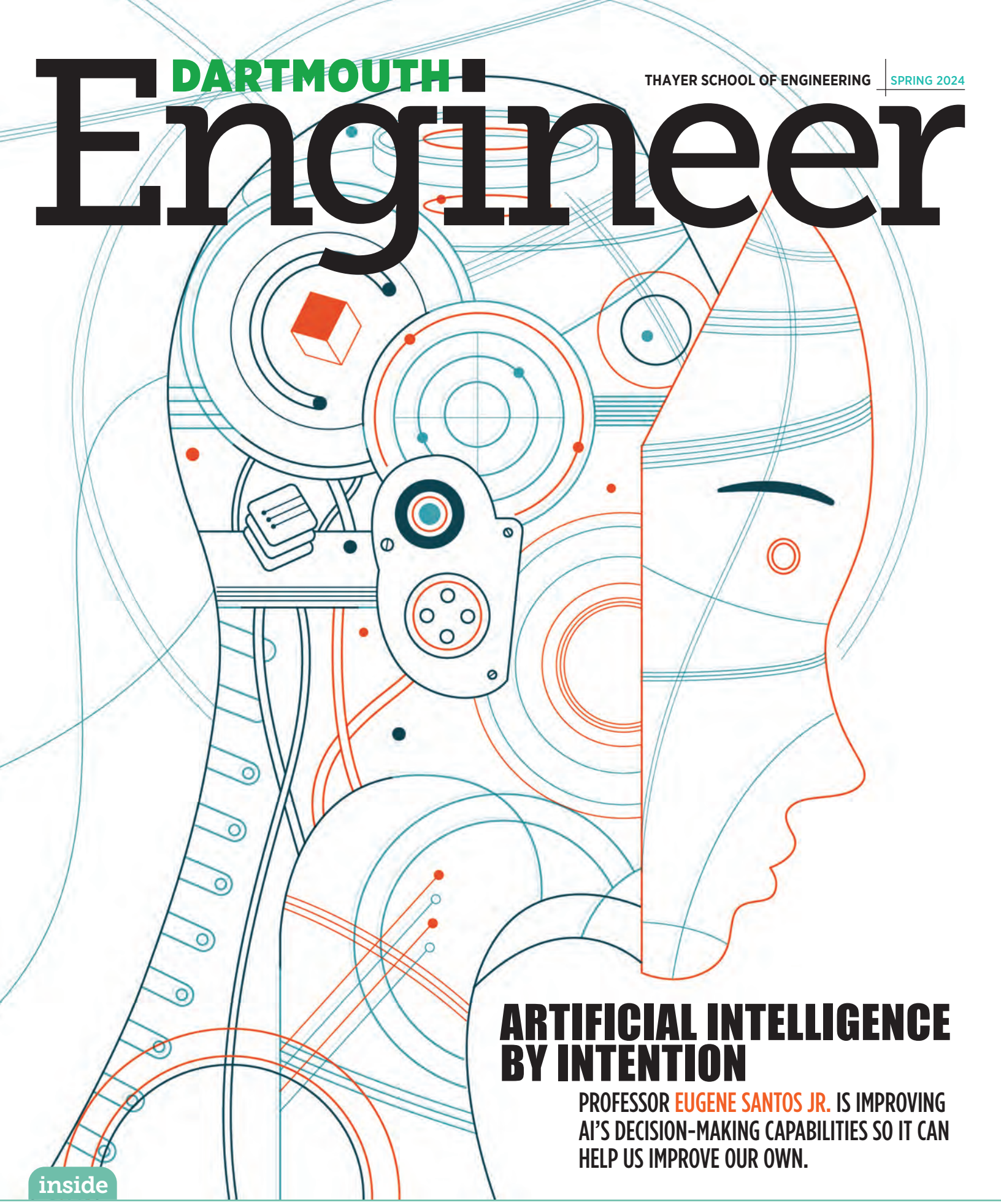
DARTMOUTH
Engineer
THAYER SCHOOL OF ENGINEERING | SPRING 2024



ARTIFICIAL INTELLIGENCE BY INTENTION

PROFESSOR EUGENE SANTOS JR. IS IMPROVING AI'S DECISION-MAKING CAPABILITIES SO IT CAN HELP US IMPROVE OUR OWN.

inside

First Look

BRIGHT IDEAS

Design Corps matches Dartmouth clients with students to help tackle complex, home-grown challenges using design thinking strategies. Clients gain access to a dedicated team that leverages human-centered design to conduct research and develop solutions to improve campus life.

Photograph by Robert Gill

Dartmouth Engineer
Volume 18 / Number 1

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DARTMOUTH ENGINEER
is published twice a year for the Thayer School of Engineering at Dartmouth community.

Printed by Villanti Printers

➤ NSF Graduate Fellow Nicholas Curtis, a PhD candidate in Professor Jiwon Lee's lab, studies the variances in the body's immune response to pathogens to inform better vaccines and treatments. See page 20 for more "Lab Work."

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"When you put all these individuals in the same room … something magical happens: Completely new ideas come out."

—PROFESSOR VIKRANT VAZE

CAMPUS CONVERSATIONS

Dean Alexis Abramson talks with Professor Vikrant Vaze.

Leading Thoughts

"Where Innovation Happens"

Dean Alexis Abramson and Professor Vikrant Vaze discuss the challenges—and joys—of optimizing systems.

The Stata Family Career Development Associate Professor of Engineering applies his operations research techniques to logistics challenges—from improving travelers' experiences to decarbonizing UN peacekeeping missions. I spoke to Professor Vaze about his approach to problem solving and how student perspectives bring unexpected solutions.

How do you define operations research?

VAZE: I define it as any method that helps you solve a decision-making problem using mathematics and computing. That can involve optimization, simulation, predictive modeling such as machine learning. It can involve statistics, game theory, mechanism design—all of these are examples of methods you can use.

Everything that we do comes down to three steps. First, there's the step of understanding the practical domain — this might involve the physics or the economics or the human behavior side of the problem. Once we understand that, we go into the question of how to model this practical system. The model will involve a bunch of equations and inequalities at the end of the day, but there is a lot of skill in getting there. It's an art as well as a science. That's where much of the innovation might happen. And then the third piece is how you solve these complicated mathematical models in a way that's optimal. That's again where innovation happens.

Typically, we end up doing a few iterations of this whole process. Many times you might talk to people, learn about the practical context, try to do a math model, and then realize, 'No, we have to change that.' That sort of feedback can happen at all these steps. But this is how all the problems go: the practical context, the math, the algorithms and computing, and then looping it back to the decision-makers.

I travel a lot. Can you walk me through how operations research is being applied to me, the flyer?

VAZE: We've done a lot of work where we asked ourselves and the airlines: 'How can we make the traveler experience better?' This can lead to a win-win because if travelers are better off, then they're willing to pay more. Most of the customer-centric work has been done in the context of pricing and revenue management, but until recently people didn't zero in on the customer behavior aspects of the scheduling process. Schedules are often designed to meet certain criteria that indirectly consider buying behavior, but they don't directly ask the real question of would the customers buy this? That is a big departure we've undertaken over the last decade. Now when I try to understand how good a schedule is, I'm going to include models from behavioral economics that take into account customer choice.

How have you expanded your research into other applications?

VAZE: One example, with the support of Irving Institute for Energy and Society as well as the Dickey Center for International Understanding, is a project called Powering Peace. This is about areas in the world ravaged by continuous conflict and a very serious problem associated with how we can bring more peace. Central to that challenge is what drives the energy dynamics, in particular, where many are focused on a diesel reliant economy. Diesel supply chains are very messy, complicated, and prone to attacks. It's a very different context because most people in these regions have no source of energy available. So, this project could drive access to electricity.

And risk on investment takes on a whole different meaning in these fragile, war-ravaged places. With these nuances in mind, we have multiple objectives and stakeholders, including several different United Nations departments involved in primarily peacekeeping operations. There is the local industry, the local governments of these states and regions, and investors. There are people interested in investing in these places, but they want to have a better analysis of the chances of these investments working out. What we are trying to do is build a big data-driven, decision-making framework where we provide tools to optimize their decisions. Then, we have tools that will take in those decisions, optimize the overall design of the system, and evaluate and present tradeoffs to stakeholders.

How do you involve students in your work?

VAZE: We have honors thesis students, MEM students, and our six PhD students working side by side. We have several [First Year Research in Engineering Experience] FYREE students, and then we have maybe two or three others who heard about the program and asked to be involved. Our freshmen are working on three different problems spread out across transport, logistics, healthcare systems, and energy and climate. When you put all these individuals with such an amazing variety of lived experiences in the same room and we start talking, something magical happens: Completely new ideas come out. That's one of the most exciting parts of my day.

PHOTOGRAPH BY ROB STRONG '04

THE Great Hall

NEWS FROM AROUND THAYER SCHOOL

"Students engaged deeply in discussions with their peers to frame aspects of the challenges facing South Sudan into research questions that could be addressed by the systems thinking skills taught in the class."

—PROFESSOR STEVE PETERSON

CLASSROOM

Powering Peace

ENGINEERING STUDENTS AND FACULTY ARE RESEARCGING WAYS to decarbonize United Nations (UN) peacekeeping missions in fragile states. Building on work from the Powering Peace project—Senior Engineering Lecturer Steve Peterson is engaging students in ENGS 18: "System Dynamics in Policy Design and Analysis" and ENGS 19: "Future of Energy Systems" courses.

"System Dynamics" students worked in small groups to identify and frame dynamic problems associated with energy and the UN mission in South Sudan. "Students engaged deeply in discussions to frame aspects of the challenges facing South Sudan into research questions that could be addressed by the systems thinking skills taught in the class," says Peterson.

A subsequent class homed in on a specific operational problem facing the UN Mission in South Sudan: managing the supply chain for diesel fuel into Juba. "I was delighted to see the degree to which students worked with each other to develop prototype simulation models of the supply chain," he says.

Three students are using Powering Peace and South Sudan as the context for term projects focused on the implications of conflict on education opportunities for children; processes that might enable a free and fair national election; and mechanisms for de-risking investment in renewable energy.

The project started when the Dickey Center for International Understanding hosted an international conference to consider ways to accelerate the transition of UN peacekeeping missions in five conflict areas in Africa. The project team includes Peterson and Professor Vikrant Vaze (find more on his work on page 5), the Dickey Center, Irving Institute for Energy and Society, and PhD researchers Lilly Yang Th'25 and Siqi Ke Th'28, who are conducting core research to build out the decision-making model. The goal is to enable stakeholders to evaluate and quantify key tradeoffs in the UN's process of transitioning to renewable energy.

ROB STRONG '04

INNOVATIONS

Engineering Mindfulness

RECENT RECONNECTIONS WITH A Dartmouth classmate and senior monastic prompted Professor Sol Diamond '97 Th'98 to reflect on how engineering is taught and its role in society. "My framing of 'human-centered engineering' is now significantly informed by the reflections I've had since engaging with Plum Village," says Diamond, co-director of the Design Initiative at Dartmouth (DIAD).

A serendipitous meeting with Brother Phap Luu—formerly Douglas Bachman '97—piqued Diamond's interest in the Plum Village Buddhist tradition founded by Thich Nhat Hanh. When a delegation of 10 Plum Village monks and nuns visited Dartmouth last spring, Diamond invited them to participate in a hands-on activity in one of his engineering design classes.

The professor also attended two retreats at the Blue Cliff Monastery in New York to learn more about the Plum Village tradition and last fall gave a talk on "Mindfulness in Engineering Problem Solving" at Luu's Deer Park Monastery in Escondido, Calif.

"These engagements with the monastics—and reading several of Thich Nhat Hanh's books, including *The Sun My Heart*—led me to reflect deeply on how we teach engineering, the role of engineering in society, and how we as humans relate to ourselves, each other, and planet Earth," he says.

Diamond, who earned the 2023 Outstanding Service Award for Faculty, has been incorporating lessons into his teaching, including through a new lecture series on engineering problem solving with a broader societal and global context. "I've already seen changes in students' presentations and reports … with respect to sustainability, social inequities, and historical and cultural factors."

—Catha Mayor

"We want to … prepare ourselves for future sea-level rise."

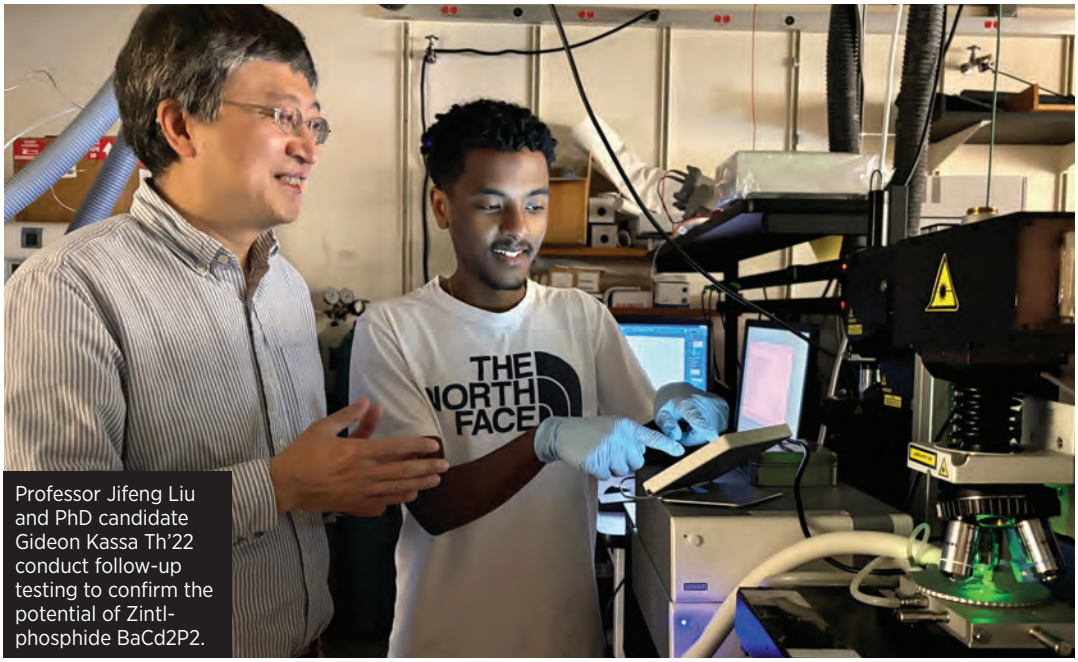
—PROFESSOR HÉLÈNE SEROUSSI

COURTESY HÉLÈNE SEROUSSI

COLLABORATION

A Better Prediction

AS THE EARTH'S ICE SHEETS continue to discharge more ice into the ocean, Professor Hélène Seroussi is studying how this will impact sea levels. She and Professor of Earth Sciences Mathieu Morlighem are using new remote sensing and fieldwork data to improve projections. "The ice will continue its slow response to climate change," says Seroussi, who first saw large changes in the Greenland and Antarctica ice sheets 15 years ago as she pursued her PhD. "If we want to be prepared, we have to be able to predict this." The pair's $1-million research grant from the Novo Nordisk Foundation is part of a larger effort led by Technical University of Denmark that includes plans to establish a Center for Ice-sheet and Sea-level Predictions. *—Catha Mayor*



Professor Jifeng Liu and PhD candidate Gideon Kassa Th'22 conduct follow-up testing to confirm the potential of Zintl-phosphide BaCd2P2.

NEW MATERIAL

High-Impact Discovery

This research is part of a $540-million, U.S. Department of Energy-funded effort to discover new photovoltaic materials.

A DARTMOUTH ENGINEERING-LED TEAM HAS DISCOVERED A NEW high-performance material for solar absorbers—the central part of a solar cell that turns light into electricity—that is stable *and* earth-abundant.

The researchers used a unique high-throughput computational screening method to accelerate the discovery process and were able to quickly evaluate approximately 40,000 known candidate materials. "This is the first example in the field of photovoltaics where a new material has been found through this type of approach with an experimental follow-up," says Professor Geoffrey Hautier. "Most people study one or two materials at a time, and we looked at 40,000."

Dartmouth researcher Zhenkun Yuan is first author on the study—published in *Joule*—with coauthors research associate Yihuang Xiong, PhD candidates Gideon Kassa Th'22 and Andrew Pike Th'25, Professor Jifeng Liu, Hautier, and researchers from eight partner institutions.

They confirmed the solar absorber material—dubbed Zintl-phosphide BaCd2P2—was not only promising in its ability to efficiently transform light into electricity but also highly stable in air and water. "When you don't have to worry about moisture and air contamination, that significantly reduces your costs," says Hautier. "We won't have it as a solar panel tomorrow, but we think this family of materials is exceptional and worth looking at."

—Catha Mayor

BREAKTHROUGH

Vaccine Advances

THAYER SENIOR LECTURER Kendall Hoyt stressed the importance of interdisciplinary coordination to bring clinical research breakthroughs to the public in a timely manner at the inaugural Dartmouth International Vaccine Conference. "You can have the safest and most effective vaccine in the world, but it does not do anyone any good if you can't get enough of them to the right people, in the right place, at the right time," says co-chair Hoyt, faculty director for the Dickey Global Health Initiative Pandemic Security Project.

The conference brought together experts from academia, foundations, industry, and government to discuss how to turn vaccines into vaccinations. Speakers—including Engineering Professor Margie Ackerman, who pioneers novel approaches to design vaccines against challenging pathogens such as HIV—covered topics ranging from the role of industry and academia to the challenges of vaccine misinformation and politicization.

The effort builds on Dartmouth's advances in vaccine research, including a method to stabilize coronavirus spike proteins for use as vaccine antigens, which serves as the foundation for COVID vaccines currently used in the United States and Europe.

CANCER RESEARCH

New Promise

HANNAH REN '24 IS USING THE 2023-24 Mazilu Engineering Research Fellowship to work with Professor John Zhang on methods for targeted cancer drug delivery. "Cancer remains a pressing global health challenge, urging the exploration of innovative approaches to enhance diagnosis and treatment," says Ren. "Recent strides in nanotechnology have unveiled fresh opportunities for precise drug delivery in cancer therapy. I am thrilled by the potential for pioneering methods in cancer drug delivery yet to be explored and tested."

Their project, "Magnetic Chip Device for Capturing Cancer Cell Exosomes and Enabling Drug Delivery in Cancer Research," aims to streamline the isolation of extracellular components, such as exosomes, from human fluids and load them with therapeutics. Exosomes—small extracellular vesicles—can transport cargo between cells and have shown promise as vehicles for targeted drug delivery, but their efficient and selective capture remains a challenge. "This pivots from point-of-care diagnostics to targeted therapy," says Zhang. "I look forward to working with Hannah on this research."

—Catha Mayor

TOP: CATHA MAYOR; BOTTOM: COURTESY HANNAH REN

lab report

Joanmarie Del Vecchio, then a Neukom postdoctoral fellow, leads a hike in Alaska to study watersheds.

Permafrost Restrains Rivers and Carbon

NEW RESEARCH COAUTHORED BY Professor Colin Meyer (below) provides the first evidence that the Arctic's frozen soil—permafrost—is the dominant force shaping Earth's northernmost rivers. It is also an increasingly fragile reservoir of vast amounts of carbon.

"The whole surface of the earth is in a tug of a war between processes such as hillslopes that smooth the landscape and forces like rivers that carve them up," says study lead and former Neukom postdoc Joanmarie Del Vecchio. "We understand the physics on a fundamental level, but when things start freezing and thawing, it's hard to predict which side is going to win."

In a study published in the *Proceeding in the National Academy of Sciences,* Meyer, Del Vecchio, and Earth Sciences Professor Marisa Palucis reported that, as the Arctic thaws, expanding rivers could unleash carbon equal to that generated by millions of cars. As climate change weakens Arctic permafrost, the researchers calculate that every 1.8 degrees Fahrenheit of global warming could release as much carbon as 35 million cars emit in a year as polar waterways expand and churn up the thawing soil.

Researchers also hope to better understand the spacing of "water tracks"—straight, closely spaced rivers that drain hillslopes at high latitudes—in permafrost landscapes, says Meyer. "Using a combination of mathematics, field observations, and remote sensing, we are describing the mechanism by which water tracks form and determining how they may change in the future as the climate changes."

Finding Favorable Quantrum Defects

"Our work paves the way for accelerated quantum defect discovery and design."
—YIHUANG XIONG

DARTMOUTH ENGINEERING RESEARCHER Yihuang Xiong and Professor Geoffrey Hautier have found a new method for identifying promising quantum defects in silicon with numerous applications, including information technology. In a study published in *Science Advances*, they used high-throughput computational screening to accurately identify and evaluate a large number of defects with favorable optical and electronic properties.

"Our work paves the way for accelerated quantum defect discovery and design, aiming to identify which impurities, when introduced into silicon, can create functional and accessible qubits for quantum information technology," says lead author Xiong.

The U.S. Department of Energy-study, titled "High-throughput Identification of Spin-photon Interfaces in Silicon," is a collaboration between Dartmouth and researchers in Belgium and Berkeley, Calif. Their research aims to speed up the pace at which information—and solutions—are processed.

"We're helping advance the implementation of quantum information technology—which encompasses everything you do with information: computing, sending, and storing—but using the 'weird' laws of quantum mechanics," says Hautier, corresponding study author. "For example, we're simulating how electrons behave in materials, and this can be used to design new materials or new drugs—it can be used for many cool and important things." —*Catha Mayor*

CLOCKWISE FROM TOP: MULU FRATKIN; ELI BURAKIAN '00; COURTESY YIHUANG XIONG

KATIE LENHART

FACULTY

DARPA Supports Sensors Work

PROFESSOR MATTIAS FITZPATRICK HAS EARNED THE U.S. DEFENSE Advanced Research Projects Agency (DARPA) Young Faculty Award. The award will support his lab's work using existing quantum computing hardware to enable a new class of quantum sensors with enhanced sensitivity to magnetic fields.

Quantum sensors are designed to detect tiny changes in such things as magnetic fields, electric fields, mechanical strain, and temperature. Enhancing their ability to make precise measurements at the atomic level could facilitate discovery in a wide range of areas such as materials science, computing, and fundamental physics.

"We want to find new approaches to sensing, information processing, and secure communication," says Fitzpatrick. "The primary goal is to harness a fundamental understanding of quantum physics to build enhanced sensitivity into a given sensor."

The project will leverage hardware typically associated with quantum computing for quantum sensing applications, thus serving as a bridge between the two fields. "Our lattice-based approach will allow us to engineer geometries that are relatively simple to build and can be scaled into larger lattices to exhibit high-performance magnetic field sensing." —*Catha Mayor*

Kudos

ADVANCED The team of **Colin Braun '23, Katie Casson '23 Th'26, Sarah Hutchinson '22 Th'25, Sierra Lee '24, Sarah Nam Th'25**, and **Grace Turner '23 Th'26** make up one of 40 advancing to the finals of the 2024 U.S. Department of Energy Solar Decathlon Design Challenge. Advised by **Professor Benoit Cushman-Roisin** and Thayer alum **Carolyn McShea '18**, the team designed a net-zero retrofit of a three-apartment structure in Wilder, Vt.

AWARDED The Class of 1982 Engineering and Computer Science Center earned the 2023 merit award for Excellence in Architectural Design from the N.H. chapter of the American Institute of Architects for the way the building "fosters collaboration to promote synergies."

HONORED Trinity College has awarded **Professor Eric Fossum**, the inventor of the CMOS image sensor "camera on a chip" used in smartphones and webcams, the inaugural President's Medal for Science and Innovation from Trinity College. Fossum is an alumnus and former trustee of the college.

COMPLETED PhD candidates **Roman Vasyltsiv Th'27** and **Savannah Decker Th'25**—both in the Medical Physics Education Program—tied for first place in the early investigator competition at the New England Chapter of the American Association of Physics in Medicine (NEAAPM) meeting.

CONVENED **Dean Alexis Abramson** and **President Sian Beilock** joined educators, lawmakers, and industry leaders in Washington, D.C., for the Education for Diversification and Growth in Engineering (EDGE) Consortium summit to help advance the $52.7 billion federal CHIPS and Science Act.

PRESENTED Engineering sciences majors **Matthew Timofeev '25** and **Vann Guarnieri '21 Th'22** and **Professor William Scheideler** presented research at the 2023 Materials Research Society meeting. They also coauthored—with **Julia Huddy Th'24**—the study "Engineering Perovskite Solar Cells for Efficient Wireless Power Transfer," published in *Applied Physics Letters (APL) Energy.*

REFERENCED A *New Yorker* opinion piece by computer sciences professor **Dan Rockmore** —"How Much of the World Is It Possible to Model?"—mentions the work of **Professors David Roberts** and **Keith Paulsen Th'84 Th'86.**

CONSIDERED In a column for the *Valley News*, "A Pipeline That Can Mitigate Global Warming?" **Professor Dan Olson** discusses new projects to transport CO2 for long-term storage in underground rock formations.

PUBLISHED **Professor Geoffrey Parker**—director of the Master of Engineering Management (MEM) program and interim faculty director for the Irving Institute for Energy and Society—coauthored an opinion piece for *MIT Sloan Management Review* titled, "Why Manufacturers Need a Phased Approach to Digital Transformation." He was also recently ranked in the "Thinkers50" for the third time.

AWARDED Thayer received more than $800,000 through the U.S. Department of Defense Defense University Research Instrumentation Program. **Professor Simon Shepherd** and researcher **Evan Thomas** will use the funds to upgrade SuperDARN.

INVENTED PhD candidates **Junhu Zhou Th'21** and **Ziqian Wu Th'23** and PhD graduate **Congran "Billy" Jin Th'23**—advised by **Professor John Zhang**—were finalists in the Collegiate Inventors Competition for their invention, Nanopure Aqua.

PUBLISHED **Professor Geoffroy Hautier** coauthored "Small-pore Hydridic Frameworks Store Densely Packed Hydrogen," published in *Nature Chemistry.*

PRESENTED PhD students **Gregory Hyde Th'24, Chase Yakaboski Th'23**, and **Clement Nyanhongo '17 Th'18 Th'24** presented on "AI for Open Science: A Multi-Agent Perspective for Ethically Translating Data to Knowledge" at the Conference on Neural Information Processing Systems.

ATTENDED PhD Innovation fellow **Adelaide Cagle Th'27** attended the Global Collaborative Congress on Osseointegration, where her abstract, "Tissue-Engineered Combination Construct for Osseointegration Support," was chosen for oral presentation.

"Our solution attaches to an existing welding helmet and utilizes common batteries and filters that can be found in most hardware stores."

—ANDREW WILSON '26

TEAM EFFORT

Breathe Easy

Team UniPAPR—**Michael Dang Th'26**, **Andrew Wilson '26, Ruilin Guo Th'26**, and **Mia Steinberg '25**—won the Phillip R. Jackson Award for best overall performance in ENGS 21: "Introduction to Engineering." The students worked with Machine Shop instructor Gary Hutchins to earn top honors with an affordable, convenient, and comfortable respiratory system for welders. UniPAPR was one of 15 teams that presented final project prototypes to the Thayer community.

HALEY TUCKER

Artificial Intelligence by Intention

PROFESSOR EUGENE SANTOS JR. IS HELPING TRANSFORM AN IMPERFECT TOOL INTO A FINELY CALIBRATED VIRTUAL ASSISTANT

BY MICHAEL BLANDING

We all know what it's like: sitting down to watch a movie, but scrolling needlessly because Netflix keeps recommending films we would never watch. Then someone chimes in that ChatGPT could fix all this.

"People are hallucinating together with ChatGPT," Professor Eugene Santos Jr. says, only half-jokingly. "Even when ChatGPT's response seems nonsensical to you, some generative AI believer will say it's you who need to broaden your thinking."

It's not that Santos is an artificial intelligence (AI) pessimist. Rather, he has spent his career pursuing AI and knows problems run deeper than mere misfires in its predictive capabilities—it's about the system misunderstanding our intentions. With AI increasingly integrated into our everyday tools, from navigation apps to smart phones and home devices, Santos believes developing AI that better interprets human intention could transform an imperfect tool into a more finely calibrated virtual assistant.

Santos, the Sydney E. Junkins 1887 Professor of Engineering, looks at how AI can help us make better decisions in fields ranging from national security to healthcare delivery to cancer research—and he believes we hold the power to improve AI in a way that truly benefits human lives.

"We're always trying to figure out each other's intentions," Santos says. "And part of that is understanding the sequence of decisions another person would make, how their arguments are unfolding in their head."

Humans naturally anticipate this sequence when interacting with others and build real-time mental models to help make sense of another's words and behavior—and ask follow-up questions to clarify when they don't understand. "If nothing else, we can communicate better, because you have both sides starting to gain better knowledge rather than going in with implicit assumptions," Santos says.

“IT’S UP TO HUMANS TO DESIGN AI SYSTEMS TO HELP US MAKE BETTER DECISIONS, RATHER THAN ALLOWING SYSTEMS TO MAKE THOSE DECISIONS FOR US.”

—PROFESSOR EUGENE SANTOS JR.

Current AI models often falter in that capacity, operating through frameworks that look for the closest match, the next most likely word or concept based on training on vast amounts of data. For example, when you accidentally click on *The Fast and the Furious*, Netflix uses that input to make its next movie recommendation, lacking the ability to realize that you actually meant to click on the adjacent *Pride & Prejudice*.

Generative AI models such as ChatGPT fare better, says Santos, since they allow more interplay with the system. For instance, if you asked ChatGPT about "Ford" with the hope of getting more information about "Gerald Ford" and it instead tells you about the car company, you can clarify you meant the former president. At the same time, large language models are also notorious for returning so-called "hallucinations"—incorrect information with the ring of truth based on what the model is trained to believe the user wants to hear.

One key to improving AI, Santos says, lies in creating models that are better at interpreting people's behaviors and the intent behind their queries. This would allow AI to refine its understanding of human thought processes and deliver more accurate information to satisfy those requests.

"The idea is that as the AI observes you, whatever information you are generating—even your facial expressions when we get that far—forms these networks of concepts and creates a running model over time of how you've interacted with it," he says. Eventually, an AI model may even be able to tell when your reasoning doesn't make sense and correct wrong assumptions before carrying out a task.

Other crucial factors to better AI are the engineers or computer scientists themselves. With AI shaping many facets of our lives, Santos says it is just as important that the people who develop integrated technology have a deeper, human-centered understanding of the profound societal implications of their work.

Santos, who also serves as director of Thayer's master of engineering program, was central to the launch this winter of Dartmouth's first online master of engineering in computer engineering. The first fully online Ivy League degree, it focuses on intelligent systems, the foundational technology for AI. And it's offered online for a reason: Diversity matters in the realm of AI. For instance, speech patterns, facial features, gender norms, and cultural practices all shape, impact, and influence human thought and behaviors engineers and developers must understand and consider.

"Computer engineering is an area that's accelerating rapidly," he says, "and the flexibility of an online program helps us reach a broader, more diverse group of engineers—people we may not have been able to reach before—and that could mean stronger AI tools for everyone."

Santos was exposed to computers early in life. His parents, both professors at Youngstown State University, were computer scientists by training—his mother an electrical engineer and his father a mathematician. "I got really lucky in that my dad brought home from the university the first teletype machine connected to a mainframe over the phone," he says. "They never pushed anything on me, but when you have this cool stuff that flows through your home, you can't avoid it."

Santos was instantly hooked, wondering even then how computers could be made more intelligent.

In the 1980s, he began studying expert systems, an early precursor to AI. During graduate studies at Brown, his interests diverged from most computer scientists studying AI. Instead of training AI to make better predictions, Santos was more interested in learning why AI made the predictions it did. After stints at the Air Force Institute of Technology in Ohio and the University of Connecticut, in 2005 he joined Dartmouth's engineering faculty, where he delved deeper into his research.

By creating AI models that focus on the intent behind decision-making, Santos has also developed a better understanding of how humans make decisions in complicated situations. "We don't work in isolation, we work in groups and organizations and influence each other," he says. AI can be particularly helpful in analyzing how intentions and decisions by some individuals affect those of others.

In one project with his sister, Eunice E. Santos, dean of the University of Illinois at Urbana-Champaign School of Information Sciences, he helped analyze the political collapse of Somalia, studying how the country went from a "nation state to a failed state to a pirate state," as he puts it. "We were able to explain shocks to the system and how it all evolved," says Santos, who coauthored a paper on "Modeling Social Resilience in Communities."

He applied similar models to analyze how countries respond to natural disasters or how an organization becomes fanatical. As these models become more refined, he says, they could be used by policymakers to prevent, intervene, or better respond to these kinds of societal crises. "If we understand how it can happen and what the impacts are, we can ideally change policies early enough so we don't get to that crisis point," he says.

In another project, he analyzed a fascinating phenomenon in social science known as "emergence," in which an unexpected outcome emerges from seemingly predictable sources. For example, during a trial, every member of the jury may enter deliberations with the belief that the defendant is guilty, but after deliberating with others, the jury may end up with a unanimous "not guilty" verdict. "Each person who is making their decision may have a certainty level where 'guilty' is slightly higher than 'not guilty,' " Santos says. However, the factors that led to that belief may differ for each juror—so as the jury compares notes, individuals g disprove each other's theories, flipping each juror to a not guilty verdict.

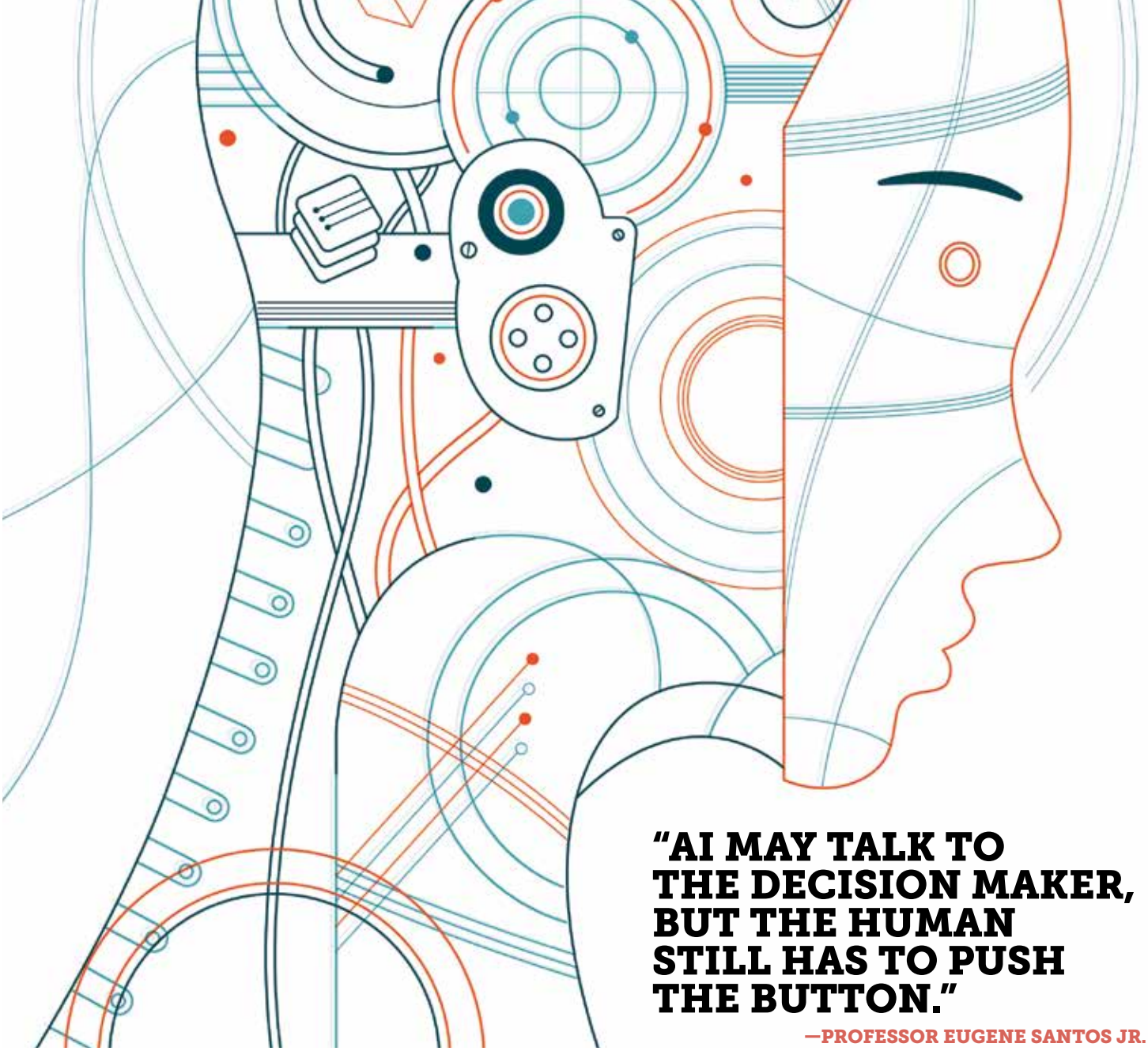
These types of outcomes are notoriously difficult to detect. In one real-world scenario, Santos analyzed results of the 2015 U.K. election, in which the polls predicted an even split for the Conservative and Labor parties, but the Conservatives won by a seven-point margin. Many pundits speculated the unexpected result was based on bad polling or respondents lying about their true voting intentions. But Santos' team built an AI model showing the outcome was a case of emergence—with certain demographic groups who felt more strongly about their decision prevailing over those who were more ambivalent on election day.

"The polls were too simplistic—they weren't considering the interactions between different groups that drove the results in a different direction," Santos says. Not only did his team's model more accurately predict the outcome than the polls, it also showed it could be applied to other situations where social influence could affect collective intelligence.

Santos himself is naturally inclined to take a creative approach to problems, says PhD student Clement Nyanhongo '17 Th'18 Th'24. "Sometimes you find yourself going in one direction, and Professor Santos is very good at giving you other ways to think about the problem and consider it from diverse perspectives," says Nyanhongo. "He encourages you to take the space and time to explore it to get a more holistic view."

Nyanhongo's research looks at how teams function, examining the interactions between members to get a better handle on how individual strengths and weaknesses affect the team's success overall. "When we evaluate teams, it's difficult to assess the contributions of individuals without introducing subjectivity and bias," he says. An AI approach can apply a more mathematical perspective to the analysis, with the aim of providing crucial information to help teams improve.

Santos' decision-based approach to AI isn't applicable only to politics and social interactions. He is also turning it to scientific discovery—using



"AI MAY TALK TO THE DECISION MAKER, BUT THE HUMAN STILL HAS TO PUSH THE BUTTON."

—PROFESSOR EUGENE SANTOS JR.

artificial intelligence to accelerate efforts to cure cancer. The challenge, he says, isn't a lack of scientific research—it's the lack of capacity to rapidly sift through the mountainous clinical data and research findings from thousands of labs and hospitals across the world to make novel connections about what works, could work, or doesn't work in cancer treatment.

"How can we bring all of that knowledge together and discover new directions to explore?" he says.

Clinicians rely on past data to develop hypotheses about the best treatments, but Santos is spearheading a more systematic approach through a $3.4 million National Institutes of Health-funded project he is leading with Dartmouth colleagues and partners from Tufts Clinical and Translational Science Institute. Santos' emphasis on decision making is ripe for the task. "It's looking at a chain of arguments that says, 'Hey, you should look at this drug because it affects this particular gene expression, and that gene expression will affect these particular changes in these organs or cells,' " he says.

By analyzing the genetic profiles of patients and the drugs they've been exposed to, he hopes to decrease the uncertainty that currently plagues cancer research and present a more educated hypothesis to researchers through the nationally funded Biomedical Data Translator Consortium. The goal is to add enough information and analysis to go live within the next year so biomedical researchers can start using it.

As an engineer and computer scientist, Santos believes we have less to fear from AI than portrayed in media and popular culture. It's up to humans to design AI systems to help us make better decisions, he says, rather than allowing systems to make those decisions for us. "People may say AI is going to start nuclear war—but that's only true if you abdicate control and give it connection to the button that fires the missiles," Santos says. "AI may talk to the decision maker, but the human still has to push the button."

In fact, he says, AI has more potential to be a force for good. It can help augment human intelligence by giving us much more capacity to observe vast numbers of interactions and discern patterns we are not able to identify by ourselves. That, in turn, can only help us do what we do better—whether that's responding to disasters, averting political crises, or coming one step closer to curing cancer.

MICHAEL BLANDING is a Boston-based journalist whose work has appeared in *WIRED, Smithsonian, The New York Times, The Nation*, and *The Boston Globe Magazine.*

"PATH TO IMPACT"

ROSE MUTISO '08 TH'08 NAVIGATES THE INTERSECTIONS BETWEEN INQUIRY AND GLOBAL ENERGY SOLUTIONS.

Mutiso connects academic rigor and societal relevance as research director at Energy for Growth Hub. She is bridging the spaces her parents occupied—the science her father pursued as head of the geography department at the University of Nairobi and the government policy her mother influenced as a technical officer in the Kenya Ministry of the Environment. With a PhD in nanotechnology and experience as a senior fellow at the U.S. Department of Energy, she can serve as translator in the global discussions around energy. It's a role she also hopes to make more accessible to female doctoral candidates in East Africa with the Mawazo Institute, a Nairobi-based nonprofit she cofounded with Rachel Strohm '08 to empower more homegrown experts and policy leaders. As Mutiso says: "Any kind of revolution requires deep, deep investments now to create the ecosystem to support whatever futures we have in mind." For her work, Mutiso earned the 2023 McGuire Family Prize for Societal Impact, a prestigious award that recognizes individuals in the Dartmouth community who have significantly improved the course of humanity, society, or the environment.

"The issues we're facing—everything from energy to AI—require people who are both deeply rooted in a strong local context and globally connected to solve problems together and learn from each other."

—ROSE MUTISO '08 TH'08

PHOTOGRAPH BY ROB STRONG '04

What about your role at Energy for Growth Hub invigorates you?

I'm trained as a scientist and an engineer, but because of my liberal arts background, I also have a strong interest in society, on making an impact. My job is connecting evidence and research to inform policy and decision making around energy, energy poverty, and energy transitions in poor countries. These are all topics that have strong technical underpinnings, so when you think about what energy technologies are most relevant to different geographies, how do you deploy them? What different conditions are needed?

We have a network of fellows and experts, and I spend a lot of my time talking with folks in academia who are experts in their field—what is new or interesting about what they're working on and how can we explain it to general audiences and then think about what the policy audiences care about. Whatever kind of niche technical work people are doing, my job is to be a translator and pull those ideas into civic policy discussions anywhere policymakers, executives, or everyday people are thinking about energy futures. I'm trying to bring the best thinking, the best knowledge to bear in those conversations.

Do you find there are messages or ideas that seem to resonate more?

Around the issues I work on—energy, poverty, climate change and its impact—I think there's a lot of techno-optimism, where a lot of people feel technology will solve problems. It's what every technologist wants to hear, because for a long time, people forgot about science. After all the years of anti-science sentiment around climate or renewables bashing, I think we've made a lot of progress. Now there's a lot of optimism around technology as a crucial tool. People understand progress has been made in the technological sphere that is making our odds stronger.

I'm excited about that, but part of my job is to bring to everyone's attention the nuanced details that get lost in these sweeping, rosy narratives, especially in Africa. There's this idea that we'll leapfrog the problems of the West and have this bright new future, that we'll never have any dirty energy and everything is going to be great. I welcome the interest in technology and science and evidence and, while we have everyone's attention, try to help folks understand that there's no silver bullet.

The danger if we leave these sweeping techno-optimistic narratives to spread unchecked is when the paradise doesn't arrive immediately, people can lose faith in the science. Everyone's really excited for this new world where all of our power will be green, we'll all drive electric cars, and it's problem solved. That can backfire if we don't draw attention to things outside of technology that help our ability to achieve

PHOTOGRAPH BY ROBERT GILL

this vision. What's the political landscape? What about the financial flows or investments? What equity issues are important? For example, in a place such as the United States, there are winners and losers of this new future. You know, what happens to the coal miners left behind? These things can be managed, but it's important to draw attention to the complex issues around the future of energy and the future of our economies, so we are tempering expectations and anticipating all these multifaceted dimensions and solving for them now.

Africa's energy future is framed as a "debate"—is discussion a better word to use?

On one hand, I think debate is a healthy thing for any society. We all have to negotiate the communal space we're inhabiting. I think it's possible to have healthy debates on any number of things, but on energy, we have come from a kind of toxic background, where you hear solar is nonsense and you're either a booster or you're not. We need to frame it in terms of trying to find the best set of options that lead to the best outcomes.

One of our fellows with the Energy for Growth Hub is a Scottish woman named Hannah Ritchie, who just published a fantastic book called *Not the End of the World*. She's a hard data scientist and a big part of her mission is to talk in a solutions-oriented way that is not partisan. My role is adjacent to Hannah's, in that a big part of my job is to look at *how* with specificity, which means thinking about a particular place and those stakeholders, their ambitions and realities, what they're trying to optimize for, what pathways are possible, and what constraints are at play.

I think there's a role for different narrative types. There's rousing, visionary rhetoric that sets up the North Star, that mobilizes people and sets the vision for what is possible. Then the challenge is how you connect the momentum built from that to action on the ground. A lot of a career and a life is balancing between those two. If you're thinking about a path to impact, you need a little bit of both the visionary leadership and the doers.

> **"IF YOU DON'T HAVE PEOPLE IN YOUR COUNTRY WHO UNDERSTAND YOUR CONTEXT … YOU'RE MAKING DECISIONS BLIND THAT COULD HAVE BIG, BIG RAMIFICATIONS."**
>
> —ROSE MUTISO '08 TH'08

Can you point to any ideas that are bright spots ahead?

One example I find exciting is from Kenya, and it's one that has deep roots. When I was growing up in Nairobi in the 1990s and into the early 2000s, it was in perpetual power crisis. We had rationing, power cuts, the grid would collapse—it was a power sector in shambles. Then, in the late 2000s and into the 2010s, there was a massive shift in its power sector—we were able to bring on board geothermal power, which displaced more unreliable hydro and expensive backup plants. Geothermal is now the foundation of our power sector. It's a massive success story that checks many boxes: It's green, it's affordable.

But building these power plants is not something that happens overnight. The history of the geothermal revolution is so deep, with investments in geological exploration decades ago around the time of independence. It's an inspiring example of a solution to an entrenched problem, but it also gives me pause because all around I can see the ways in which we are not planting the seeds. The changes we want to see in the next decade require investments now, not just in the infrastructure but also in the know-how. Any kind of revolution requires deep, deep investments now to create the ecosystem to support whatever futures we have in mind.

That brings us to the Mawazo Institute. It seems you're already investing in a solution.

I think expertise and investing in thinking and foundations are crucially important. When I first edged my way from the lab into energy tech policy in Washington, D.C., I started working on U.S. energy and science policy and then found such a contrast when I moved into policy and technology issues in developing countries. When there are debates around science policy in the United States, there's such a rich knowledge ecosystem that everyone is drawing from. Academics have been studying the issue for a long time. Interest groups have been advocating, pushing, and doing their own research. There are lobbyists in the mix. The passage of the Inflation Reduction Act, which is the most important climate legislation in the history of the United States, is a great illustration of the long path to a landmark decision. There were all these different ideas and voices that shaped and strengthened and negotiated a compromise position.

But then in the international space, a lot of these decisions are driven by development agencies, the World Bank or USAID or whatever, and they are made much more unilaterally. Somebody in Washington, D.C., thinks some thoughts and decisions are made quickly and away from the context. I found there are very few Africans or local people involved in that decision making. I would often find myself one of the few African women in these spaces where people are strategizing around investments in energy or poverty, you name it.

Rachel and I were interested in what would happen if more Africans, in particular women, are able to build careers as experts and leaders. We wanted it to be possible for women in the country to have global reach and influence and to do their bit to lead world-class scientific investigations. Mawazo's fellowship program provides seed funding for research, conference travel, supplemental training, and mentorship. Our hope is that women early in their research careers will shape important conversations about the future of their societies.

What else is on your desk right now?

One of the projects is around the green hydrogen economy, which is a very buzzy topic in energy and climate circles. Hydrogen made from renewable energy is a way to displace fossil fuels in many parts of our economy that are hard to decarbonize, and many African countries are excited about the prospect of taking advantage of renewable energy endowments. Being a first mover in this space could have massive upside, but the kinds of investments needed to put down a stake in the future hydrogen economy are massive. It's a risky gamble. When African countries are weighing whether to go big on this, we need smart people around the decision-makers in government and industry who help them weigh the tradeoffs and are providing credible, rigorous advice in a complex and highly uncertain environment. If you don't have people in your country who understand your context—and are able to adapt the science and temper it with understanding of the realities—you're making decisions blind that could have big, big ramifications.

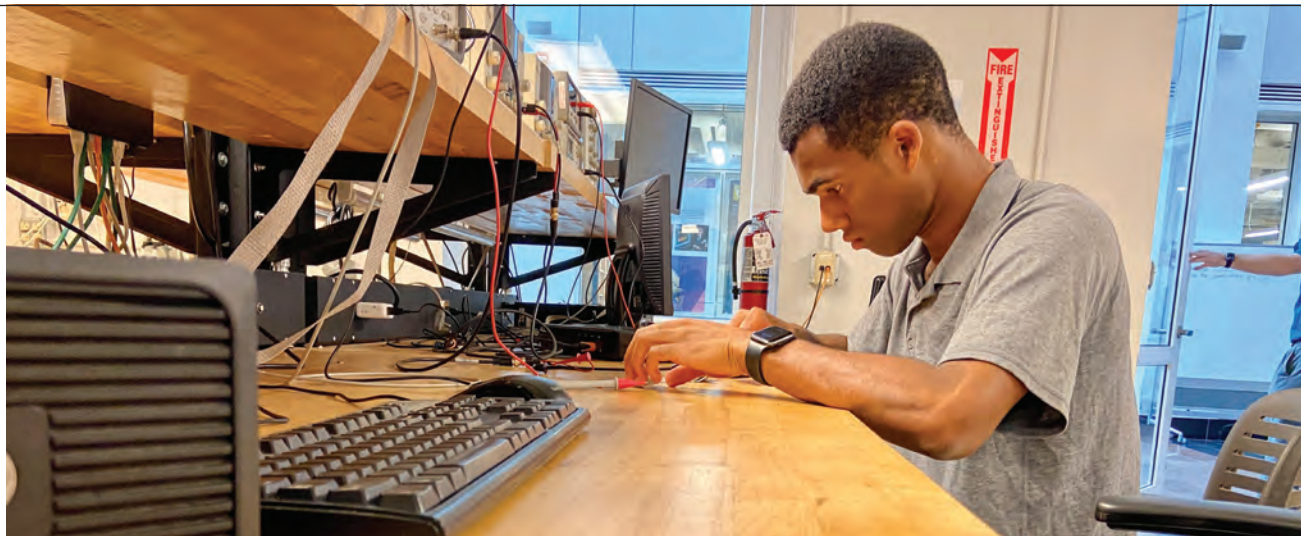
We're in this moment where the local and the global have to intersect. I think the issues we're facing—everything from energy to AI—require people who are both deeply rooted in a strong local context and globally connected to solve problems together and share and learn from each other. These interconnections are necessary to seed and spread the knowledge and ideas for the many problems we are solving now and into the future.

LAB WORK

PhD candidate Rachel Osmundsen Th'22 (right) trains fellow PhD candidate Aubrey Tang Th'26 on using transmission electron microscopy (TEM) to polish metal samples for analysis in the Metallurgy Lab. Professor Ian Baker's team uses TEM to analyze metals' crystal structure and deformation in an effort to improve their mechanical or functional properties. Photo by Mark Washburn

PHOTOGRAPHS BY CATHA MAYOR EXCEPT AS NOTED

LABORATORIES ACROSS THE WEST END enable students and professors from a range of disciplines to bring new concepts to life. More than 80 percent of undergraduates take at least one engineering or computer science course, using Dartmouth Engineering's 60-plus labs in hands-on, collaborative learning. Additional spaces, such as the Cable Makerspace, "welcome students to 'think with their hands' by bringing their ideas out of their head and into reality," says Professor Eugene Korsunskiy. "It is outfitted with beginner-friendly fabrication equipment, such as laser cutters and 3D printers, and accelerates the pace of discovery and invention by lowering the barriers to entry and shortening the time between idea and prototype." It's an example of engagement that begins from the moment students step on campus. Incoming students in the First-Year Student Enrichment Program explore hands-on engineering by building battery-powered or solar-powered marble machines. Another program—funded by the National Science Foundation—offers a term of research lab experience to encourage undergraduates to consider a career in materials science. From emerging technologies to advanced materials and biotechnology, cutting-edge labs connect professors, research scientists, and undergraduate, master's, and PhD students to test theories, advance prototypes, and solve complex problems.



PhD student Philip Mulford Th'25 was part of a student team that won Best Technical Paper in NASA's Breakthrough, Innovative, and Gamechanging Ideas challenge for its lunar exploration robot — dubbed SHREWs for Strategic Highly compliant Roving Explorers of other Worlds. Developed in Professor Laura Ray's lab, SHREWs is actually several connected rovers with the ability to inch down sides of craters. Photo by Mark Washburn

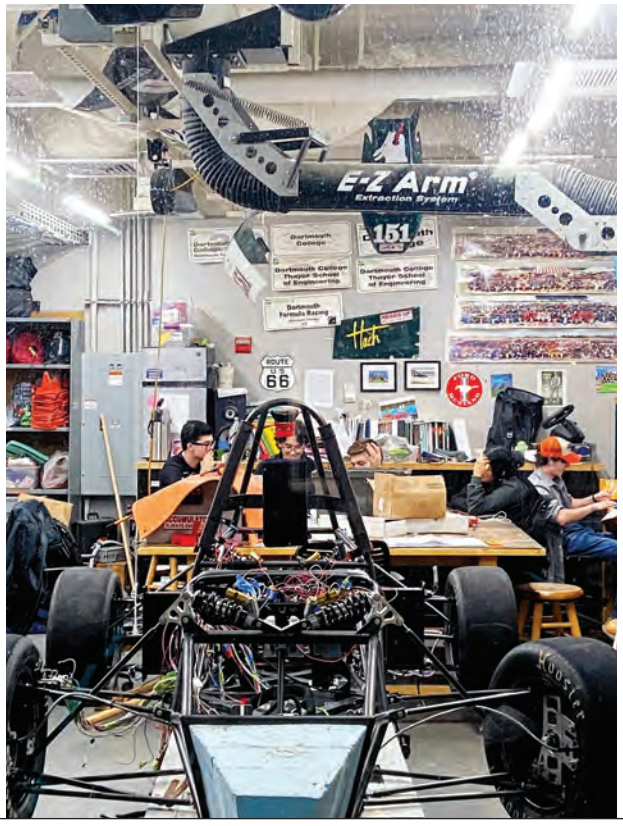
➤ *The Electronics Project Lab enables students to design, build, and test electronics and circuits with the support of a professional engineer on staff.*

➤ *Students participating in the National Science Foundation Research Experience for Undergraduates program consider different career paths by spending a term conducting lab research as materials scientists.* Photo by Haley Tucker

➤ *Students build simple circuits, integrating sensors and actuators, for their ENGS 21: "Introduction to Engineering" class in Couch Project Lab.*

▲ *Joseph Harrington Th'24 practices tungsten inert gas, or TIG, welding aluminum in the Machine Shop.* Photo by Tishya Khanna Th'24

➤ *Every year, technical instructor Daniel DeNauw helps students build bridges for ENGS 33: "Solid Mechanics." Student teams design and build scale models using SolidWorks to analyze and predict maximum loads as well as how far the bridge roadway will bend at a load of 1 kN. Thayer's Instron machine then puts the students' designs to the test in the annual contest in Couch Lab.*



➤ *The Dartmouth Formula Racing team gathers for an evening session in the Allyn Large-Frame Lab.*

➤ *PhD Innovation Fellow Steven Ionov Th'24 preps for an experiment in Professor Jiwon Lee's Immunoengineering Lab.*

➤ *Professor Daniel Olson and PhD candidate Shu Huang Th'25 engineer organisms that naturally break down lignocellulose into efficient biocatalysts that can withstand the rigors of industrial-scale fermentation. The research provides an important foundation for the nascent cellulosic biofuels industry.*

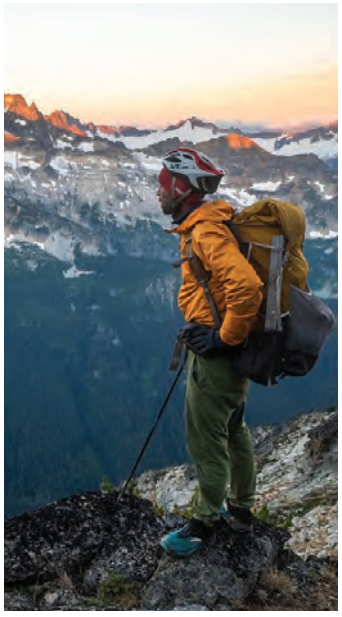
Alumni News

FROM AROUND THE WORLD

spotlights

The Advocate

Longtime philanthropic powerhouse **Tref Wolcott Borden '85** has joined the board of Boston-based Doc Wayne, a provider of mental health therapy for youth. "In light of so many children and older youth being impacted by the conflicts and strife worldwide," she says, "it is imperative that mental health supports are scaled to meet their needs to ensure the trauma they endure does not have lifelong implications." Doc Wayne's sports-based approach helps children in the United States and in more than 25 other countries, including those in conflict zones. She previously served as executive director of the Fish Family Foundation, which supports lower-income individuals and families in immigration and naturalization programs, and of the Tiger Foundation, which supports educational, vocational, and social services organizations focusing on low-income, high-risk populations. In those roles, she used the systems approach learned as an engineering sciences major to develop grant program strategies and determine impact. That impact is what has kept her engaged—now as a volunteer—in the nonprofit field. "I saw firsthand how these nonprofit partners were changing families' lives," says Borden. "I'm drawn to low-income populations because they are underserved, face entrenched structural barriers to advancement, and need support the most." Her philosophy is embedded in an appreciation of friends and family, including two college-age daughters. "We survived the heartbreak of losing my son earlier this year by coming together and leaning on the support of community," says Borden. "That experience drives my daily appreciation for the life with which I've been blessed."



Jeff Hashimoto '93 ▲

The Adventurer

The challenge: Bag Washington's 100 highest mountains. The twist: Link the peaks by bicycle. High school science teacher **Jeff Hashimoto '93** and neighbor Langton Ernest-Beck dreamed up the ultimate peak-bagging adventure using only human power. "I wanted to see as much beautiful mountain scenery as possible without adding CO2 to the atmosphere," he says. The numbers were daunting: 1,900 miles of cycling, 835 miles of hiking, and nearly 500,000 total feet of elevation gain. Some days Hashimoto would stagger out of his tent wondering if could go another day. "I'd think, 'I'm going to climb a mountain today, or four mountains today?" the engineering sciences major told *Outside* magazine. "I don't think I can make it over to this log to go pee. But things would loosen up." According to mountaineering site SummitPost, only 92 people had ever completed all 100 when the pair biked 66 miles to the Enchantment range. There, they kicked off the challenge by climbing seven peaks and a total of 27,600 vertical feet. **Uhuru Hashimoto '23 Th'26** joined the pair in June—and he and his father kept morale high by singing songs from 1980s. The trio finished the challenge in mid-August, climbing 12,281-foot Mount Adams before pedaling back home to Ellensburg. "The thing that has been cool is the effect our story has had on people," says Hashimoto. "I

Tref Wolcott Borden '85 ▲

"I was born lucky and I know it, so giving back is important to me."

—TREF WOLCOTT BORDEN '85

"We are helping create an engineering profession capable of meeting the challenges of the 21st century."

—STEPHEN SECULES '07 TH'07

On the Job

STEPHEN SECULES '07 TH'07 | PROFESSOR

The engineering professor studies ways to diversify engineering as lead of the Research Group and the Justice Equity Diversity Inclusion (JEDI) Ambassadors program at Florida International University.

How does diversifying engineering improves outcomes?

First, it helps undo historical exclusion that originally defined engineering as a field exclusive for white, middle-class men. Second, the populations that engineers design for span all demographic categories, so the engineers we educate should be as diverse as the populations we serve. Third, the way we educate today has consequences for student outcomes in persistence and achievement and repercussions for the engineering field of tomorrow. We are helping create an engineering profession capable of meeting the challenges of the 21st century.

What techniques are effective in encouraging a broader mindset?

First, try to look at the classroom experience from the student perspective. Then, perhaps drawing on that student perspective, look for items in the classroom that could unintentionally communicate to students that they don't belong or are failing. Are there classroom competitions that highlight who comes in last place? Does everyone seem to ask questions equally? Once you've thought about some of the perspectives and challenges that might be coming up for students, try shifting things. For instance, are there ways to structure open-ended activities so that they are not competitions but instead emphasize collaboration and open-ended exploration?

What make you optimistic?

There have been a lot of strides for women in engineering. I remember feeling proud of Dartmouth for reaching gender parity, although the field at large is somewhere around 25 percent women. Most of the numbers regarding Black students in graduate school and in engineering professions have somewhat stagnated, and they are still significantly underrepresented relative to their national population. However, there is more support for LGBTQ and disabled students in engineering now, which I think has resulted in more visibility and diversification. In some ways, that shift seems to be about broader societal acceptance and our collective ability to talk about these populations. Sometimes I think the conversations we have already constitute progress.

showed photos to my high school classes, and I had kids who have not spent much time in the outdoors ask about climbing mountains. I hope our trip will inspire others to pursue their dreams while finding ways to pursue these dreams with minimal environmental impact."

The Entrepreneur

Former PhD Innovation Fellow **Danielle Castley Th'20** has spun her entrepreneurial training and research into her own company. She is founder and CEO of Becq, a Camden, N.J.-based designer and manufacturer of radiation shielding for the nuclear and space industries. The materials engineer says her love of the work is an essential ingredient to success: "I love shielding so much that people make fun of me—it's what I want to talk about all day," says Castley. "I'm always excited to figure out the next thing when it comes to shielding design and our software and what we can do for our customers." Clients include U.S. Department of Energy National Laboratories, microreactor companies, and commercial nuclear power plants. "We're working on shielding for space reactors as well," she says. "I hope in five years that companies are using our shielding to go to the moon and do deep space exploration or to protect military bases." Castley started Becq as a PhD student and landed the first project as she was finishing her thesis. She credits the PhD Innovation Program with incubator support: "You're surrounded by professors who are renowned engineers, inventors, and entrepreneurs and they always make time to provide guidance," she says. "The lessons I learned in Professor Eric Fossum's entrepreneurship classes have translated to everything I do. And Professor Laura Ray is balanced, kind, and brilliant. She knows how to break apart a problem and build and efficient solution."

The Artist

Multimedia artist **Samantha Modder '17 Th'18** enjoys dabbling in a range of mediums. "I think the fact that I started off as an engineer and now I'm an artist has made me feel like I can do whatever it is I'm interested in," says the University of Tampa graphic design professor. Following an entry in her first faculty art show in 2023—with a piece printed of digitally manipulated ballpoint pen titled *Her Hair Like the Sun and Clouds*—she is now designing clothes from her own prints, having taken an introduction to fashion design course where she learned to sew. Her fondness for ballpoint pens is an homage to growing up in Sri Lanka, when access to art supplies was severely limited. In high school, she took physics, chemistry, and advanced math courses and watched her brother go off to the United States to study engineering. Dartmouth was at the top of Modder's list when she applied in 2013, thrilled to find a top school where she could double major in engineering and studio art. "The fact I started off as an engineer and now I'm an artist has made me feel I can do whatever it is I'm interested in," she says. That philosophy was reinforced during a summer internship with Professor Kofi Odame: "He would come to art exhibitions that I had on campus and tell me he loved my work," says Modder, who displayed her work at the Top of the Hop and created a mural for the Geisel School of Medicine that drew attention to health disparities in the Black community. "It made me feel I didn't have to stick to a traditional path."

Samantha Modder '17 Th'18 ▲

"I'm always excited to figure out the next thing when it comes to shielding design and our software and what we can do for our customers."

—DANIELLE CASTLEY TH'20

The Lifesaver

As product lead at Prepared, **Keshav Vasudevan Th'16** is focused on saving lives. And it's not hyperbole: He's enhancing a public safety platform that allows 911 callers to share videos, photos, and sounds with dispatchers and emergency responders in real time. "Keshav's achievements … across multiple industries and developing lifesaving, innovative, and industry-defining solutions are outstanding," wrote judges when naming him 2023 Product Development/Management Executive of the Year during the International Business Awards. Prepared is a government-technology startup employed by call centers covering more than 20 percent of the U.S. population, according to *Forbes* magazine. The company initially signed on school systems, but when the hundreds of schools on the platform were no longer in session during Covid, it launched a second iteration focused on 911 centers, sheriff's offices, and fire and police departments. "I want to build products that can make a real difference in the world," says Vasudevan, who joined the company at the start of 2022 after bringing technology products from ideas to successful business ventures in three industries. "Prepared provides the dispatchers and responders with increased situational awareness, more accountability, and better information," he says, "all in service of saving people's lives."

Keshav Vasudevan Th'16 ▶

thayer notes

1940s

Kendrick Kelly '47 Th'48: I am now 97 years old. I had a wonderful civil engineering career working on large construction projects at various locations around the world. Dartmouth and Thayer are a fond memory.

1950s

Larry Furrer '56 Th'57: I will turn 90 in July, I hope. In recent months, I officiated a wedding and attended a father-daughter dance with my great-granddaughter. Clint Eastwood, into his 90s and still very active, was asked how he did it. He replied that it was easy, that he got up every morning and did not let the old man in. With inspiration from Clint Eastwood, I wrote the following verse in the poem, "Don't Let the Old Man In."

He's always there in the morning,
But I hear a voice within.
It's sending me a warning,
Don't let the old man in!

Though I start out kind of slow,
I shake off all chagrin,
I tell myself, "Get ready to go."
And don't let that old man in!

I always have to walk with care,
Especially when I begin.
I admit sometimes I get a scare,
But I don't let the old man in.

Great grandkids help to keep me spry,
They make me laugh and grin.
I'm worn out when they say goodbye,
But I don't let the old man in.

By 10 o'clock, we say alright,
Let's both of us call it a night,
By then there isn't any doubt,
All day I kept the old man out.

Alan Peyser '56 Th'57: I have had a wonderful life and accomplished many things. All of them have involved technical and engineering matters, ranging from commanding satellites into orbit to selling 60 or more countries equipment to coordinate the use of the Comsat satellites through big Earth stations to eventually starting a company called Cable and Wireless and growing it to more than $1 billion in revenue.

1960s

Neil Drobny '62 Th'64: My part-time work at Western Michigan University continues to go well. I am into the second year of a program in which students work competitively in self-selected teams on critical sustainability problems of their choosing. It is called the Bronco Challenge for Sustainable Impact. The challenge is a voluntary activity, and a unique aspect is that students work for prizes (not grades) that I raise from corporate sponsors. The work done by the teams is evaluated by a panel of external judges at the end of the year. The first-place team gets $10,000 to divide among themselves and use for any purpose; second- and third-place teams receive $6,000 and $3,000, respectively. The challenge has received international recognition for innovation in higher education. Participation is a great resume-building experience for the students.

1970s

Steve Pitschke '77 Th78: I retired in January of 2023 as senior manager of software engineering at the software integrity group (SIG) division of Synopsis. Since then, I have been enjoying my time immensely with my wife. The main activities I've been engaging in are snowboarding, delivering meals to seniors, playing tennis, reading, playing online bridge with friends, and just enjoying down time.

1990s

Doris H. Martínez '91: I'm excited to begin a new chapter in our 30-plus-year-old production company, Metro Studio, with a new division specialized in high-speed, tabletop cinematography, filled with robotics and many moving parts! It's a beautiful experience, especially for me as an engineer. I'm also very excited with the news of our first grandchild, whom we expect in February. We will be traveling to London from Bogotá to be with our eldest daughter and her husband after the birth of their firstborn.

Becca Sullivan Völker '92 Th'94: After a move to Germany in 2006, I started teaching English. This required some reinvention of myself. Three years ago, however, I started a career-changer program to become accredited in math and 'technik' in a local German gesamtschule (for grades five to 10). I had my final exam on February 16—and while almost everything that could go wrong, did go wrong, I still passed with a comfortable margin. Easily the most difficult thing I've ever done, and not because of the language!

2000s

Alex Streeter '03 Th'04 Th'05: This spring marks my 15-year anniversary at DEKA Research & Development, down in the old textile mills in Manchester, N.H. In that time, I've been fortunate to work on our advanced prosthetic arm (Luke) and stair-climbing wheelchair (iBot), among other projects. I'm surrounded and supported by smart coworkers and continually have to learn new skills. For example, I've migrated away from expensive software such as Matlab and Ansys—tools I learned to use at Thayer—and instead use open-source tools such as Python and Mecway day to day. I incorporate geometric dimensioning and tolerancing (GD&T) into my mechanical design, detailing, and inspection. I routinely use technologies that were either inaccessible or simply didn't exist during my studies: low-cost microcontrollers (Arduino), single-board computers (Raspberry Pi), low-power wireless communications (Bluetooth), micron-scale metrology (CMM), wire-bonding electronics, even CT scanners to look inside complex assemblies. Developing brand new medical technologies to help people is rewarding, but also challenging. It's a long, winding road to success that encompasses the whole development timeline—from concept and invention through regulatory approval and manufacturing, the timeline can last a decade.

2020s

Michelle Wang '21 Th'22 Th'23: I am six months into my one-year master's program, Schwarzman Scholars, in Beijing. Our program is a scholarship program focused on global affairs and global leadership. I'm taking classes on international relations, China's social institutions, Chinese, China's modern history, and other China-related courses. I've been meeting leaders from all over the world and learning from four-star generals and top professors in China.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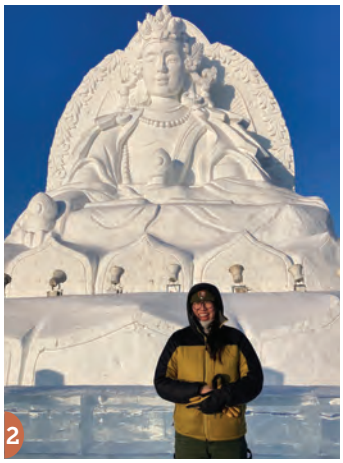
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Gallery

1 Becca Sullivan Völker '92 Th'94 has enjoyed living in Germany since 2006.

2 Michelle Wang '21 Th'22 Th'23 visits the sculptures at the Harbin Ice and Snow Festival.

3 Larry Furrer '56 Th'57 and granddaughter Katherine attended a family wedding at which he officiated.

in memoriam

SAMUEL C. FLORMAN '46 TH'46 TH'73

— 1925-2024 —

Career combined science with liberal arts

Samuel C. Florman '46 Th'46 Th'73—renowned civil engineer, general contractor, and former Thayer board member—died on February 3, 2024, at age 99.

Due to the outbreak of World War II, he began at Dartmouth in the summer of 1942. The following year he enlisted in the Navy V-12 program, earning his BS, Phi Beta Kappa. He took graduate courses at Thayer until February 1945, when he was sent to the Navy Civil Engineer Corps officers training school. The newly commissioned ensign began the voyage across the Pacific to join a Seabee battalion being mustered for an invasion of the Japanese mainland—only to arrive the day before the surrender. He turned his efforts to building a dam for the U.S. Army in what was then known as Truk, Micronesia.

Returning to New York City, he studied literature at Columbia and embarked on interwoven careers as a writer and construction contractor. He cofounded Kreisler Borg Florman Construction Co. in 1956 and spent the next 60-plus years working on projects that included bridges, schools and colleges, sanitary facilities, and hospitals. He also published more than 300 articles on technology and general culture and *The Existential Pleasures of Engineering*. "Every engineer has experienced the comfort that comes with total absorption in a mechanical environment," he wrote. "Somewhere among the states of being sought by wise men falls that wondrous moment in which the engineer becomes absorbed with the machine."

He was elected to the National Academy of Engineering and earned the Ralph Coats Roe Medal from the American Society of Mechanical Engineers, the Sterling Olmsted Award from the American Society for Engineering Education, and the Civil Engineering History & Heritage Award from the American Society of Civil Engineers.

In 1983, he received Thayer's highest honor, the Robert Fletcher Award, in recognition of achievement and service, which included a term as president of the Dartmouth Society of Engineers and as a member of the Thayer Board of Overseers. A decade later, he earned the Sylvanus Thayer Fellows Award for service to the school. He was also a member of the boards of trustees of the Hospital for Joint Diseases Orthopedic Institute, Ethical Culture Fieldston School, and New York Hall of Science.

He is survived by his wife, Judith, sons David and Jonathan and their spouses, five granddaughters, and two great-grandsons.

Gustave "Gus" Ruetenik '46 of Zoar, Ohio, died December 9, 2023. He attended Dartmouth, where he was active in Sigma Phi Epsilon, and earned his BS in mechanical engineering from Cornell University, with his studies interrupted by service in the Navy during World War II. As the owner of Ruetenik Farms with his parents and wife Elizabeth, he grew Christmas trees near Zoar since 1947. He and his wife became full-time residents of Zoar after he retired from Ohio Bell in 1981 as a mechanical engineer. He was a founding member of the Ohio Christmas Tree Association and participated in its Trees for Troops tree-donation program to the overseas troops through 2022. He was predeceased by Elizabeth and daughter Sarah. He is survived by children Bonnie, Katherine, and Gustave and their spouses; eight grandchildren; and eight great-grandchildren.

Robert E. Keane '47 Th'48 of Fernandina Beach, Fla., passed away September 9, 2023. His education at Dartmouth was interrupted when he left to enlist in the U.S. Navy. After being honorably discharged, he returned to earn his AB and master's in civil engineering at Thayer. Keene became an instructor in civil engineering at Thayer and then worked as a cost estimator at United Engineers and Constructors Inc. and Nielsons Inc. before forming construction management consulting firm Keane Associates. He received the 2018 American Red Cross Northeast Florida Disaster Services Lifetime Achievement Award and 2019 Amelia Island Genealogical Society President's Award. He was predeceased by former wives Barbara and Anne and son Robert Jr. He is survived by daughters Joanne and Judith and their spouses; eight grandchildren; 10 great-grandchildren; and two stepchildren.

Paul R. Meyer '51 Tu'52 Th'52 of Middlebury, Vt., died on August 24, 2023. At Dartmouth, he was a member of Cabin & Trail, the Dartmouth Mountaineering Club, and the Outing Club. He earned graduate degrees in business and engineering as part of the

five-year Tuck-Thayer program and was honored with the Churchill Prize for outstanding academic achievement and citizenship. After graduation, he served as a second lieutenant in the U.S. Air Force in Japan, before joining Eastman Kodak as an engineer. He went on to earn a PhD in mathematics at Columbia and then taught mathematics, first at Hunter College and then at Lehman College, until retirement in 1999. His academic career included numerous visiting appointments and the publication of 25 journal articles on topology. He is survived by his second wife, Susan; children Gretchen, Kristen, Lisa, and Peter and their spouses; seven grandchildren; and one great-grandson.

S. Robert Jelley '52 Th'53 died in his Guilford, Conn., home on January 3, 2024. At Dartmouth, he was active in The Dartmouth and graduated Phi Beta Kappa with his AB and master's in civil engineering from Thayer. He attended officer candidate school and served in the Navy Civil Engineer Corps in Morocco. Back in the States, he lived for several years in New York City, working for the engineering firm Howard Needles designing entrance ramps for the Washington, D.C., beltway. He then earned his JD from Harvard in 1961 and joined the law firm of Wiggin and Dana in New Haven, Conn. where he practiced law. He was involved in the founding of the Guilford Land Conservation. He was predeceased by his wife, Elizabeth, and is survived by children Sarah, William, and Peter and their spouses; two grandsons; and two step-granddaughters.

Peter H. Gulick '55 Th'59 died at his home in Bend, Ore., November 29, 2023. Born in Phoenix, Ariz., Gulick came to Dartmouth from Deerfield Academy. In Hanover, he earned an AB in physics, was a member of Alpha Delta Theta and Air Force ROTC, and played hockey and lacrosse. He served two years as a jet pilot with the N.H. Air National Guard before returning to Dartmouth to earn his master's in mechanical engineering at Thayer. In 1965, he started a 32-year career with Digital Equipment Co. in Europe. He was predeceased by his wife, Sue. He is survived by children Cynthia, Katherine, Stephen '81 Th'89, and Kenneth and their spouses; 10 grandchildren, and partner Kathy.

Kenneth W. Ragland '57 Th'58 passed away on September 1, 2023. At Dartmouth, he was in Debt Tau Delta and the rowing club. He earned an MS in mechanical engineering and then worked for three years building missiles for the U.S. Navy in Point Mugu, Calif. He received additional schooling at the University of Michigan, earning an MS in engineering science and a PhD in aerospace engineering. Ragland participated as a research fellow in nuclear physics in a nine-month Academy of Sciences exchange to Novosibirsk, USSR, studying gas dynamics. He joined the faculty of the University of Wisconsin for a career of more than 30 years teaching and conducting research centered around fluid dynamics, combustion, air pollution control, and renewable energy. In 1995 he was named chair of the mechanical engineering department. He is survived by Nancy, his wife of 67 years, and daughters Laura, Lisa, and Emily.

Cameron "Sandy" B. Duncan '63, former president of the Detroit Music Hall Center for the Performing Arts, passed away on August 28, 2023. He majored in engineering sciences at Dartmouth, where he was a brother of Zeta Psi (vice president) and ran track all four years. After receiving his MBA in marketing from Indiana University, he served his country as an officer in Vietnam. In 1970, he moved to Detroit, Mich., and began a 32-year career at Deloitte & Touche. Duncan's contributions to the Detroit cultural community include management or board roles with the Detroit Opera, Detroit Symphony Orchestra, and The Parade Co. Duncan also assisted with the restoration of the Statue of Liberty and Ellis Island. He is survived by his brother, his companion, and an extended family of nieces and nephews.

| in memoriam |

HENRY W. PARKER '46 TH'47

— 1924-2023 —

Professor put Stanford engineering program on the map

Henry "Hank" W. Parker '46 Th'47, Stanford professor emeritus of civil and environmental engineering, died in Hanover on July 7, 2023, at age 99. A master of logistics and planning of large-scale highway and dam construction projects, he was recruited to the Stanford Construction Engineering and Management Program to provide graduate education for the thousands of engineers then completing the interstate highway system and the many dam projects dotting the arid Western states.

Elected a fellow of the American Society of Civil Engineers, Parker's courses covered everything from estimating concrete mix and form design to construction, surveying, human factors, and work improvement. His best-known contribution to construction theory and practice was the 1988 book, *Productivity Improvement in Construction,* which continues to provide many relevant concepts and methods.

"Hank put the Stanford construction program on the map globally, both in academia and in industry," says Martin Fischer, Stanford professor of civil and environmental engineering. He had "boundless passion for the built environment and those who create it. He undoubtedly made construction safer, of higher quality, and more productive."

At Dartmouth, Parker was active in the Outing Club, Glee Club, Cabin & Trail, and Theta Delta Chi and competed in football and cross country. He graduated early, Phi Beta Kappa with a bachelor's in engineering sciences, as part of the Navy V-12 program and served in the Marines during World War II before completing his MS at Thayer. Prior to his lengthy Stanford tenure, Parker worked for Winston Brothers Construction Co. of Minneapolis and served in the Korean War from 1950 to 1952. After early retirement in 1982, Parker continued to teach full time for several years until he and his wife, Polly, returned to Hanover, where he was active in the Dartmouth Society of Engineers.

Parker was predeceased by Polly, his wife of 69 years; he is survived by children Martha, David, Jeffrey, and Judith; grandchildren Ross, Whit, Annie, Ellie, and Will; and two great-grandchildren.

Collaborations

"It has been really rewarding to train students ... and to see how their work has the potential to inform and change clinical practice."

—PROFESSOR MARGIE ACKERMAN

Graduate students Slein and Backes seek new treatments for neonatal herpes.

Insights Into Antibodies

Findings from a study by Professor Margie Ackerman and researchers from Dartmouth's Geisel School of Medicine offer new insights into how antibodies function in combating herpes simplex virus (HSV) infections.

Their research may lead to possible new treatments for neonatal herpes. HSV infections are common and typically affect the skin and the nervous system. Although these viruses often lay dormant in the body, HSV can be more dangerous for those with weak immune systems, in some cases causing corneal blindness and brain infections. Neonatal HSV infections are particularly devastating—severe infections can spread to internal organs and the brain—and are one of the deadliest neonatal infections.

As they have in the past, Ackerman and David Leib, chair and professor of microbiology and immunology at Geisel, combined the expertise and resources of their labs while supervising the work of PhD candidate Matthew Slein, and MD-PhD student Iara Backes, co-first authors on the study published in *Cell Reports Medicine*. "It has been really rewarding to train students such as Matt and Iara at the intersection of molecular engineering and medicine and to see how their work has the potential to inform and change clinical practice," says Ackerman.

ROB STRONG '04

IN THE NEWS

"What's Next for Generative AI: Household Chores and More"

MIT Sloan School of Management

Coauthor Professor Geoffrey Parker explains how "Large X models" that turn text into actions may ultimately allow generative AI to water plants and peel potatoes.

"ChatGPT: Here's What It Is, How It Works, and How It's Evolving"

CNET

Dean Alexis Abramson is quoted on getting a handle on the evolving power of ChatGPT: "It's unavoidable that students will use ChatGPT, so why don't we figure out a way to help them use it responsibly?"

"Teaching Evaluations Are Broken. Can They Be Fixed?"

The Chronicle of Higher Education

Professor Eugene Korsunskiy is quoted on Dartmouth's participation in the AAU STEM Demo Projects: "Our thesis here is teaching is more about a series of learnable skills than any sort of magic talent or trait that some people have and some people don't.

"A Good-for-something Second Brain"

Nature Communications

Rachael Hachadorian Th'21 mentions Professor Brian Pogue in an essay describing the highs and lows of taking a research project from hypothesis to publication. "The vast majority of my research motivation comes from a gratitude, almost a debt, that I feel I owe to medical doctors," she writes.

@thayerschool

New EDGE Scholars Fatmata Sesay '27, Victoria Ruiz '26, and Lorenzo Rodriguez Th'25 were among 14 students getting an inside look at Micron Technology's state-of-the-art semiconductor fabrication facility—an "opportunity to gain insights from industry professionals," says Ruiz.

I'm an Engineer and an Esports Commentator

PhD student Philip Mulford Th'25 discusses how he became an Esports commentator and how practicing communication skills benefits his research at youtu.be/R5KnftAlSVo.

@thayerschool

Thayer kicked off its Fireside Chats—a series of informal conversations about themes that impact life and work with Dean Alexis Abramson, Professor Katie Hixon, PhD candidate Julia Huddy Th'24, and MShop technical instructor Izzy Labombard sharing their experiences.

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Award-winning Array

The Class of 1982 Engineering and Computer Science Center earned Leadership in Energy and Environmental Design (LEED) Platinum certification, the U.S. Green Building Council's highest designation for sustainable features, including rooftop solar.

Photograph by Eli Burakian '00