Penn Engineering

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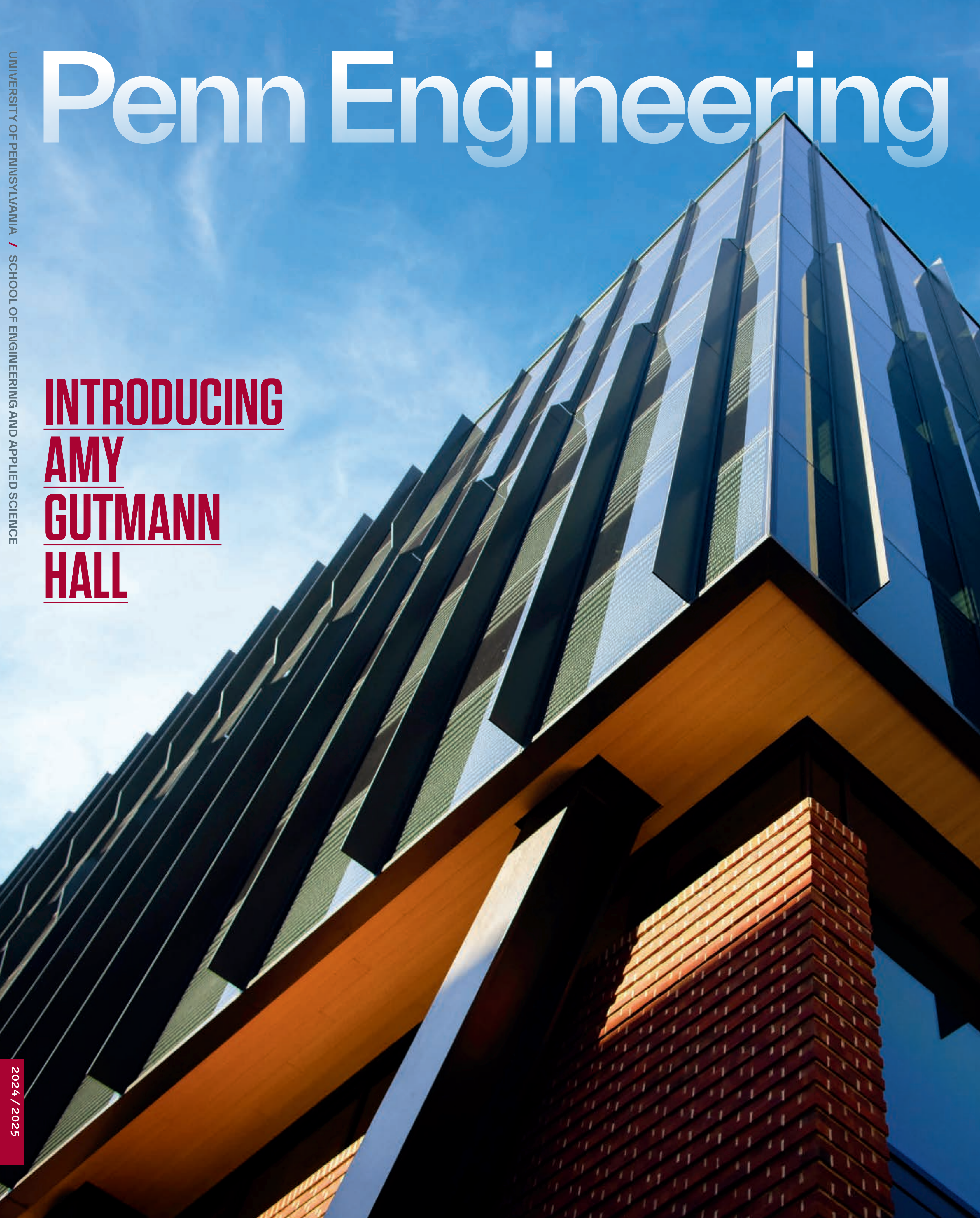

INTRODUCING AMY GUTMANN HALL

2024 / 2025

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FROM THE DEAN

Engineering as Optimism

Vijay Kumar
Nemirovsky Family Dean


Lisa Godfrey

BACK IN MAY, I told the Class of 2024 that "to be an engineer is to be an optimist." There are many challenges faced by humanity, but I remain a dedicated optimist when it comes to the ability of engineers (especially our Penn Engineers!) to meet and overcome grand challenges, including human health, climate change and the responsible implementation of artificial intelligence (AI).

These challenges also present unique opportunities to capitalize on data science and AI to drive innovation and discovery. I'm proud to share that the last year at Penn Engineering has exemplified this spirit of optimism.

This spring, Penn Engineering announced two new degree programs, the Raj and Neera Singh Program in Artificial Intelligence bachelor's program, and the Raj and Neera Singh Program in Artificial Intelligence online master's in AI. Both degrees are the first of their kind in the Ivy League and will prepare future engineers with a deep understanding of AI technologies and the social and ethical responsibilities they must consider.

During the September 27 dedication ceremony for Amy Gutmann Hall, our newest building and the future home of AI innovation at Penn, I shared with our alumni, friends and special guests that, "For a university, a new building is a monument, not to the past, but to the future." Indeed, Amy Gutmann Hall is a monument to optimism, particularly that of Harlan M. Stone (C'80), the building's lead donor, who is also a Penn Engineering parent, Advisor and University Trustee. Penn Engineering is deeply grateful to Harlan and his vision for Penn, and especially for his choice to name the building in honor of the leadership and dedication of Penn President Emerita Amy Gutmann.

Finally, on October 17, Penn Engineering launched its newest initiative, Responsible Innovation, at an event co-hosted by Perry World House and held at the Penn Washington Center. With guest speakers Michael Horowitz, the Richard Perry Professor and Director of Perry World House, and Penn Trustee and Engineering Board member Ted Schlein (C'86), the critical themes of this event included considering the long-term impacts of technological innovation, balancing innovation with regulation, and prioritizing the incorporation of ethics and social impact into engineering education.

These advancements are each made possible by the dedication of our global community of alumni and friends. To each of you, I am grateful for your steadfast commitment and continued support, and I especially look forward to what our shared sense of optimism will bring to our students, our community and the world.

THE BIG PICTURE

What Is This?

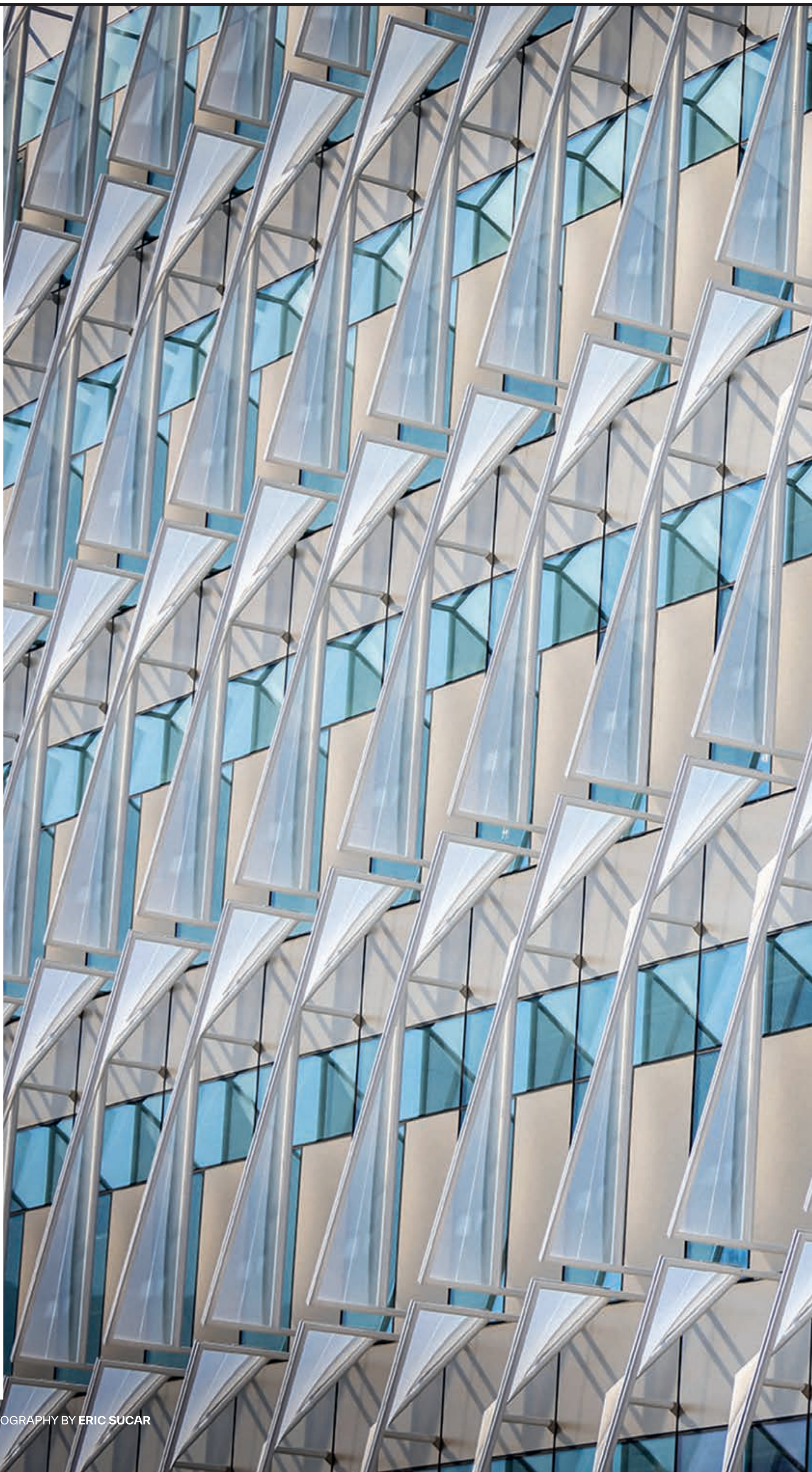
A microscopic surface? An AI-generated image? A series of fun-house mirrors? Wrong. This is a close-up view of the sun shades on the facade of the new Vagelos Laboratory for Energy Science and Technology (VLEST), located on Penn's campus at 32nd and Walnut Streets.

Slated to open this winter, the 112,500-square-foot laboratory is a collaboration between Penn Engineering and Penn Arts & Sciences and promises to usher in the future of energy research and technology at Penn. It is therefore fitting that the building itself was designed with energy and sustainability at the forefront.

The building's sun shades were designed by Behnisch Architekten, a German architectural firm, and have a "striking finlike shape, working in tandem with a horizontal and vertical window design that efficiently manages solar gain while still allowing for occupant-friendly views," notes *Penn Today*.

In other words, a critical building design challenge can be managing the energy impact of sunlight while still allowing for uncovered windows where occupants of the spaces are able to leverage daylight and see outside. The unique facade of the VLEST is simultaneously able to reduce energy usage caused by solar heat impact and allow for stunning views because these geometric shades feature a bottom panel that reflects away the solar heat from the glass surface while the smaller top panel encourages the diffusion of light deep into the space above eye level.

To learn more about this leading-edge building design, use the QR code to check out the full piece, "What's That? Sun shades at the Vagelos Lab," originally published in *Penn Today* and written by Brandon Baker.



PHOTOGRAPHY BY **ERIC SUCAR**

BREAKTHROUGHS

Extending Battery Lifespan and Capacity Through Self-Healing Materials

BY Ian Scheffler

ONE OF THE greatest challenges in the fight against climate change is energy storage. Fossil fuel essentially stores itself, with its energy locked inside its own chemical bonds. But how do you store more sustainable, but otherwise ephemeral, forms of energy, like the power of the wind and sun?

For Eric Detsi, Associate Professor in Materials Science and Engineering (MSE), the answer is batteries, with the caveat that batteries powerful enough to meet the future's energy demands — the International Energy Agency projects that worldwide battery capacity will need to sextuple by 2030 — do not yet exist.

In most batteries used today, from the disposable alkaline batteries in household appliances like alarm clocks to the rechargeable lithium-ion batteries in hybrid and electric vehicles, the electrodes between which ions flow are typically made of solid materials like metal oxides or graphite. But, as Detsi points out, each cycle of charging and discharging the battery damages the material because the electrodes expand and contract, sometimes by as much as 300%, which is one of the reasons why even rechargeable batteries gradually lose capacity and eventually fail.

"There is a need for materials that can store a large amount of lithium, sodium and magnesium for use in high-performance batteries," says Detsi. "The problem is that the more lithium, sodium or magnesium a battery material can store, the more it expands and shrinks during charging and discharging, resulting in huge volume change."

Some researchers, including the late 2019 Nobel laureate John Goodenough, one of the creators of lithium-ion batteries, recently started

PHOTOGRAPHY BY **KEVIN MONKO**

to develop batteries with liquid electrodes, which don't break when their volume changes. But liquid electrodes present other challenges, namely the difficulty of safely manufacturing and using batteries that behave like water balloons. In other words, just building larger or liquid batteries won't work—to design the batteries of the future, researchers will need to create entirely new materials.

What's more, many of the elements typically used in mass-produced, rechargeable batteries—like lithium and cobalt—are becoming increasingly expensive, not to mention entangled in human rights abuses, as demand for batteries increases. (Last year, Siddharth Kara, a professor at the University of Nottingham, published *Cobalt Red: How the Blood of the Congo Powers Our Lives*, an exposé about the abysmal labor practices in the Democratic Republic of the Congo, which produces three-quarters of the world's cobalt.) "The need for high-performance batteries for emerging energy storage applications such as grid-scale storage and electric vehicles led me to study materials for batteries," says Detsi.

To that end, his group has been studying batteries made primarily of sodium and magnesium, which are cheaper and less ethically fraught since sodium and magnesium are plentiful in the earth's crust. More importantly, sodium and magnesium resources are abundant in the U.S. For example, according to the U.S. Geological Survey (USGS), 68.8% of the world's reserves of sodium carbonate (soda ash) and 14.5% of the world's sodium chloride (salt), which are needed to make sodium, are found in the U.S.

Detsi's group is using these metals to develop electrodes that shift between liquid and solid states to avoid damage during charge cycles while still being easy to manufacture. "When the material is in the solid phase, it will start degrading due to the huge volume changes occurring during charge storage," says Detsi. "However, when the material transforms from solid to liquid, it 'heals' itself by recovering from volume-change-induced degradation."

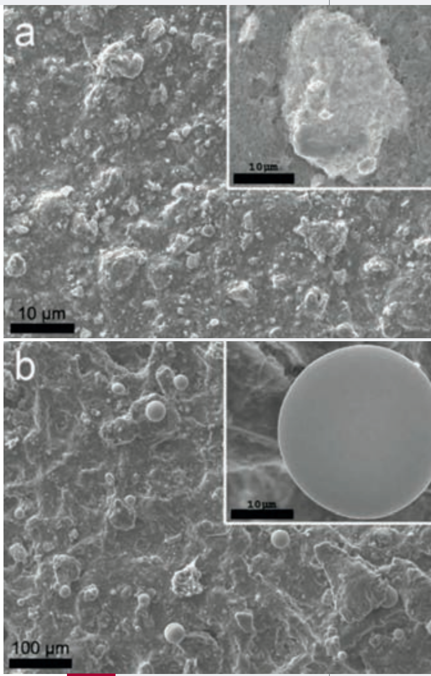
At first, Detsi demonstrated the feasibility of this approach using an anode—the electrode that collects ions during charging—made of dimagnesium pentagallide (Mg_2Ga_5), a mixture of magnesium and gallium, the latter of which has a low melting point, making it easy for such alloys to shift from solid to liquid.

In 2019, Detsi's lab, along with that of Vivek Shenoy, Eduardo D. Glandt President's Distinguished Professor in MSE, in Mechanical Engineering and Applied Mechanics (MEAM), and in Bioengineering (BE), showed that self-healing anodes made of Mg_2Ga_5 could withstand more than 1,000 charge cycles. "Before our work," says Detsi, "the cycle life of state-of-the-art magnesium-ion battery anodes was only 200 cycles." In other words, the addition of the self-healing anode quintupled the initial lifespan of magnesium-ion batteries.

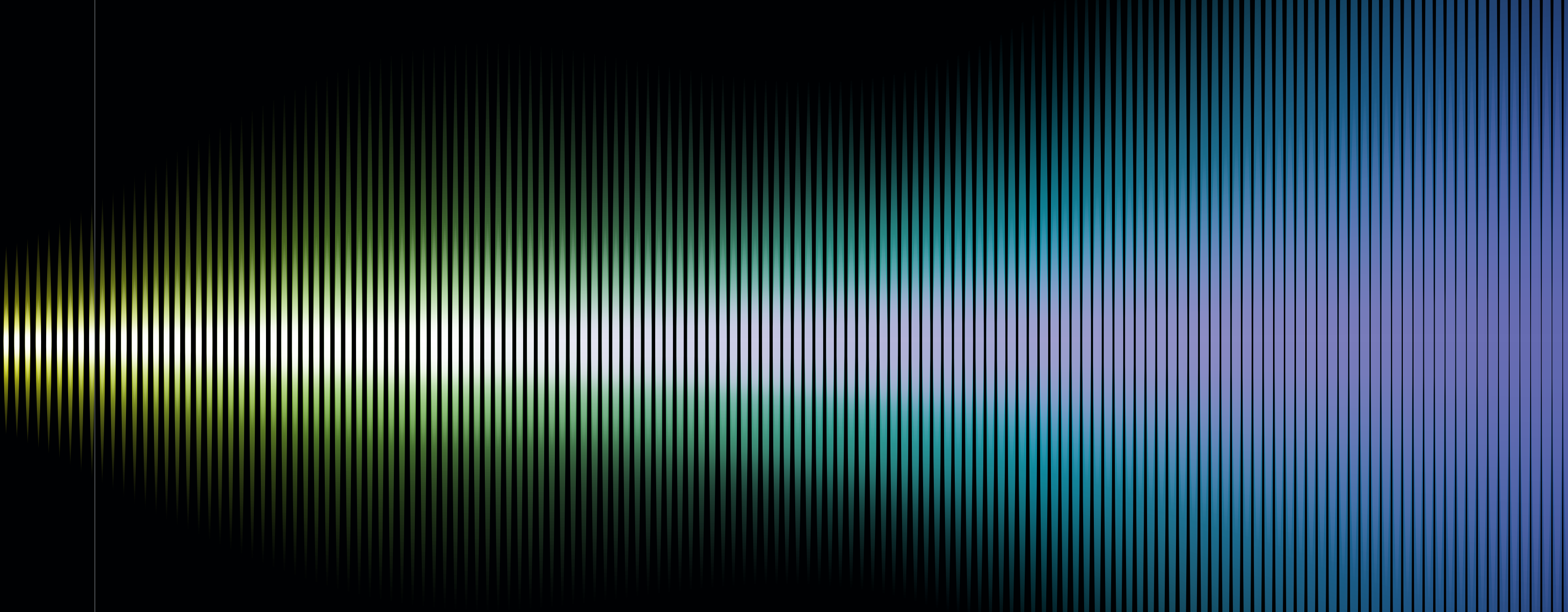
Earlier this year, Detsi's lab pushed the envelope even further, using a gallium-indium anode that melts at room temperature, potentially opening the door to commercial applications. The experimental anode survived 2,000 charging cycles while retaining 91% battery capacity. "This is unprecedented," says Detsi. For context, the iPhone 15 can sustain 1,000 charging cycles while retaining 80% battery capacity.

In order to advance the project, Detsi and his co-authors—Lin Wang and Alexander Ng, recent Ph.D. graduates, and Roxana Family, a postdoctoral fellow—employed a variety of advanced imaging techniques to better understand the material's transformation from solid to liquid, including X-ray diffraction, X-ray scattering, X-ray spectroscopy and cryogenic scanning electron microscopy. The latter technique involves freezing the liquid metal anodes at different stages to better study the self-healing process, as Detsi and his group described in a 2023 paper published by the American Chemical Society.

Nearly a decade ago, when Detsi and his group started exploring the concept of self-healing sodium- and magnesium-ion batteries, hardly anyone took his ideas seriously. "I remember a reviewer of one of our proposals on sodium-ion batteries asking why sodium-ion batteries are not commercialized if they are so great," Detsi says. "At the time, there was only one startup company developing sodium-ion batteries. Now there are many across the globe."



In this microscopic view, a novel battery developed by the Detsi lab using dimagnesium pentagallide (Mg_2Ga_5), a mixture of magnesium and gallium, is shown before (a) and after (b) the self-healing process takes place.



To 6G and Beyond

THE ELECTROMAGNETIC SPECTRUM is one of the modern world's most precious resources. Only a tiny fraction of the spectrum, mostly radio waves representing less than one billionth of one percent of the overall spectrum, is suitable for wireless communication.

It's a crowded space, with wireless communications mostly using the lower-frequency bands, which are also carefully controlled by the Federal Communications Commission (FCC).

Current wireless networks, including 5G, 4G and 3G, operate from 600 MHz to 6 GHz. Devices use different filters for different frequencies, meaning that the typical smartphone includes upwards of 100 filters to ensure that signals from different bands don't interfere with one another. The FCC recently made available what is known as the Frequency Range 3 (FR3) band, which includes frequencies from about 7 GHz to 24 GHz, for commercial use. FR3 will likely roll out for 6G or Next G, and current filter technologies in those bands are highly limited.

To combat this issue, Troy Olsson, Associate Professor in Electrical and Systems Engineering (ESE), has collaborated with Mark Allen, Alfred Fitler Moore Professor in ESE, and Firooz Aflatouni, Professor in ESE, to create a new filter that is designed to be adjustable, so that engineers can use it to selectively filter different frequencies rather than have to employ separate filters for each frequency.

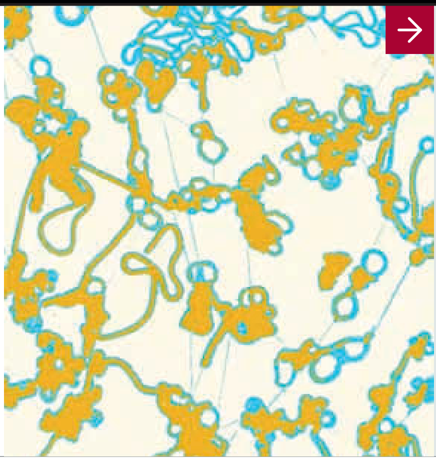
This means not having to put another 100+ filters in your phone with many different switches, creating the most viable path to using the FR3 band.

INSIDE ENGINEERING

Bioengineering

CHARACTERIZING CELLULAR CARGO

Jina Ko, Assistant Professor, has created a novel tool to characterize the contents of extracellular vesicles, the cargo-carrying particles excreted by many cells, potentially advancing the early detection of diseases like cancer.



Chemical and Biomolecular Engineering

LIQUID CRYSTAL CONVEYOR BELTS

Chinedum Osuji, Eduardo D. Glandt Presidential Professor, has demonstrated that under the right conditions, liquid crystals form astonishing structures reminiscent of biological systems, spontaneously generating filaments and flattened discs that can transport material from one place to another.

Leveraging AI to Fight Antibiotic Resistance

THE RISE OF drug-resistant bacteria, resulting from years of treatment misuse, is a growing global health crisis that causes approximately 4.95 million deaths per year and threatens to make even common infections deadly.

To combat this problem, education is key (be sure to finish your full course of antibiotics!), but it must be complemented with the development of new antibiotic solutions.

César de la Fuente, Presidential Associate Professor in Psychiatry and Microbiology in Penn Medicine, in Bioengineering and in Chemical and Biomolecular Engineering in Penn Engineering, and in Chemistry in Penn Arts & Sciences, leads a team of interdisciplinary researchers to tackle this looming threat.

First, de la Fuente pioneered an artificial intelligence tool to mine the vast and largely unexplored biological data—more than 10 million molecules—from both modern and extinct organisms to discover new antibiotic candidates. This method dramatically reduces the usual time and costs associated with developing new preclinical drug candidates, and means that new candidates can be identified within hours instead of years.

Now, as de la Fuente works to usher in a new era of antibiotic discovery, he is working with Jacob Gardner, Assistant Professor in Computer and Information Science, whose work explores how machine learning techniques can be applied to large-scale, high-dimensional optimization problems in the natural sciences.

Together, the team is taking some of the potential antibiotics identified from extinct organisms and using AI to optimize these candidates to be even more effective and broad spectrum.

Penn Engineers César de la Fuente (left) and Jacob Gardner (right) are collaborating to optimize potential new antibiotics.

Kevin Monko

Computer and Information Science

IMPROVING DEPRESSION DETECTION

Sharath Chandra Guntuku, Research Assistant Professor, has collaborated to show that methods used to detect possible depression through language in social media posts break down when applied to posts made by specific racial groups, highlighting the importance of considering the intersection of race, health risks and social media.

Electrical and Systems Engineering

LIGHT-SPEED COMPUTING

Nader Engheta, H. Nedwill Ramsey Professor, and Firooz Aflatouni, Professor, have developed a new chip that uses light waves, rather than electricity, to perform some of the complex math essential to training AI, potentially accelerating the processing speed of computers while also reducing their energy consumption.

Materials Science and Engineering

NOVEL NANOCRYSTALS

For the first time, a team led by Christopher Murray, Richard Perry University Professor, has observed different nanoparticles combining into one superstructure in real time, an advance that could lead to manufacturing materials that combine properties like magnetism and photoluminescence.

Mechanical Engineering and Applied Mechanics

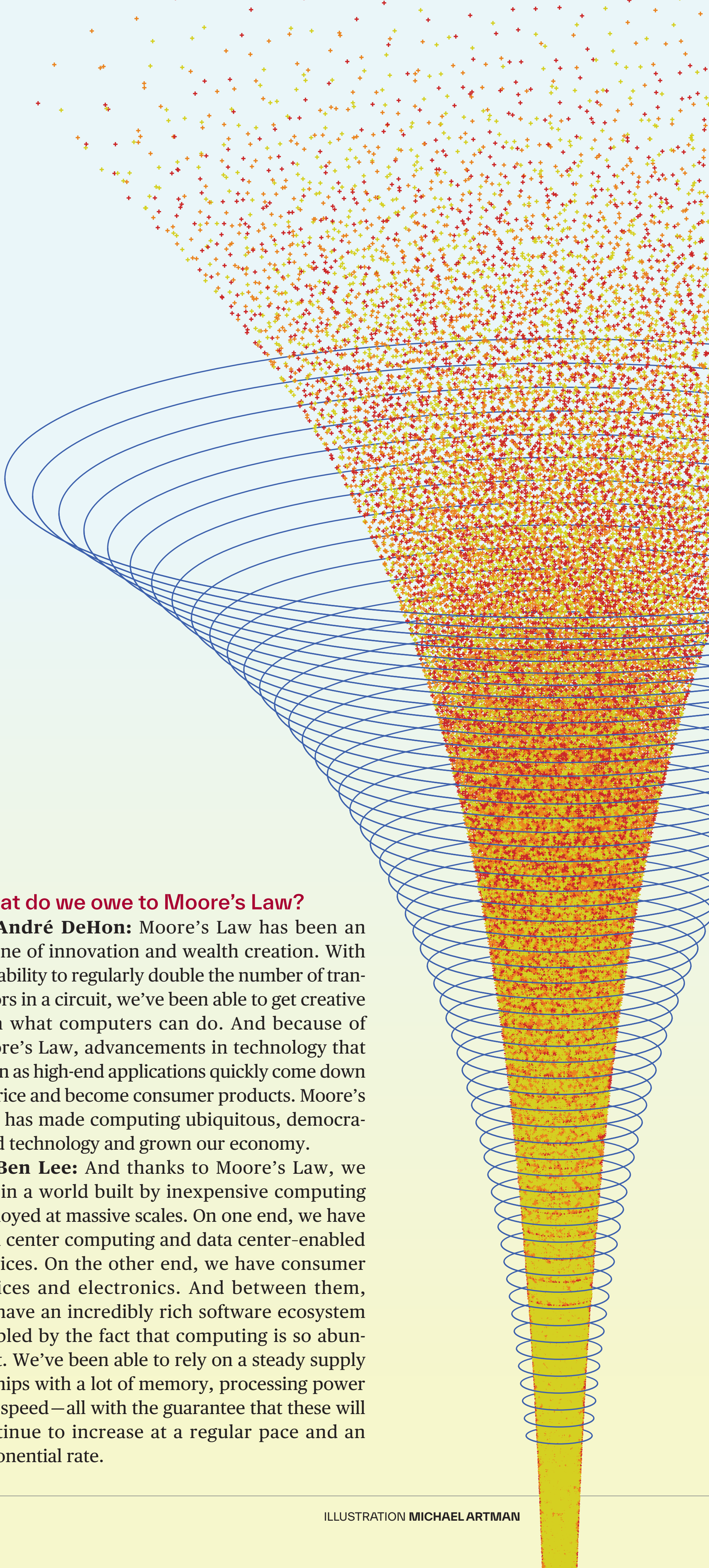
SELF-FOLDING ROBOTS

Cynthia Sung, Associate Professor, has developed CurveQuad, a tiny robot powered by a single motor that uses curved-crease origami to self-fold, unfold, crawl and steer, underscoring origami's potential in designing low-cost robots. The manufacturing process for CurveQuad is also scalable to large-volume production.

IN QUESTION

Is Moore’s Law Really Dead?

BY **Devorah Fischler**



IN 1965, GORDON Moore defined a relationship between cadence and cost for computing innovation that came to be known as “Moore’s Law.” This rule both described and inspired the exponential growth that built the Information Age.

As Moore predicted, integrated circuits doubled their processing power every two years. Chips got smaller, faster and cheaper. Transistors shrank, and energy requirements dropped. And in line with Moore’s vision, computers transformed our infrastructure, homes and thumbs. Markets acclimatized to this regular pace of progress, and the software industry flourished.

We’ve come to expect rapid improvements in technology. But can Moore’s Law go on forever?

Despite its success, doubts about the future of the Intel founder’s forecast are nothing new. Fears about the limits of fundamental physics have long accompanied the mandate to halve transistor sizes, and fresh difficulties regulating energy costs and heat have headlined the last decade of engineering challenges.

With speed bumps on the path of progress ahead, experts have become at once more contemplative and ambitious about the future of computing technologies.

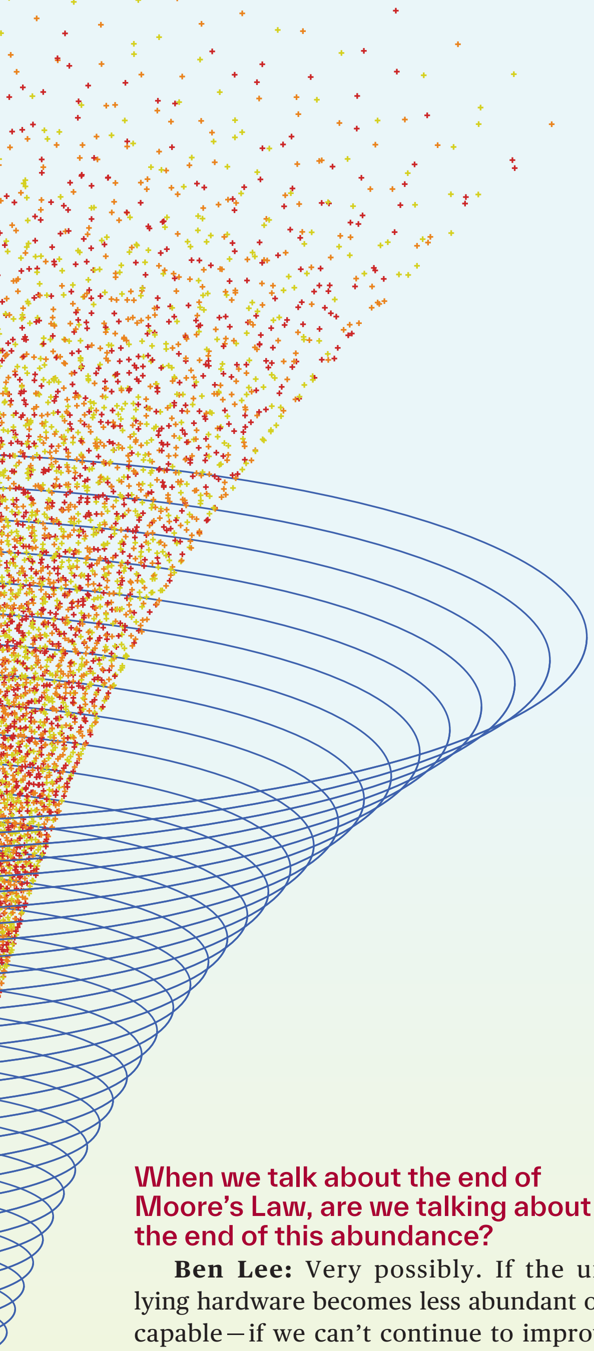
In this Q&A, Ben Lee, Professor in Computer and Information Science (CIS) and Electrical and Systems Engineering (ESE), and André DeHon, Boileau Professor of Electrical Engineering in CIS and ESE, dig into the stakes of Moore’s Law and reflect on the consequences and opportunities of its possible end.

What do we owe to Moore’s Law?

André DeHon: Moore’s Law has been an engine of innovation and wealth creation. With our ability to regularly double the number of transistors in a circuit, we’ve been able to get creative with what computers can do. And because of Moore’s Law, advancements in technology that begin as high-end applications quickly come down in price and become consumer products. Moore’s Law has made computing ubiquitous, democratized technology and grown our economy.

Ben Lee: And thanks to Moore’s Law, we live in a world built by inexpensive computing deployed at massive scales. On one end, we have data center computing and data center-enabled services. On the other end, we have consumer devices and electronics. And between them, we have an incredibly rich software ecosystem enabled by the fact that computing is so abundant. We’ve been able to rely on a steady supply of chips with a lot of memory, processing power and speed—all with the guarantee that these will continue to increase at a regular pace and an exponential rate.

ILLUSTRATION **MICHAEL ARTMAN**



When we talk about the end of Moore's Law, are we talking about the end of this abundance?

Ben Lee: Very possibly. If the underlying hardware becomes less abundant or less capable—if we can't continue to improve on memory, processing power or speed—that will translate into constraints on what we can build on software. And we're already running into trouble with scaling. Take augmented reality. If we want to expand what AR can do and Moore's Law no longer holds, wearable devices risk becoming too bulky and hot, putting an entire form of media at risk of stalling. And think of AI. We're seeing a lot of data centers and GPUs dedicated to AI applications. If those chips don't get smaller, more power-efficient or less hot, we're going to see real sprawl in data center buildings.

André DeHon: The democratization I mentioned earlier would also be at risk. We're talking about widening gaps between well-resourced entities and everyday people. It will take a lot of money to buy all these chips and build these networks and data centers. Technology will cease to trickle down.

Engineers are experts in navigating constraints. The end of Moore's Law would expose us to risk, but could that pressure also bring with it opportunities to try new things?

André DeHon: Absolutely. And this sheds light on a drawback of Moore's Law. Because we've had the ability to keep decreasing transistor size to increase computing power, we've been throwing transistors at problems that didn't require them as a solution. It's a brute force method, and Moore's Law has incentivized it at the expense of smarter ones like creative architectures and better coordination between software and hardware engineers. There are some exceptions. MP3 design was very clever in its encoding. It gave us digital music around a decade before Moore's Law would have enabled it.

Ben Lee: And in the early 2000s, scientific computing—high-performance computing—required massive improvements in energy efficiency that Moore's Law couldn't have provided. The usual reliance on exponential growth in the number of cores on a chip was a dead end for this kind of application, and so we saw some real creative thinking—a shift from CPUs to GPUs—and renewed interest in custom design, including hardware-software codesign.

Since there's already a track record of innovation that skirts Moore's Law, is there a chance that we will continue to see the same kind of progress with a different hardware story?

Ben Lee: It's possible. I'm not entirely optimistic about cost. These new technologies are going to be expensive, and we don't yet have clear paths forward for equity of access.

André DeHon: There is, however, a lot to be optimistic about. Moore's Law has been revolutionary, but it has also bred reliance on crude solutions to problems we could have been solving with creativity and efficiency. The future will be built by computer engineers who can now prioritize this kind of innovation. There's a lot to catch up on.

Moore's Law has been an engine of innovation and wealth creation. With our ability to regularly double the number of transistors in a circuit, we've been able to get creative with what computers can do.

Benjamin C. Lee

André DeHon

IN PRACTICE

Building a Clean Energy Future

BY Natalie Pompilio

THE AMOUNT OF carbon dioxide in Earth's atmosphere reached an all-time high this May, and odds are, 2024 will rank as the warmest year on record.

Climate intervention requires more than lowering greenhouse gas emissions through increasing energy efficiency and transitioning to renewable power sources; we also need to remove the carbon dioxide that is already in the atmosphere.

Jennifer Wilcox and her team at Penn's Clean Energy Conversions Lab are finding ways to do just that. An expert on all things "carbon management," she's been pursuing carbon-reducing and -removal technologies her entire career.

"We're almost out of time," says Wilcox, Presidential Distinguished Professor of Chemical Engineering and Energy Policy in the Kleinman Center for Energy Policy and the Department of Chemical and Biomolecular Engineering. "If there's something I can do that will have an impact, I'm going to do it."

Establishing National Policy at DOE

Wilcox recently completed her tenure at the U.S. Department of Energy (DOE), where she served as the Principal Deputy Assistant Secretary for Fossil Energy and Carbon Management. There, she expanded the department's research and development (R&D) program, putting an emphasis on new carbon management methods, including carbon capture, removal, conversion and storage, with the goal of minimizing environmental and climate impacts of fossil fuels.

That 3.5-year appointment delayed Wilcox's arrival to Penn's campus until this year, but gave her another way to showcase more than a decade's worth of clean-energy efforts, including research that led to the creation of the direct air capture (DAC) technology used by Heirloom, a 2020 startup. Noah McQueen (GR'21), Heirloom's co-founder, was one of Wilcox's graduate students at Worcester Polytechnic Institute (WPI) before following her to Penn Engineering, where he completed his Ph.D. while she was at DOE.

Heirloom's technology leverages magnesium or calcium-rich feedstocks that react with carbon in order to capture CO_2. Once captured, the resulting carbonate minerals are then heated, and CO_2 is re-released in a high-purity form for compression and deep underground storage. Alternatively, in cases where the carbon removal is done on a smaller scale, the carbon can be stored in concrete products.

Regarding McQueen's work with Heirloom, Wilcox is modest. "I'm a teacher, and when my students are successful, I'm proud of them. I'm a cheerleader," says Wilcox, noting that McQueen made *Forbes*' 2023 "30 Under 30" list for social impact.

Predicting a Cleaner Future

Wilcox similarly downplays her DOE achievements. She'd just completed her move from WPI to Penn in late 2020, when she received an email from the incoming Biden-Harris Administration asking if she was interested in a job at the DOE's Office of Fossil Energy.

She assumed it was spam and deleted it. "Then they sent me another one. My husband said, 'That's not spam. You need to submit your CV,'" Wilcox recalls. "I hadn't even unpacked my boxes. I wasn't looking for another job."

But the opportunity was too good to pass up. Penn's leadership, recognizing the government's interest in Wilcox as confirmation they'd asked the right person to join their team, granted Wilcox leave before she'd even started work.

Soon after taking office, President Biden signed an executive order committing the nation to eliminating carbon pollution from the electricity sector by 2035 and to achieving net-zero emissions across the economy by 2050.

That prompted a change to Wilcox's office that went far beyond a name addendum. (The Office of Fossil Energy added the words "and Carbon Management" to its letterhead.) It was also tasked with distributing billions of dollars in carbon management R&D and demonstration funding. One such DOE project in western Pennsylvania has since moved on to more advanced stages without needing government support. "The private sector scooped them up," Wilcox says. "That's how it should happen."

Another DOE success for Wilcox? Being part of the 2021 launch of the "Energy Earthshots" initiative: eight

PHOTO BY KEVIN MONKO

well-funded, clean-energy research goals, including enabling the removal and storage of CO_2 from the atmosphere for less than $100/net metric ton of CO_2 within the decade. During a 2018 TED Talk, Wilcox had proposed a similar program, modeling the funding strategy after the U.S.'s successful Apollo program in 1966, when it allocated about half of 1% of GDP in funds. In modern terms, that's about $100 billion. Investing even a fraction of that amount would have a significant impact in the fight against climate change. "I made a prediction, and six years later, I was building and launching that program," Wilcox says. "It was surreal."

Creating New Solutions at Penn

Now back at Penn, Wilcox says her lab will continue to find engineering-based solutions to the problem of man-made pollution.

Those solutions could include using ultramafic rocks, which are rich in magnesium and calcium that readily react with carbon. Through enhanced rock weathering, these rocks could ultimately detoxify bodies of water, a treatment that may potentially reduce the acidity in the Schuylkill River. She also hopes to explore engineering approaches to increasing the amount of carbon stored in woody biomass in forests.

"People get nervous when we say we're going to drill a well a mile underground and inject CO_2. They don't know what that means," she says. "But when you mineralize carbon in a rock, or remove CO_2 from the atmosphere through enhanced forest uptake, that's a more comfortable solution. The social barrier feels easier to overcome."

She's also interested in repurposing industry waste. That could mean using fly ash—a coal combustion byproduct—to source minerals that can store carbon, sourcing rare-earth elements for making batteries for electric vehicles or magnets for wind turbines, or leveraging old batteries to extract critical minerals that American manufacturers now source from abroad. This approach is costly, she notes, but carries invaluable co-benefits.

"You have to flip it. It's not about the cost. It's about the value," she says. "It's valuable that we wouldn't need to depend on other countries for critical materials and at the same time create jobs where they have been lost because mining coal is on the decline. There's value because you're remediating and restoring ecosystems."

A native of Maine, Wilcox is also excited about a new collaboration she's launched between Penn and academics at the University of Maine's School of Forest Resources. She also talks about the possibilities of using the outdoor space provided by Pennovation Works (where her lab resides) to carry out more controlled carbon-removal forest and agriculture experiments with some of the same rocks that led to Heirloom's technology through enhanced rock weathering.

"I get excited about these projects and working with students on cutting-edge ideas that have a solid pathway to positive climate and environmental impact. I'm ready to get going."

Heirloom's Direct Air Capture (DAC) facility in Tracy, CA, is capturing CO_2 from the atmosphere and embedding it permanently in concrete, which can then be used in the foundations of buildings and other structures.

"WE'RE ALMOST OUT OF TIME. IF THERE'S SOMETHING I CAN DO THAT WILL HAVE AN IMPACT, I'M GOING TO DO IT."

Kevin Monko

INTRODUCING

Amy Gutmann Hall

BY **Olivia J. McMahon**

Eric Sucar

The formal dedication of Amy Gutmann Hall occurred in September at a University-wide event that included celebratory remarks and a ribbon-cutting ceremony.

ON September 27, more than 200 members of the Penn community and honored guests gathered in the Stavis Family Auditorium in Amy Gutmann Hall to formally dedicate and open the University's new home for innovation in data science and AI.

"This is a day for celebration," said Vijay Kumar, Nemirovsky Family Dean of Penn Engineering, while welcoming the group. "I am proud to say that Penn has been at the forefront of the data science and AI revolution, and with this new building, the sky is the limit."

Held nearly three years to the date of the building's early October 2021 groundbreaking, the ceremony welcomed attendees inside the building for the first time, where they could experience the soaring six-floor, 116,000-square-foot facility that will produce the engineers and the technologies that will bring us the future of collaborative AI and data-driven solutions.

"Amy Gutmann Hall will be a place for discovery and breakthroughs, and there are already so many of these happening at Penn," said J. Larry Jameson, Interim President. "From physics to political science, from art to archeology, these are going to be represented here."

With the addition of this new facility, Penn is poised to continue its trajectory of leadership in addressing grand challenges. "Things we only thought of as science fiction are now becoming realities. And some of those realities will emerge in Amy Gutmann Hall," said Ramanan Raghavendran (ENG'89, W'89, LPS'15), Chair, Board of Trustees. "Our world faces many great challenges—in health care, in education, in public policy, in climate and sustainability. At Penn, we take on these challenges. We find solutions."

“It wasn’t that long ago that Amy Gutmann Hall was just an inspired idea,” said Rob Stavis (EAS’84, W’84), University Trustee and Chair of Penn Engineering’s Board of Advisors, as he led the group in a toast marking the occasion. “Thanks to the effort and commitment of so many in this room, this bold plan was transformed into a spectacular reality.”

THE FUTURE OF DATA SCIENCE AND AI

Located at 34th and Chestnut Streets, Amy Gutmann Hall expands the School’s existing footprint by about 20% and boasts an impressive array of spaces for research, teaching and student collaboration, centralizing resources and tools for scholars from across Penn and beyond. Highlights include dedicated cross-disciplinary research spaces, leading-edge teaching labs, a Data Science Hub and flexible, multi-use learning spaces that enhance community building.

“Amy Gutmann Hall is designed to welcome you in with open, warm spaces. As you move up through the building, you start to transition from spaces for the whole community to specialized spaces for research and collaboration,” says Zachary Ives, Adani President’s Distinguished Professor and Chair of Computer and Information Science (CIS). “From the outside, you can see into the labs and classrooms, and we can showcase Penn Engineering in a way we haven’t before.”

The building will empower Penn Engineers and their collaborators to conduct interdisciplinary research in a field that has transformed scientific discovery, is rapidly advancing and is making its impact felt in disciplines as diverse as public policy, medicine, meteorology and law.

“I see the future as being the integration of data-driven approaches—AI together with machine learning—and data science approaches, which are model-based approaches,” says René Vidal, Penn Integrates Knowledge and Rachleff University Professor in Electrical and Systems Engineering (ESE) and in Radiology and Director of the Innovation in Data Engineering and Science (IDEAS) initiative at Penn. “Looking at the field even just 10 years ago, the progress is staggering. Amy Gutmann Hall will bring us to the next level of addressing this integration and translating advancements in AI to many applications. It’s truly exciting.”

“Each research floor in the new building is broad and cross-cutting, allowing for the cross-pollination of ideas from fields like bioengineering and neuroscience, computational social science, medicine and safe and trustworthy AI.”


Eric Sucar

A CENTERED APPROACH

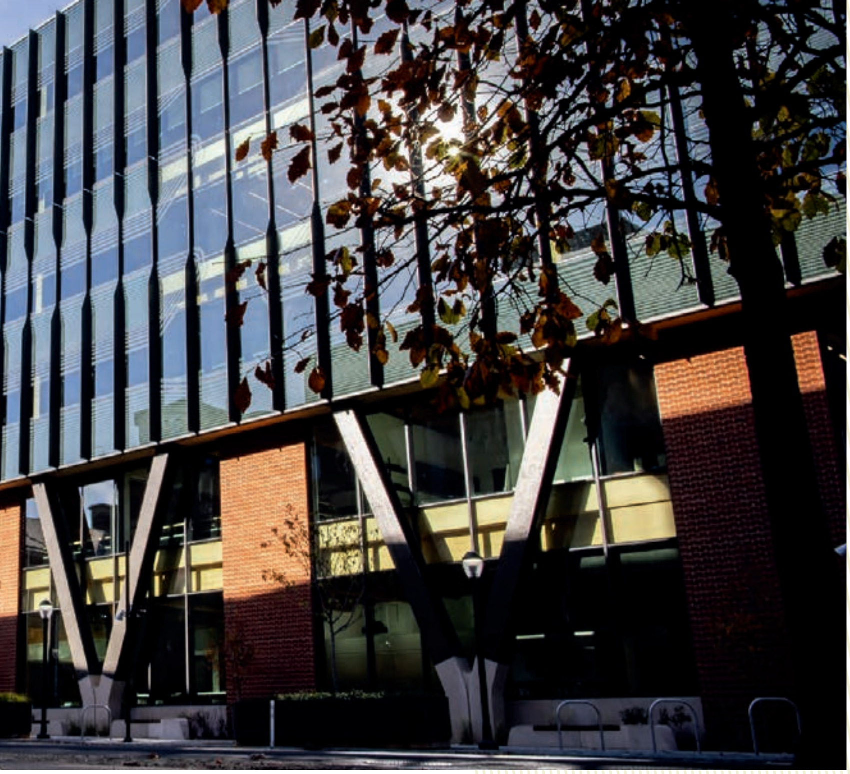
Penn’s IDEAS initiative encompasses scholars across several departments in the School and its research centers, including faculty from the Warren Center for Network and Data Sciences, the GRASP robotics lab, the ASSET (AI-Enabled Systems: Safe, Explainable and Trustworthy) Center and Penn’s new Center for Media, Technology, and Democracy.

“The co-location of faculty in my field, which is computer vision and machine learning, with those in other disciplines such as natural language processing is also exciting,” adds Vidal.

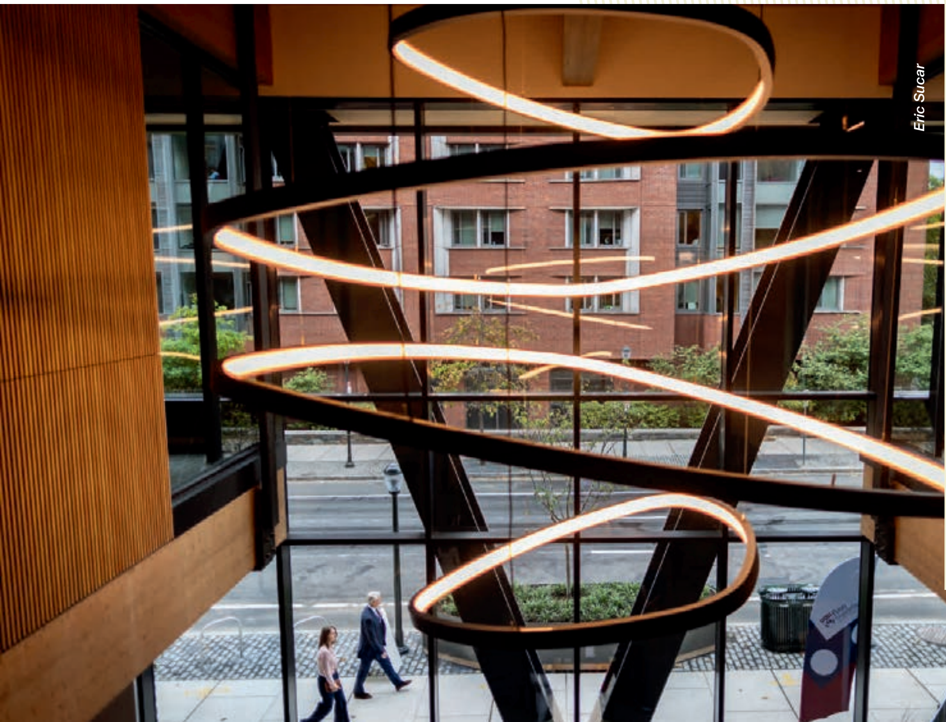
Amy Gutmann Hall was designed with this interdisciplinary co-location at the forefront. It is equipped with dedicated spaces to support exploration and advancements in several multidisciplinary fields, including the Harlan Stone Center for Perception, the Schlein Center for Cybersecurity and The Duran Center, which focuses on data-driven solutions in health care.

“One of the real strengths of Penn, both in campus and in culture, is how easy it is for individuals to reach outside the boundaries of their disciplines and programs,” says Ives. “Each research floor in the new building is broad and cross-cutting, allowing for the cross-pollination of ideas from fields like bioengineering and neuroscience, computational social science, medicine and safe and trustworthy AI.”

TRANSFORMATIONAL SUPPORT



Lisa Godfrey



Eric Sucar

Lisa Godfrey

HARLAN M. STONE (C'80)

Amy Gutmann Hall was made possible by a transformative, $25 million commitment — the largest in Penn Engineering's history — from Harlan M. Stone (C'80) in 2019. A University Trustee, member of Penn Engineering's Board of Advisors and Chair of the School's Technical Advisory Board, Stone has been a lifelong advocate of integrating engineering with the arts and humanities. An alumnus of Penn Arts & Sciences and a Penn Engineering parent, Stone, in consultation with the University, chose to name the building in honor of Amy Gutmann for her extraordinary vision and leadership.

"We all know that Amy has been and remains very important to the mission and the values of the University of Pennsylvania," said Stone during his September 27 dedication remarks. "Amy Gutmann has been much more than the longest-serving President in our University's history; she is also an eminent educator and an incredible voice — loud and clear — for the accessibility of education in our nation, a fundamental part of our democracy."

AMY GUTMANN

The Honorable Amy Gutmann (HON'22), who served as U.S. Ambassador to Germany from 2022–2024, is President Emerita of Penn, the Christopher H. Browne Distinguished Professor of Political Science in Penn Arts & Sciences and a Professor of Communication in the Annenberg School for Communication. As Penn's eighth and longest-serving President, Gutmann left an indelible mark on the University, shaping its future and elevating it to new heights of academic excellence, innovation and global influence.

"'Find a path forward or make it,'" said Gutmann on September 27. "Penn is making it — here at Amy Gutmann Hall, and throughout the campus, the city and the world. The future is bright when we work together for good."

Photos by Kevin Monko

Amy Gutmann Hall boasts an impressive array of spaces for research, teaching and student collaboration, centralizing resources and tools for scholars from across Penn and beyond.

Why prioritize safe and trustworthy AI? “Like many technologies, AI is a dual-use technology,” says George Pappas, UPS Foundation Professor of Transportation in ESE and Associate Dean for Research in Penn Engineering. “It can transform the world positively or negatively, and it is up to us to ensure that AI is a force for improving our lives.”

Penn Engineering’s ASSET Center is working to do just that. “Recent advances have captured society’s imagination, but there are also concerns about these technologies and trust,” says Rajeev Alur, Zisman Family Professor in CIS and the Founding Director of ASSET. “The goal is to improve the reliability of AI systems, which is especially important in applications like health care, and this requires long-term, collaborative research on the foundations side to build the next generation of systems and solutions. In doing so, we will also establish Penn Engineering as a leader in the trustworthy AI space.”


Eric Sucar

The construction of Amy Gutmann Hall used mass timber, a sustainable, yet remarkably resistant material. The warmth of the exposed wood throughout the spaces creates a welcoming, inspiring environment for the Penn Engineering community.

EDUCATIONAL EXCELLENCE

Upon entering the building, visitors will be immediately immersed in the unique educational environment that Amy Gutmann Hall provides. Within view on the first floor are the Rachleff Hybrid Learning Classroom Suite, a flexible teaching space, and the Jacqueline Africk and Andrew Africk Laboratory, an undergraduate lab that supports integrated hardware- and software-based instruction and project work at the nexus of AI and the physical world.

“The opportunity to have an undergraduate teaching lab as the foundation of the building is very exciting,” says Siddharth Deliwala, Alfred Moore Senior Fellow and Director of ESE Lab Programs. “The building allows for innovative educational programming where AI is not a separate technology, rather the computing is physically all around.”

Anchoring the east end of the first floor is the Stavis Family Auditorium, which will host collaborative events and large lectures alike, allowing Penn Engineering to expand its course offerings. The auditorium’s south-facing wall is entirely made up of windows, creating an open and inviting, flexible-use space.

The second floor features additional teaching labs for cloud computing and ESE Senior Design, together with the Detkin Laboratory, which is being relocated from its previous home in Moore. These spaces are complemented by project design areas, group study rooms and open spaces with soft seating where students can connect and study, fostering community and a vibrant innovation culture.

These facilities will enhance the experience of students taking courses like those in Penn Engineering’s Data Science minor and master’s programs, and in particular, will anchor the School’s two newest degree offerings: the Raj and Neera Singh Program in Artificial Intelligence bachelor’s program and the Raj and Neera Singh Program in Artificial Intelligence online master’s program, each the first of their kind in the Ivy League.

Both programs allow students to capitalize on the outstanding career prospects of a rapidly growing field and feature a unique blend of courses in AI foundational principles, in the applications of AI in various engineering disciplines and in AI ethics, providing students with modern tools they can use as they develop AI technologies that have positive societal impact.

“Amy Gutmann Hall will have an enormous effect on student education and research,” says Pappas, who also serves as the Director of the undergraduate AI degree program. “It will become the center of all things AI at Penn.”

“These modern, flexible teaching spaces that have embedded recording studio capabilities designed to support live, synchronous learning mean that the

“Amy Gutmann Hall will have an enormous effect on student education and research. It will become the center of all things AI at Penn.”

experiences of our online students will be unparalleled," adds Chris Callison-Burch, Professor in CIS and Director of the online AI master's program.

Together, students in Penn Engineering's courses and programs will leverage these opportunities, but the benefit does not stop there. Students in CIS, ESE and beyond will be at the forefront of innovation around AI, such as the need to support, or even better, reduce the amount of power that AI technologies currently gobble up.

"Some estimate that in eight years, 15% of total global energy will be used to run AI data centers," says Deliwala. "We need to make computers less power hungry, to optimize energy use and develop better edge computing solutions. To do this, we need to blur the lines between disciplines. It's a great vision for Penn Engineering's educational programming."

PRINCIPLED PRACTICE

Amy Gutmann Hall was planned under the University's *Penn Compact*, with its foundational tenets of Innovation, Inclusion and Impact. Serendipitously, it also exemplifies the goals of Penn's new strategic framework, *In Principle and Practice*, which holds at its core the principles of Penn as an Anchored, Interwoven, Inventive and Engaged University that strives to "channel Penn's excellence and its boundless creative energy to meet the needs of our time."

The positive impact of Amy Gutmann Hall will be felt far outside Penn Engineering. During planning, the building's facilities were also designed to meet unmet needs across campus, the City of Philadelphia and beyond.

One key feature resides on the building's third floor: the Data Science Hub. Envisioned as a hybrid library reference desk and core facility, users will be able to access expertise in data collection, analysis and visualization.

"The Data Science Hub is a first for Penn," says Ives. "Whether it's in the medical school or individuals in the City looking at how to best use their data, the Hub will connect our expertise with the people who need it. Additionally, we will be able to offer programming to pass on that expertise in a focused setting to users, opening the door to everybody."

This open door means the building will also be able to host Penn Engineering's Inveniam Outreach programs. Inveniam Outreach provides local youth with high-quality STEM training and enrichment programs that span the K-12 journey and connects participants to education and career readiness resources.

"With Amy Gutmann Hall, we're giving Philadelphia students access to the kinds of hands-on experiences and mentorship that can be life-changing," says Chanda Jefferson, Director of Community Engagement and Outreach in Penn Engineering's Office of Diversity, Equity and Inclusion. "These labs and courses will help them build confidence and prepare for college and beyond. Penn's outreach programs are truly one of a kind."

In addition to democratizing access to data science and related expertise, planning for Amy Gutmann Hall ensured that Penn's values were upheld in the materials and construction of the building itself. Designed by Lake|Flato together with KSS Architects, and with construction led by Gilbane Building Company, Amy

"The Data Science Hub is a first for Penn. Whether it's in the medical school or individuals in the City looking at how to best use their data, the Hub will connect our expertise with the people who need it."

Amy Gutmann Hall features open, collaborative spaces with soft seating where students can connect and study, fostering community and a vibrant innovation culture.

Kevin Monko

Gutmann Hall is the City's first mass timber building, a material that reduces a building's embodied carbon footprint by an estimated 55 to 70 percent. The material, fabricated in Quebec, Canada, arrived on campus in 82 truckloads, and in addition to its sustainability, the exposed wood evokes a warm, welcoming environment throughout.

Each piece of Amy Gutmann Hall seamlessly comes together to make it the ideal place for Penn Engineering to develop and deliver on the promise of AI and data science. "People should be excited about the future of AI," says Callison-Burch. "It will have a tremendous impact on the nature of work, because it has the potential to make people more productive, creative and collaborative. Amy Gutmann Hall is a huge opportunity for Penn to help define the future."

LEARN MORE about Amy Gutmann Hall and the future of AI and data science at Penn.

LOOKING AHEAD

Planning for Amy Gutmann Hall has also allowed the School's leadership to re-examine its share of campus as a whole.

"Amy Gutmann Hall served as a catalyst for Penn Engineering's *Blueprint for Campus Transformation*," says Mike Matthews, Vice Dean of Finance and Administration for Penn Engineering, in reference to the School's new space planning initiative. "It set the stage for broader optimization efforts to provide state-of-the-art facilities for high-impact research, collaborative learning environments and spaces that enhance the overall sense of home for the Penn Engineering community."

The initiative will involve the renovation of existing facilities, such as Hayden Hall North and GRW/Levine North, to provide enhanced collaboration and student engagement, and the addition of new, pathbreaking spaces, including interdisciplinary teaching labs, student spaces and a Think-Model-Make Center, where undergraduates will be free to create, make mistakes and achieve a sense of empowerment in overcoming those mistakes.

The project encompasses approximately 552,000 square feet (or about 85% of total space) across 15 buildings, no simple feat, especially as one considers repurposing spaces in historic buildings like Towne and Moore.

"When you have a complex like ours where buildings last for 100 years or more, we are stewards of these spaces," says Zac Stevenson, Senior Director of Planning, Design and Construction for Penn Engineering. "As stewards, we want to ensure that we improve upon these spaces and responsibly serve the community while maintaining the integrity and history of our School."

Upon full implementation of the plan, the hope is that Penn Engineering's part of campus will share in a harmonious design that welcomes prospective students and faculty and attracts top talent to Penn.

"In 10 years, when asked who among the top 20 schools is doing it right, I'd want our peer schools to say that Penn Engineering is in the top two or three of that list," says David Meaney, Solomon R. Pollack Professor in Bioengineering and Senior Associate Dean of Penn Engineering. "Penn was the first Ivy to create an AI undergraduate engineering degree, to create the kinds of spaces like those in Amy Gutmann Hall. I think many people will come to visit us at Penn Engineering when they have their own buildings to build."

Beyond

PHOTOGRAPH BY **JIM WATSON**

Earth

By Janine White

Michelle Parker (GEN'93, GR'00) has always been interested in space exploration.

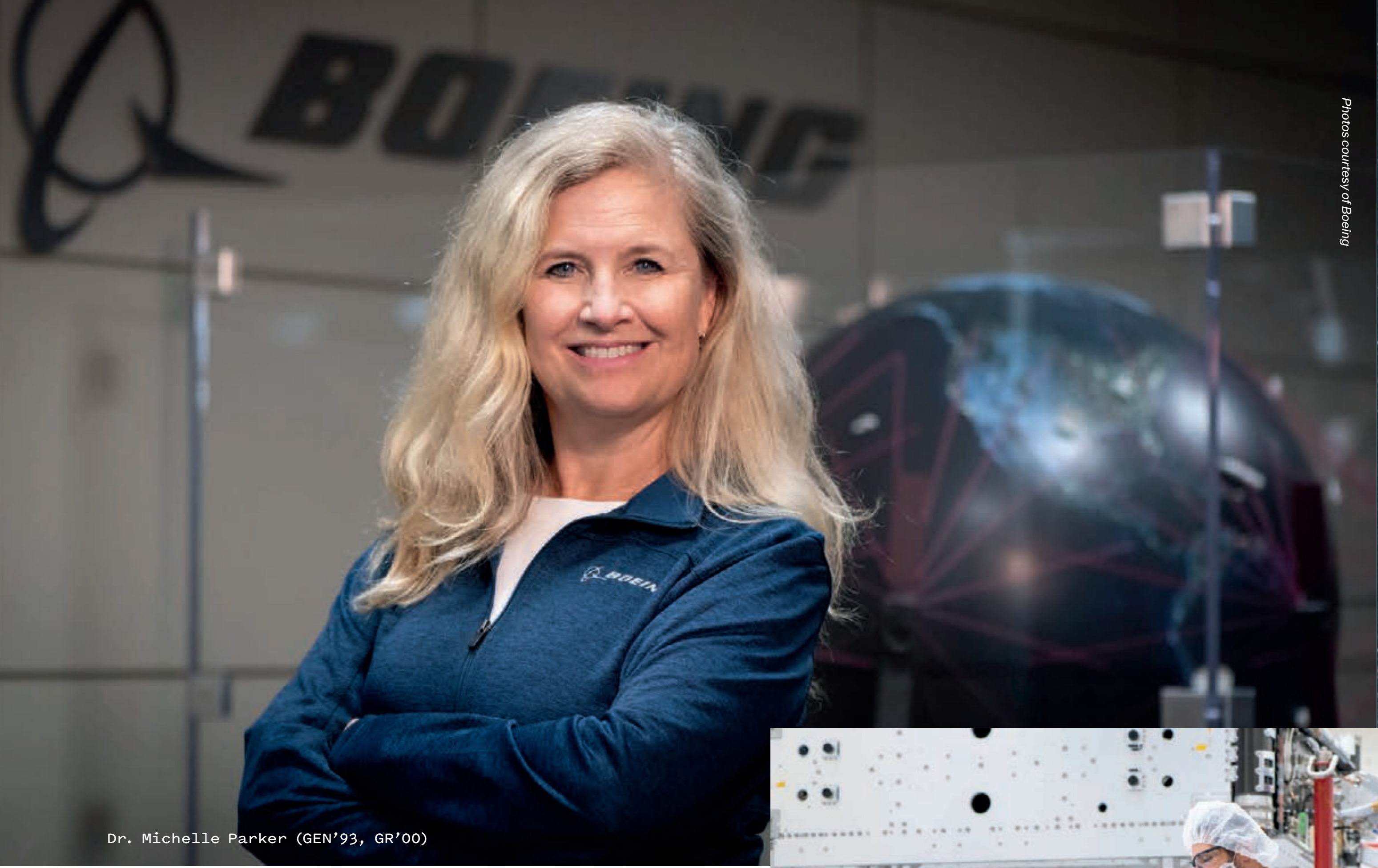
"As a child, I would draw the solar system on my chalkboard. I knew all the names of the planets," she says. "I would watch the space shuttle launches."

That skyward enthusiasm was complemented by an early affinity for math and science, and a deep curiosity that led her to follow her engineer dad around the house as he fixed things. After a high school physics class opened her eyes to the idea that "you can describe the universe with mathematics," she decided she, too, wanted to be an engineer. Ultimately, the choice led her to a job at Boeing, and an up-close view of spacecraft liftoffs.

Parker was at the Kennedy Space Center two years ago to see NASA's Artemis I launch at 1:47 a.m. Eastern and usher in a new era of deep space exploration. The uncrewed flight was a major milestone in the preparation for Artemis II going up in 2025, with four astronauts who will become the first humans to orbit the moon since 1972. Long term, the program aims to establish a lunar base and send humans to Mars.

As Chief Engineer of Space and Launch, Parker led the Boeing team that designed and built several key components of the new Space Launch System rocket to propel Artemis missions out of Earth's atmosphere.

"Launches never get boring, but that was probably one of the most exciting," Parker says of Artemis I. "The loudest, brightest launch that I had seen, and everything went perfectly. For me, from a thermofluids background, it was just amazing to see that rocket, all the propellant, thrusters, and everything that it took to bring that system together."



Photos courtesy of Boeing

Dr. Michelle Parker (GEN'93, GR'00)

Parker has since been promoted to Vice President of Boeing Space Mission Systems, where her portfolio includes commercial and government satellites, and the reusable space plane X-37B. Based in Los Angeles, she has worked at Boeing for three decades, in both technical and business leadership positions. In each role along the way, she says, she has applied her Penn Engineering master's and doctorate degrees in Mechanical Engineering and Applied Mechanics (MEAM) to forge a career where she gets to "push boundaries" and "design the next set of products that will take humankind further into space."

Although her current job means she's "not in the nitty-gritty technical details" every day, she is still fueled by the same passion that inspired her to sketch planets in chalk as a child.

"It's a really interesting time," she says. "We're talking about colonies on the moon, going to Mars. All of these things that we've talked about for decades are actually within our grasp and will likely happen in the next few decades or so."

FLIGHT TEST

Parker grew up near Philadelphia, in South Jersey, and she was familiar with Penn. So after getting a bachelor's in Mechanical Engineering at Lehigh University and deciding to move directly on to pursuing advanced degrees, she chose Penn Engineering and specialized in thermofluids. "I fell in love with the campus as a graduate student," she says.

Even now when she returns to visit, she makes time to stroll Locust Walk and around the Towne and Moore buildings. She appreciates the changes: "It's just great to see the growth of the campus, and yet it still remains core to what it's always been." One thing has stayed the same, however. She always stops by a food truck for a soft pretzel and coffee, her grad school fuel.

Inside Penn's classrooms, she was awed by Michael A. Carchidi, Senior Lecturer in MEAM, who "would just write on the board, with no notes," in vector calculus. MEAM professor Haim H. Bau's chaos theory class "spoke to me," she says. "The whole mathematical representation of chaos results in these beautiful plots and graphical representations of the equations."

After two years, she finished her master's, her qualifying exams and her Ph.D. coursework.

Then she pressed pause.

"I felt like I really needed to go get some real-world work experience and see exactly how I was going to use this knowledge that I now had," she says.

Instead of digging in for a dissertation, she moved to Los Angeles in 1995 for a job as a thermophysics engineer at what was then Hughes Space and Communications. (Hughes became part of Boeing in 2000.)

After about a year, she was ready to return to Penn, equipped with a clear vision for her doctoral research and a Hughes Fellowship. She would conduct experiments and analytical work in L.A., and return to Penn for a month or so each semester to work with Portonovo S. Ayyaswamy, now Professor Emeritus in MEAM.

For her dissertation, Parker tapped into her passion for space and also incorporated her on-the-job experience in heat transfer for mechanical systems. Her research focused on a device to prevent satellite electronics from overheating: the loop heat pipe.

Standard heat pipes had long been used to maintain optimal operating temperatures, but satellites were getting bigger and loaded with more and more electronics. A bigger radiator to emit heat would help, but as with all things space travel, there are size restrictions. The solution: folding radiators that could open up and deploy in orbit to provide more cooling surface. (Think of a trifold brochure.) However, that meant the pipe transferring the heat would need to bend as well. Standard heat pipes weren't flexible. Enter the loop heat pipe.

"The systems that we build for space, like satellites, rockets or space stations, are complex. The ability to collaborate across different subsystems and come up with an overall system that's going to operate well is extremely important."

When Parker chose her subject, this flexible solution was under development, but engineers didn't know how the device would behave in space or affect satellites' temperature-regulating processes. She modeled the practical application of the loop heat pipe, running simulations and analyzing potential behaviors.

In late 1997, she and her colleagues got the chance to put a loop heat pipe experiment on the 24th flight of the Space Shuttle Columbia. The data informed the models Parker was developing, and the first satellite using a loop heat pipe launched in late 1999. The device continues to be a core part of Boeing's high-power satellites, and Parker still feels a personal connection to that Columbia STS-87 mission.

"I take my family to the California Science Center, where they have all the patches for all the space shuttles," she says. She points to the one stitched with Space Shuttle Columbia STS-87 and tells her kids, "That was mine."

ONWARD JOURNEY

Boeing has been making satellites since the 1960s, and that legacy is meaningful to Parker. Electrical engineer Harold Rosen, who designed one of the earliest models, Syncom 2, was at the company well into the 2000s. "I still used to see him and talk to him at the copy machine," she says. "So there is this historical connection for those of us who have crossed paths with some of the originators of this space ecosystem that we're seeing grow so extensively today."

Looking toward that future, Parker often makes time to connect with students and early-career professionals who may follow in her footsteps. Her advice for them is shaped by her own professional motivators and achievements. While technical skills are a must, she says, communication and teamwork are vital.

"The systems that we build for space, like satellites, rockets or space stations, are complex. The ability to collaborate across different subsystems and come up with an overall system that's going to operate well is extremely important," she says.

Parker sees the increase in the number of women enrolling in engineering schools as a "trend in the right direction" because "whether it is women or diversity of background, a team that is bringing different ideas, different learnings into a discussion or a design meeting really enriches the conversation, and those different perspectives help us get to the best solution."

Still, not every day is easy, even when you love your job as much as Parker. That's why she never forgets to mention the usefulness of resilience.

"There are setbacks, there are anomalies, and that's what makes it interesting," she says. "Space is not an easy domain. We are doing new things every day, and when we figure out how to do those things, it's extremely exciting."

STOPPING SEIZURES BEFORE THEY START

BY Melissa Pappas

Neurological disorders such as epilepsy, Alzheimer's, Parkinson's and certain forms of dementia are the leading cause of disability and the second-leading cause of disease worldwide. These disorders disproportionately affect low-resourced communities due to lack of access to specialized health care, and many of these complex diseases lack curative solutions. The need to address neurological disorders is high, yet current diagnostics and treatments are not effective for preventative or personalized care and are not accessible or affordable enough to meet the needs of the more than 3 billion people living with neurological disorders.

Flavia Vitale, Associate Professor in Bioengineering in Penn Engineering and in Neurology in Penn's Perelman School of Medicine, works to meet this need, developing accessible and affordable solutions for the diagnosis, treatment and rehabilitation of people living with neurological disorders.

"I started my research career in biomedical engineering hoping to one day help humanity," says Vitale. "But it wasn't until I gained a more diverse skill set during my doctoral and postdoctoral research across chemical engineering and materials science that I was able to do that in a real way."

Vitale's multidisciplinary skills are what allow her to develop devices that help people living with brain disorders. Her lab's current research projects leverage innovation in materials and fabrication approaches to develop devices that are able to interface with and control different chemical and electrical signals inside the brain.

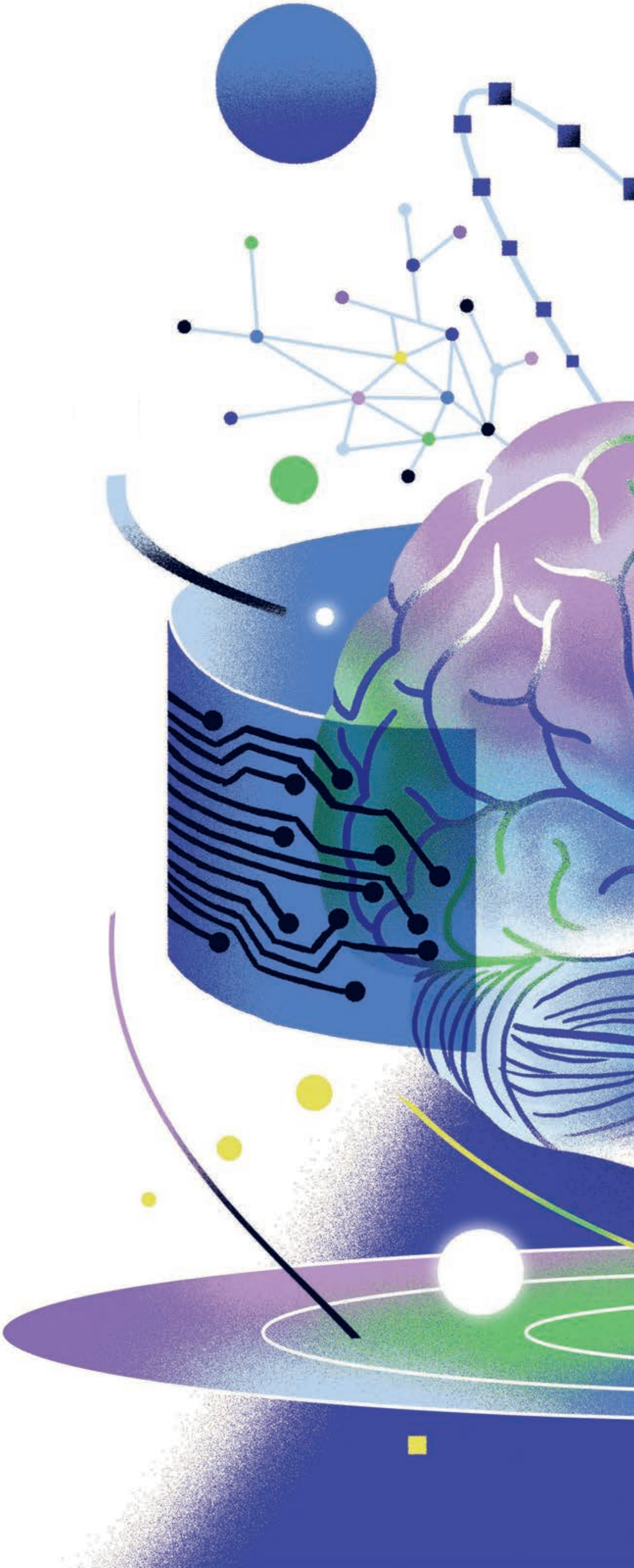
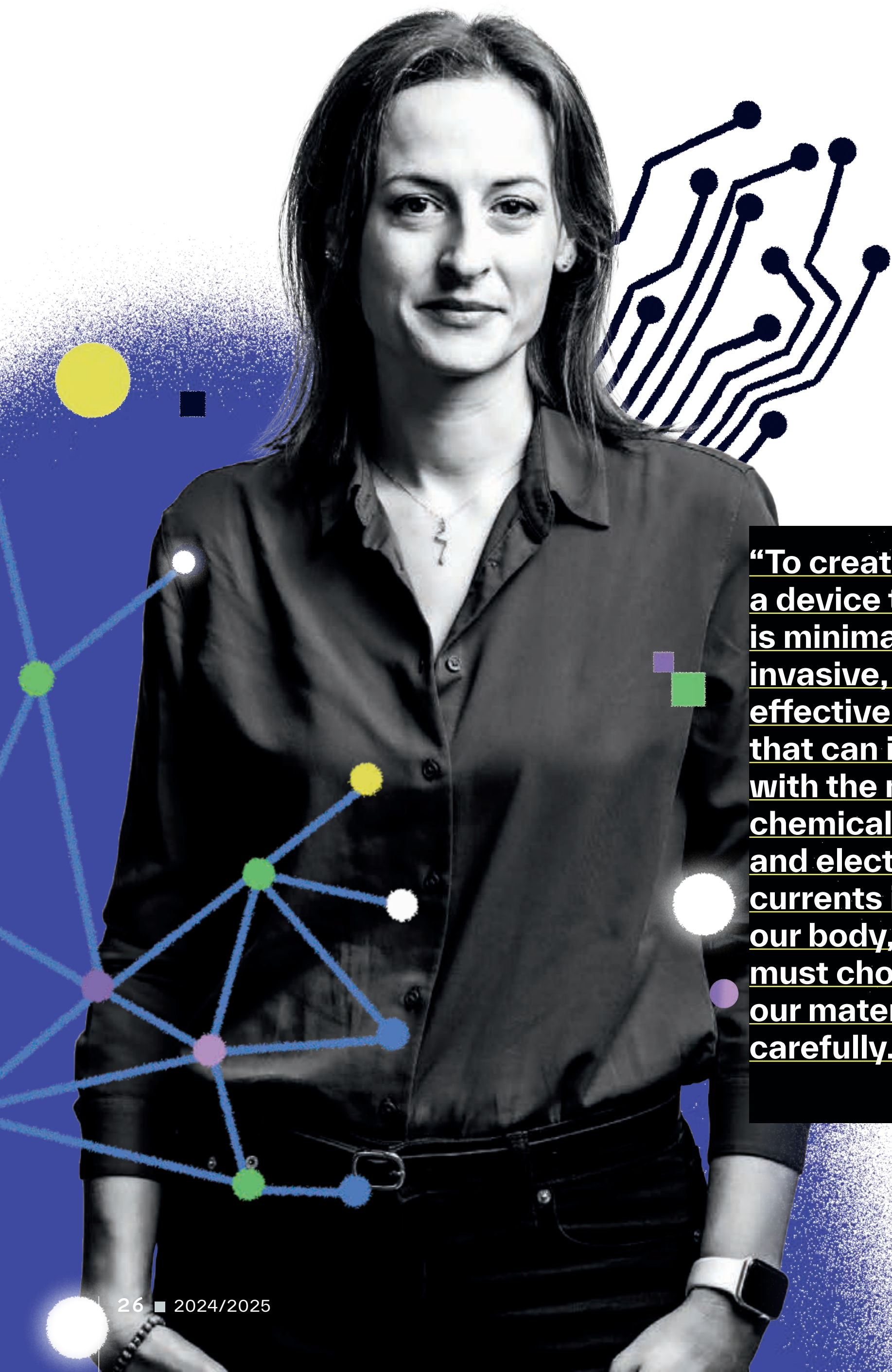


ILLUSTRATION BY **MATT CHINWORTH**

EXPANDING UNDERSTANDING

Focused primarily on understanding the brain activity involved in epilepsy-induced seizures, Vitale aims to design and develop brain-interface devices to pinpoint and suppress uncontrolled brain activity to prevent seizures from happening. She hopes that her work will lead to revolutionary health care for the 30% of epilepsy patients whose conditions are drug resistant. Currently, those patients either wait out the uncontrolled brain activity and oftentimes life-threatening convulsions, or hope to be eligible for invasive surgeries to either remove the part of the brain where seizures originate or to implant the seizure-controlling devices that are currently available.



"Very little is known about the brain during an epileptic episode," says Vitale. "We don't know what knobs to turn or what buttons to push to stop or prevent a seizure, nor can we ensure that when we remove a piece of the brain, those seizures will stop."

Current implants used to treat refractory epilepsy, the kind that is not treatable by medication, have been designed based on this incomplete understanding of the brain.

"These seizure-suppressing devices are not exact," says Vitale. "They cast a wide net, emitting electrical signals to the surrounding parts of the brain without much selectivity."

But, the brain is multimodal; it operates through both chemical and electrical interactions. Chemicals constantly flow through the synapses and ion channels of our neurons. Many of these molecules hold a positive or negative charge, and the flow of these ions causes electrical gradients, which give rise to action potentials measured in volts. It is these fluctuations in voltage across neuronal membranes combined with the chemicals themselves that create the intricate electrochemistry in our brain that allows us to move, think and feel emotions. Current seizure-suppressing devices are only speaking the electrical language to talk to the brain, completely neglecting the chemical communication.

In contrast, Vitale's work will combine the chemical and electrical languages of the brain together with her expertise in nanofabrication to design a new device.

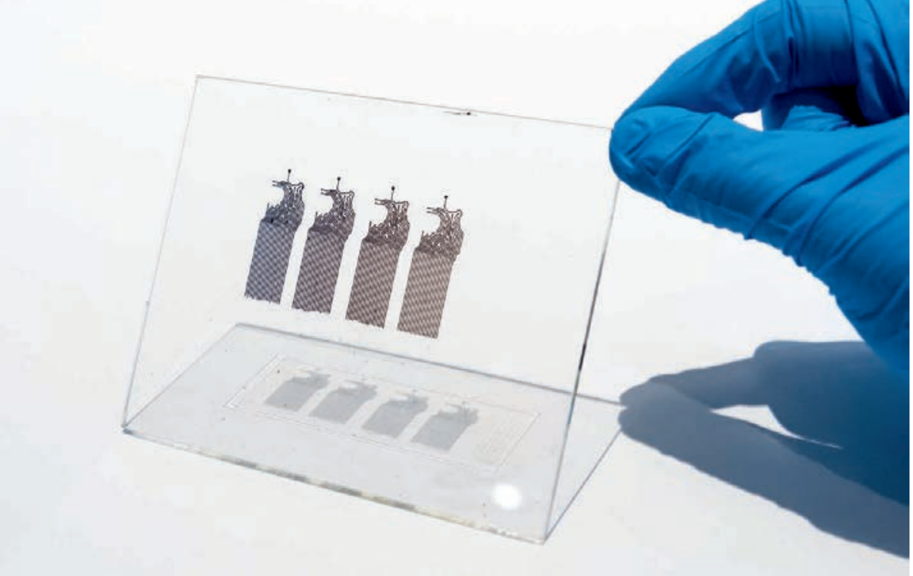
"To create a device that is minimally invasive, highly effective, and that can interact with the multiple chemicals and electrical currents in our body, we must choose our materials carefully."

NOVEL DEVICES

"To create a device that is minimally invasive, highly effective, and that can interact with the multiple chemicals and electrical currents in our body, we must choose our materials carefully," says Vitale. "Right now, my group is turning to electrically conductive nanomaterials known as MXenes to do this work."

MXenes, pronounced "max-eens," are 2D-layered materials that exhibit properties of both ceramics and metals. They conduct heat and electricity like metals but are strong and heat-tolerant like ceramics. They have been applied to new technologies across energy storage, medicine and flexible displays, and researchers estimate that there are more than a million stable MXene compounds that remain undiscovered.

PHOTOS BY **KEVIN MONKO**



The Vitale Lab engineers the electrochemical, mechanical and optical properties of nanostructured materials and integrates them in soft, multimodal bioelectronic interfaces that can seamlessly monitor and modulate the nervous system at high spatio-temporal resolution and at multiple scales, from individual cells to large-scale circuits.

Vitale's chosen MXene compound can be functionalized with unique chemical-recognizing compounds to selectively write, detect and recognize specific neurotransmitters in the brain. They are also safe, affordable and easy to process, a win-win for an improved and accessible device.

Another bonus when using MXenes is their ability to be used in research-advancing experimentation.

"Because the chemical compounds and these devices made with MXenes are transparent, we can use these devices in light-controlled experiments," says Vitale. "We can use light to excite cells or regions in the brain, or we can use light and fluorescence indicators to look at fluorescence fluctuation inside the brain on a cellular level as an additional indicator of cellular activity."

INCREASING ACCESS

Vitale is a 2024 recipient of a National Science Foundation (NSF) CAREER Award for her work, which will further actualize some of her first long-term research projects at Penn. Looking ahead, she hopes to collaborate across disciplines to develop MXene-based interfaces to investigate brain disorders and then to design other responsive, wireless and AI-integrated devices that could infer brain state and help doctors and patients make informed decisions.

Additionally, funding from the CAREER Award also allows her to welcome new students into her lab. "One of the most exciting aspects of our work is our summer internship offered to a different high school student from the Philadelphia School District each year for the next five years," says Vitale. "Penn Medicine hosts a yearly cohort of about 25 high school students who participate in educational and training sessions on campus throughout the academic year. Of those students, those interested in neuroengineering will be invited to apply to the summer internship in our lab and get hands-on research experience."

Vitale will also share her work and career story through themed seminars on engineering health-care technologies to inspire students to see engineering as a tool to serve humanity, and will continue to train undergraduate and graduate students at Penn in research, guiding them in their careers across academia, industry and entrepreneurship at the epicenter of the innovations in her field.

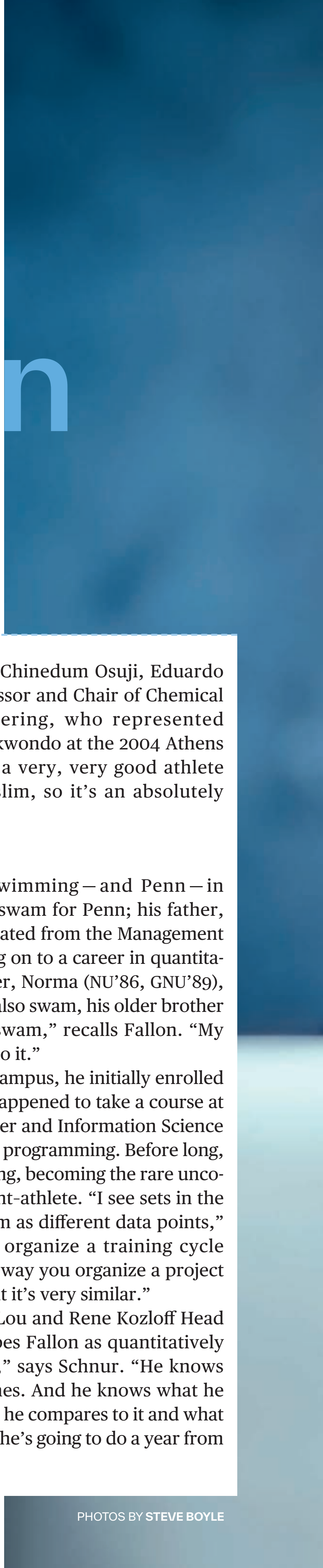
"I am truly grateful to be doing this work at Penn," says Vitale. "My location on campus places me centrally between the medical and engineering complexes, coordinating with my intellectual needs for this work and the work I hope to pursue in the next decade as a result.

"After my postdoc, I realized that I knew a lot about technology and nanomaterials, but I still needed to understand the needs of clinicians, the everyday problems of doctors and the patients I was trying to help," she continues. "Being at Penn and collaborating with folks at the Penn Center for Neuroengineering and Therapeutics and Penn Health-Tech has been key in the connecting of those dots, helping me bring technologies from the lab to real people as fast as possible."

Engineering an Olympian

Matt Fallon's Journey from Penn to Paris

BY Ian Scheffler



Only about 200,000 people have competed in the Olympics since their revival a little over a century ago. In the same time frame, roughly 13 billion people have been born. In other words, the odds of becoming an Olympian — setting aside the fact that some countries have produced disproportionately many, and that the most recent Games were the first to achieve gender parity — are about 0.0015%.

Put differently, it's hard to get into Penn—the Class of 2027 had a 5.8% admit rate—but it's about 3,800 times harder to become an Olympian, which makes it all the more awe-inspiring that Matt Fallon (CIS'25, W'25) has done both.

This past summer, Fallon represented the U.S. (and Penn!) at the Olympic Games in Paris, coming in 10th in the 200-meter breaststroke, after setting an American record in the event and winning the national title at the U.S. Olympic Trials, his third in a row.

"It's tremendous," says Chinedum Osuji, Eduardo D. Glandt Presidential Professor and Chair of Chemical and Biomolecular Engineering, who represented Trinidad and Tobago in Taekwondo at the 2004 Athens Games. "The odds of even a very, very good athlete making the Olympics are slim, so it's an absolutely incredible achievement."

Roots at Penn

Growing up, Fallon had swimming—and Penn—in his blood. His parents both swam for Penn; his father, William (EE'84, W'84), graduated from the Management & Technology Program, going on to a career in quantitative finance, while his mother, Norma (NU'86, GNU'89), studied nursing. His siblings also swam, his older brother at Penn. "My entire family swam," recalls Fallon. "My parents really brought me into it."

When Fallon arrived on campus, he initially enrolled at the Wharton School, but happened to take a course at Penn Engineering in Computer and Information Science and found he had a knack for programming. Before long, he applied to Penn Engineering, becoming the rare uncoordinated dual-degree student-athlete. "I see sets in the pool and how I'm doing them as different data points," Fallon says. "The way you organize a training cycle throughout the year and the way you organize a project in code—it's not identical, but it's very similar."

Mike Schnur (C'88), the Lou and Rene Kozloff Head Coach of Swimming, describes Fallon as quantitatively gifted. "He's a math master," says Schnur. "He knows how fast he's going at all times. And he knows what he did seven years ago, and how he compares to it and what he did a month ago and what he's going to do a year from now—he's very analytical."

PHOTOS BY STEVE BOYLE

Swimming With a Strategy

Breaststroke, Fallon's specialty, is perhaps the most technical swimming discipline, since it requires swimmers to repeatedly enlarge the surface area they present to the water, spreading their arms and feet wide before snapping back into a streamline, all the while trying to minimize drag. "You have to make sure you have a fast recovery," Fallon points out.

What makes Fallon distinctive as a breaststroker is his "back half" strategy, in which he typically lags behind his competitors for the first half of a race, then chases the field down. "I've always been a more endurance-oriented swimmer," Fallon says. "I've never been able to get out there with the fastest people."

In high school, Fallon, who swam for the Greater Somerset County YMCA in his native New Jersey, set multiple national YMCA records, not just in the 200-meter and 200-yard breaststroke, but also in the 400-meter individual medley. In some cases, Fallon didn't just come from behind to win, but "negative split" his races, meaning that his second half was actually faster than his first.

Back-halfing requires meticulous pacing—if the field gets too far ahead, even a swimmer as gifted as Fallon will simply run out of pool, as unfortunately happened in Paris. Fallon missed the Olympic finals by less than a tenth of a second—the equivalent of a finger's length.

"I know that frustration all too well. You're trying to fix something and that creates a whole other set of new problems, and then you've got to go back and restart."

Still, just by making the Olympic team, Fallon accomplished his two aquatic goals for the year: make the team and break 2:07 in the 200-meter breaststroke, which he did by setting a new American record of 2:06.54 at the U.S. Olympic Trials. “I’m a bit odd for a swimmer in the sense that I don’t necessarily set a goal at the start of the year,” says Fallon, “but this was really a year where I thought about the sport differently.”

This past summer, Matt Fallon (CIS’25, W’25) represented the U.S. at the Olympic Games in Paris, coming in 10th in the 200-meter breaststroke, after setting an American record in the event and winning the national title at the U.S. Olympic Trials, his third in a row.

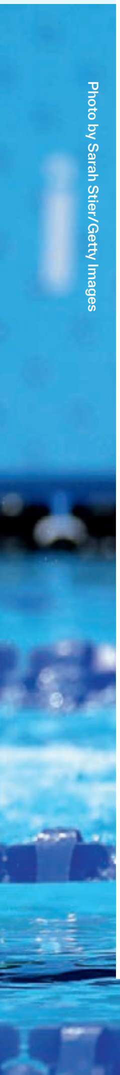


Photo by Sarah Stier/Getty Images

From Penn to Paris

Like most elite swimmers, Fallon practices nearly a dozen times a week, swimming tens of thousands of yards—eight sessions in the pool and two in the weight room—a grueling schedule when you tack on coursework at both Penn Engineering and Wharton.

Whenever those practices don’t translate into results at meets, Fallon revises his training, much like a programmer debugging faulty code. “I know that frustration all too well,” says Fallon. “You’re trying to fix something and that creates a whole other set of new problems, and then you’ve got to go back and restart.”

Last year, one change Fallon made was to focus on the front half of his race. If he just stayed even with everyone else, he figured his strong back half would carry him to victory. Indeed, at the Olympic Trials, Fallon started in fifth place, then moved up to third by the halfway mark, giving him plenty of room to lay down the fastest back half in the field, easily winning by more than two seconds.

“I know I’ve had it in me this entire time,” says Fallon, who qualified first in the 200-meter breaststroke at the 2020 Olympic Trials, only to finish eighth in the final. “I just wanted to really be able to get out and do it on the biggest stage.”

After his victory at the Olympic Trials, Fallon joined the U.S. National Team for training trips to North Carolina and Croatia before arriving in Paris. He spent two weeks in the Olympic Village, which turned out to be much like college—a lot of downtime between high-stakes assessments. “What they’re putting on TV are all of the glamour shots,” Fallon says. “There’s definitely a lot that goes on between those moments that’s more low-key.”

In the Village, Fallon had the chance to meet swimmers from around the world, some of whom he’d encountered before at events like last year’s World Championships, where he claimed bronze in the 200-meter breaststroke. “They’re all very nice people,” Fallon says. “I didn’t have a bad experience with a single one of them.”

Fortunately, Fallon largely avoided the Olympic Village-related hardships that other swimmers shared with the media, like having to sleep outdoors to beat the heat (Thomas Ceccon, a backstroker from Italy), or finding worms in his fish (Adam Peaty, a breaststroker from Great Britain). “The U.S. gave us air conditioners and mattress pads,” says Fallon. “There was one time where I went to the salad bar—there are four salad bars—and there was no lettuce at any of them, so I couldn’t really make a salad, but other than that, the food was pretty good.”

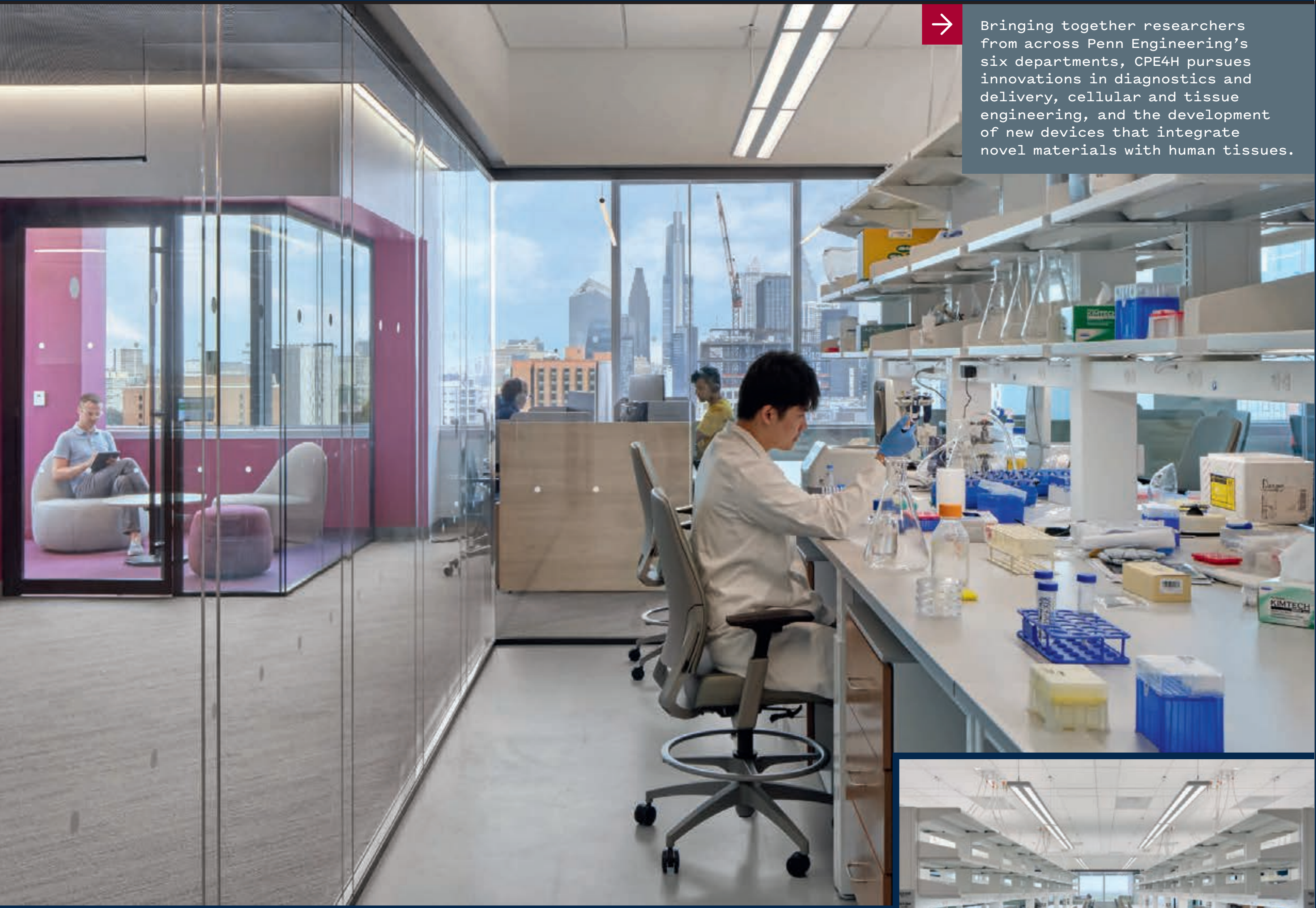
Now, as a senior, Fallon looks forward to delving into AI and the nuances of information storage — he’s enrolled in both CIS 4210/5210: Artificial Intelligence, the flagship lecture taught by Chris Callison-Burch, Professor in Computer and Information Science, and CIS 4500/5500: Database and Information Systems—and returning to competition with his fellow Quakers. “I’m excited to just get back into the swing of things,” says Fallon. “With the Olympic experience under my belt, I think I can handle just about anything.”

WELCOME TO CPE4H

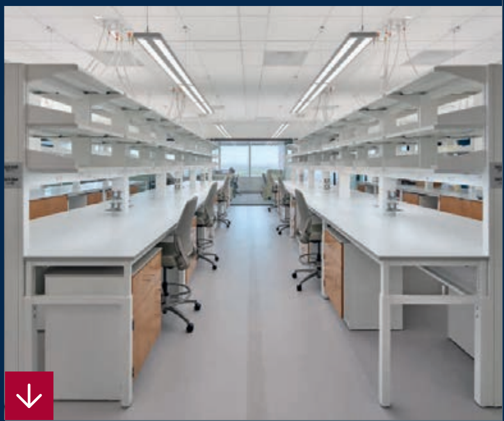
CAMERA ROLL

Penn Engineering's Center for Precision Engineering for Health (CPE4H), housed in One uCity Square, a new 13-story, 400,000-square-foot building located on 38th Street across from Penn Presbyterian Medical Center, welcomed four new core faculty members to campus this year. Pictured from left are Sherry Gao, Presidential Penn Compact Associate Professor in Chemical and Biomolecular Engineering, Shujie Yang, Assistant Professor in Mechanical Engineering and Applied Mechanics, Noor Momin, Stephenson Foundation Term Assistant Professor of Innovation in Bioengineering, and Yihui Shen, J. Peter and Geri Skirkanich Assistant Professor of Innovation in Bioengineering.

FACULTY PHOTO BY **KEVIN MONKO**



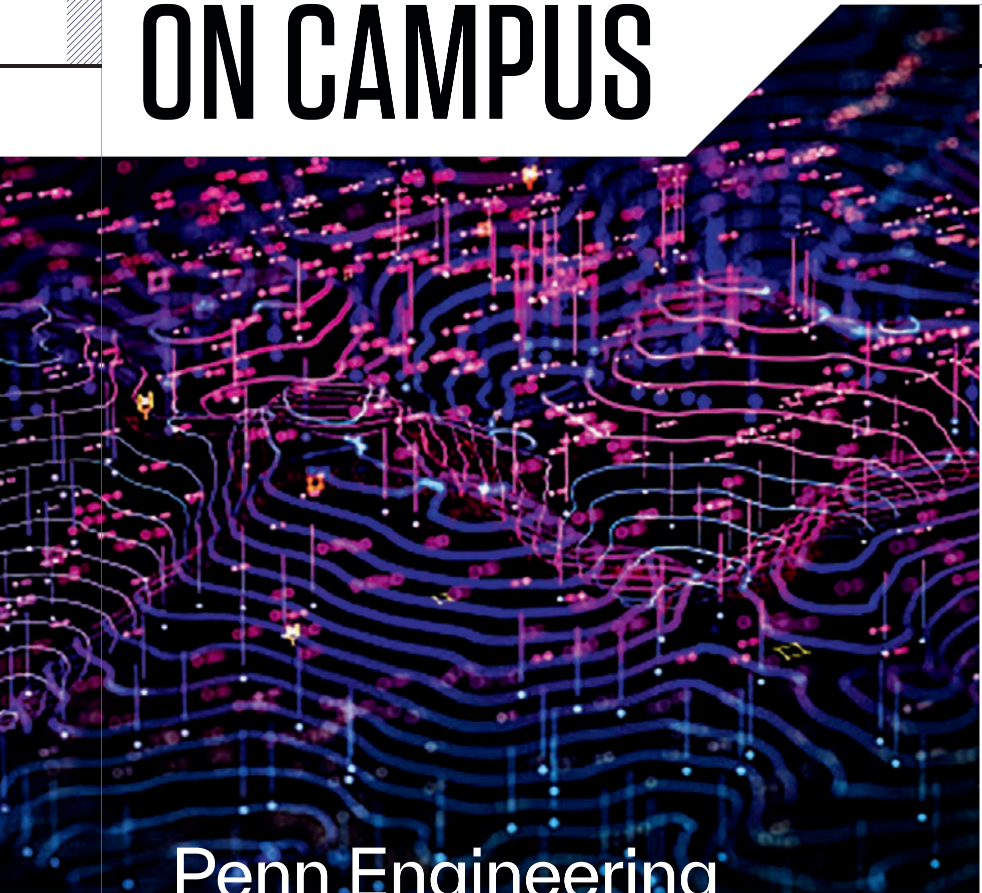
Bringing together researchers from across Penn Engineering's six departments, CPE4H pursues innovations in diagnostics and delivery, cellular and tissue engineering, and the development of new devices that integrate novel materials with human tissues.



In One uCity, bright, light-filled labs are co-located with collaborative spaces for CPE4H members and their research groups to deliver next-gen solutions in precision health.

Multi-use, customizable spaces are embedded with state-of-the-art technologies that allow for real-time research and learning activities with collaborators from across Penn's campus and around the world.

PHOTOS BY **TODD MASON | HALKIN MASON PHOTOGRAPHY**



Penn Engineering Launches Two New AI Degree Programs

In 2024, Penn Engineering announced two new, groundbreaking degree programs, the Raj and Neera Singh Program in Artificial Intelligence Bachelor of Science in Engineering program, and the Raj and Neera Singh Program in Artificial Intelligence Master of Science in Engineering in AI Online. Both programs are the first of their kind in the Ivy League and will prepare future engineers with a deep understanding of AI technologies – and their risks and rewards. The undergraduate and master's programs will be led by George Pappas, UPS Foundation Professor of Transportation in Electrical and Systems Engineering and Associate Dean for Research at Penn Engineering, and Chris Callison-Burch, Professor in Computer and Information Science, respectively.

Arjun Raj Receives Heilmeier Award

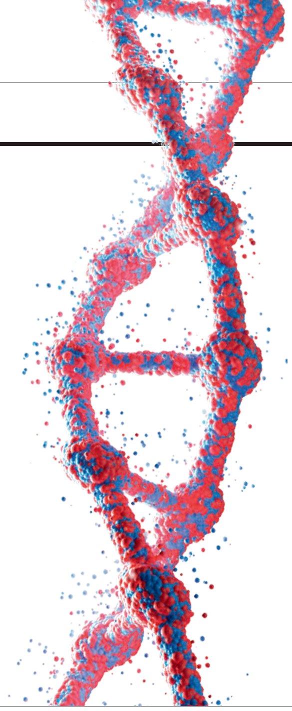
ARJUN RAJ, Richard K. Lubin Professor in Bioengineering and in Genetics, has been named the recipient of the 2023-24 George H. Heilmeier Faculty Award for Excellence in Research for "pioneering the development and application of single-cell, cancer-fighting technologies." The Heilmeier Award, named for the late George H. Heilmeier, a Penn Engineering alumnus and member of the School's Board of Advisors, honors a Penn Engineering faculty member whose work is scientifically meritorious.

Mark Allen Named Chair of Electrical and Systems Engineering

MARK ALLEN, Alfred Fitler Moore Professor, has been named Chair of the Department of Electrical and Systems Engineering. With secondary appointments in Mechanical Engineering and Applied Mechanics and Chemical and Biomolecular Engineering, Allen comes to this position after serving more than 10 years as the inaugural Scientific Director of the Singh Center for Nanotechnology.

George Pappas Elected to the National Academy of Engineering

GEORGE PAPPAS, UPS Foundation Professor of Transportation in Electrical and Systems Engineering and Associate Dean for Research at Penn Engineering, has been elected to the National Academy of Engineering (NAE) for his significant "contributions in analysis, synthesis, and control of safety-critical cyber-physical systems." Election to the NAE is among the highest professional distinctions accorded to an engineer.



$18M NSF AIRFoundry to Revolutionize RNA Research

THE NATIONAL SCIENCE Foundation Artificial Intelligence-driven RNA Foundry (NSF AIRFoundry), led by the University of Pennsylvania and the University of Puerto Rico and supported by an $18 million, six-year grant, will use AI to design, optimize and synthesize RNA and delivery vehicles by augmenting human expertise, enabling rapid iterative experimentation and providing predictive models and automated workflows to accelerate discovery and innovation.

New $10M Center for Media, Technology, and Democracy

THE UNIVERSITY OF Pennsylvania has announced $10 million in combined funding for a new Center for Media, Technology, and Democracy. Operating in partnership with five other schools at Penn, the Center will be housed in Penn Engineering's Amy Gutmann Hall and will facilitate research synergies across the fields of law, political science, media, communications, data science, AI and more to explore the impact of media on democracy.

IEEE Dedicates Milestone to Grace Hopper at Penn Engineering

ON MAY 7, the Institute of Electrical and Electronics Engineers (IEEE) dedicated an IEEE Milestone marker in recognition of the significance of the A-0 compiler, an early innovation in computer programming developed by Grace Hopper, the pioneering computer scientist who served as a lecturer at the University of Pennsylvania. The dedication took place in the Moore Building, adjacent to the room that houses the Electronic Numerical Integrator and Computer (ENIAC), the world's first general-purpose computer, which was developed at Penn.

NEW FACULTY

Tom Farmer
Practice Associate Professor
Computer and Information Science

Ph.D. in Computer Engineering
George Washington University

Xue (Sherry) Gao
Presidential Penn Compact Associate Professor
Chemical and Biomolecular Engineering

Ph.D. in Chemical and Biomolecular Engineering
University of California, Los Angeles

Lorena Grundy
Practice Assistant Professor
Chemical and Biomolecular Engineering

Ph.D. in Chemical and Biomolecular Engineering
University of California, Berkeley

Brian Halak
Practice Professor
Bioengineering

Ph.D. in Immunology
Thomas Jefferson University

Ling Li
Associate Professor
Materials Science and Engineering

Ph.D. in Materials Science and Engineering
Massachusetts Institute of Technology

Antonio Loquercio
Assistant Professor
Electrical and Systems Engineering

Ph.D. in Computer Science
University of Zurich

Samantha McBride
William K. Gemmill Term Assistant Professor
Mechanical Engineering and Applied Mechanics

Ph.D. in Mechanical Engineering
Massachusetts Institute of Technology

Noor Momin
Stephenson Foundation Term Assistant Professor of Innovation in Bioengineering

Ph.D. in Biological Engineering
Massachusetts Institute of Technology

Robert M. Radway
Assistant Professor
Electrical and Systems Engineering

Ph.D. in Electrical Engineering
Stanford University

Joel Ramirez
Lecturer
Computer and Information Science

M.S. in Computer Science
Stanford University

Yihui Shen
J. Peter and Geri Skirkanich Assistant Professor of Innovation
Bioengineering

Ph.D. in Chemistry
Columbia University

Edward Steager
Research Assistant Professor
Mechanical Engineering and Applied Mechanics

Ph.D. in Mechanical Engineering
Drexel University

Jessica Weakly
Lecturer
Mechanical Engineering and Applied Mechanics
Ph.D. in Mechanical Engineering and Applied Mechanics
University of Pennsylvania

Nathan Wei
Assistant Professor
Mechanical Engineering and Applied Mechanics
Ph.D. in Aeronautics
California Institute of Technology

Shujie Yang
Assistant Professor
Mechanical Engineering and Applied Mechanics
Ph.D. in Mechanical Engineering and Materials Science
Duke University

Koditschek Doctoral Fellowship Honors Family's Resilience, Love of Education

WITH A GENEROUS gift to Penn Engineering, longtime Penn professors Daniel E. Koditschek, Alfred Fitler Moore Professor in Electrical and Systems Engineering, and his wife, Anne M. Teitelman, Associate Professor Emerita in Penn Nursing, endowed a doctoral fellowship in Electrical and Systems Engineering to honor Koditschek's paternal grandmother, Elsa Koditschek, and her son and daughter-in-law—Koditschek's father and mother—Paul and Leah Koditschek. Elsa Koditschek's extraordinary story was detailed in a 2018 article in *The New York Times*, "The Nazi Downstairs: A Jewish Woman's Tale of Hiding in Her Home."

Engineering Entrepreneurship Turns 25, Launches Fellows Program

NOW IN ITS 25th year, Penn Engineering Entrepreneurship has launched a new Fellows Program, enrolling its first cohort in January 2024. Open to a small, select group of juniors, seniors and first-year master's students, the program offers a transformative educational experience, where Fellows participate in dedicated, seminar-style courses in the spring and fall semesters, and spend the summer at high-growth tech startups with executive mentors.

Penn Engineering Online Celebrates 5 Years of Master's Degrees

IN 2019, PENN Engineering Online diversified the online education space by expanding access to the School's already wildly successful Master of Computer and Information Technology (MCIT) degree. Staying up to date with industry demands, the program opened its second master's offering, the Master of Science in Engineering in Data Science, in 2022. Penn Engineering has been a pioneer in online education at the University, expanding access to an Ivy League education to a new cohort of students and broadening Penn's global reach.

CIS Student Wins at Apple Swift Student Challenge

RENA LI (CIS'27) is a winner in the 2024 Apple Swift Student Challenge, which gives student developers the opportunity to showcase their creativity and coding capabilities. For the Challenge, Li created a prototype app called "Eco Journey," which serves as a starting guide for individuals to learn more about the environment, calculate carbon footprints, find important resources for recycling and more.

IN MEMORIAM

Charles D. Graham

Charles D. Graham, Professor Emeritus in Materials Science and Engineering, passed away on March 18, 2024, at the age of 94.

Graham received a bachelor's in Metallurgical Engineering with distinction from Cornell University in 1952. He then went on to earn a Ph.D. in Physical and Theoretical Metallurgy as a Fulbright Scholar at the University of Birmingham in England in 1954. Following his doctoral studies, he worked as a research metallurgist at the New York-based General Electric Research and Development Center, where he was named a John Simon Guggenheim Memorial Foundation Fellow in 1961.

After his time in industry, Graham first came to Penn as a visiting professor in 1969 and then joined the faculty in 1970 as a professor in the then-named Department of Metallurgy and Materials Science (now Materials Science and Engineering) in Penn Engineering. He served as Chair of the Department from 1979 until 1984. Graham earned emeritus status in 1997.

Graham's research was in magnetic materials and measurements, domain structure, amorphous alloys and permanent magnets. He was a senior member of the IEEE Magnetics Society and a member of ASM International, formerly known as the American Society for Metals, and the Metallurgical Society. He also served as Chair of the IEEE-APS Annual Conference on Magnetism and Magnetic Materials. Graham was a visiting scholar-researcher at several institutions, including Cardiff University, the University of Bath and the University of Birmingham. He authored more than 120 papers and book chapters and held several patents. During his time at Penn, he was active in the Faculty Senate and served as Chair of the *Almanac*'s Advisory Board. Later in his career, he served as a Senior Design instructor in Materials Science and Engineering and prioritized STEM-focused programs for visiting high school students.

Solomon R. Pollack

Solomon R. Pollack, Professor Emeritus in Bioengineering, passed away on August 4, 2024, at the age of 90.

Pollack was a Penn alumnus, having earned his bachelor's, master's and Ph.D. degrees in Physics from the University in 1955, 1957 and 1961, respectively. His 60 years on the faculty at Penn began in 1964, when he joined the faculty as an assistant professor in the then-named Department of Metallurgy and Materials Science (now Materials Science and Engineering). He later joined the Department of Bioengineering as a professor in 1977, and was a member of the faculty until 2003, when he earned emeritus status. During his time at Penn, Pollack also held secondary appointments in Orthopaedic Surgery and in the School of Nursing.

Pollack's expertise was in the bioelectrical properties of bone and connective tissue, the electrical stimulation of bone growth and fracture healing, and transport phenomena in bones. He was a trailblazer who drove scientific discoveries to applications and commercialization. Pollack was also an outstanding teacher and mentor and was awarded Penn's Lindback Award for Distinguished Teaching in 1968 and Penn Engineering's S. Reid Warren, Jr. Award in 1992. He was an exceptional mentor to his graduate students, many of whom have led distinguished careers at peer institutions. His long history of leadership and service at Penn Engineering included serving as Chair of Bioengineering from 1977 to 1982, and then again from 1990 to 1991, and as Associate Dean of Graduate Education and Research from 1981 to 1986.

The Solomon R. Pollack Professorship was established by Pollack's daughter Andrea Pollack and son-in-law Adam Usdan in honor and recognition of his groundbreaking and transformational contributions to the Department of Bioengineering in the School of Engineering and Applied Science.

$13.5M From DARPA to Enhance National Computer Security

PENN ENGINEERING HAS secured a $13.5 million grant from the Defense Advanced Research Projects Agency (DARPA) to pioneer cutting-edge technology aimed at enhancing national computer security. This award harnesses the School's security leadership to fundamentally shift the state of the art in computer protection, moving the field from today's typical "patch-and-pray" approach to a foundational, resilient approach that remains secure in the presence of even the most sophisticated software bugs.

Jing Li, André DeHon and Jonathan M. Smith (Photo courtesy of Felice Macera)

Penn Engineering Launches Responsible Innovation Initiative

At an October 17 kickoff event co-hosted by Perry World House, Penn Engineering launched its new Responsible Innovation initiative at the Penn Washington Center in Washington, D.C. After opening remarks from Vijay Kumar, Nemirovsky Family Dean, the afternoon's talks included keynote speaker Michael Horowitz, the Richard Perry Professor and Director of the Perry World House at the University of Pennsylvania, and guest speaker and Penn Trustee Ted Schlein (C'86), pictured above. Critical themes that emerged from the event included the need to consider the long-term impacts of technological innovation, balancing innovation with regulation and prioritizing the incorporation of ethics and social impact into engineering education.

Three New Scholarly Professorships Awarded

THANKS TO THE tremendous dedication and generosity of our donors, in Fiscal Year 2024, Penn Engineering awarded three recently established scholarly professorships:

Boileau Professorship of Electrical Engineering: Generously established by the late Oliver C. Boileau, Jr. (EE'51, GEE'53) and his late wife, Nan Eleze Boileau, the inaugural recipient of the Boileau Professorship is André DeHon, Professor in Electrical and Systems Engineering.

Misra Family Professorship: Endowed through the generosity of Rajeev Misra (ME'85, GEN'85), the first member of the faculty to hold the Misra Professorship is Mayur Naik, Professor in Computer and Information Science.

Richard K. Lubin Professorship: Established with the generous support of Richard K. Lubin (CHE'67) and the Richard K. Lubin Family Foundation, the Lubin Professorship is held by inaugural recipient Arjun Raj, Professor in Bioengineering.

LEARN MORE

To read full stories and access the School's latest news, visit *Penn Engineering Today* using the QR code below.

WHY I GIVE

Alexander Paul Carobus

In high school, Alexander Carobus (ENG'99, C'99) discovered a passion for computer games that developed into a deep interest in computers and eventually led him to pursue a bachelor's degree in Computer Science from Penn Engineering.

After graduation, Carobus earned a master's from Stanford and joined Google when it had about 200 employees, rising to the level of Senior Staff Engineer. There, he worked on search technologies and was a founding member of the AdSense team, the program that allows creators across 58 million-plus websites to monetize their content.

Carobus never lost his love of games, and in 2009, he co-founded Wild Shadow Studios and created *Realm of the Mad God*, which became a critical and commercial success. Now, 25 years after graduation, Carobus reflects on his time at Penn Engineering and why, as a member of the Benjamin Franklin Society, he has prioritized continued support of the School's Annual Fund.

What drew you to computers and, eventually, to study Computer Science at Penn?
Like most engineers, I was always driven to understand how things work and to use that understanding to build new creations. Computers became a natural target of this desire and I wanted them to be the primary focus of my studies in college. However, I also had other interests I wanted to pursue, and being able to do a dual degree in Computer Science and Psychology really attracted me to Penn.

Why did you leave Google to found your own gaming companies?
Google was an amazing place to do engineering. Being able to work on projects that had a global impact with world-class engineers was an incredible opportunity. But, my passion was still for games and I could not pursue it inside Google. Building a company brought a new set of challenges, but creating a game and having players respond to it was the best experience of my professional life.

How did Penn Engineering contribute to your current success?
Much more important than any single skill or technology, a great engineering education gives you a general set of mental tools for approaching problems. In computers, change is constant, so what Penn Engineering did was allow me to learn how to learn, which is essential to finding the best solutions.

What would you like to say to current students?
I like to say that college is like training wheels for real life. You can make mistakes and try things out, and those mistakes aren't as high-stakes because you are learning within a safety net of mentorship and support. So, take advantage of this time to explore.

Why is it important to you to give back to Penn Engineering?
I love Penn and feel grateful to it for all the opportunities it gave me. My time at Penn and everything I learned from my professors and fellow students formed the basis of all I did in my career. I am happy I can help the next generation of graduates to start their own adventures.

HONOR ROLL

Download the 2024 Honor Roll and learn more about the ways that you can give to Penn Engineering.

PHOTO BY JAY WATSON

Penn Engineering Board of Advisors

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CONTACT US to learn more about these incredible opportunities to continue your educational journey and gain skills and knowledge that will set you apart in the job market.