MVPs of Data Analytics

Students and graduates of the Sports Analytics Research Group are using quantitative analysis to give teams the wisdom they need to perform better.

ALSO IN THIS ISSUE

Signal and Noise

Data in the Driver's Seat

'Seeing' the Air Move

JOHNS HOPKINS ENGINEERING MAGAZINE

Partnerships Prepare Students for Practice

As engineers, our work does not begin and end with problem-solving through elegant equations or optimized modeling. The most impactful solutions we create must also navigate context—from budgets, regulations, and organizational timelines to aesthetics and cultural expectations. That is why our partnerships with external organizations—corporations, research sponsors, government labs, and nonprofits—are not ancillary to an engineering education; they are essential to how engineering is taught and learned.

This issue highlights how partnerships prepare students for real practice. Take undergraduate Talia Hovsepian's gap year with an F1 racing team in London: While translating raw data into race strategy, she discovered that insights must be actionable under extreme time pressure and strict parameters (p. 18). Students in our Sports Analytics Research Group work with professional teams to produce analyses that optimize performance while requiring deep knowledge of team needs and sport regulations (p. 28). In a past issue, we reported on important, corporate collaboration, the JHU + Amazon Initiative for Artificial Intelligence, which lets graduate students work with industry mentors to develop customer-driven products.

Beyond domain knowledge, these partnerships teach students accountability: how to set milestones, report progress, and revise plans when obstacles arise. These are professional habits that cannot be fully learned in isolation; they bring students face-to-face with the messiness of implementation.

Even as the tools we use to solve problems evolve rapidly—driven largely by advances in AI and machine learning—there is no virtual substitute for the experience of working directly with external clients and the iterative process of adjusting needs, expectations, financial constraints, and unforeseen challenges.

I'm proud of the rich range of real-world experiences we provide which equip our students with the judgment, resilience, and professional habits they'll need to lead responsibly in industry, academia, and public service.

Thank you for all that you do.

Ed Schlesinger
Benjamin T. Rome Dean

JOEL KIMMEL

"Beyond domain knowledge, these partnerships teach students accountability: how to set milestones, report progress, and revise plans when obstacles arise."

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Cover illustration by Bratislav Milenković

Spider Senses

Although functionally blind, orb-weaving spiders catch prey on their webs by sensing vibrations with their legs while crouching.

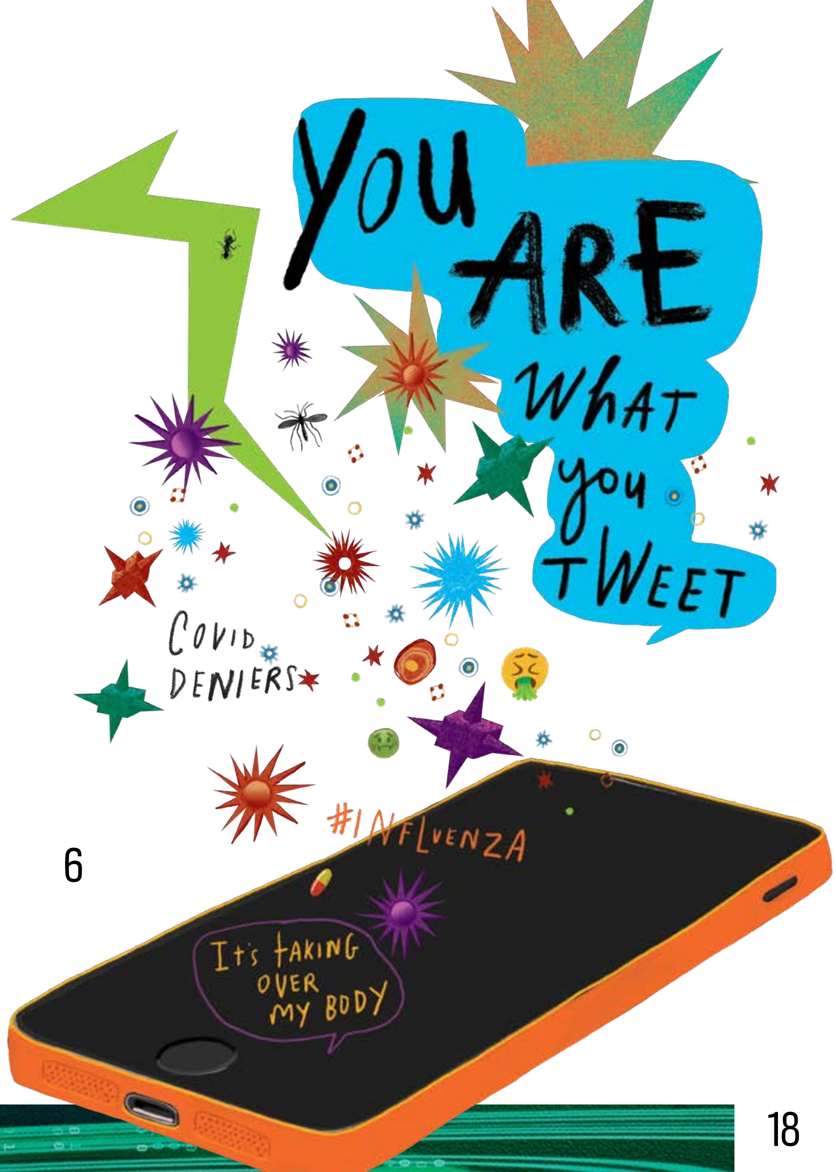
To understand this behavior, Chen Li's mechanical engineering lab, along with biology Assistant Professor Andrew Gordus and civil and systems engineering Assistant Professor Jochen Mueller, created a spider robot with vibration sensors. It hangs at the center of a wheel-shaped web, and, while crouching, shakes its web to detect a prey robot caught on a spiral thread. It locates the prey by sensing a change in vibration frequency. The closer the prey robot, the shorter its spiral thread, and the higher its frequency—just like a shorter guitar string that vibrates at a higher pitch.

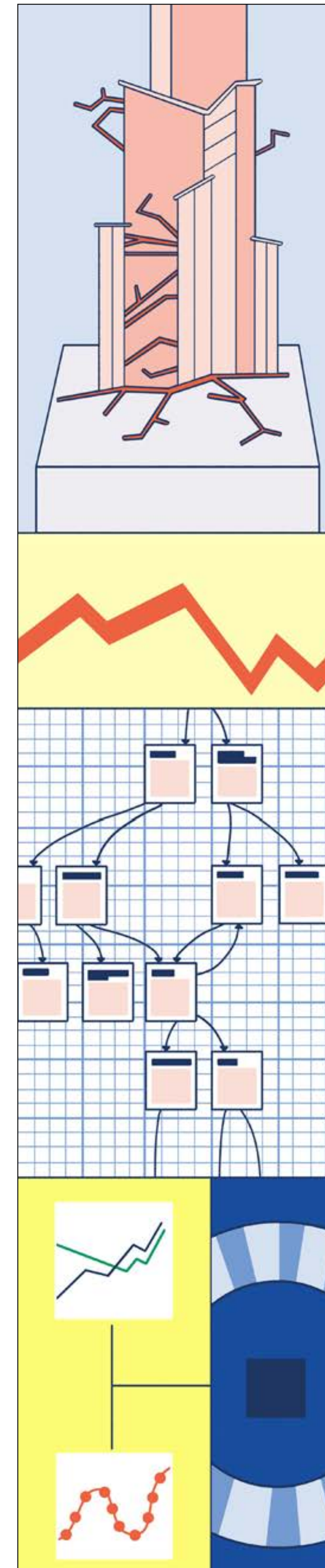
These findings could inform next-generation robotic sensors.

Below: Chen Li, associate professor of mechanical engineering, and Eugene Ho-Yu Lin, graduate student

JOHNS HOPKINS ENGINEERING MAGAZINE

SPRING 2026





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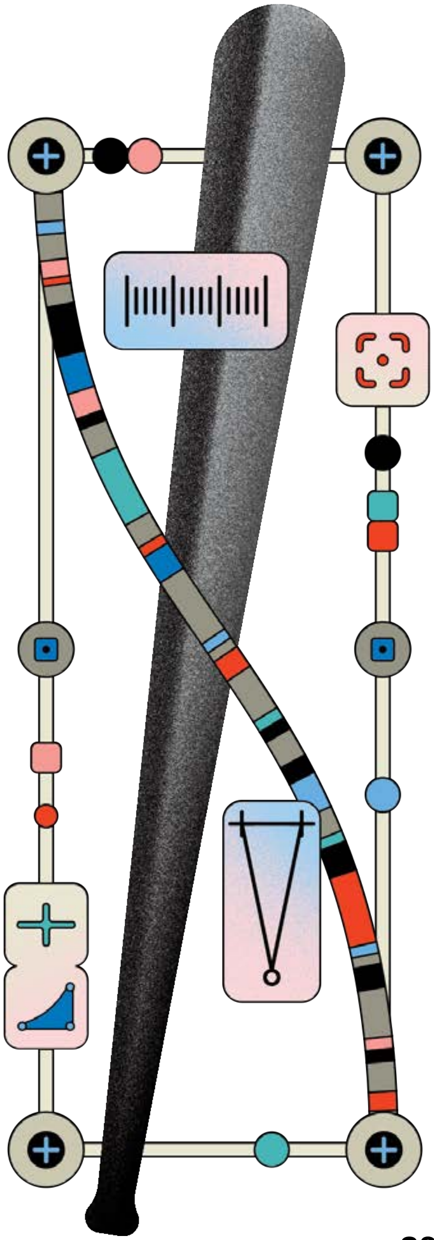

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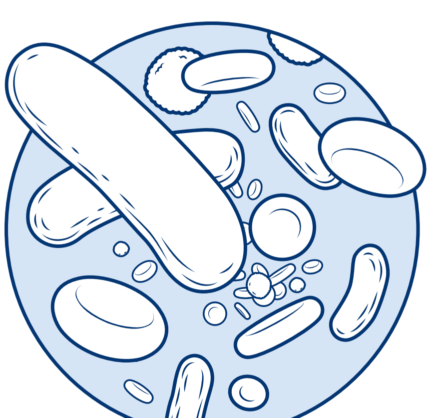

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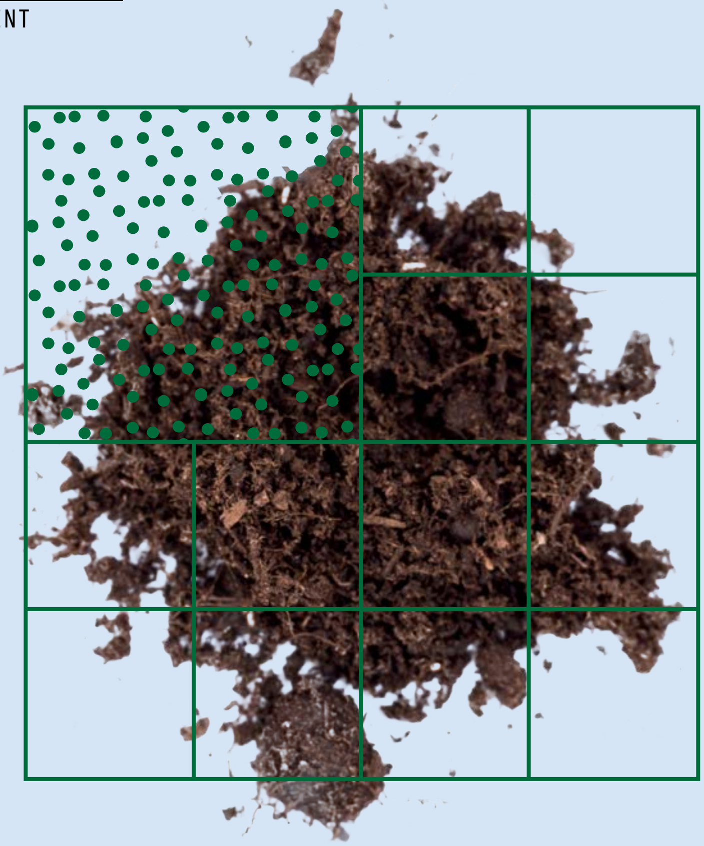
ALSO



Mobilizing to Map the U.S. Soil Microbiome

Johns Hopkins University geneticists and students, along with more than 150 researchers and students at 40 sites nationwide, are cataloging the nation's vast and largely unknown soil microbiome—the microorganisms that are key to the ecological functions that sustain human, animal, and plant life.

"The soil is the most biologically active environment on the planet, and yet we've sampled only a tiny fraction of life within it," says computer scientist Michael Schatz, senior author of a related study published in *Nature Genetics* and JHU's Bloomberg Distinguished Professor of Computational Biology and Oncology. "This scientific void we're trying to fill on microbial diversity could only be accomplished through this network of scientists and students."

The effort, part of the BioDiversity and Informatics for Genomics Scholars (BioDIGS) consortium, is one of the biggest microbiome studies ever attempted. It has already resulted in the discovery of more than 1,000 new strains of bacteria and never-before-seen microbes.

It also is encouraging the next generation of genetic scientists and strengthening genetics course materials at participating schools. "Students can be very sophisticated data scientists," says Schatz. "They were involved with sample collection and now we're leaning on them to help build out the reference genomes of the microbes, to scan and ID genes—everything. We knew we couldn't do it alone."

— JILL ROSEN

150
The BioDIGS consortium includes 150 researchers and students at more than 40 institutions across the U.S.

59%
Soil, the Earth's most biodiverse habitat, is home to around 59% of all species on Earth.

99%
An estimated 99% of soil microorganisms remain unstudied, or part of what scientists refer to as microbial "dark matter."

Exploring the Infinite

When Ed Scheinerman's 7-year-old granddaughter asked him, "What is the number before infinity?"—he knew he was onto something. There isn't a number before infinity, but that impossibility sparked an idea: Could he take readers on a journey through the many faces of infinity?

Scheinerman, a professor of applied mathematics and statistics and vice dean for special projects at the Whiting School, is the author of *A Guide to Infinity: Ten Mathematical Journeys*. The book, which explains concepts of infinity in accessible ways, was published in early 2026 by Yale University Press.

Scheinerman hopes readers will walk away both unafraid of infinity and inspired by the creativity inherent in mathematics. "Mathematics isn't just about solving equations," he explains. "It's about inventing ideas, exploring them, and seeing how they connect to the world."

— SALENA FITZGERALD

Awards

NATIONAL ACADEMY OF ENGINEERING

Younan Xia, Bloomberg Distinguished Professor of Nanoscience and Nanotechnology, was elected to the 2026 Class of the National Academy of Engineering, one of the engineering profession's highest honors, for his "research and leadership in the invention and rational development of advanced materials for nanomedicine and regenerative medicine."

DARPA YOUNG FACULTY AWARD

Alex Marder, an assistant professor of computer science, received a DARPA Young Faculty Award for his proposal, "ASSURE: Avoiding Sophisticated Surveillance on User Equipment Through Real-Time Evaluation."

SLOAN FELLOWS

Three faculty members have been named 2026 Sloan Research Fellows by the Alfred P. Sloan Foundation. These two-year fellowships are awarded to early-career scientists in the U.S. and Canada who show strong potential to be leaders in their fields.

Mateo Díaz, assistant professor of applied mathematics and statistics

Yayuan Liu, the Russell Croft Faculty Scholar and assistant professor of chemical and biomolecular engineering

Soledad Villar, assistant professor of applied mathematics and statistics

AISC LIFETIME ACHIEVEMENT AWARD

Benjamin Schafer, the Willard and Lillian Hackerman Professor of Civil and Systems Engineering, received the American Institute of Steel Construction's Lifetime Achievement Award.

IEEE AZRIEL ROSENFELD LIFETIME ACHIEVEMENT AWARD

Rama Chellappa, a Bloomberg Distinguished Professor of Computer Vision and Artificial Intelligence, received the IEEE's 2025 Azriel Rosenfeld Lifetime Achievement Award for his contributions to computer vision.

LIGHTS On: Expanding Grid Capacity

As electricity demand surges across the U.S., a Johns Hopkins project is helping states expand grid capacity faster and more affordably. LIGHTS (Leadership in Grid Innovations for High-Voltage Transmission for States) is funded by the Department of Energy. "LIGHTS addresses a critical gap in moving research into practice," says Yury Dvorkin, a member of the Ralph O'Connor Sustainable Energy Institute (ROSEI) and the project's primary investigator.

The LIGHTS team is working with PJM, which coordinates wholesale electricity markets across 13 states, including Maryland. As grids in these regions face rapid load growth—often driven by data centers—the team is developing algorithms and models to help governments improve cost savings, reliability, and speed.

"We don't have 10 years to wait for traditional transmission projects," says Abe Silverman, a ROSEI researcher and the project's co-PI.

LIGHTS is identifying upgrades to boost capacity on existing lines, such as replacing aging conductors with carbon fiber alternatives and using real-time weather and system data to ensure line safety.

"Our goal is to provide actionable insights that help states move faster, spend smarter, and strengthen reliability," Dvorkin says. "We can unlock enormous value in a fraction of the time it takes to build something new."

— WICK EISENBERG

INTELLIGENCE

Can AI Conform to Social Norms?

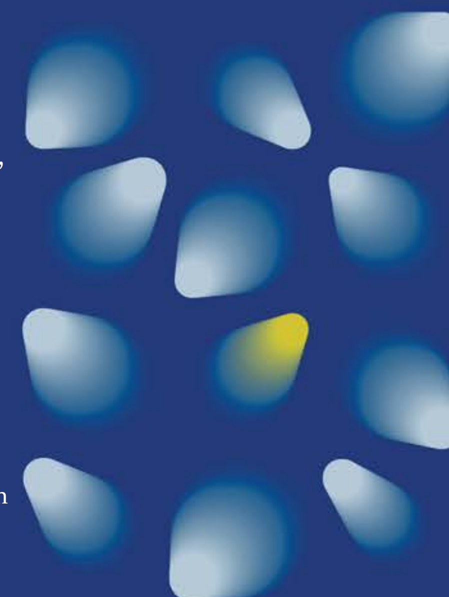
According to Gillian Hadfield, Johns Hopkins Bloomberg Distinguished Professor of AI Alignment and Governance, we're not ready for the AI transformation that's coming. "Getting AI governance right is crucial, because we're about to integrate these systems into our societies—the ultimate test of large-scale human cooperation," Hadfield says.

"We're not looking to the future and asking what governance structures, legal frameworks, and institutions we need to first establish," she warns. "We're heading toward a world with millions of AI agents participating with essentially zero legal infrastructure to manage their participation."

A member of JHU's Data Science and AI Institute, Hadfield was hired in 2025 as part of a new cluster of BDPs whose research weaves data science, data-driven research, and AI even more fully into the fabric and future of the university. With expertise in technology, law, and institutional economics, her work focuses on ensuring that artificial intelligence follows the ethical norms that allow human societies to thrive.

Hadfield approaches the AI alignment problem from both technical and policy perspectives. She is concerned with developing AI systems that can understand and conform to human normative institutions, as well as with establishing the legal and regulatory structures needed to guide AI.

Underpinning her work are human normative systems, including social norms, informal dispute resolution, and formal systems of law, which she explains are the fundamental infrastructure of human groups.



"It's more than just following societal rules; it requires a deeper understanding of what value those rules have in society."
Gillian Hadfield

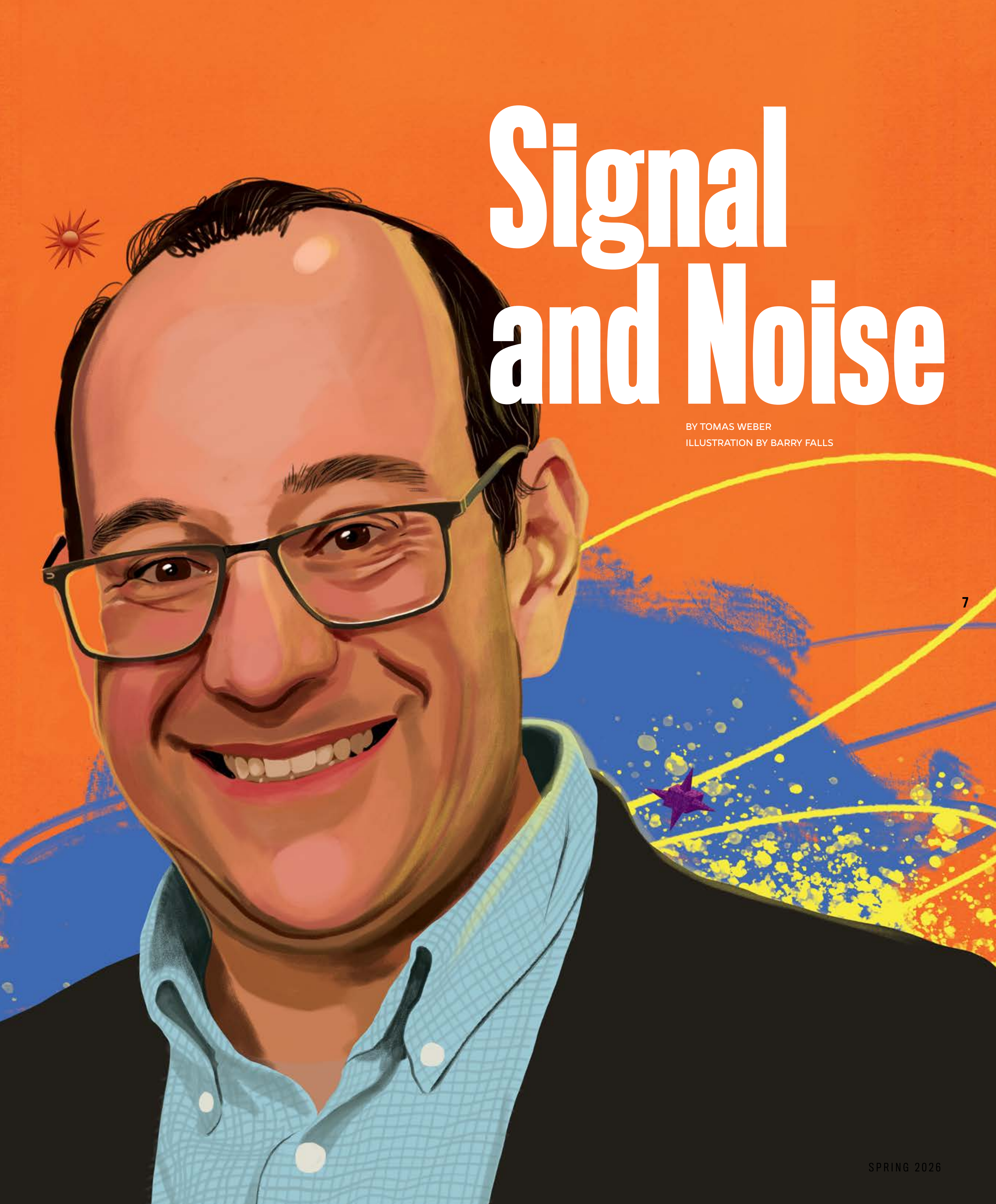
Hadfield builds computational models of these systems to ultimately enable AI systems that align with human normative institutions and reasoning. "It's more than just following societal rules; it requires a deeper understanding of what value those rules have in society," she says. Her work challenges conventional thinking about how legal rules are made and enforced, and she has become a leading voice in the call to redesign legal infrastructure to serve a globalized and digitally transformed society.

— JAIMIE PATTERSON

IMPACT
FACULTY INNOVATION

ALSO IN THIS SECTION

From tweets to medical records, **Mark Dredze** finds **meaning in massive data**. As director of the Data Science and AI Institute, he is **bringing together** scientists, clinicians, and scholars across Johns Hopkins to **unlock AI's full potential**



Signal and Noise

BY TOMAS WEBER
ILLUSTRATION BY BARRY FALLS

Across society—from labs to legislatures, boardrooms to classrooms—artificial intelligence is transforming how knowledge is produced and put to work. Like the internet, or even electricity before it, the technology is fast becoming a kind of infrastructure, deeply embedded in the tools scholars rely on every day. And no field is immune to its influence.

"AI is causing a revolution in how we do science," says Mark Dredze, the John C. Malone Professor of Computer Science at the Whiting School of Engineering. "And it's happening across the board. This isn't limited to engineering or biology, chemistry or sociology. It's everywhere."

Universities are facing a critical question: How can they harness AI responsibly to advance knowledge across every field? Doing so will demand more than technical know-how. It will require leaders who can transcend disciplinary boundaries—researchers who can connect computer scientists with clinicians, engineers with humanists, policymakers with data experts—turning technological advances into collaborative research programs that solve real-world problems.

At Johns Hopkins, that's a responsibility that's fallen to Dredze.

Last October, after an extensive international search, Dredze was appointed director of the Data Science and AI Institute, a universitywide initiative housed in the School of Engineering. The institute, which was launched in 2023 and brings together more than 150 faculty members across disciplines, aims to coordinate AI research across Johns Hopkins divisions and to accelerate interdisciplinary partnerships at a moment when the technology is advancing at breathtaking pace.

"I don't say this lightly," says Dredze, who is a specialist in natural language processing and public-interest AI. "These tools have reached a point where they can fundamentally change the way research is done."

Dredze's new role is to guide the university's efforts at the foreground of the AI revolution. But long before AI dominated the headlines, Dredze was helping lay the foundations for that revolution, integrating computational methods with public health and medicine, showing how big data can shape critical decisions.

He's harnessed social media platforms to track disease and developed tools to analyze online misinformation. He's pioneered techniques for identifying racial bias in the way doctors interpret what their patients tell them and used AI to track online tobacco discourse, arming public health leaders with real-time intelligence. He's also advised congressional staff on AI. And although Dredze is a computer scientist by training, his breakthroughs are only possible by way of an unusually deep engagement with a multitude of domains.

"What sets Mark apart," says Nanyun (Violet) Peng, Engr '17 (PhD), Dredze's former graduate student and now associate professor of computer science at the University of California, Los Angeles, "is his curiosity about the human processes that create data: how a journalist plans a story or how a patient describes a symptom. Because Mark combines a domain curiosity with deep technical insight into natural language processing and machine learning, he can ask questions that others miss."

> **"I don't say this lightly. These tools have reached a point where they can fundamentally change the way research is done."**
> Mark Dredze

ROOM TO EXPLORE

It's an instinct that took root early.

Between earning dual bachelor's degrees in computer science and engineering at Northwestern University and completing his PhD in computer science at the University of Pennsylvania, Dredze took an unlikely sidetrack: a master's degree in Jewish studies, where he focused on textual analysis and historical interpretation—an early glimpse of the boundary-defying scholar he would later become.

"It was always meant to be a detour," Dredze says. And while he remained set on computer science, immersing himself in a humanistic discipline sharpened his interest in language and the ways meaning is constructed—questions that would later animate his work in natural language processing.

During his doctoral studies, Dredze was torn between going into industry or academia. He took roles with IBM, Microsoft, and Google. But then he realized a university career would allow him more freedom to follow his diverse interests.

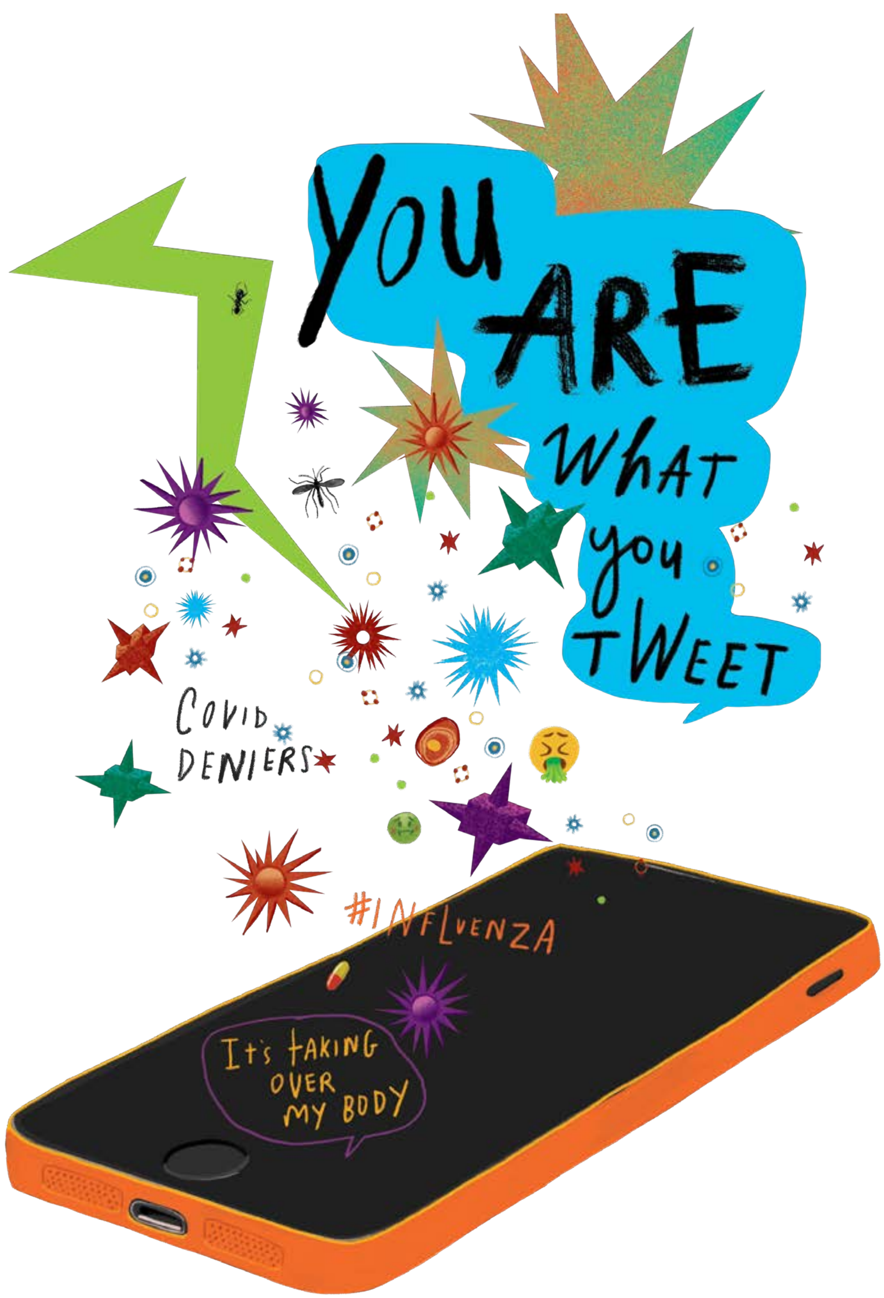
"One of the things I really love about an academic career is that there's space to get interested in different things and see where it takes you, without being too worried about the destination," he says. "You can look at a problem and think, 'This is interesting,' and maybe it takes you somewhere completely different than you expected. Maybe it's a dead end. Maybe it circles back. But the university gives you room to explore."

Arriving at the Whiting School of Engineering in 2009 as an assistant research professor, Dredze had never worked on anything health-related. His training was in speech and language processing, building systems to analyze text and model how people write and speak. But within two years, he'd pioneered an entirely new subfield of public health: social media health informatics.

So how does a scholar trained to parse language start tracking disease?

DECODING SOCIAL MEDIA

While Dredze continued his work teaching AI systems to interpret spoken language when he began at Johns Hopkins, he was also scanning the horizon for larger questions. Rather than rushing into a new specialty, he chose to spend his first years simply listening.



"I said, 'Okay, well, this is great—but where are the other interesting, smart people at Hopkins? And everyone said, 'Well, you really should go to East Baltimore and talk to people in public health and medicine,'" Dredze recalls. "And so that's what I did."

He discovered that epidemiologists and clinicians at the university's medical campus and the Bloomberg School of Public Health were grappling with a persistent challenge: how to track infectious diseases such as influenza quickly and accurately. Traditional surveillance systems depended on hospital reports and laboratory testing. They were rigorous—but they were also slow, with outbreaks often outpacing the official data.

At the same time, Twitter was taking off, with millions suddenly narrating their daily routines in real time. Alongside people's posts about their breakfast or their travel plans were updates about their fevers, sore throats, and aches and pains. Dredze, who had already been studying the social media platform as a source of large-scale language data, wondered whether that volume of data could be made useful for public health officials.

It looked promising at first sight. But turning those posts—like "I gots da flu" or "sick with this this flu it's taking over my body ughhhhh"—into public health insights required more than keyword searches. In a project that came to be known as "You Are What You Tweet," Dredze and his students developed models capable of distinguishing genuine reports of infection from expressions of worry or general discussion.

A sudden rise in tweets mentioning "flu" could signal an uptick in cases, Dredze explains, or just heightened anxiety following a news story. "Spotting that distinction came from Mark's ability to think like an epidemiologist while solving problems like a natural language-processing researcher," says Peng. "He realized that to track the disease, we first had to decode the way people talk about the disease."

The work began modestly. But it quickly gathered momentum. NPR and *The Washington Post* covered the research, with subsequent research teams citing it heavily. The Centers for Disease Control and Prevention began taking notice. Colleagues in medicine and public health started reaching out about using social media platforms to study vaccine hesitancy, mental health, and emerging outbreaks. Within a few years, a new field had firmly taken root, with Dredze having helped establish what is now known as social media health informatics. But he would soon confront a more sinister dimension of the data he'd learned to decode.

SENSING 'THE PULSE'

By 2018, a different kind of outbreak was commanding attention.

Intelligence agencies had concluded that foreign actors had infiltrated American social media, with Twitter disclosing 10 million tweets that had been posted by Russia's Internet Research Agency.

Dredze, who at that point had been collecting and archiving Twitter data to study public health for years, quickly understood the stakes. He was in an ideal position to ask what role health might be playing in these ominous campaigns.

He and his collaborators sifted through the posts and began to decode the agenda. Their expectation was that Russian-linked accounts would be pushing anti-vaccine propaganda—but they soon realized that the data was telling a more complicated story. Some accounts did criticize vaccination. Unexpectedly, though, some accounts seemed to promote it. Instead of pushing a single agenda, the bots seemed to be amplifying the most inflammatory voices on both sides.

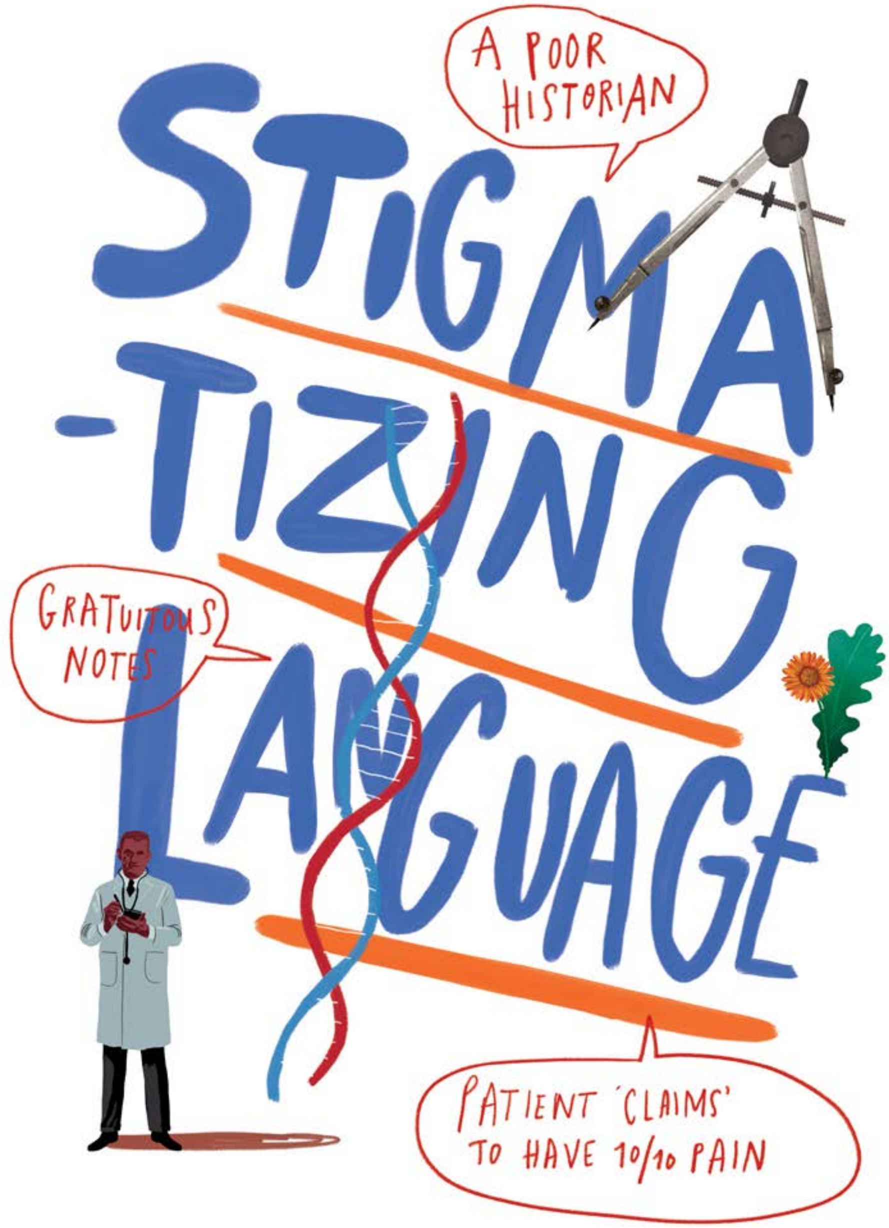
"The trolls seemed to be using vaccination as a wedge issue, promoting discord in American society," Dredze says.

Thanks to his previous work, Dredze was able to move quickly. "When someone identified this information need, we were in a position to fulfill it," Dredze says, about a project that ended up informing journalists, lawmakers, and public health officials about the nature of an unfolding threat.

"Mark possesses a unique radar for emerging data sources," says David Broniatowski, a professor of engineering management and systems engineering at The George Washington University, who collaborated on the project. "By the time the rest of the field caught up to the problem, Mark had already built the infrastructure to answer it."

The project was timely, but it was also prescient. Since 2018, the misinformation ecosystem has grown more complex, and distrust in science runs deeper. Dredze was one of the first researchers to show how digital language could shape public health in ways few had previously anticipated. "Mark can sense the 'pulse' of a field, identifying critical problems before they hit the mainstream radar," says Broniatowski.

And then Dredze began considering other ways written language can shape human health. If digital language could influence our health through our smartphones, he wondered, what might it be doing inside the clinic?



BECOMING BILINGUAL

By the late 2010s, electronic health records had become near universal across major American health systems. Inside all those histories, assessments, and discharge summaries lay patterns—trends that had the potential to shed light on treatment decisions and even uncover unexpected therapeutic benefits of drugs. The challenge was in finding a way to sift through the overwhelming volume of data and sniff out what was useful.

"Medical decisions today, big and small, are all driven by evidence," Dredze says. "We need data to make these kinds of decisions. We've been collecting data in the medical system for a long time that may contain the answers to many questions. But it's really hard to analyze because the data is so large. It's at scale. It's diverse."

Mary Catherine Beach, BSPH '99 (MPH), professor of medicine at the Johns Hopkins University School of Medicine, had been thinking about one potentially concerning facet of that vast archive: the way physicians write about their patients. Some details in a medical record are necessarily difficult—a history of substance use, say, or missed appointments. But other phrases, she says, carry judgments that may not be clinically essential and could end up informing the care a patient receives.

"We were looking at what we now call stigmatizing language in patient records," explains Beach, who has been collaborating with Dredze and other researchers on a long-term project to use clinical records to study bias since around 2020. "Sometimes there might be details that are important to record. But then there's stuff that is somewhat gratuitous, that clinicians will write, maybe out of frustration. That comes across to the people reading it."

Much of that language operates indirectly. A physician may not write that they doubt a patient's pain. Instead, they might say the patient "claims" to have "10 out of 10 pain," or describe someone as a "poor historian." It's a subtle signal—but to clinicians it's as clear as day.

Beach and Dredze began discussing whether natural language processing could detect these patterns—which meant Dredze had to learn to speak doctor.

Computer scientists and physicians often don't speak the same language, and bridging the gap required practice. "I'm not a medical doctor," says Dredze, who compares the process—which gave him the fluency to identify where his tools can meet clinical needs and when to defer to the domain experts—to learning French. "Becoming bilingual in disciplines is the same as becoming bilingual in language—you just have to practice," he says. "If you want to learn how to speak French, you need to take some French lessons, but also, you just need to talk to people in French a lot, all the time."

The collaboration, which led to a Johns Hopkins Discovery Award, given annually to interdisciplinary teams across the university that are poised to arrive at important breakthroughs, resulted in models capable of identifying several categories of stigmatizing sentiment in clinical notes.

Their findings were sobering. Notes about Black and Hispanic patients, they discovered, contained more language undermining credibility and less language affirming it, compared to notes about white and Asian patients.

"We can bring our perspective, he can bring his perspective, and together we can create something that neither one of us could have done without the other."
Mary Catherine Beach

When clinicians discount a patient's account, diagnoses can be delayed and treatments misdirected. "A lot of patient safety events or medical errors are caused by not taking seriously or listening to what somebody is telling you," says Beach. And because medical records are read by multiple providers, the tone of one note can shape the assumptions of the next. "That is infectious in the note," she says.

Beach describes the partnership as a model of interdisciplinary investigation. "It was a perfect example of why interdisciplinary collaboration works," she says. "We can bring our perspective, he can bring his perspective, and together we can create something that neither one of us could have done without the other."

Over the years, Dredze's refusal to stay in his lane has led him to examine gun violence prevention, suicide risk assessment, geriatric syndromes in older adults, and drug use monitoring in online forums. He helped build Tobacco Watcher, a platform that has delivered actional intelligence to tobacco control researchers for more than a decade. He has published more than 350 papers across public health, medicine, computer science, and linguistics.

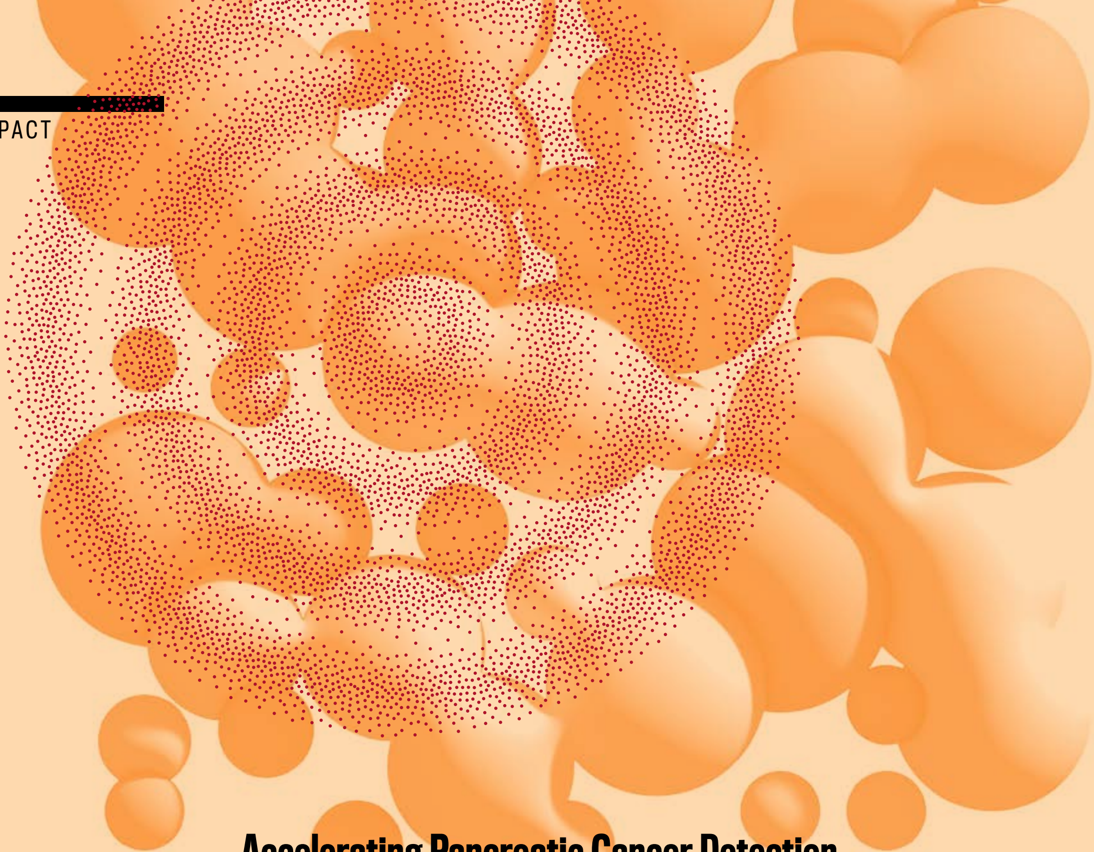
But Dredze's ultimate goal, amid all this prolific output, might seem surprising: to make himself unnecessary. He wants to design AI tools to replace himself.

"Putting myself out of business would be lovely," he says, "because the number of people who want to do these types of studies far exceeds the time I will ever have. If I can eliminate myself from that pipeline, that would remove a huge bottleneck in medical research."

But Dredze won't be putting himself out of a job any time soon. As the new director of the Data Science and AI institute, his impact across the university is now greater than ever—an appointment he was, as he puts it, "surprised and incredibly honored" to receive.

As to what comes next, that's now much larger than any one project. As AI transforms the way science is conducted in every domain, Dredze's task is to guide that revolution thoughtfully while bringing as many scholars to the table as possible—while ensuring it remains anchored in real-world problems.

"Building those bridges and making those connections," he says, "is going to be the most impactful thing we can do." ⛊



Accelerating Pancreatic Cancer Detection

CASES DIAGNOSED TOO LATE FOR EFFECTIVE TREATMENT
80-85%

HOSPITALS PROVIDING DATA
145

3D CT SCANS ANALYZED
36,000+

ANATOMICAL STRUCTURES ANNOTATED
993,000

Pancreatic cancer is the third-leading cause of cancer-related deaths in the U.S., with 80% to 85% of cases diagnosed too late for effective treatment. Its silent progression and anatomical complexity make early detection difficult for radiologists.

Now, a team including Johns Hopkins computer science researchers—collaborating with NVIDIA and institutions worldwide—has developed a database aimed at leveraging artificial intelligence to spot pancreatic cancer earlier, when it is potentially treatable.

The Pancreatic Tumor Segmentation Dataset, or PanTS, is the largest fully open-source CT scan dataset for pancreatic cancer detection. The work, developed by Wenxuan Li, Engr '23 (MSE), a PhD student, Assistant Research Professor Zongwei Zhou, and Bloomberg Distinguished Professor and computer scientist Alan Yuille, was presented at the 39th Annual Conference on Neural Information Processing Systems.

"Although current AI isn't yet ready for population-wide screening, if we use imaging biomarkers, clinical notes, and deep neural networks to select high-risk patients, we can transform a blunt screener into a precision detection tool," says Zhou, senior author of the project, who holds a joint appointment in oncology.

The dataset contains over 36,000 3D CT scans from 145 medical centers, with expert-validated annotations of more than 993,000 anatomical structures, including the pancreas, tumors, and surrounding organs. Each scan includes metadata—patient age, sex, diagnosis, imaging protocols, and biomarkers—to help develop models that identify high-risk individuals across diverse populations and imaging conditions. PanTS was built with NVIDIA's MONAI Label, an open-source AI framework for medical imaging that supports interactive 3D segmentation and scalable, human-in-the-loop annotation workflows.

Models trained on PanTS significantly outperform those trained on existing public datasets, gains that the team attributes to PanTS' scale and anatomical detail. The public dataset includes a reserved test set for third-party validation so developers and hospitals worldwide can train and evaluate models.

"Our team will keep promoting open science in medical computer vision—especially for cancer research, where public annotated datasets are limited," says Li.

By enabling earlier, more accurate tumor detection, PanTS could improve survival rates and transform pancreatic cancer care. Researchers are already developing an algorithm that reportedly detects pancreatic cancer in CT scans over a year earlier than most radiologists—thanks to PanTS training data.

— JAIMIE PATTERSON

The Platinum Problem

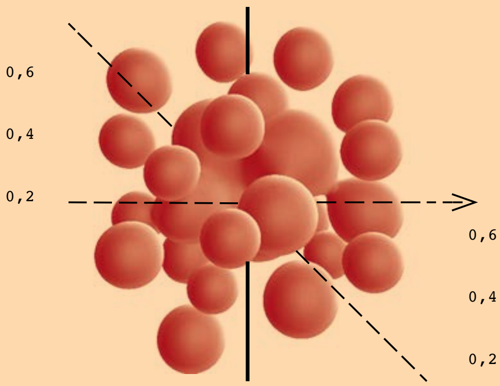
Hydrogen fuel cells provide clean, renewable, reliable, low-emission electricity. A stable domestic energy source, they also offer flexibility and support other renewables like wind and solar.

Even with these advantages, significant obstacles remain to broad adoption, including the high cost and material constraints of platinum, the catalyst for the oxygen reduction and hydrogen oxidation reactions.

Searching for cheaper, more abundant catalyst alternatives, a team of materials scientists led by Corey Oses, an assistant professor of material science and engineering and a member of JHU's Ralph O'Connor Sustainable Energy Institute, looked to high-entropy alloys, or HEAs. "We believed they were the best option because they're made of many components that might be able to mimic or even exceed the emulator, outperforming a material like platinum," Oses says.

To predict which HEA combinations would work best, the team created an AI framework. "Our goal was to quickly screen more compositions and generate rapid predictions. We wondered if we could teach an algorithm these properties and then integrate it into a machine learning framework," says Oses. "And the answer is yes, we can." Their study was published in *Nano Futures*.

While this project focused on one common type of atomic arrangement—body-centered cubic structures—future work will explore other arrangements found in HEAs and close the loop between computation and experiment. Top AI predictions



“Our goal was to quickly screen more compositions and generate rapid predictions. We wondered if we could teach an algorithm these properties and then integrate it into a machine learning framework. And the answer is yes, we can.”
Corey Oses

will be synthesized and tested, with results fed back to refine the model.

“That cycle could speed and economize the hunt for platinum alternatives,” Oses says. By combining computational depth with practical shortcuts, the approach aims to accelerate discovery of catalytic materials that could lower costs and help hydrogen fuel cells reach wider commercial use.

— CONNER ALLEN

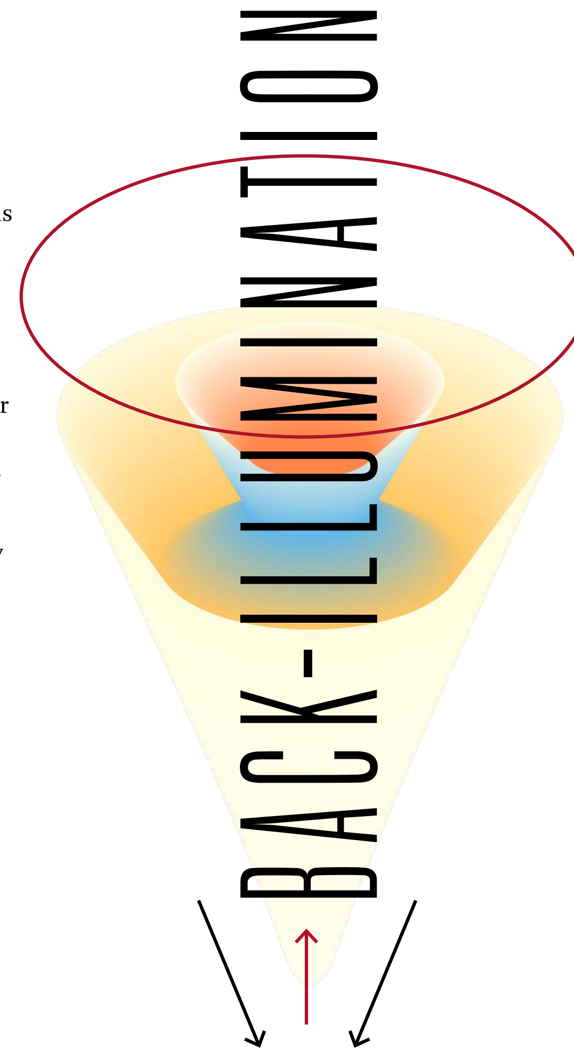
HOW IT WORKS

Bye-Bye Biopsies

Current medical imaging often fails to see clearly through thick tissue or capture fast-moving targets like blood cells in real time. To make a diagnosis, doctors resort to removing tissues, cutting them into thin slices, and dyeing them for analysis through a microscope. It can take days to get the lab results.

Biomedical engineer Nicholas Durr and surgical resident Gregory N. McKay, Med ’24 (MD/PhD), have developed a new microscopy method to change that. Called back-illumination tomography (BIT) and detailed in the journal *Optica*, the technique produces real-time, high-resolution images of living tissue and flowing blood cells—opening a potential path toward faster diagnoses and fewer invasive biopsies.

— CATHERINE GRAHAM



HERE’S HOW IT WORKS

1. It uses tissue scattering rather than avoiding it.

Thick tissues scatter light, creating a murky “fog” that hides details. A standard biopsy removes tissue from the body so that it can be sliced into thin, transparent slices. The BIT system takes advantage of tissue-scattering. It projects a virtual light source deep into a tissue. Tissue-scattering creates a virtual semicoherent source that back-illuminates the more superficial structures. This light interferes with a reference wave, revealing structures that were previously hard to image.

2. It doesn’t need chemical stains.

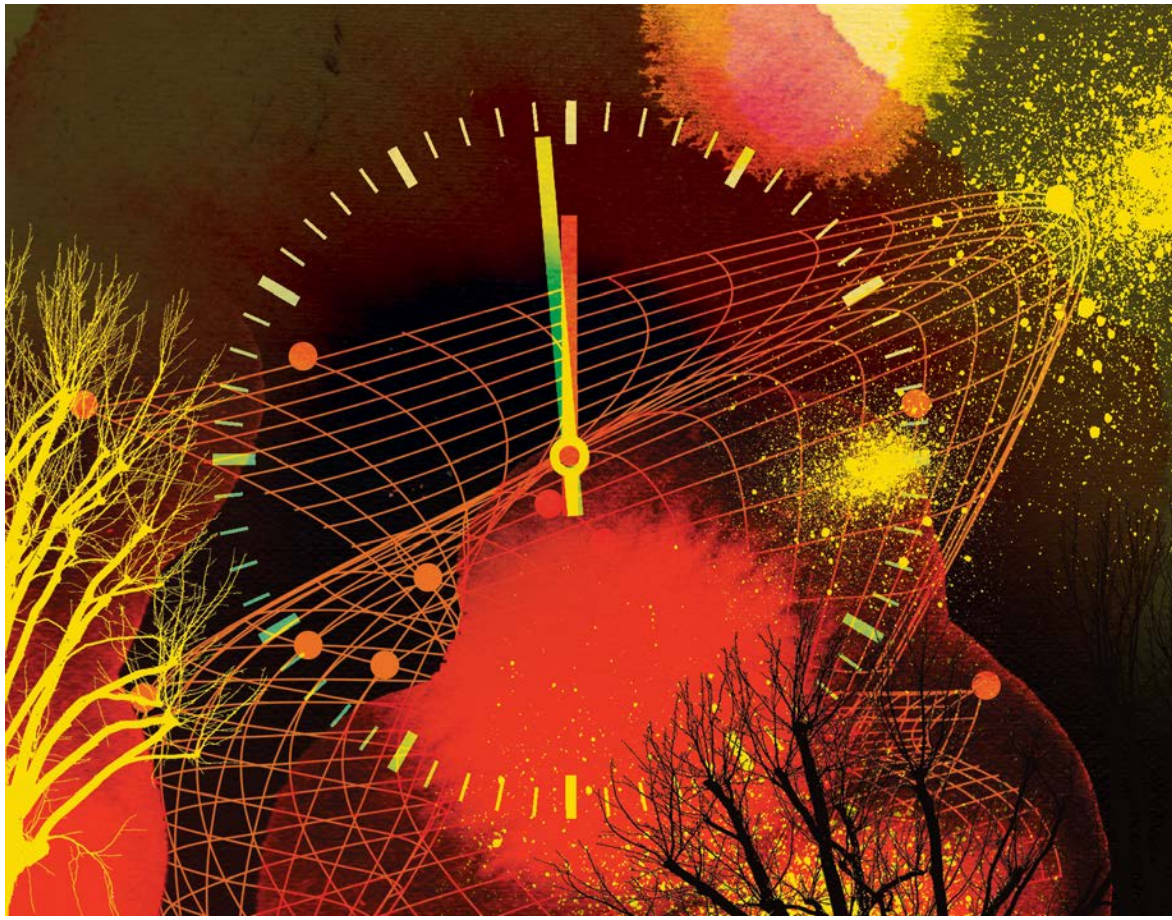
Most cells are transparent and require chemical dyes to be viewed under a microscope. The BIT system skips the dyes by harnessing how light scatters and creates distinctive interference patterns when it hits cellular components like a nucleus or a membrane. By capturing these patterns, BIT generates sharp, 3D images of unstained tissue that reveal the same structural details as traditional biopsies but without chemical processing or tissue removal.

3. It tracks high-speed motion.

The BIT system captures moving targets far more effectively than traditional imaging. While standard microscopes are often too slow to track rapid movement, the BIT system captures full frames at high speed, making it possible to visualize fast biological processes—such as individual blood cells racing through a vessel—in real time without the motion blur common in other techniques.

4. It eliminates wait times.

With further refinements, the technology could transform disease diagnosis. By using AI to virtually “stain” the images, results that currently take days to process in a lab could be delivered instantly. The team is now combining views from different angles for more accurate 3D images, with the goal of replacing lengthy surgical biopsies with bedside diagnosis.



"By using simulation models that predict how groups make decisions, we can support more effective planning and evacuation to reduce negative effects."
Susu Xu

SIMULATIONS

Tapping AI to Improve Wildfire Evacuation

Susu Xu
Assistant professor of civil and systems engineering

When a wildfire strikes, residents, incident response teams, and public safety officials spring into action to make decisions aimed at preserving life and property. But not all those decisions are sound.

"During the Los Angeles wildfires last year, we saw a lot of negative effects related to evacuation," says Susu Xu, an assistant professor of civil and systems engineering.

"While some people left prior to the fires, others chose to evacuate at the last minute, causing traffic congestion and prompting drivers to abandon their cars on the same roads used by emergency response teams. We also saw that many people did not have the means to evacuate."

Xu is leading a Johns Hopkins team that—together with researchers from University of Florida—has been awarded nearly $1.2 million by the National Science Foundation's Fire Science Innovations Through Research and Education program to advance AI-enabled tools that predict human behavior during wildfire evacuations. Xu says the project aims to strengthen community resilience by understanding how civilians, incident response teams, and public safety officials make protective action decisions during deadly blazes.

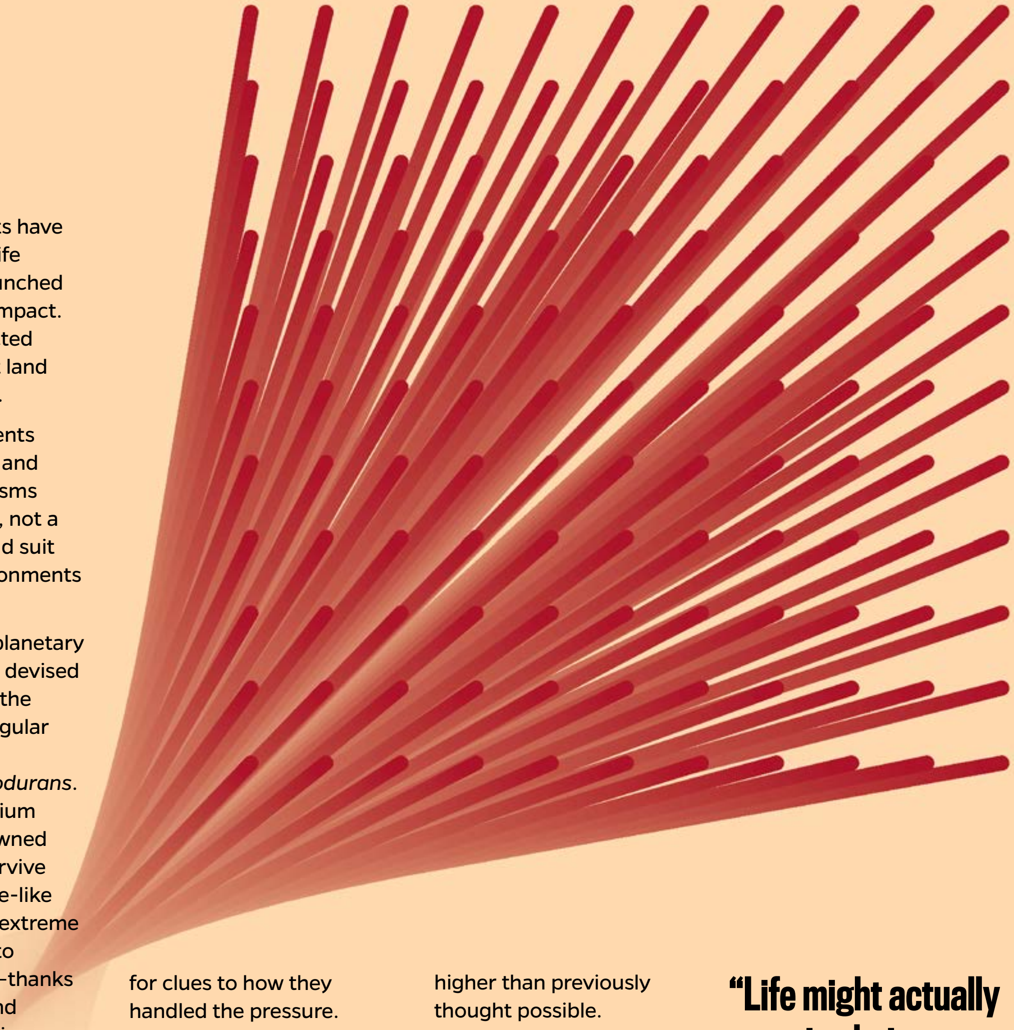
"By using simulation models that predict how groups make decisions, we can support more effective planning and evacuation to reduce negative effects," she says.

The project will produce simulation methods to promote teaching, training, and learning and will support wildfire resilience by allowing public safety officials to use open-access tools.

Current behavior prediction models include behavioral and psychological theory but don't fully represent the complexity of human decision-making. The team found that by introducing behavioral theory and psychological theory to guide the reasoning process of large language models, or LLMs, they could significantly improve mimicry of the human reasoning process, allowing them to better understand how implicit mental states are shaped under stressful conditions, how people are making decisions, and how choices vary among individuals and groups.

— DANIELLE MCKENNA

SHONAGH RAE



Hitchhiking on an Interplanetary Journey

Tiny life forms tucked into debris from an asteroid hit could catapult to other planets—including Earth—and survive, a new Johns Hopkins University study finds.

The work demonstrates that a certain hardy bacterium easily withstands extreme pressure comparable to an ejection from Mars after an asteroid hit, as well as the inhospitable conditions it would face during the ensuing interplanetary journey.

The study, published in *PNAS Nexus*, suggests that microorganisms can survive remarkably more extreme conditions than expected and raises questions about origins of life. The work also has significant implications for planetary protection and space missions.

"Life might actually survive being ejected from one planet and moving to another," says senior author K.T. Ramesh, a mechanical engineer and the Alonzo G. Decker Jr. Professor of Science and Engineering, who studies how materials behave in extreme conditions. "This is a really big deal that changes the way you think about the question of how life begins and how life began on Earth."

Impact craters cover the surfaces of most bodies in the solar system. Mars, a planet that could harbor life, is one of the most cratered celestial bodies. Scientists know asteroid strikes can launch material across space—and Martian meteorites have been found on Earth.

However, scientists have long wondered if life forms could be launched from an asteroid impact. Tucked inside ejected debris, they might land on another planet.

Previous experiments were inconclusive and focused on organisms common on Earth, not a life form that would suit the extreme environments of other planets.

To test a realistic planetary ejection, the team devised a way to replicate the pressure and a singular biological model: *Deinococcus radiodurans*. This desert bacterium from Chile is renowned for its ability to survive inhospitable, space-like conditions—from extreme cold and dryness to intense radiation—thanks to its thick shell and ability to self-repair.

"We do not yet know if there is life on Mars, but if there is, it is likely to have similar abilities," Ramesh says.

The experiment simulated the pressure of an asteroid strike and ejection by sandwiching the microbe between metal plates and then using a gas gun to fire a projectile at it at speeds up to 300 mph, generating 1 to 3 gigapascals, or GPas, of pressure.

For perspective, pressure at the bottom of the Mariana Trench, the deepest part of the Earth's oceans, is a tenth of a GPa—so even the experiment's lowest pressure was more than 10 times that.

Afterward, the team assessed bacteria survival and examined the survivors' genetic material for clues to how they handled the pressure.

The bacteria were tough: Nearly all survived 1.4 GPa with no damage, and 60% survived 2.4 GPa, with some cells experiencing ruptured membranes and internal injury.

"We expected it to be dead at that first pressure," says lead author Lily Zhao, Engr '21 (MSE), a mechanical engineering graduate student. "We started shooting it faster and faster, but it was really hard to kill."

In the end, what did die was the equipment. The steel configuration holding the plates fell apart before the bacteria did.

When asteroids hit Mars, ejected fragments can produce pressures close to 5 GPas or more. Here, the microbe easily survived almost 3 GPas, much higher than previously thought possible.

"We have shown that it is possible for life to survive large-scale impact and ejection," Zhao says. "What that means is that life can potentially move between planets. Maybe we're Martians!"

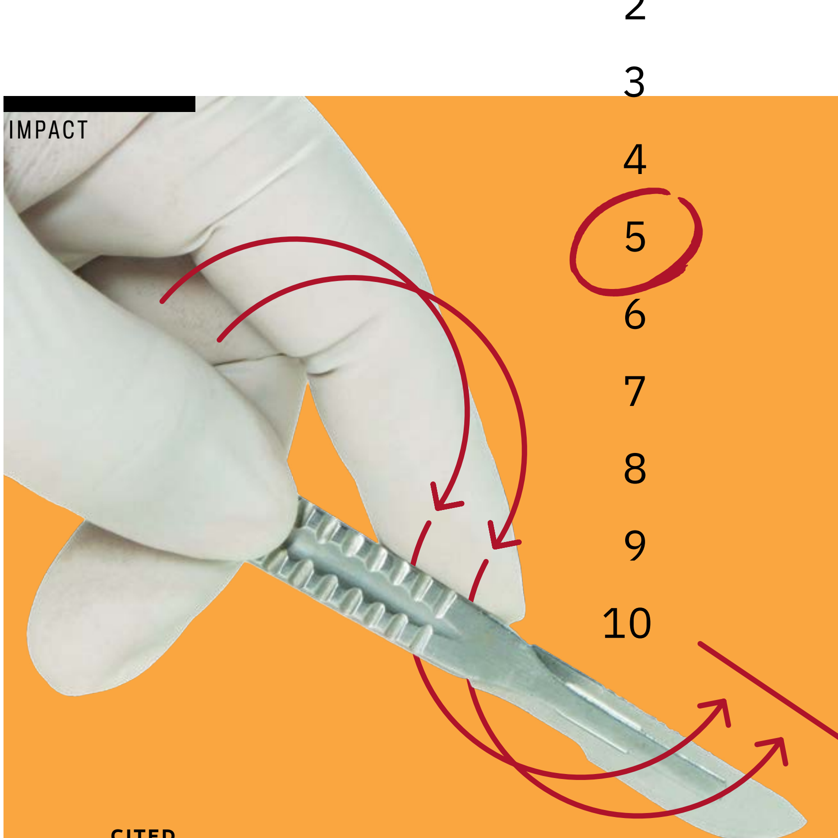
Current rules limit contamination of potentially habitable worlds and tightly control returned samples; if material can travel between planets naturally, those policies may need revisiting, the team says.

The team next hopes to explore whether repeat asteroid impacts result in hardier bacterial populations—or whether bacteria adapt to this kind of stress—and whether organisms like fungi can survive these conditions.

— JILL ROSEN

"Life might actually survive being ejected from one planet and moving to another. This is a really big deal that changes the way you think about the question of how life begins and how life began on Earth."

K.T. Ramesh



CITED

“Right now, an attending surgeon who already is short on time needs to come in and watch students practice, and rate them, and give them detailed feedback–that just doesn’t scale.”

Mathias Unberath, John C. Malone Associate Professor (Computer Science), commenting on a new AI tool he and his team developed—trained on videos of expert surgeons at work—which offered student surgeons real-time personalized advice as they practiced suturing. His work was showcased and honored at the International Conference on Medical Image Computing and Computer Assisted Intervention.

“The goal is to design stronger, more reliable materials and to refine predictive models for systems that experience sudden, burst-like energy releases, whether deep in the Earth or within engineered structures.”

Jaafar El-Awady (Mechanical Engineering), on how his team found that sudden bursts of energy—from a microtear on the Earth’s surface to an earthquake—follow the same statistical principles. Their findings were published in *Acta Materialia*.

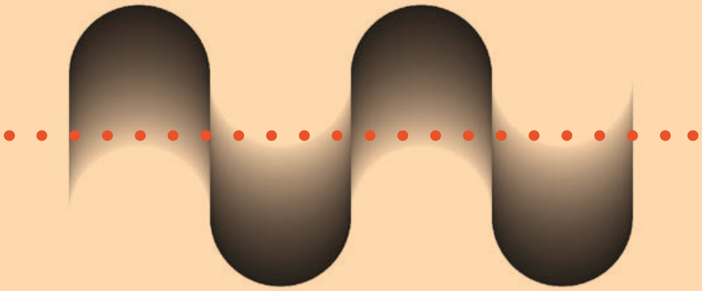
“What’s most exciting is that wearable sensors now let us objectively capture how patients with vestibular disorders actually move in their daily lives. These insights will guide the development of smarter, more personalized rehabilitation strategies.”

Kathleen Cullen (Biomedical Engineering), discussing potential advances for treating superior canal dehiscence syndrome—an inner ear disorder that triggers constant dizziness and balance issues. Her team’s findings were published in *Scientific Reports*.

“Our condition assessment model can help governments save public resources and money, especially in smaller, developing countries. It’s a way to help ministries of finance and public works foresee future financial needs and better prepare for severe natural events.”

Gonzalo Pita (Civil and Systems Engineering), on how his team developed a building condition assessment tool to support government efforts in ensuring structures are in sound condition and prepared to withstand natural disasters.

Impulse Control for Better Decisions



A mathematical model developed by Haoyang Cao could help businesses, financial planners, and engineers make smarter high-stakes decisions.

Cao, an assistant professor of applied mathematics and statistics and a member of the Data Science and AI Institute, and her team focused on “impulse control” decision-making, a framework that reflects how organizations actually operate.

Rather than making tiny, continual changes, companies typically wait until conditions reach a tipping point and then act decisively.

“Our model is much closer to this reality,” Cao says. “People observe a situation over time, and only when the tipping point is reached, they make a move,” she adds, citing examples such as an Amazon warehouse suddenly placing a large restocking order or an investor moving funds in one major trade. “It’s sudden, not gradual. Real decision-making is messy,” she adds, “and algorithms must embrace that mess.”

That realism matters. Poorly timed decisions can lead to empty shelves, wasted inventory, unnecessary transaction fees, or lost profits. Yet translating those reactionary choices into mathematics has long challenged researchers. Current methods assume smooth, continuous behavior—but in the real world, decisions often arrive as abrupt shocks.

> **“People observe a situation over time, and only when the tipping point is reached, they make a move.”**
> Haoyang Cao

To bridge that gap, the team used reinforcement learning, where an algorithm learns through exploration and feedback, and built an operator-based framework that tracks how a system “renews” after each jump—for example, how inventory levels reset after a major order.

Rather than rely on simple rules and idealized equations, their flexible approach learns from experience to discover better timing and order sizes, identifying what “too low” means amid shifting demand, prices, and shipping costs.

The researchers are now expanding the work beyond a single decision-maker to situations where many agents interact, such as competing firms ordering from the same supplier or investors reacting to one another’s trades.

— SALENA FITZGERALD

QUIZ ME

Brain-Inspired Robot Dogs

After disasters, power outages and infrastructure damage can disrupt cloud-dependent communications, which is why electrical engineer Tinoosh Mohsenin is designing robot dogs that work when signals fail.

Equipped with energy-efficient, on-device edge AI, they combine internal mapping, multimodal sensor fusion, and real-time adaptive decision-making. Inspired by the human brain’s ability to reorient and act without external cues, the system can perceive, reason, and act locally while conserving battery power for extended operations.

TAKE OUR QUIZ TO LEARN MORE

The main purpose of Mohsenin’s research is to:

A. Replace human rescue workers

B. Support human rescuers and increase their operational reach

C. Entertain victims with robotics shows

Answer: B
Mohsenin’s goal is to protect and support rescue workers, sending robots into dangerous environments so responders can concentrate on saving lives.

What functions could networked robot rescue dogs perform?

A. Transmit video to rescue workers

B. Relay survivor locations

C. Communicate a survivor’s vital signs

Answer: All of the above
Networked robot dogs could navigate and map disaster zones, identify signs of life, transmit live video, relay survivor locations, and assess hazards.

When external communication is unavailable, how do the robots make decisions?

A. They stop functioning

B. They rely solely on remote control

C. They use embedded AI to navigate and make local decisions

Answer: C
The robots are equipped with AI that allows them to operate independently when connectivity is lost.

What do Mohsenin’s new robots utilize for navigation?

A. Traditional GPS only

B. Internal mapping and sensory fusion

C. Manual remote guidance

Answer: B
The robots combine internal mapping with sensory data to navigate through chaotic disaster zones without relying fully on external signals.

The researchers are focused on extending battery life through which of the following methods?

A. Using larger batteries

B. Developing smaller, more efficient AI models

C. Adding charging stations in disaster sites

Answer: B
They optimize algorithms and power management to prolong operational time in critical situations.

Data in the Driver's Seat

For Talia Hovsepian, the answers are in the numbers.

BY CLAIRE GOUDREAU
ILLUSTRATION BY TAVIS COBURN

Talia Hovsepian

In the world of Formula One racing, every tenth of a second matters. Just ask Talia Hovsepian, an applied mathematics and statistics student who's spending her gap year in England as a student data scientist for the Racing Bulls, a team best known for its up-and-coming young drivers.

Last year in the Dutch Grand Prix, Racing Bull's Isack Hadjar placed third, just 3.233 seconds after the winner. It was the team's first podium finish since 2021. If Hadjar had been 2.5 seconds slower, he'd have missed the podium entirely.

Hovsepian's world revolves around these numbers. Her job is to optimize. Which parts of the car can be made lighter? Can the downforce distribution be improved?

"Every car is overweight," she says. For example, "There's a particular sensor on our car that we wanted to replace because it weighs about a kilogram, which doesn't sound like that much, but in the grand scope of the car, that's about 3 seconds over the course of a Grand Prix."

“Knowing that the car is two-tenths of a second faster because of the work that I put in is really exciting for me.”
Talia Hovsepian

Ultimately, Hovsepian was able to reduce the sensor’s weight by 700 grams—a heavy lift in the world of F1.

The data science group supports other areas at Racing Bulls. Teams such as aerodynamic performance bring problems or ideas to the data scientists, hoping the solution is somewhere in the numbers.

“We’ll spend two weeks doing exploratory analysis and tell them what it will take to solve their problem, and they tell us to proceed or that they have another priority,” Hovsepian says. “It’s almost like a project-oriented class where you have unlimited access to the professor because he sits right next to you all day. But at the same time, they trust me with the same caliber of projects of anyone else in the group.”

Hovsepian’s interest in Formula One racing was fueled at the Whiting School, where she gained experience designing off-road vehicles as a member of Blue Jay Racing. She also researched F1 racing strategy under Tamás Budavári, a professor of applied mathematics and statistics. “When I applied to Racing Bulls, I was lucky enough to have some actual experience in the field,” she says.

On race days, Hovsepian and the other students set up shop in the operations room. Although their headsets can hear other teams’ radios, Hovsepian spends most of the race focused on the Racing Bulls driver. Sometimes, the race ends without her even knowing who won. After working so hard on the car, the team’s success is her success.

“Not only do I get to do cool bits of mathematics that are really at the forefront of research and interesting theoretical stuff, but I get to see it being applied,” Hovespian says. “Knowing that the car is two-tenths of a second faster because of the work that I put in is really exciting for me.”

“These are all the things that I’ve been seeing on TV that I now get to have a part in,” she says. “In the entryway of our office is last year’s car, so every day I come in, I see a Formula One car and think, ‘Wow. I actually work for this team.’”

Associate Professor Carsten Prasse and Kate Burgener.

White Rot to the Rescue

Antidepressants and other psychoactive drugs are designed to affect the human brain. But after they enter the water system in excrement or unused drugs flushed down the drain, traces of these compounds can enter the environment in biosolids—the nutrient-rich material left over after wastewater treatment that is used as fertilizer. New research suggests an unexpected mitigation strategy: using wood-rotting fungi that can break down these chemicals before they reach soil, crops, and people.

Conventional wastewater treatment methods are effective at killing pathogens and reducing metals, but they are far less successful at neutralizing complex organic chemicals. This limitation prompted the research team to explore new, low-cost, and sustainable approaches to reducing pharmaceutical contamination before biosolids are applied to croplands.

Researchers in the Johns Hopkins Department of Environmental Health and Engineering, which spans the Bloomberg School of Public Health and the Whiting School of Engineering, have shown that two species of white-rot fungi—oyster and turkey tail mushrooms—can degrade a wide range of psychoactive pharmaceuticals commonly found in biosolids. The findings were published in *ACS Environmental Au*.

Biosolids are widely used across the United States as fertilizers and soil conditioners because they are rich in nitrogen, phosphorus, and organic matter. While some studies have shown that pharmaceuticals can be absorbed by plants grown in biosolids-amended soils or irrigated with wastewater, there is no conclusive evidence that these chemicals reach people who consume those crops.

Nonetheless, "Even small concentrations of these compounds can have psychological effects when consumed, which is why they have become contaminants of concern," says Kate Burgener, a PhD candidate and lead author of the study.

The researchers focused on white-rot fungi, a group of fungi known for their ability to decompose lignin—the tough polymer that gives wood its rigidity. The two species—*Pleurotus ostreatus* (oyster mushroom) and *Trametes versicolor* (turkey tail)—are among

“Even small concentrations of these compounds can have psychological effects when consumed, which is why they have become contaminants of concern.”
Kate Burgener

the most studied and most widely available mushroom species. Biosolids from a municipal wastewater treatment plant were spiked with nine psychoactive drugs, including commonly used antidepressants such as citalopram and trazodone. The fungi were then allowed to grow directly on the biosolids for up to 60 days.

Both fungal species proved highly effective. Each degraded eight of the nine pharmaceuticals tested, with removal rates ranging from approximately 50% to nearly complete elimination after two months. Chemical analyses showed that the fungi were not simply trapping the drugs but chemically transforming them, often into less toxic products.

The study was co-authored by Carsten Prasse, associate professor in the Department of Environmental Health and Engineering, and supported by a U.S. Environmental Protection Agency National Priorities grant and Johns Hopkins University.

— DANIELLE UNDERFERTH

Reliable Imaging for Clinical Impact

As an undergraduate at the University of Texas, Austin, Nethra Venkatayogi enjoyed developing algorithms for medical technologies, but she felt she was missing out on the larger clinical picture.

Pursuing a doctorate under the guidance of Muyinatu “Bisi” Bell, the John C. Malone Associate Professor in the departments of Electrical and Computer Engineering, Biomedical Engineering, and Computer Science at Johns Hopkins, would rectify that.

“Hopkins was a very easy choice for me, because it’s tops for surgical research. Dr. Bell’s lab is especially the right place because she works on women’s health and medical imaging technologies that are very translatable to clinical research,” says Venkatayogi.

One of Venkatayogi’s early projects addresses the shortcomings of ultrasound in detecting breast cancer. When concerns arise in mammograms, women are usually advised to receive follow-up ultrasounds, but the imaging technology is imperfect in analyzing dense breast tissue, which can be found in nearly half of women aged 40-plus. Ultrasounds cannot easily distinguish (usually benign) fluid-filled cysts from solid potentially cancerous masses. As a result, women undergo anxiety-inducing biopsies even when they don’t need them.

The solution, developed in the PULSE Lab directed by Bell, interprets ultrasound images more reliably.

Venkatayogi developed a user interface that lets radiologists subjectively assess whether masses are solid or fluid-filled. This subjective assessment was compared with another algorithm developed in the PULSE Lab that uses a validated threshold to distinguish solid from fluid-filled masses. “In essence, we are making it more objective for clinicians, because otherwise radiology is dependent on the reader,” Venkatayogi says.

In initial tests with patients, doctors working with the new method accurately identified masses 96% of the time. They were right just 67% of the time analyzing the same masses with their regular tools. “Our achievement will change the landscape of how breast cancer is diagnosed,” predicts Bell. The results of the study appeared in *Radiology Advances*.

“In essence, we are making it more objective for clinicians.”
Nethra Venkatayogi

Now, Venkatayogi is working to improve surgical guidance for hysterectomies. During surgery, cutting off blood supply to the uterus is necessary to remove it. But sometimes surgeons accidentally cut or damage the nearby ureter, which transports urine from the kidney to the bladder.

To address this problem, Bell’s lab uses photoacoustic imaging to guide surgeons. The technique uses short laser pulses at different wavelengths to illuminate tissue, causing it to expand and create sound waves. These sound waves are then detected and processed to create images and image-based information. In the resulting photoacoustic image, the uterine artery appears different from the ureter, helping surgeons recognize and avoid errors.

Venkatayogi used her skills in breast radiology assessment to develop a user interface that allowed surgeons, residents, and engineers to evaluate the safety of the procedures based on various combinations of provided photoacoustic information. The results of the study were published in the *International Journal of Computer Assisted Radiology and Surgery*.

Venkatayogi is currently training an AI model with raw data obtained prior to the formation of a photoacoustic image. Trained on this data, the model will be able to identify and differentiate between the ureter, uterine artery, and a surgical tool tip. Based on initial user feedback, the system will deliver real-time surgical guidance, such as distance measurements and auditory warnings (similar to beeps from trucks reversing).

Bell appreciates these efforts toward making new technologies more easily adopted. “Nethra helps understand, for different technologies, what the users actually want, and what will be most beneficial to surgeons or those entering the field for the first time,” Bell says.

Venkatayogi’s efforts promise real impact. At a “Hopkins on the Hill” event in Washington, D.C., where she was showcasing her federally funded research, she met a woman who had undergone bladder complications after a hysterectomy. “She was so excited that there’s technology being developed to prevent this from happening to anyone else,” Venkatayogi says. “Explaining our research to the public really helps, because it reminds me why doing this work matters, especially when I hear from a patient who has gone through it.”

— POORNIMA APTE

Handshaping Communication

Handshapes—distinctive hand configurations used to form signs—are the building blocks of any sign language. But despite their linguistic importance, many AI models for processing sign language rarely model them explicitly.

Among the challenges in AI hand shape recognition are that the same handshape can appear in different configurations in one video, and a single sign can comprise multiple handshapes.

Alessa Carbo (above), a third-year computer science student working with Eric Nalisnick, an assistant professor of computer science, has taken an important step toward addressing this challenge. She and Nalisnick developed a neural network to improve the computational recognition and translation of signed languages; Carbo is first author of their findings, which were published in the *Proceedings of the 2025 Conference on Empirical Methods in Natural Language Processing*.

Their approach could give researchers new insights into how people use sign languages and help pave the way for enhanced linguistic analysis and better communication technologies for the Deaf and hard-of-hearing communities.

Johns Hopkins computer scientists previously demonstrated that modeling handshapes can improve American Sign Language translation accuracy by 15%. Carbo and Nalisnick wanted to see if they could improve on that by separating a hand's static orientation from a signer's motions over time.

To do this, they used a graph neural network divided into two submodels: One looks at how the hand's shape changes over time during a single sign, while the other searches for video frames that show a handshape in its most recognizable orientation. Testing this approach on a new dataset of annotated ASL videos, they found that separating time dynamics and hand configuration improves handshape recognition significantly.

"And because handshape is a fundamental parameter of all sign languages, our model can be a useful tool for sign language linguists," Carbo says. "Say a linguist has a large collection of videos of people signing and wants to find all occurrences of a particular handshape—our model could allow her to quickly and automatically find those video segments.

"We're excited that our work could help with both AI applications and researchers trying to find new insights about how people use sign languages around the globe," Carbo says.

— JAIMIE PATTERSON

CHANGE AGENTS

The Empathy Algorithm

In his sophomore year, biomedical engineering major Bikram Bains, Engr '26, was determined to find a meaningful volunteer opportunity at The Johns Hopkins Hospital. Enter Chaplain Elizabeth Tracey in the medical intensive care unit (MICU), who created the This is My Story (TIMS) Program during the COVID-19 pandemic. She wanted to use AI to streamline the program's audio editing process, which involved condensing detailed interviews into brief, soulful windows into a patient's life.

For the last six years, Tracey and her team have been interviewing patients or their loved ones (if they are unable to verbally communicate) to get to know them on a personal level. These interviews seek to capture the patient's identity by asking about sources of joy, essential care information for the medical team, and sources of peace. The responses typically generate human interest insights—about cherished pets, beloved grandchildren, interesting hobbies—that can help clinicians connect with the patient. These connections can transform the health care experience, helping the patient to feel seen and understood while encouraging the provider to deliver care with more empathy and intention.

The interviews are edited and integrated into the patient's medical records so that the entire care team can listen to them at any time.

"The TIMS Program interested me because of its focus on improving human-centered care even in the most intense medical situations," says Bains. "The unique opportunity to use my technical skills in AI to improve a process while maintaining a personal approach to care was very appealing to me."

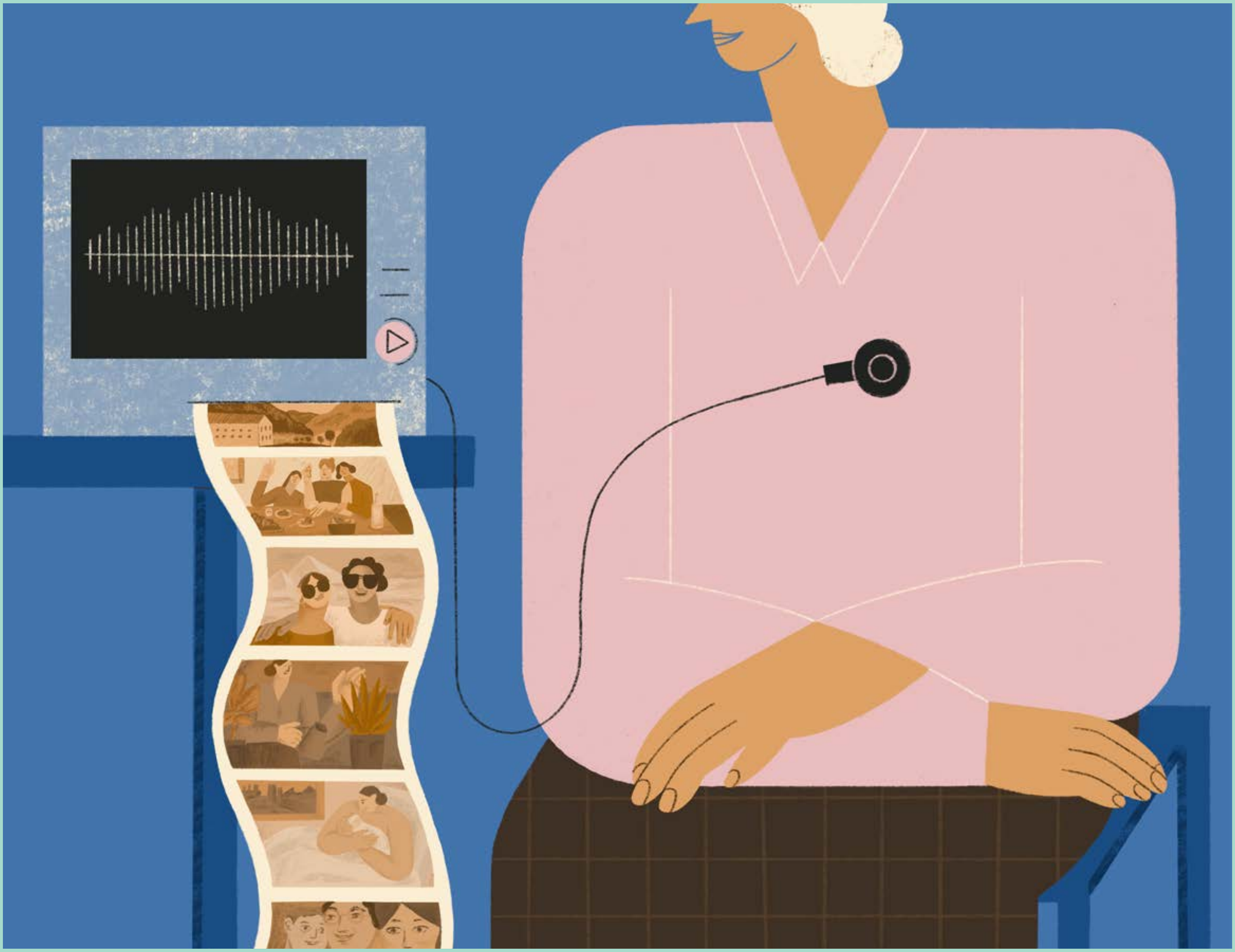
Bains recruited his roommates Sampath Rapuri and Edgar Robitaille—both biomedical engineering and computer science double majors—to join him. The students developed an AI model that can automate the editing process of interviews and recognize subtle details that can be highlighted, such as a love of dogs, to help a clinician and patient connect. They were also challenged with training the model to remove disfluencies such as "um."

> **"The unique opportunity to use my technical skills in AI to improve a process while maintaining a personal approach to care was very appealing to me."**
> Bikram Bains

The team's AI model supports a larger effort to improve TIMS efficiency by using an app.

"After seeing the benefits of TIMS recording both for the medical team and patients and families, it was clear that we needed an app to streamline and standardize the process. Bains, Rapuri, and Robitaille have developed the process to edit TIMS recordings into their final form as part of the app's functionality," Tracey says. "Without their contribution, we would not have a functional app."

By uniting empathy and AI in their work, the students are



working toward improved efficiency while keeping the program's focus on the "personal touch." In fact, their AI model can edit the interviews to a comparable level to that achieved by a medical student trained for one hour by Tracey and her team.

"It is not hard to get an output from an AI model, but it is hard to get the right output, especially when you have such sensitive information. You must have a lot of thoughtfulness, and we had high standards on what we wanted the output to be, which took a lot of experimenting," Bains says.

Fresh off a publication in *JMIR Medical Informatics*, the team is now finalizing a second paper analyzing the application of their model throughout the hospital.

"We have grown as engineers through this opportunity to work on a project that impacts real patients and care providers at the hospital. Having that instant feedback with a direct pipeline from the classroom to the clinic is extremely gratifying," says Rapuri.

That pipeline was supported by a network of Johns Hopkins resources. Utilizing HopGPT (formerly the Hopkins AI Lab) allowed them to run their sophisticated models, while a Catalyst Award from the Johns Hopkins Office for Undergraduate Research funded the computational resources needed to turn the team's ideas into working solutions.

With this infrastructure in place, the trio was able to adapt as quickly as the field itself. "As AI evolved over the last two years, we kept our ear to the ground and stayed informed on advances that could improve our project," says Bains.

This hands-on experience has done more than solve a technical challenge; it has shaped the students' futures. Now seniors, all three plan to attend medical school after graduation with an interest in specializing in critical care. They hope to stay involved with TIMS even from afar and pass the project to a new cohort of students to continue.

— CATHERINE GRAHAM AND HOLLY PAESCH

HELENA PALLARÉS

COURSE AUDIT

Discerning Data

From navigating traffic to choosing a movie on Netflix to adjusting our sleep schedules for optimal health, we rely on data to inform many decisions we make each day. But how do we know we have the "right" data or that we are reading it correctly? In the course Storytelling with Data, Andy Ross and Jenna Frye, associate teaching professors in the Center for Leadership Education, demonstrate the importance of ethically collecting and interpreting data. Through hands-on projects that encourage experimentation, students also learn how to design effective data visualizations that are tailored to specific audiences.

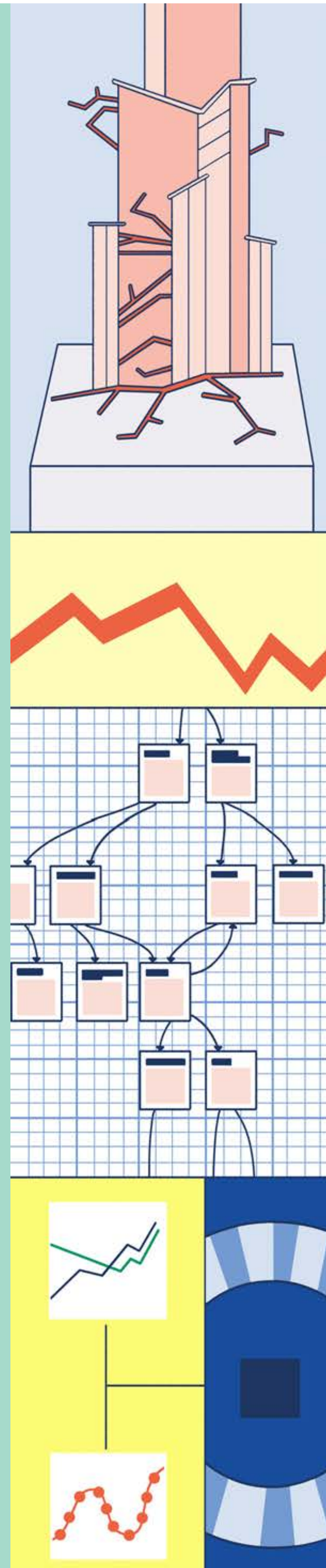
KEY TAKEAWAYS

DATA ISN'T NEUTRAL
Through the project Mapping and Unmapping, students examine maps, including cylindrical Mercator projection maps, which are designed to make it easier for sailors to plot straight-line courses from constant compass bearings. Mercator maps also distort land masses (Greenland appears roughly the same size as Africa, though Africa is 14 times larger), which in turn distort our cultural understanding of these continents. Students then explore geospatial data by designing their own interactive maps.

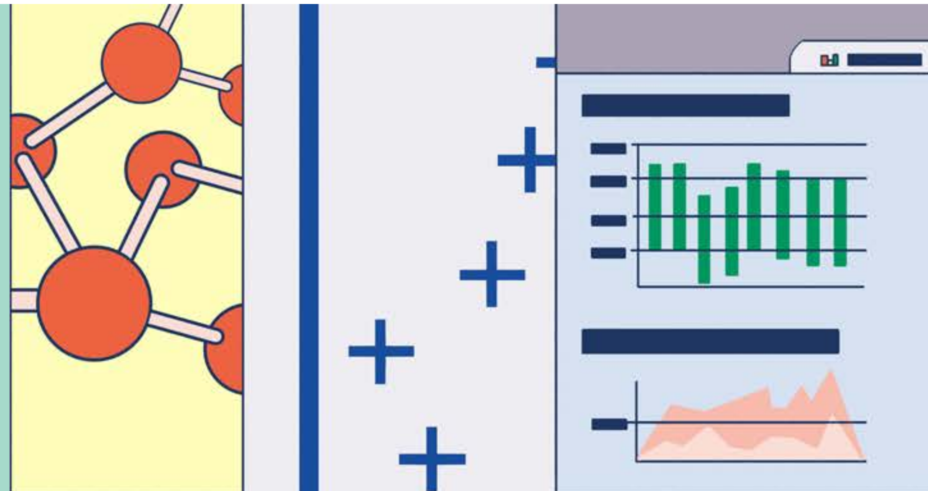
MORE THAN GRAPHS AND DASHBOARDS
Storytelling with Data goes beyond more common methods of data visualization to incorporate tactile artifacts and interactive systems. Students learn to use several computer programs, such as Tableau and Twine, as well as to employ design principles including color, balance, visual hierarchy, and even motion graphics. A data sculpture assignment also invites students to create a 3D visualization that engages more than one of the audience's senses.

KNOW YOUR AUDIENCE
For their final project, students are tasked with creating a digital narrative with multiple data visualizations that speaks to their audience, such as a technical team, executives, or a more general audience, without significant background knowledge on the subject. To do this, they must prioritize their audience's needs while creating an engaging, memorable story.

— EMILY MYRICK

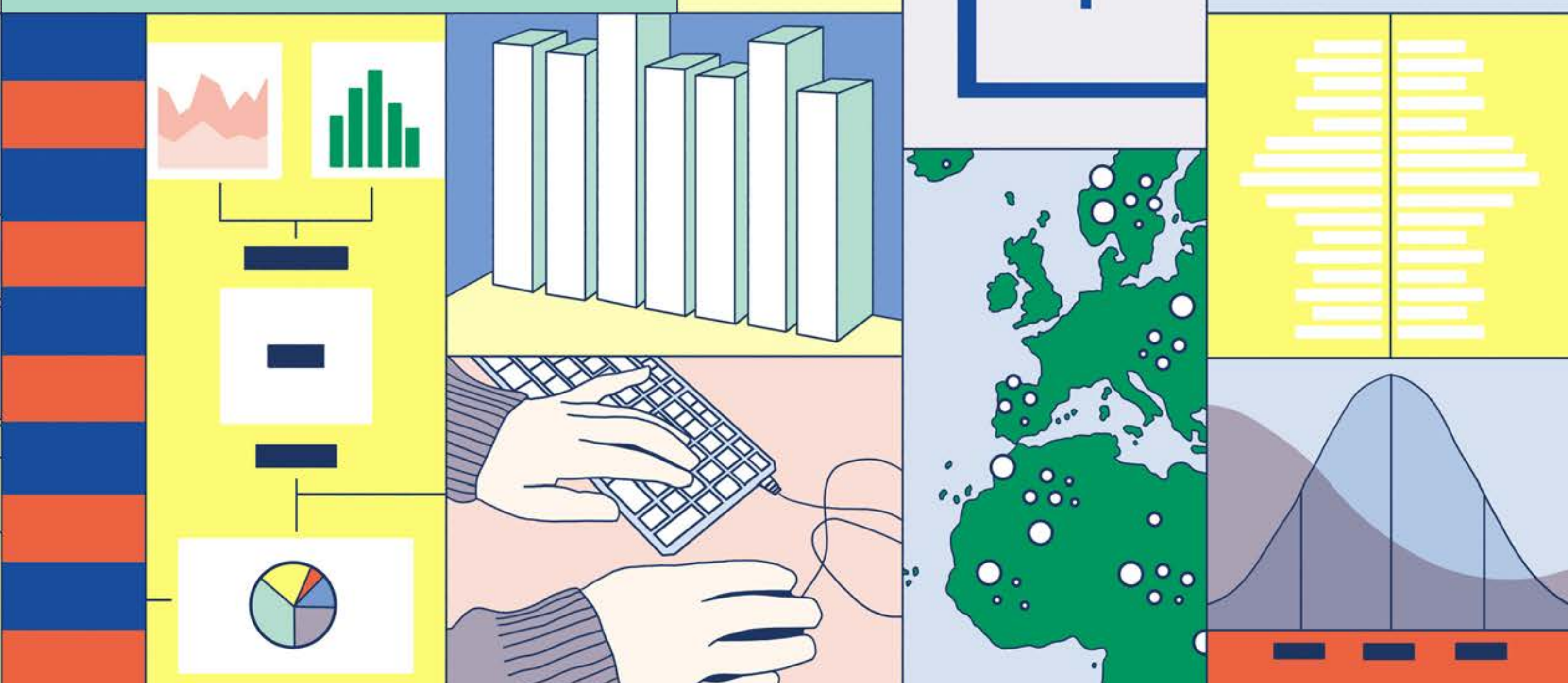


"Design is not just about aesthetics. It is fundamentally about communication. Small decisions can determine whether someone immediately grasps the main idea or misses it entirely."
Michael Baum, Engr '27, computer science



“I learned that the first thing you should know is your target audience. Effective communication requires tailored messaging, visuals, and details that resonate with the audience’s background.”

Aiden Kim, Engr ’26, applied mathematics and statistics



“Data is constructed through human choices about what to measure, how to categorize it, how to frame those measurements and, unfortunately, how to weaponize it. That’s why developing the ability to question and deconstruct those choices is just as important as learning to analyze the numbers themselves.”

Instructor Jenna Frye

FIEN JORISSEN

'Seeing' the Air Move

Charles Meneveau is leading efforts to transform hard data into colorful swirls that offer insights into wind farm efficiency.

BY JONATHAN DEUTSCHMAN

Wind farms, a perennial source of green energy, already supply more than 10% of electricity in the United States. But since they are affected by the turbulent flows ubiquitous in the atmosphere, can future wind farms be made even more efficient?

Charles Meneveau, the Louis M. Sardella Professor in Mechanical Engineering, is analyzing datasets from computer models to improve the performance of large arrays of wind turbines. The datasets are part of the Johns Hopkins Turbulence Database, established with support from the Ralph O'Connor Sustainable Energy Institute and the Institute for Data-Intensive Engineering and Science, which Meneveau helps direct.

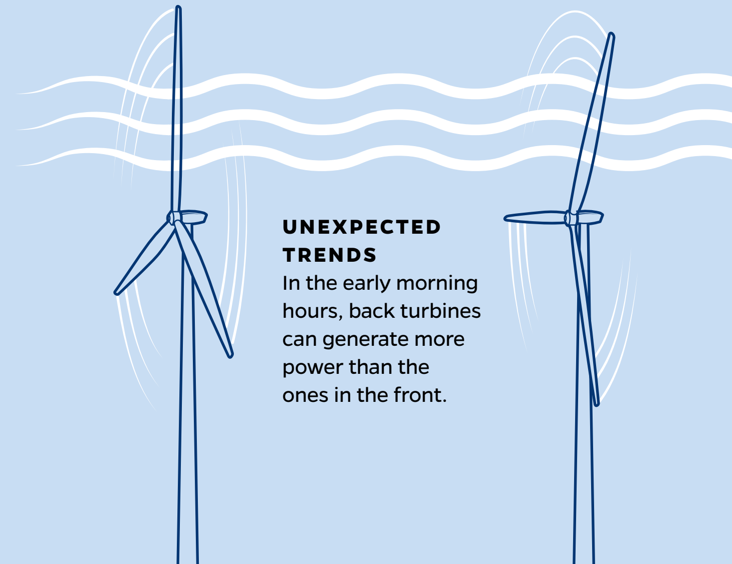
Researchers can take something invisible and give it color and shape, essentially "seeing" the air move. The result may look like abstract art, but it's hard science and physics, and when illustrated, can reveal important trends and nuances.

"Our team simulated a wind farm for a full 24 hours to analyze what's happening at different times of the day and night, under very different atmospheric conditions," says Meneveau.

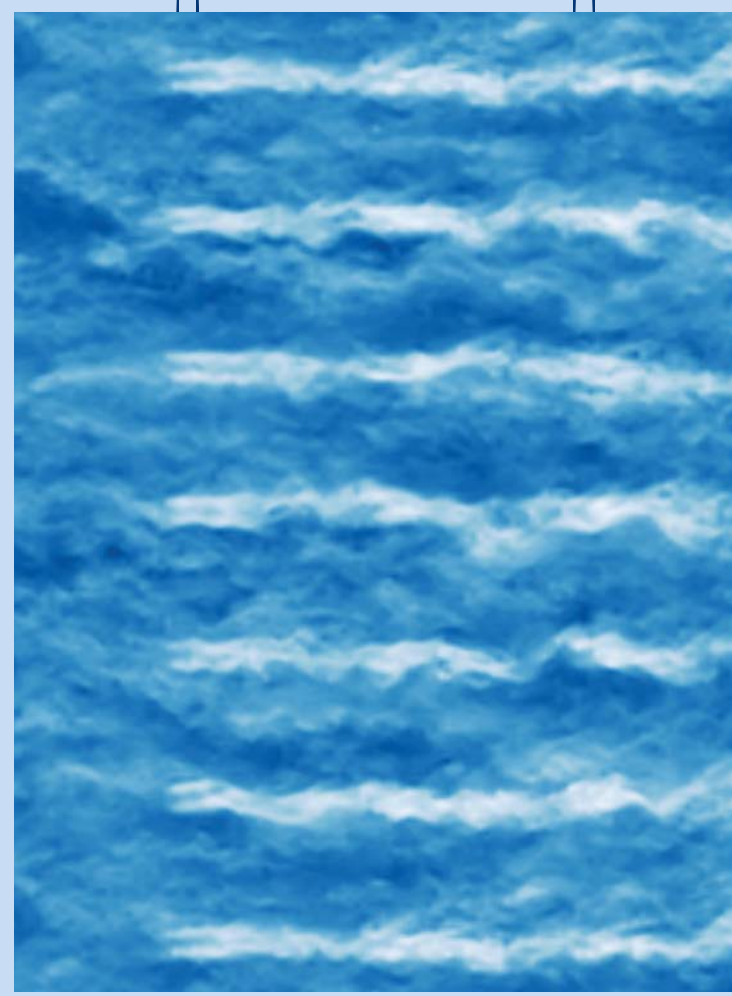
"We observed, for instance, that in the early morning, when the sun is rising but conditions are still nighttime-like, the back turbines generate more power than the ones in the front, which is usually the other way around," says Meneveau. "The downstream turbines can generate more power at this time in the 24-hour period. Being able to predict such unexpected trends and their probability of occurrence is crucial for estimating power generation potential over time, which is important for planning and economic feasibility studies."

The Johns Hopkins Turbulence Database, a massive repository of datasets from computer simulations of various types of turbulent flows that is publicly available, is one of 10 chosen by the National Science Foundation to be integrated into the National Artificial Intelligence Research Resource Pilot. A Johns Hopkins civil and systems database related to fracture mechanics was also selected for this program.

"It's very complex data, but we put it out into the world, and researchers interested in a specific type of turbulence can find and use it to further their work. This effort is continuing to put Hopkins on the map in terms of generating trusted data for scientists and engineers, as well as for AI training," says Meneveau.

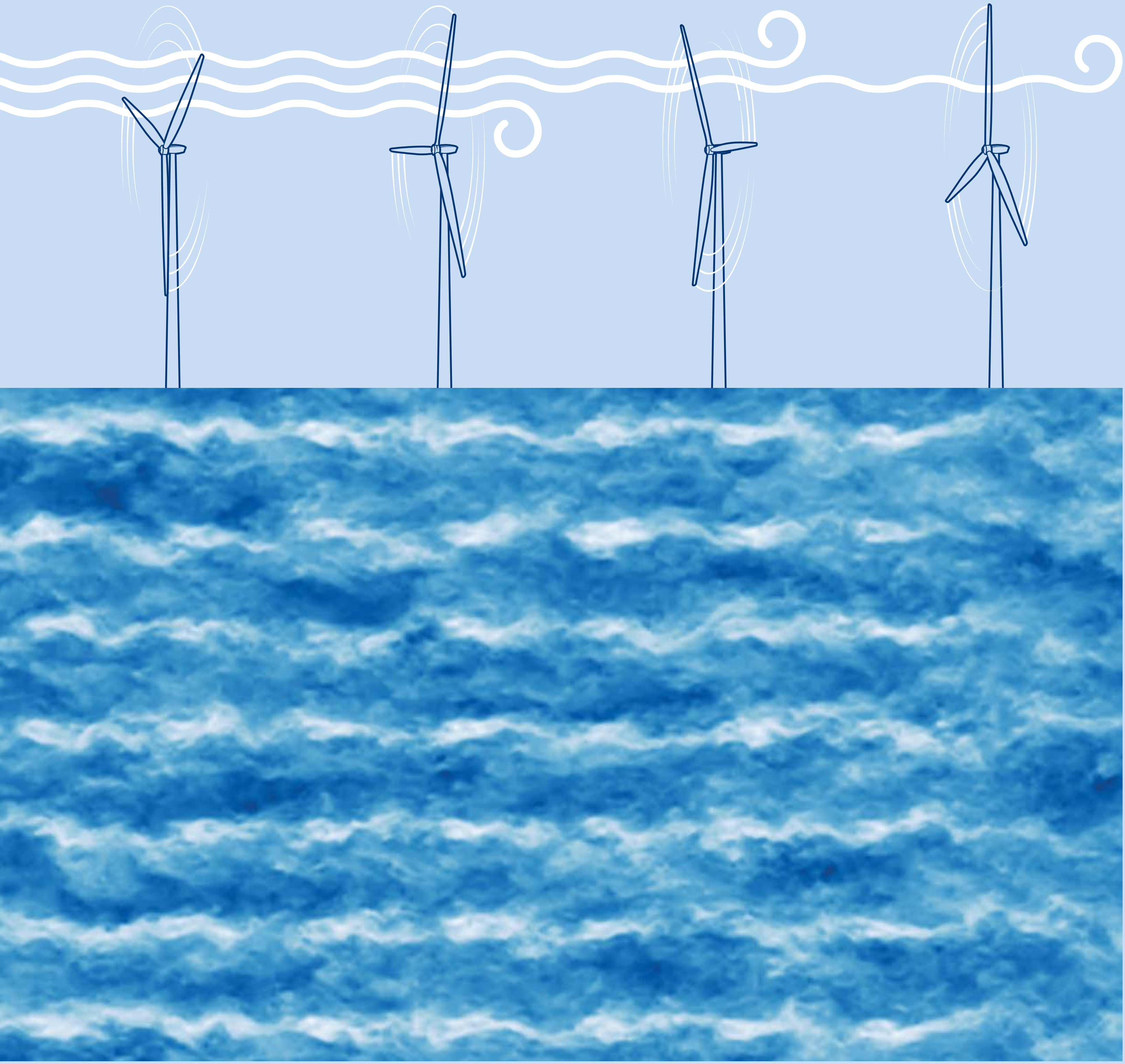


UNEXPECTED TRENDS
In the early morning hours, back turbines can generate more power than the ones in the front.



15 MW

Power generated by a single turbine (enough to supply 13,000+ homes with electricity)



CHARLES MENEVEAU, LINE ART: CHRIS PHILPOT

1.5M Homes

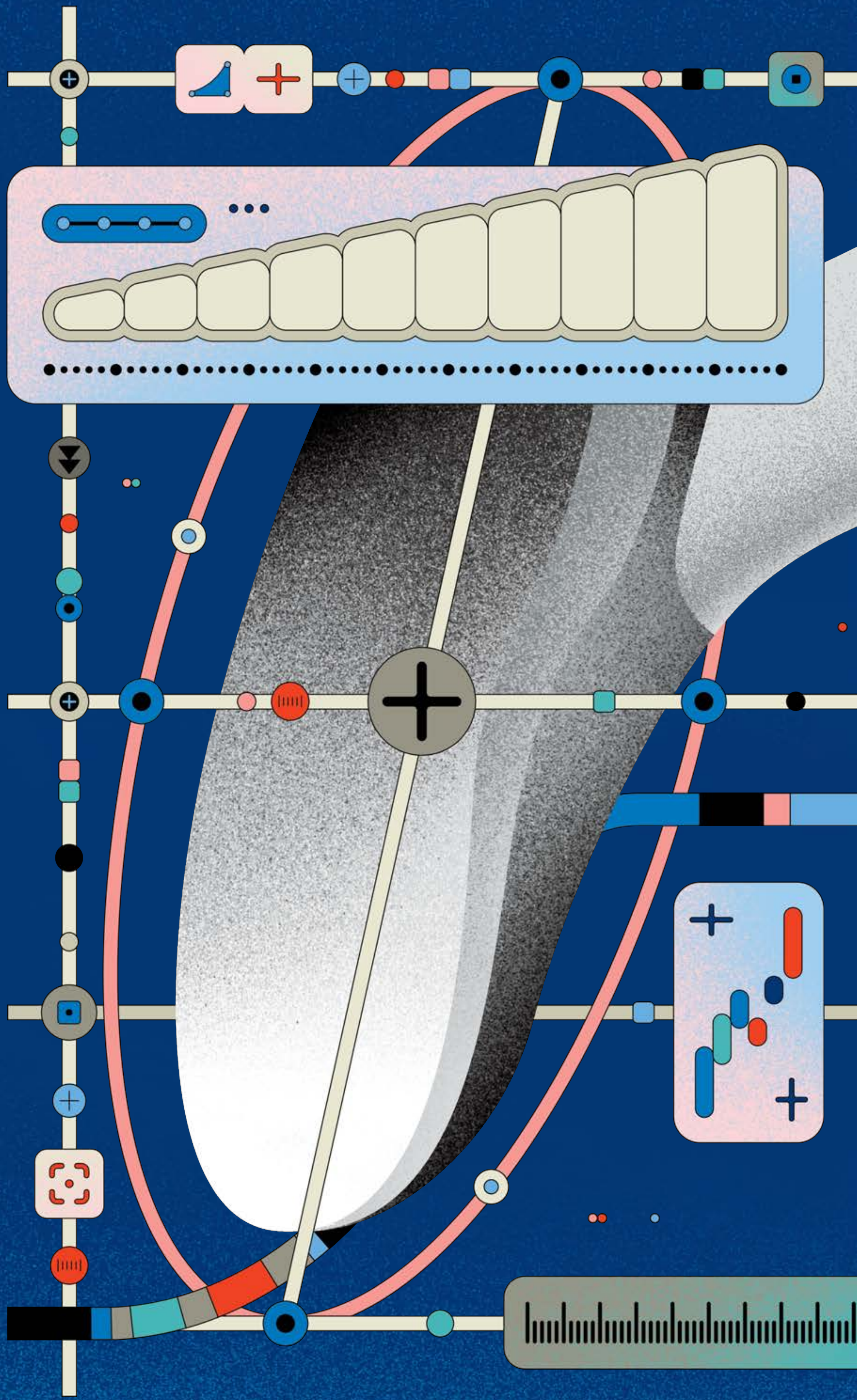
Could be powered by electricity generated from a 110-turbine wind farm

70 Terabytes

Data generated by the wind farm computer simulations in the Johns Hopkins Turbulence Database

"Our team simulated a wind farm for a full 24 hours to analyze what's happening at different times of the day and night, under very different atmospheric conditions."

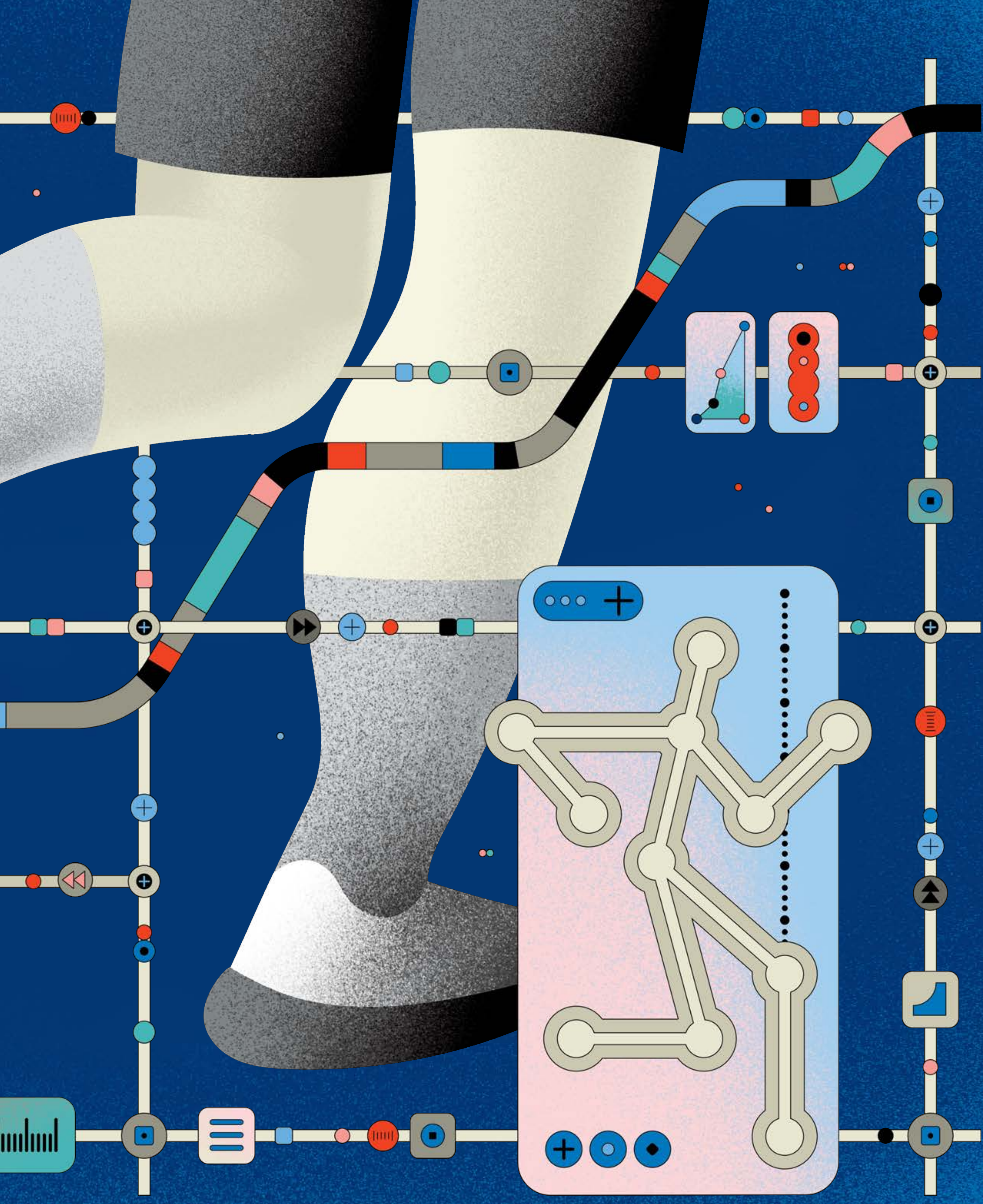
Charles Meneveau



THE **MVPS** OF DATA ANALYTICS

Students and graduates of the Sports Analytics Research Group employ quantitative analysis to give all types of teams the wisdom and hard numbers they need to perform better.

BY ALEXANDER GELFAND
ILLUSTRATION BY BRATISLAV MILENKOVIĆ



For a baseball team, choosing the right batting lineup can mean the difference between winning and losing. But determining the best sequence of hitters is complicated, since each individual player's strengths and weaknesses affect the overall performance of the lineup in ways that can be hard to predict.

Enter the Lineup Optimizer, an online tool that uses advanced math and slick software design to help teams squeeze the most runs possible out of their lineups.

The Lineup Optimizer was originally developed by students Benjamin Buman, Engr '27, Kiran Shay, Engr '27, and Jake Rasmussen, Engr '25, under the mentorship of Anton Dahbura, Engr '81, '82 (MSE), '84 (PhD), founder and director of the Sports Analytics Research Group, or SARG, at the Whiting School.

While the interface is so simple that anyone can use it, the Lineup Optimizer employs combinatorial mathematics to determine the optimal order of a sequence of hitters, modeling the effect that each player's individual stats have on the group's collective performance across hundreds of thousands of permutations.

It has already yielded insights that could help teams at all levels, from high school to the major leagues, boost their performance. For instance, while conventional wisdom places faster players first, the Lineup Optimizer suggests that leading with a slugger could generate more runs.

Like the dozens of other student-led projects that have run under the SARG banner since Dahbura established the program in 2014, the students' tool illustrates how quantitative analysis can help teams make better decisions.

"There's a transformation process from data to information to knowledge to wisdom," says Dahbura—a process that can inform and guide virtually all aspects of a sports operation, from the choices that players and coaches make on the field to the ones that executives make in the front office.

As a result, many professional sports teams now have analytics departments that drive improvements in everything from training programs to fan engagement. By combining real-world problems with advanced research methods, SARG aims to mirror the way those departments work while pushing the boundaries of what sports analytics can achieve.

Students Benjamin Burman, Kiran Shay, and Jake Rasmussen with their advisor, Anton Dahbura

LIVING THE DREAM

The roots of modern sports analytics can be traced to Earnshaw Cook, a professor of mechanical engineering at Johns Hopkins who in 1964 published *Percentage Baseball*, one of the earliest attempts to subject sports data to rigorous mathematical analysis. At the time, Cook's approach didn't win many fans in the professional sports community, which preferred gut feelings to math. But that didn't stop Dahbura from following in Cook's scientific footsteps more than a decade later.

Born in Maryland and raised in El Salvador, Dahbura is a lifelong baseball fanatic: He co-founded his high school team; provided Spanish play-by-play commentary for major league radio and television broadcasts while still in his teens; and both coached and played for the Johns Hopkins Blue Jays baseball team. The first computer program he wrote as an undergraduate was a baseball game simulator.

After earning his PhD in electrical engineering at the Whiting School, Dahbura went on to a successful career in industry before returning to Johns Hopkins in 2012 as executive director of the JHU Information Security Institute. But his passion for the national pastime never wavered.

"I'm always thinking about baseball," he says.

In the mid-'90s, Dahbura had begun experimenting with using computer-based techniques to design baseball season schedules—an intricate exercise in combinatorial mathematics that requires balancing the needs and wants of multiple teams in a fair and efficient manner.

Shortly after returning to Johns Hopkins, he gave a seminar on the topic in the Department of Applied Mathematics and Statistics that attracted the attention of Associate Research Professor Donniell Fishkind, Engr '95 (MSE), '98 (PhD). The two began recruiting students to apply advanced optimization techniques to baseball scheduling—a project that became known as the Baseball Scheduling Optimization group. (The former now functions as a sister group to SARG.)

Within a few years, the group was using a supercomputer to produce fully optimized schedules for most of the minor leagues, sometimes in a matter of minutes. (For even the most expert human being, the task can take weeks.) After Major League Baseball took over minor league scheduling in 2020, the group began scheduling independent leagues, and it recently began scheduling the country's top junior hockey league.

Fishkind, who uses his optimization classes as a pipeline for the group, says the opportunity to put students to work on a challenging sports problem was priceless.

"From a pedagogical standpoint, this was living the dream: The students got training in the classroom that had an immediate and sexy application," he says.

BUILDING AN AI ECOSYSTEM

By 2014, Dahbura had begun assigning other kinds of sports-related problems to students and was enjoining other faculty to serve as program mentors. He also began cultivating relationships with professional sports organizations, including the Baltimore Orioles, which has sponsored a variety of SARG projects—including an automated bat measurement system that streamlines the process of tailoring bat sizes more effectively to individual players' needs while ensuring they remain in compliance with league regulations.

Traditionally, team equipment managers have used calipers and other hand tools to measure bat dimensions—a potentially error-prone process that can take up to an hour per bat. The computer vision system that Kevin Wu, Engr '26 (BS, MSE), and Jason Sun, Engr '26 (MSE), devised for the Orioles can do it in seconds, and with 99.8% accuracy. The Orioles subsequently set up a dedicated room to deploy the bat measurement system.

"The Hopkins students are amazing," says Sig Mejdal, a former NASA engineer who oversees the Orioles' analytics department. Mejdal keeps a running list of potential SARG projects that could benefit the Orioles while giving students experience in the field. "With the Hopkins group, the Orioles have quite a few very skilled analysts right in their backyard," he says. "Giving them interesting projects is a no-brainer."

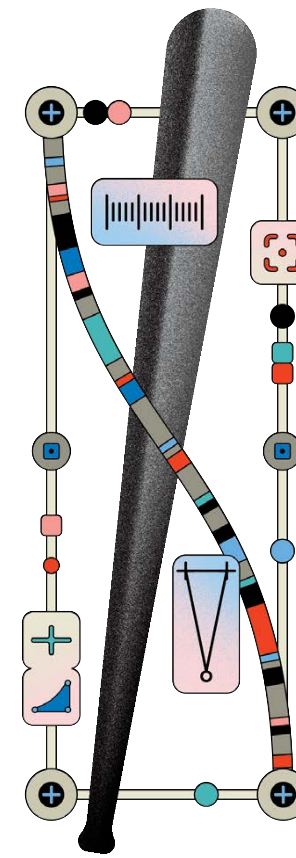
Today, more than 50 students are engaged in over 20 projects that cover activities ranging from football, soccer, and golf to eSports, marathon running, and Formula One racing. Students do co-ops with teams such as the Orioles and the Ravens, and many go on to professional careers in sports analytics and related fields. When he isn't helping out part time as SARG's research program coordinator, for example, Tad Berkery, Engr '24 (BS, MSE), is a full-time analyst for the Washington Nationals. Other alumni have worked as analysts for the Miami Dolphins, the Cleveland Guardians, and the San Diego Padres.

Most recently, the group has plunged into AI. Sun, for example, is currently leading 11 students in an effort to develop a sports AI ecosystem that will make it easier for teams, researchers, and even fans to develop and use AI tools.

The students are split into two groups. One is focused on creating AI agents that can perform complex tasks like helping a trainer customize a recovery plan for an injured player. The other is building a platform that developers could use to construct their own bespoke agents. The goal is to make the entire ecosystem publicly available, providing both a development platform and a library of AI agents that anyone can access.

"Currently, building a sports AI tool or agent from scratch takes months. We hope that with our ecosystem, it will only take hours," says Sun, who believes that will "change what is possible" for sports analytics.

And that, after all, is what SARG is all about.



"With the Hopkins group, the Orioles have quite a few very skilled analysts right in their backyard."

Sig Mejdal

ALSO IN THIS SECTION

The Human Side of AI

Dan Shapero leads LinkedIn during a pivotal period.

BY HEATHER LOWE

Dan Shapero, Engr ’00, is a mathematician by training, but the first thing he sees in today’s labor market isn’t numbers or statistics—it’s the people whose lives and livelihoods are at stake.

Shapero was named LinkedIn’s chief executive officer this April after serving as the company’s chief operating officer since 2021. In that role, he oversaw global sales, operations, product, and marketing for the world’s largest professional network.

With 1.3 billion members across more than 200 countries and territories worldwide, LinkedIn represents an enormous cross section of job seekers. From that vantage point, Shapero sees a shared question emerging in every industry and every part of the world: How profoundly will artificial intelligence transform the way we live and work?

“I’ve led through boom times and downturns, including the pandemic,” he says, “but this moment feels entirely different. The speed at which people are learning to do their jobs differently is unprecedented. I feel a tremendous responsibility to ensure LinkedIn can help people navigate that change.”

AI is a contributor to the disruption, but not the only driver. A recent LinkedIn report found that the primary forces behind today’s slower jobs market are interest rates and macroeconomic headwinds. And while AI will undoubtedly reduce the need for some roles, it will also create new ones—making a blend of AI literacy and distinctly human skills the new baseline for employability.

That balance explains why Shapero embraces AI’s transformative power even as he works to demystify it. “At its core, the AI revolution is really a math revolution,” he says.

It’s a shift he’s seen happening firsthand. At Johns Hopkins, he majored in math and economics before transferring to applied mathematics, a decision that proved pivotal. With its emphasis on statistics, algorithms, and game theory, applied math offers an ideal framework for understanding the neural networks and probabilistic models that underpin modern AI.

Today, that background allows Shapero to oversee both the building of LinkedIn's products and the push to make them more powerful and accessible. The work is less about raw calculation than judgment—and at his level, the right answers are rarely obvious.

"The more senior you get, the harder the choices become," he says. "There's no clean rubric that tells you what to do. To use a poker analogy, you see a lot of hands, but you only play a few."

In practice, that means he's perpetually in student mode, absorbing enormous amounts of information before acting. At times, he's also a teacher, publishing content and courses on LinkedIn Learning.

"I do as much homework at LinkedIn as I ever did in college," he says with a laugh. His reading spans product metrics, labor market trends, customer feedback, and emerging research—all in service of steering the company's operations and positioning LinkedIn as a trusted authority on the world of work.

For Shapero, leadership in this era must be human above all else. "When you're young, you think leadership is a style you need to learn," he says. "As you get more senior, you realize there's no 'leader you' versus another you. There's just you."

Curiosity and adaptability anchor his approach. "The core career belief is that, on average, the best people get the best jobs," he says. "But we don't always behave like we truly believe that. If we did, we'd spend more time learning and less time chasing the next rung on the ladder."

It's a belief he's personally tested. After leading a sales team of 1,500 at LinkedIn, he realized that the best leaders also have product skills. So, he made the unconventional decision to step back into an individual contributor role to deepen his expertise in the product.

"Everyone thought I was crazy," he says. But mastering a new area would later become a defining advantage, enabling him to bridge functions and perspectives across LinkedIn.

That willingness to prioritize craft over title traces back to his undergraduate years. At Johns Hopkins, he co-founded an internet business with a classmate and discovered a passion for entrepreneurship.

"Hopkins is where I fell in love with startups," he says. He went on to spend his early career at a series of young companies before attending Harvard Business School and joining LinkedIn in 2008, when it was still in an early phase of growth.

Much has changed since then, but LinkedIn's mission has remained strikingly consistent.

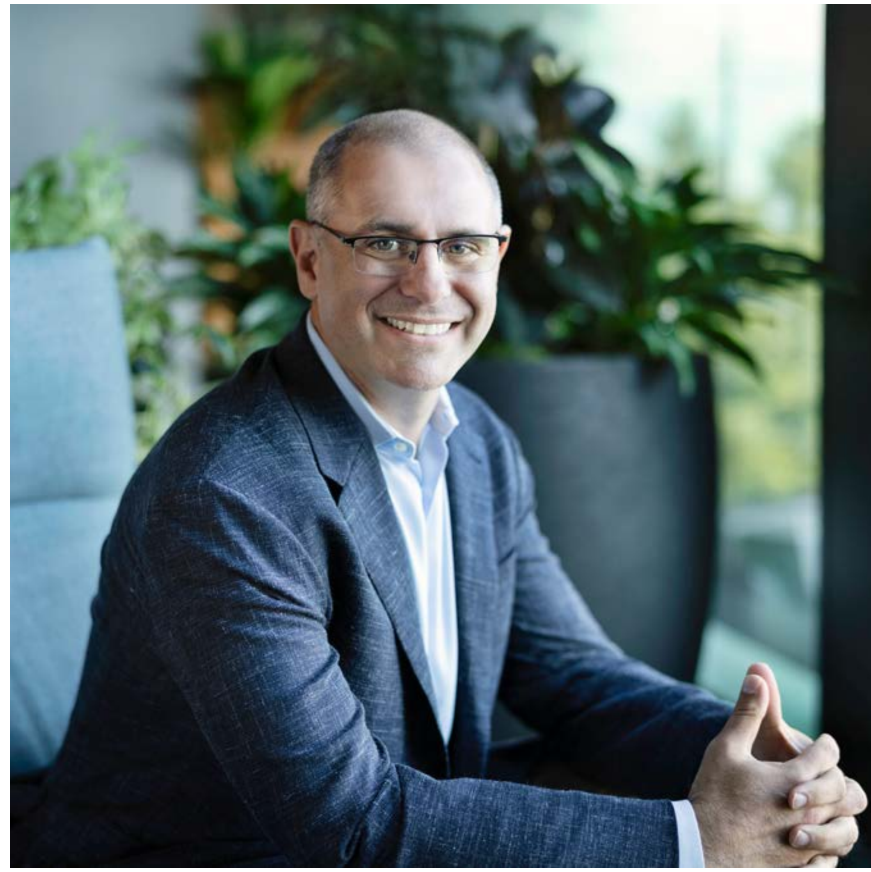


PHOTO PROVIDED BY LINKEDIN

Dan Shapero, CEO at LinkedIn

"We've always been clear about what we're here to do: help people navigate their careers and their working lives," Shapero says.

Looking ahead, he expects LinkedIn to become more AI-driven, more powerful, and more personalized. And that personalization is essential, because while AI may be a math revolution, it's ultimately a human one. The challenge is to equip people with the knowledge, confidence, and connections to navigate what comes next.

"The more senior you get, the harder the choices become. There's no clean rubric that tells you what to do. To use a poker analogy, you see a lot of hands, but you only play a few."

Dan Shapero

THERMAL ENGINEERING

One Cool Job

In November 2023, NASA sent a new laser communication device to the International Space Station. The system, called the Integrated LCRD Low Earth Orbit User Modem and Amplifier Terminal (ILLUMA-T), improves data transmission between the space station and Earth.

Making it possible was Emily Maheras, Engr ’20, ’23 (MS), a thermal engineer for NASA.

Temperatures in space, unfiltered by our atmosphere, can be incredibly cold when in shadow, or intolerably hot in direct line of the sun. Maheras’ job is to protect devices from these harsh conditions. In 2024, she won an Exceptional Engineering Achievement Medal from NASA for her work developing active and passive cooling designs for ILLUMA-T.

“It had to stay in a range, from negative 20 to 50 degrees Celsius,” says Maheras, an employee of NASA contractor Vertex Aerospace. “For this application, we had a cooling loop, so it circulated fluid throughout the spacecraft and kept things from getting too hot or too cold.”

During Maheras’ senior year, she got an internship at NASA. An initial mechanical design assignment didn’t excite her, though, so she turned her attention to thermal engineering. “It feels like you’re working on a puzzle, keeping things within temperature ranges,” she says. “It clicked with my brain more.”

She stayed at NASA while earning her master’s degree through the Whiting School’s Engineering for Professionals programs. “The best part about Hopkins is that there were a lot of classes focused on collaborating, working through projects as a team,” she says.

Learning how to spitball and problem-solve with a diverse group has served her well. She was the only thermal engineer on the ILLUMA-T assignment as it neared launch, she says, and had to work closely with mechanical engineers, structural engineers, and others.

Her new project, providing thermal protection for the Habitable Worlds Observatory, is already larger, with four thermal engineers on a team of about 100, and is expected to grow.

The space telescope they’re developing, set to launch in 2040 at the earliest, is larger than previous ones, possibly requiring entirely new cooling techniques. “In the past, some telescopes had a large sunshade,” she says. “We may consider going down that route, but the shade would be much larger, the size of a football field.”

— KAREN NITKIN

> **“For this application, we had a cooling loop, so it circulated fluid throughout the spacecraft and kept things from getting too hot or too cold.”**
>
> Emily Maheras

SEEING CLEARER

A New Vision for Accessibility

Rebecca Rosenberg, Engr ’22 (MS), has always been drawn to challenges. She excelled in STEM subjects from a young age, leading her to briefly consider a career in neurosurgery, “because it was the hardest thing I could think of,” she recalls. There was just one complication: Rosenberg was born with oculocutaneous albinism—a genetic condition that affects the eyes, skin, and hair, causing reduced pigment and vision differences.

“If a normal person sees in high definition, I see in standard definition,” she explains. “The world around me isn’t blurry; I just have fewer pixels.”

At school, Rosenberg’s vision level placed her in a gray area for support. Audio-only tools made it hard to focus, especially in classes like math, and when she asked to learn Braille, administrators denied her request, saying she was too sighted to justify the cost.

By her undergraduate years studying biomedical engineering at Bucknell University, Rosenberg had learned to advocate for herself. Professors enlarged and reformatted course materials—a simple fix that worked well for her and sparked a bigger idea: a scalable tool to help others maximize their usable vision.

With a summer grant, she began developing ReBokeh (a play on a photography term for light out of focus), an app that uses smartphone cameras to help people with low vision adjust contrast, zoom, and focus in real time, enhancing user independence in any environment.

Momentum built until the COVID-19 shutdown in March 2020. “Everything was upside down,” she says, “but a light at the end of the tunnel was getting into CBID at Johns Hopkins.”

The Center for Bioengineering Innovation and Design brings small teams together for an intensive

> **“Everything was upside down, but a light at the end of the tunnel was getting into CBID at Johns Hopkins.”**
>
> Rebecca Rosenberg

one-year master's program, during which they design and launch medical devices to solve real-world problems. An Abell Fellowship allowed Rosenberg to extend her work for a second year while applying what she learned directly to her startup.

After graduating and completing a year of beta testing, she launched ReBokeh in June 2022. Early demand was strong, thanks to a waiting list built during development, but reaching new users proved difficult. She says a turning point came after an interview with BBC News. Within weeks, the app attracted users in 95 countries; it now serves people in more than 115 countries.

Since then, ReBokeh has expanded through partnerships with museums, transit systems, and sports leagues seeking to improve accessibility. The Clinton Presidential Library has become the first presidential library in the nation to offer ReBokeh. Investments from startup accelerators and a Zero Project Award—presented at the United Nations in Vienna—have further validated Rosenberg's mission.

"There are 25 million Americans with low vision, and even more who will have vision changes as they age," Rosenberg notes. "It's exciting to build something that can help at that scale."

— ERIN LEWIS

JOEL KIMMEL

THE RIGHT MIX

The System Behind the Salad

Leslie Silverglide, Engr '02, who majored in Geography and Environmental Engineering, has spent nearly two decades building MIXT around a once-contrarian idea: that a salad could be a full, craveable meal. When she and her husband, David, opened the first location in San Francisco in the mid-2000s, the concept met skepticism—salads were seen as sides, not centerpieces. MIXT reframed that equation, layering proteins, grains, and bold flavors into composed meals designed to satisfy, not supplement.

It's about balancing health with pleasure. "When people tell us that they crave our food," she says, "that makes our day."

Right from the start, Silverglide's engineering background gave her a systems-oriented lens. On opening day, she watched chefs zigzag across the line to assemble orders, grabbing ingredients from all directions. That night, she mapped the station and reorganized it so a salad could be built in a single, efficient flow.

"As an engineer, you learn to dissect a problem into smaller pieces," she says. "It's a test-and-learn mentality."

Today, that same mindset shapes how she runs the business. The question isn't just how to grow, but how to grow well. MIXT operates in California and Texas, with national expansion guided as much by discipline as ambition. In a retail environment where competitors tend to expand their territory at any cost, she is focused on long-term viability—choosing locations that will make sense not just this year, but decades from now. "The hardest thing is knowing when to walk away," she says.

> **"As an engineer, you learn to dissect a problem into smaller pieces. It's a test-and-learn mentality."**
> Leslie Silverglide

That long view extends beyond real estate. MIXT is a certified B Corp (a for-profit company that has been independently verified to meet high standards of social and environmental performance, accountability, and transparency), and Silverglide approaches sustainability as an operational system, scrutinizing everything from sourcing and packaging to building materials and energy use.

The company's biggest test came during the pandemic, when MIXT had to shift almost overnight from a thriving business to a surviving one. "The only thing I could do was be vulnerable and act quickly," she says. "I looked at my team and said, 'Let's get to work and get to the other side.'"

More than 90% of the company's leaders have been promoted from within. That philosophy emerged early, when Silverglide realized that building a company meant being responsible for people's livelihoods. Today, that ethos shows up in a culture that prizes teaching, internal mobility, and shared ownership of the mission.

"We have team members who started as dishwashers and are now general managers," she says. "A former salad chef is running our IT department. The growth stories are what I am most proud of."

Looking ahead, Silverglide is always entrepreneurial and increasingly interested in how to better support an aging population as they transition to different ways of living. And at MIXT, she continues to test and refine—new menu items, new partnerships, new markets. Yet the mission remains consistent: create something people return to, not just because it's good for them, but because they love it.

— HEATHER LOWE

TOP: Miguel Xavier Diaz-Lopez

BOTTOM: Michael Pryzby and (from left) students Oliver Lehman and Jason Zhao

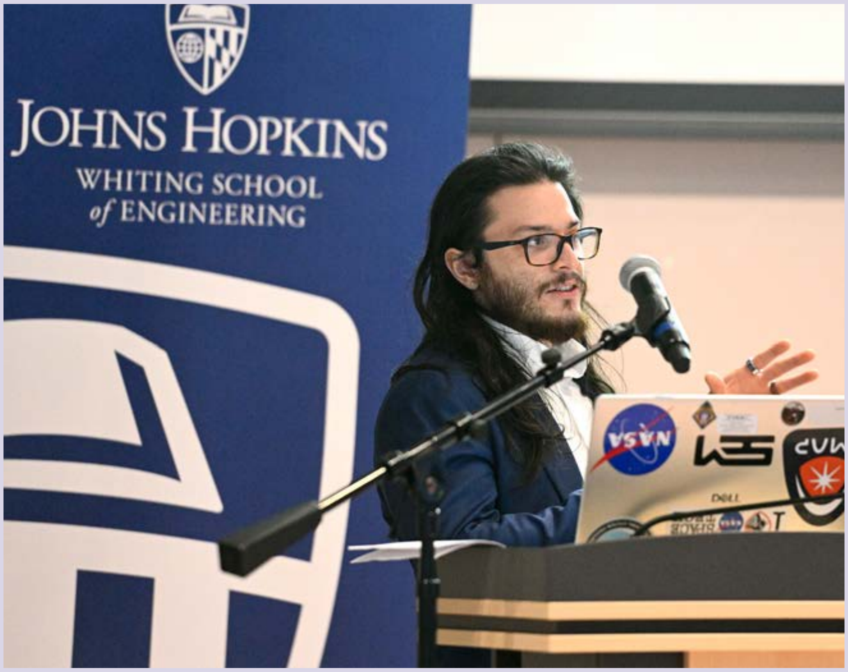
NEWSFEED

From Homewood to Saturn's Titan Moon

During the Whiting School's annual celebration of Engineering Week in February, Miguel Xavier Diaz-Lopez, Engr '25 (PhD), returned to campus to speak with students about his role as chief strategist in JHU's Applied Physics Laboratory's Mechanical Engineering Group, part of the Space Exploration Sector. Diaz-Lopez guides the building, integration, and testing of lunar technology efforts, including the Dragonfly rotorcraft lander scheduled to launch for Titan, Saturn's largest moon, in 2028.

As a PhD candidate, Diaz-Lopez worked in the Fluid Transport Lab with Rui Ni, an associate professor of mechanical engineering.

Michael Pryzby, Engr '09 (MS), a Johns Hopkins Super Mentor and a 2025 recipient of JHU's Heritage Award, moderated the discussion.



Notable

Rebecca Lawler, Engr '18 (MS), who studied space systems engineering through WSE's Engineering for Professionals program, was selected by NASA to join its 2025 astronaut candidate class. Formerly a lieutenant commander in the U.S. Navy, Lawler has logged more than 2,800 hours in more than 45 aircraft.

Competing in his fourth Olympic Games this year, **Emery Lehman**, Engr '23 (MS), took the silver medal in men's team speed skating at the Milan Cortina Olympics. Lehman, who studied civil engineering through WSE's Engineering for Professionals program, won the bronze medal in the same event in 2022.

Juzer Vasi, Engr '73 (PhD), received the Padma Shri, one of India's highest civilian honors, for his lifetime contributions to semiconductor and microelectronics research. Vasi, who studied electrical and computer engineering at Johns Hopkins, is a professor emeritus in the Department of Electrical Engineering at the Indian Institute of Technology Bombay.

Sarah Warren, Engr '23 (MS), competed for Team USA in the women's 500m speed skating event at the 2026 Milan Cortina Olympics, placing 28th. Warren received her master's degree in applied biomedical engineering through WSE's Engineering for Professionals program.

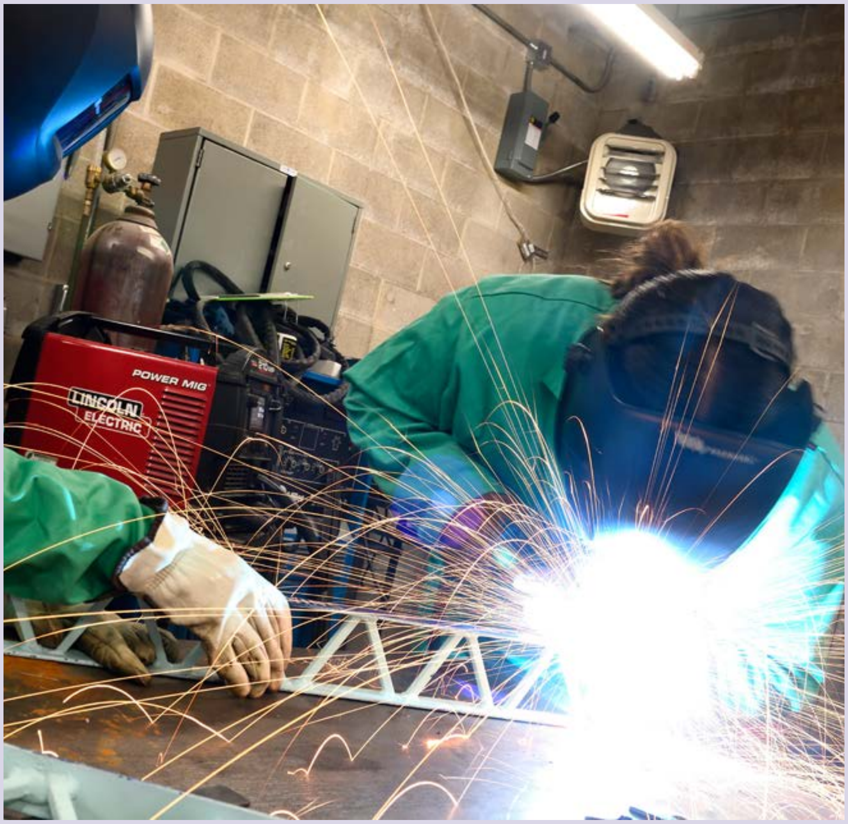
Yining Zhu, Engr ’21 (MSE), ’25 (PhD), has been named to the 2026 Forbes “30 Under 30” list in the science category. He was selected from more than 10,000 nominees and joins an elite group of young innovators recognized for advancing transformative scientific and technological breakthroughs.

Blue Jays Bond in the Bay Area

More than 80 Johns Hopkins Engineering and Krieger School of Arts and Sciences alumni and students gathered in January for the annual Bay Area Entrepreneurship and Technology Networking Reception.

The sold-out event, co-hosted by Whiting School Dean Ed Schlesinger and Christopher Celenza, dean of KSAS, included a talk by Dan Shapero, Engr ’00, CEO of LinkedIn (p. 32), and Mark Dredze, the director of JHU’s Data Science and AI Institute (p. 6).

The speakers each shared their unique perspective on AI, including its promise and risks in areas ranging from its integration in the workplace to its impact on fields ranging from management to global health. A lively discussion followed, and alumni and students also had the chance to network and learn about what’s happening at Hopkins Engineering today.



LEFT: Civil and systems engineering students Wendy Holguin (right) and Madison Villarba (left), fabricate a scale-model bridge for the Steel Bridge Competition.

Rewarding Student Initiative

Johns Hopkins engineering students eager to pursue independent projects often need seed funding to get their ideas off the ground.

Thanks to the generosity of WSE’s community, these students can apply to the Student Initiatives Fund for support to turn ideas into reality. Launched in 2006 and funded and overseen by a committee of engineering alumni and friends, the SIF provides grants to engineering student-led teams through a competitive application process.

Only projects unrelated to coursework are eligible, and team projects are prioritized over individual ones. “This is all very intentional,” says Dean Ed Schlesinger. “We want to reward ingenuity and independence and encourage collaboration and community building.”

Schlesinger adds that the fund can also bridge earliest-stage ideas and the start of the commercialization process. “If we can enable a student to build a prototype and define their goals, we’re providing a launch pad for projects that could receive additional support and resources, including mentorship and grants through the Pava Marie LaPere Center for Entrepreneurship.”

> **“We want to reward ingenuity and independence and encourage collaboration and community building.”**
> Ed Schlesinger

Recent fund-supported projects include Agara Bio, a team that is developing a biodegradable and sustainable colorimetric wound dressing, and Oralis, a needle-free mucosal vaccination platform designed for use in low-resource settings. The fund has also helped student teams compete nationally and internationally in rocketry, steel bridge building, and wind turbine design and construction.

To make a gift or learn more about the Student Initiatives Fund, contact the Whiting School’s Office of Development and Alumni Relations at (410) 516-8723 or engineering@jhu.edu.

Become a Whiting School Ambassador

Whiting School Ambassadors are active, dedicated alumni who are committed to growing and strengthening the greater Hopkins Engineering community.

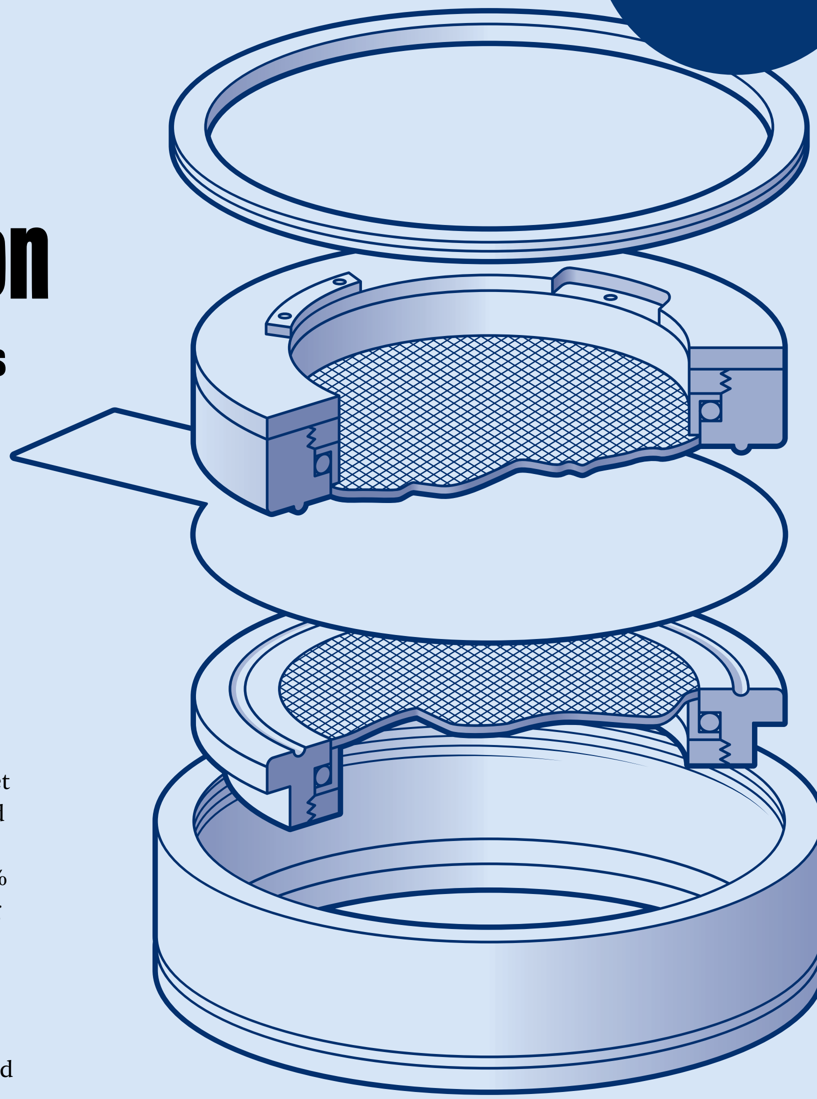
Ambassadors engage in a range of activities that have a direct impact on students and help advance the school’s mission. Some volunteers choose to participate virtually as student mentors, while others return to campus to network with students and peers, lead panel discussions at career-related events, or judge engineering student competitions.

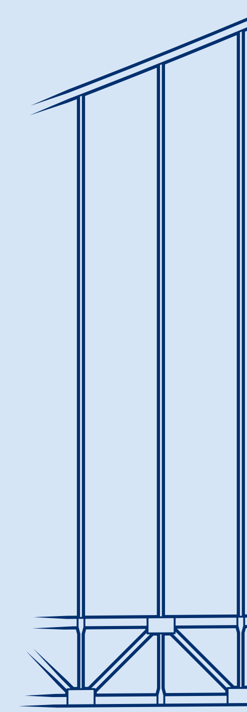
To learn how you can get involved, contact the Whiting School’s alumni relations team at (410) 516-8723 or engineering@jhu.edu.

150 Years of Innovation

Highlighting Johns Hopkins Engineering's enduring impact as we celebrate JHU's sesquicentennial.

BY ABBY LATTES
ILLUSTRATIONS BY CHRIS PHILPOT

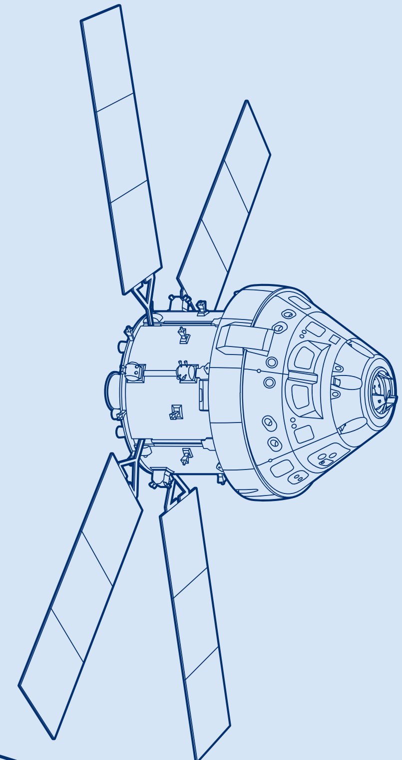




SOUND DOMINANCE

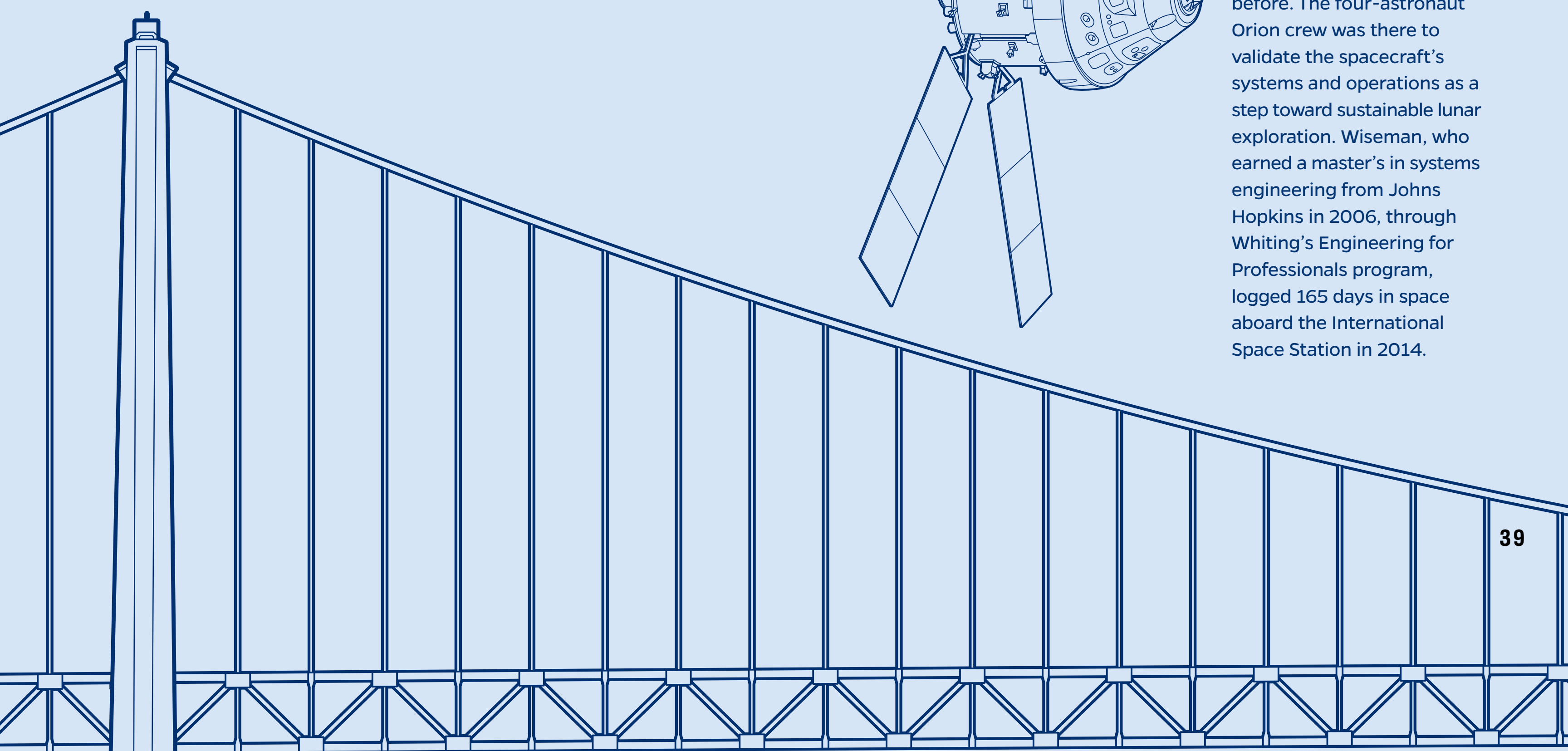
While working at Bell Labs in 1962, James West revolutionized sound technology as co-inventor of the electret microphone. This simple, efficient, and highly sensitive device dominated the market for 40 years, accounting for 90% of microphones in cell phones, hearing aids, and more. West joined JHU's electrical and computer engineering faculty in 2001, where his focus has been on improving people's lives in direct and impactful ways. He developed a noninvasive "smart stethoscope" designed to improve diagnostic abilities in low-resource settings, worked with NASA on an automated vest for monitoring the health of astronauts, and contributed to remote sensing technologies. Throughout his career, he also has been a major national force in mentoring and supporting women and students of color in STEM fields.

Diagram of the electret microphone adapted from James West and Gerhard Sessler's 1962 patent application



FAR SIDE OF THE MOON

As mission commander of NASA's Artemis II in April, Reid Wiseman, Engr '06 (MS) traveled more than 240,000 miles from Earth—farther than any human had gone before. The four-astronaut Orion crew was there to validate the spacecraft's systems and operations as a step toward sustainable lunar exploration. Wiseman, who earned a master's in systems engineering from Johns Hopkins in 2006, through Whiting's Engineering for Professionals program, logged 165 days in space aboard the International Space Station in 2014.



San Francisco Oakland Bay Bridge

BRIDGING PROGRESS

Civil engineer Robert Scanlan, one of the world's most acclaimed experts on the effects of wind on bridges and other structures, joined the Johns Hopkins faculty in 1984, where he remained an active teacher and researcher until his death in 2001. A foundational figure in aeroelasticity and wind engineering, Scanlan's methods for analyzing long-span bridges under wind loading are now standard practice worldwide, and his research on flutter derivations and bridge dynamics paved the way for the construction of today's larger, sturdier, and more cost-effective bridges.

STOPPING SEPSIS

Sepsis, the body's extreme response to infection, claims at least 350,000 lives annually in the U.S. Its symptoms often mirror other conditions, complicating timely diagnosis—yet an hour delay in treatment can be fatal. Computer scientist Suchi Saria is greatly improving outcomes for these patients with the Targeted Real-Time Early Warning System, an AI-powered tool that integrates electronic health records with machine learning to help doctors diagnose sepsis nearly two hours earlier than traditional methods. It already is reducing mortality rates by 18% in dozens of hospitals across the country.

Is power the thing with feathers?

Rajat Mittal
Professor of mechanical engineering

"In simulations, a three-feather flapping wing produced up to twice the lift-for-energy efficiency of a single element—so you get roughly double the lift output for the same power. The linked feathers achieve this by letting air slip through them on the upstroke and capturing that air to improve lift on the downstroke. That reduces wasted forces and boosts performance, which could benefit small drones, flapping robots, and turbines."

Does your salad have a drug problem?

Carsten Prasse
Associate professor of environmental health and engineering

"As farms turn to reclaimed wastewater, we wanted to determine how lettuce, tomatoes, and carrots absorb and chemically alter four psychoactive drugs. It turns out leafy greens held the highest concentrations, while tomato fruit and carrot root had about 220-fold and seven-fold lower levels, respectively. Plants transformed the drugs into multiple metabolites, and the variety of these breakdown products tracked with how much original drug was present—not the plant species—raising questions about food-safety implications."

Can we reveal the secret lives of cells?

Dingchang Lin
Assistant professor of materials science and engineering and core researcher in the Institute for NanoBioTechnology

"Just like tree rings that document climate changes from centuries ago, GEMINI, a genetically encoded intracellular recording platform, creates ring-like molecular records of cellular histories inside cells. By looking at GEMINI's cross sections under a microscope, we can read what individual cells have experienced via small, fluorescent 'rings.'"

Johns Hopkins
Whiting School of Engineering

JH 150 Years

A legacy tomorrow, **an impact today.**

Johns Hopkins Legacy Match

Support the future of engineering at Johns Hopkins with a qualified gift through your estate plan or a life income gift and a portion of your legacy gift will be matched with an outright gift* of up to $25,000, benefiting the program or purpose of your choice today.

Here's how it works:

- Document your estate gift or life income gift
- \+ An outright gift* will be made to an area of your choice
- = Immediate support for your preferred designation
- \+ A legacy that supports the future of Johns Hopkins

To ensure your gift qualifies for the Johns Hopkins Legacy Match, please contact the Office of Gift Planning at 410-516-7954 or giftplanning@jhu.edu. Learn more at giving.jhu.edu/legacy-match.

*Outright gift will equal 10% of the full value of the bequest intention or life income gift, up to $25,000.

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“By establishing and supporting the William R. Brody Faculty Scholar program, Robert Seder and Deborah Harmon have enabled my lab to study, understand, and leverage the power of our own immune systems to fight diseases in new ways.”

Jamie Spangler,
William R. Brody Faculty Scholar, Associate Professor of Biomedical Engineering and Chemical and Biomolecular Engineering, 2026 President’s Frontier Award recipient

Established in 2008 by then university trustee Robert Seder, A&S ’81, and Deborah L. Harmon in honor of former Johns Hopkins University President William R. Brody, the William R. Brody Faculty Scholar award supports promising young faculty in the Department of Biomedical Engineering. Research advances enabled through this support led to Spangler receiving one of the university’s top honors—the President’s Frontier Award, an annual prize given to a faculty member making transformative contributions to their field.

GIVE TODAY