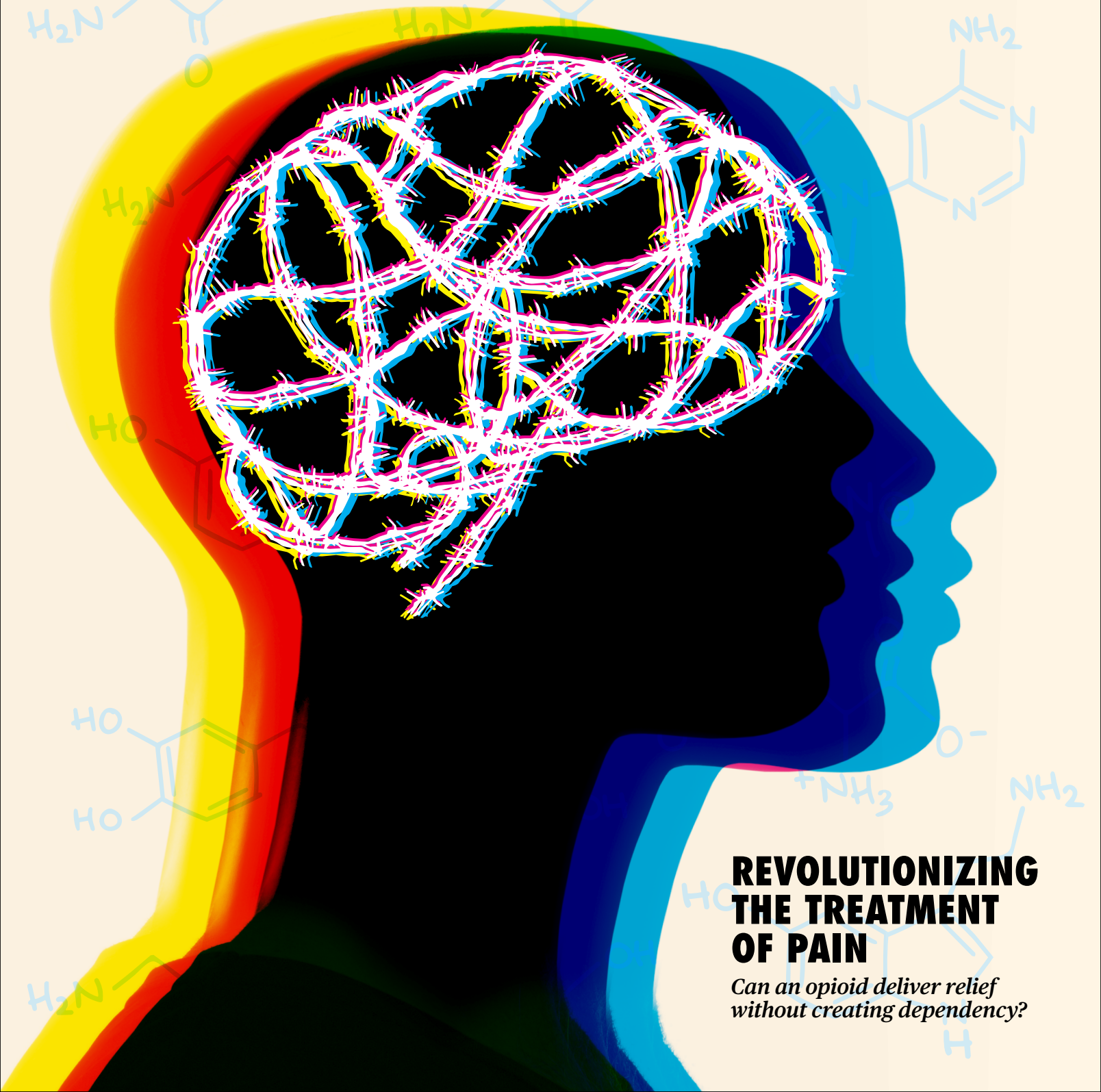
Temple University

Spring/Summer 2026

Research in Action



REVOLUTIONIZING THE TREATMENT OF PAIN

Can an opioid deliver relief without creating dependency?

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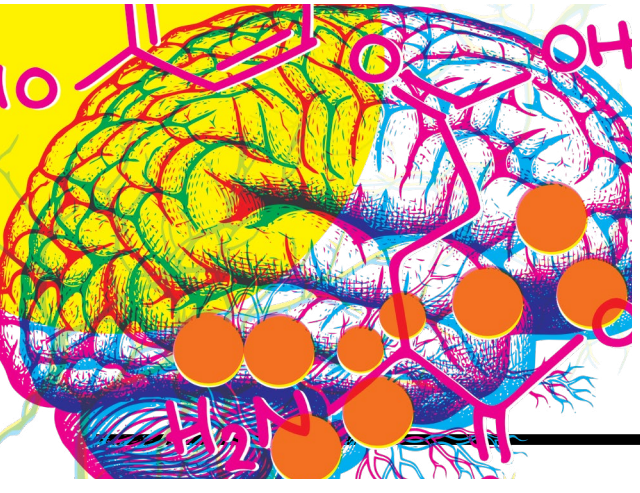


Researchers in Temple's Center for Microbiology and Immunology lead pioneering research on host-microbe interactions, immune responses and inflammation-related diseases.

Joseph V. Labolito

A Message from the Vice President for Research

Joseph V. Labolito

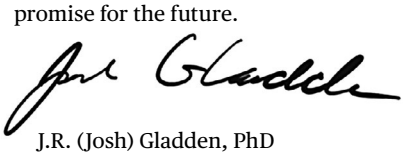
At Temple University, research is driven by people. As I look across our university, I see faculty and researchers who are asking hard questions, pursuing new knowledge and applying their expertise to some of the most pressing challenges facing society. Their commitment shapes a culture that values relevance, collaboration and impact across disciplines.

One of Temple's strengths is our ability to move ideas outward and connect scholarship and discovery with the needs of society. We bring together scholars from across the university with partners across Philadelphia, the nation and the world in the development of research-based innovations. In these pages, you will find just a sampling of Temple research, including work in areas such as sustainability, healthcare innovation, robotics and education research.

As Philadelphia's public university, Temple embraces its responsibility to serve as a strong, engaged anchor institution for our city. The majority of our graduates remain in the Philadelphia region, fueling the local economy, strengthening organizations and contributing to the city's long-term vitality. Our undergraduate students, graduate students and postdoctoral researchers also play an important role in our research, gaining experiences that prepare them to contribute to society with skill and purpose. Temple has long been an institution that opens doors and elevates people, and research is one of the most powerful ways we do that.

Our university operates within a broader research ecosystem with a long history of excellence. Philadelphia has been a global center of research and innovation for generations, and Temple has been part of that success. As the landscape evolves, I remain focused on sustaining our momentum while ensuring we stay adaptable, collaborative and forward-looking. Through various new initiatives, including the Broad Street Innovation Corridor and the Innovation Nest, we are fostering partnerships that attract investment, support growing enterprises and connect talent with opportunity. In this report, I discuss this work further in a conversation with President Fry, where we reflect on Temple research and its role in Philadelphia's innovation ecosystem.

The stories in these pages reflect the ambition and purpose that define Temple research. They describe research grounded in real challenges, shaped by real expertise producing real results that matter for society. I am grateful to the faculty, students, staff and partners who make this work possible, and I hope this publication offers a clear sense of the impact of Temple research today and its promise for the future.



J.R. (Josh) Gladden, PhD
Vice President for Research
Professor of Physics
Temple University

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THE FUTURE OF RESEARCH

A CONVERSATION WITH PRESIDENT JOHN FRY AND VICE PRESIDENT JOSH GLADDEN

Betsy Manning, *KLN '87, CLA '08*

Story by Stephen Orbanek

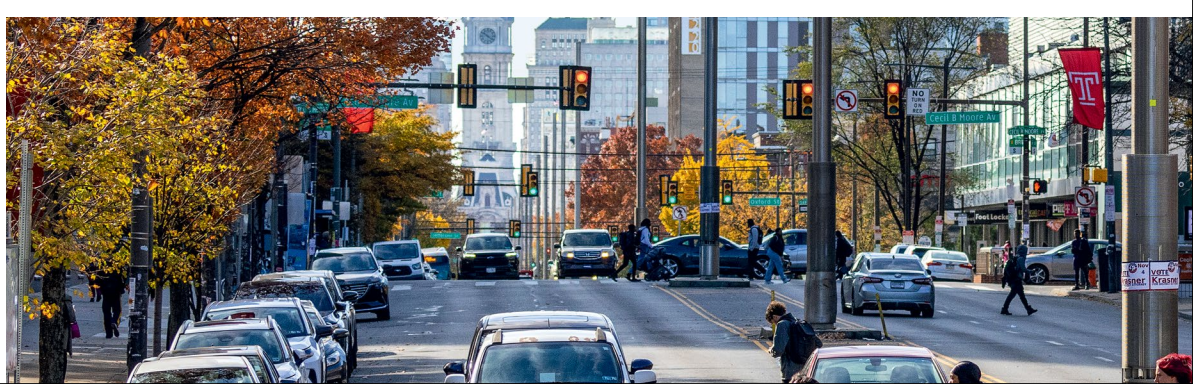
The solutions to many of society's most urgent challenges can only be found through research, discovery and translation. With the introduction of its strategic plan, *Forward with Purpose*, Temple University is equipped to face those challenges and solve complex problems.

Organized around three priorities, including Research in Action, the plan builds on the considerable momentum Temple already demonstrates in areas of discovery and innovation.

The university's annual research expenditures are now well in excess of $300 million, a figure Temple aims to further grow as part of its efforts to produce research and creative endeavors with true impact.

Temple University President John Fry recently sat down with Vice President for Research Josh Gladden at the Innovation Nest to discuss the university's research ecosystem and his optimism for increasing its impact in the years to come.

(EDITOR'S NOTE: This conversation has been edited for length and clarity.)



VICE PRESIDENT JOSH GLADDEN: Let's first talk about the role of public research universities and society, President Fry. How do the crucial contributions of research universities, specifically urban research universities like Temple, anchor their communities and regions?

PRESIDENT JOHN FRY: I do not think you could make a stronger case for the importance of a public urban research university in America than right now. Our challenges are significant across society and especially within certain sectors, but our opportunities are great, especially when you think of the advent of artificial intelligence and how we can push new boundaries and fields. The need for anchor institutions like Temple University and Temple Health, in a city like Philadelphia that has some great challenges, is essential in my mind.

GLADDEN: How are we creating an environment for innovation at Temple to support our research goals and build a robust research ecosystem here?

FRY: Thanks to you, your colleagues, and especially the faculty and the deans, our research portfolio has grown tremendously over the last decade. It has been very weighted towards the National Institutes of Health and National Science Foundation, but we're hoping to explore new partnerships. As you and I have discussed many times, we want to see more of a partnership with the Department of Defense, particularly around some of the work that's happening in Philadelphia's Navy Yard. I feel really good about where we are now, but we need to be positioned to grow our sponsored research to the $500 million-plus range, and I think that's possible. One of the ways of achieving that is to do more with Temple Health, particularly the Fox Chase Cancer Center, which is one of the jewels in the health system crown.

Ultimately, I think that it comes down to some very basic things. We need to provide our faculty with an environment where they have the support, space and funding to do their best work, because discovery is such a fundamental part of our mission. And we need to put discovery out in front of everything along with access and opportunity for our students.

GLADDEN: I totally agree with that, and I think $500 million is not out of grasp for us. The growth has been there, but there is more that we could do to support that growth. And what we're also trying to grow is the impact of the university on our local communities, and I'm excited about that.

FRY: Right. I think the community-based research we can undertake is really profound. Look at all of Temple's 17 schools and colleges, all of which in one way or another are embedded in neighborhoods and communities throughout Philadelphia. There are problems that we're all trying to solve together in the community, and our university can flex to meet those needs. That also speaks to our urban character, as it's an immutable part of our identity. Our strategic plan has the pillars of Place-based Impact and Research in Action, and those two pillars are highly synergistic. So, what better place to put the strategic plan into practice than on one of America's great boulevards, which is Broad Street?

GLADDEN: Well, that's a good segue to the next question, which is focused on the Innovation Corridor. Tell us a little bit more about the Innovation Corridor and the impact it will have on Philadelphia and the region. What kinds of breakthroughs, opportunities and outcomes do you hope the corridor will accelerate?

FRY: First, the Innovation Corridor is an effort to connect the various academic assets and health assets of Temple. There's only a mile between Main Campus and the Health Sciences Center campus, but it feels like a pretty long mile. In the last year and a half, our university and health system have done a good job of getting to know one another better, and we continue to make progress through various collaborations.

Then, we had this serendipitous opportunity when Terra Hall came up for sale in the wake of the unexpected closure of the University of the Arts. This building had been so well outfitted by UArts, and it gave us a place to bring together Boyer, Tyler and so many academic assets focused on the fine and performing arts, as well as our professional schools.

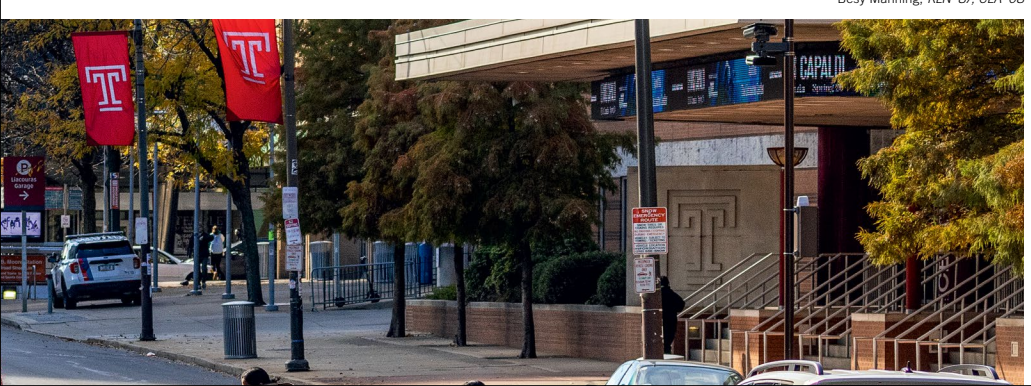
So, now, we have three distinct campuses with Main Campus, the Health Sciences Center and Terra Hall, which will serve as our new Center City campus.

So, how do we link all these academic assets along Broad Street? It is now our job to create an environment where people can find each other, where students can find faculty, where faculty can find each other and where all members of our community can find partners to accomplish their goals. We already have some new partnerships in place that are starting to flourish. One example is the Pennsylvania Academy of the Fine Arts, which was America's first museum and first art school, and partnerships like this will be really powerful for Temple.

When we think about research and partnerships, we often think about large agencies like the National Institutes of Health, but we should also be thinking about corporate, clinical and industrial partnerships. That is where I feel Temple University and Temple Health have tremendous amounts of upside. We need to pursue a deliberate strategy and develop a stronger playbook around partnerships. That is the core strategy that will help ensure the Innovation Corridor thrives.

Watch the extended conversation between President Fry and Vice President Gladden at magazine.temple.edu/research.

Besy Manning, *KLN '87, CLA '08*



Research Snapshot

Joseph V. Labolito

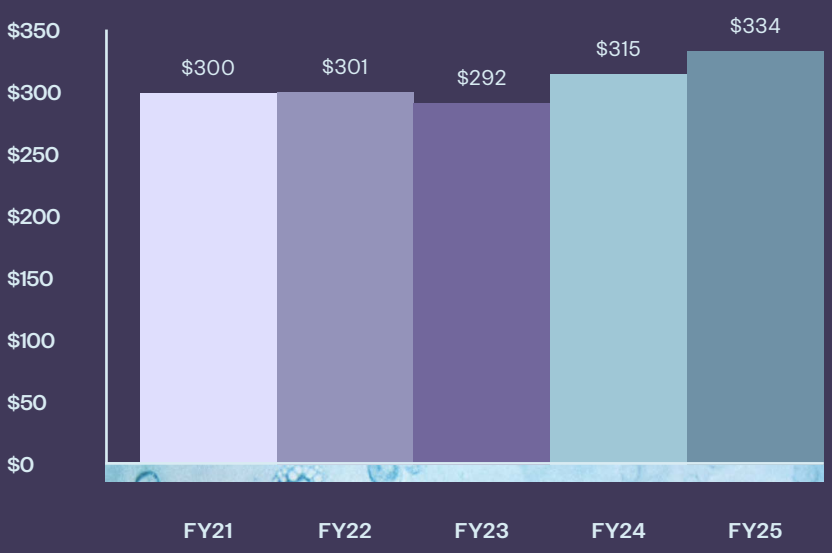
R1
Carnegie Classification

Top 20%
research expenditures among public institutions nationally

No. 83
for U.S. patents 2024
NAI Top 100 U.S. Universities

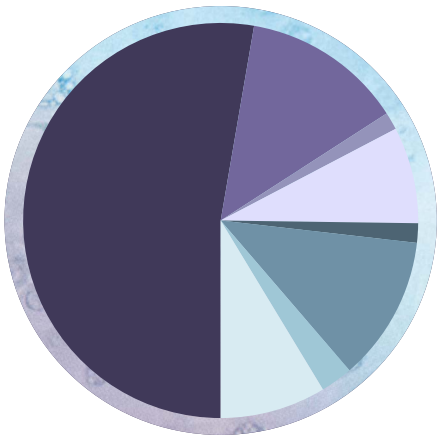
Expenditures

*in millions



Funding by source

FY25



- **Federal** ($97,731,808)
- **Federal pass through** ($24,424,653)
- **Local** ($2,667,138)
- **State** ($14,649,299)
- **Foreign** ($2,946,412)
- **Foundation/nonprofit** ($22,043,443)
- **Industry/organizations** ($4,889,420)
- **Other** ($16,068,013)

By the numbers

FY15–FY25

$349,351,421
startup funding raised

30
startups formed

694
invention disclosures

279
patent applications

169
patents issued

90
license and options agreements

Ryan S. Brandenberg, *CLA '14*

Out of the lab, into the world

Here's a look at four transformative startups turning research breakthroughs into real-world impact.

1. Helping seniors stand tall

Every year, an estimated 1 in 4 adults fall, resulting in about $50 billion in medical costs. To address this widespread problem, Professor of Neuromotor Science **W. Geoffrey Wright** in Temple's Christopher M. Barnett College of Public Health co-founded UprightVR, a startup using virtual reality (VR) to assess and treat fall risk in seniors.

The company's portable, affordable VR headsets guide patients through a series of balance-based scenarios to measure their reactions to various visual stimuli. The data captured helps identify sensory, motor and central processing deficits that contribute to fall risk, enabling physical therapists to design targeted treatment plans using both traditional therapies and UprightVR's gamified therapies.

2. Climbing to the top of drug discovery

With Philadelphia emerging as a major hub for biotechnology, Ladder Bio sits at the cutting edge. Tackling difficult-to-treat targets in inflammation, autoimmune disease and oncology, the company is commercializing a unique platform to generate next-generation therapeutics.

Founder **Christian Schafmeister**, professor of chemistry in Temple's College of Science and Technology (CST), and his innovative team have pioneered the development of spiroligomer molecules–synthetic, ladder-shaped compounds engineered to be small enough to penetrate cells and selectively target proteins. Ladder Bio plans to use these molecules to create an oral drug as an alternative to treatments that require injections. Ultimately, the spinout is opening a new chemical space and therapeutic modality for drug discovery.

3. Good dental care for good dogs

Sources estimate that over 40% of adults show signs of periodontal disease. In pets, that number jumps to 80-90% over age three. Yet treatment options that reverse the disease remain limited. As a nonsurgical alternative, Associate Professor **Santiago Orrego** and research associate **Carolina Montoya** of Temple University's Kornberg School of Dentistry developed a novel gel technology to address this. Licensed by Oral Biolife, and branded Ambrilux Dental Gel, the treatment facilitates the regrowth of bone tissue lost to periodontal disease and supports a healing environment.

Through a collaboration with a publicly traded animal health company, the Temple-developed platform has now been translated into a commercially available veterinary dental device for dogs. The dental gel delivers a targeted formulation directly into periodontal pockets, where its piezoelectric properties help stimulate regeneration in areas damaged by disease.

4. Enhancing patient safety during surgery

When surgical needles or sharp objects are lost inside the body, the consequences can be serious–and costly. To address this problem, **John Noel**, professor of physics in CST, and urologic oncologist Daniel Eun developed the Melzi Sharps Finder, now the flagship product of Melzi Surgical, which the duo co-founded.

The device allows surgeons to search directly inside a patient's body for metallic objects, such as surgical needles, instruments, broken fragments and guidewires, many of which may not be detectable on X-rays. In doing so, the technology enhances patient safety while reducing hospital costs. In April 2022, the company secured a $4 million investment, and an expanded marketing and sales effort to hospital systems nationwide is currently underway.

News Briefs

Not just child's play

For nearly 30 years, **Kathy Hirsh-Pasek** has advocated for the power of joy to enrich early childhood education. Named a "scientific entrepreneur" by the American Association of Psychology, the Stanley and Debra Lefkowitz Distinguished Faculty Fellow in the Department of Psychology and Neuroscience in the College of Liberal Arts has dedicated her career to discovering the most effective pedagogical approaches for young children.

In January, Hirsh-Pasek appeared on *Good Morning America* to discuss the new edition of her award-winning book *Einstein Never Used Flash Cards: How Our Children Really Learn—and Why They Need to Play More and Memorize Less*. Originally published in 2003, this groundbreaking evidence-based resource advocates for unstructured and guided play as a more effective way for children to develop critical, social and language skills than using flash cards or memorizing facts. The updated text includes the latest research findings on how play supports learning and a new chapter on navigating digital media.

"Play helps children learn so many valuable skills," she says. "They learn what we call the six c's: collaboration, communication, content, critical thinking, creative innovation and confidence. In the business literature today, we see that these are the skills that are needed in a time of AI. Computers will be faster than us and will know more facts than us. But they're not going to know how to think, discover, create and explore."

> "Every child deserves to wake up each day surrounded by opportunities to learn, to grow and to flourish."
>
> —Kathy Hirsh-Pasek, Stanley and Debra Lefkowitz Distinguished Faculty Fellow in the Department of Psychology

Hirsh-Pasek is also the founder of the Playful Learning Landscapes Action Network (PLLAN), which seeks to bring playful learning interventions to cities and transform everyday landscapes, such as bus stops, playgrounds, grocery stores and more, into rich, educational opportunities.

In partnership with Watchdog Real Estate Project Management and Masters Group Design, PLLAN has launched Live and Learn, an innovative Philadelphia-based pilot program that seeks to advance education equity by embedding playful learning installations into affordable housing developments. Last fall, Hirsh-Pasek presented this model to Philadelphia City Council.

"Live and Learn shows us what we can do with architectural design that goes beyond functionality and moves into intentionality," shares Hirsh-Pasek. "We believe strongly that every child deserves to wake up each day surrounded by opportunities to learn, to grow and to flourish."

Izzy Lopez and Katie DuBoff

Kathy Hirsh-Pasek (second from left) and collaborator Roberta Michnick Golinkoff joined George Stephanopoulos on *Good Morning America* on Jan. 27, 2026, to talk about their new book.

Photo by ABC/Paula Lobo

Justice reimagined

At the core of **Rachel López's** work is a belief that justice cannot be fully realized unless those most affected by the legal system help shape it. Acting on that conviction, the professor of law launched Temple Law's Participatory Law Fund, a first-of-its-kind initiative designed to support collaborative research between legal scholars and directly impacted community members–especially those who have experienced incarceration, violence or systemic injustice.

López has already demonstrated the potential of this approach in her own scholarship. In "Redeeming Justice," published in the Northwestern University Law Review in 2021, she collaborated with currently and formerly incarcerated people in Pennsylvania to argue for a fundamental human right to redemption.

The publication spurred a campaign to end life sentences without parole before the United Nations and sparked dialogue across legal and advocacy communities about the role of mercy and rehabilitation in the justice system.

At Temple's Beasley School of Law, López teaches courses on human rights advocacy, public interest law and criminal law, encouraging students to consider how legal systems operate across different cultural and political contexts. She was recently named Temple's inaugural Leonard Barrack '68 Chair in Law in recognition of her pioneering work.

Lina Chowdhury Duffy, *KLN '25*

"Participatory law is not just about who writes the law. It is about who gets to imagine what justice can look like."

—Rachel López, Leonard Barrack '68 Chair in Law

Stress less at the dentist

For many people, the sound of a dentist's drill can evoke feelings of distress, fear and nervousness.

Now, a group of Kornberg School of Dentistry researchers are exploring the origins of dental anxiety and identifying ways to alleviate it.

After evaluating patient-reported experiences, the research team–including Laura H. Carnell Professor and Dean of Kornberg **Amid Ismail**, Assistant Professor **Eugene M. Dunne**, and Professor and Director of the Center for Public Health and Behavioral Science Research and Chair of the Department of Oral Health Sciences **Marisol Tellez**–found that a cognitive behavioral therapy-based dental anxiety intervention reduced the need for avoidant coping strategies such as listening to music, reading, fidgeting or squeezing something. Because patients were no longer relying on coping strategies, their fears may have been reduced as well.

The project was funded by a grant from the National Institute of Dental and Craniofacial Research and the findings were published by Frontiers in Oral Health.

Ayana Jones

Improving pharmaceutical training in a global context

When students from Temple's Lewis Katz School of Medicine and the School of Pharmacy travel to Tamale, Ghana—the capital of the country's Northern region—they build partnerships and systems that strengthen healthcare delivery long after their visit.

Through the Academic Model Providing Access to Healthcare Ghana, Temple faculty and students work closely with students, pharmacists and healthcare educators from the University for Development Studies (UDS) and Tamale Teaching Hospital in Ghana to enhance a pharmacy training program that addresses gaps between classroom learning and clinical practice.

Last summer, two Katz students, **Anastasia Velikovskaya** and **Austin Patrick Malloy**, and one School of Pharmacy student, **Gabrielle Stuart**, joined three Ghanaian pharmacy students from UDS in Tamale to develop a hands-on curriculum that uses patient-actors for pharmacy education training.

Their research study, "In situ simulation in pharmacy education to improve pharmacists' patient care process," demonstrated the success of the curriculum. Specifically, more than 90% of students perceived that the training program was relevant to their education and their future pharmacy practice, more than 80% of students reported feeling more competent in medication management skills, and more than 80% of students felt that they gained confidence in applying their pharmacotherapy skills and communication.

"Equitable global health research requires a context-driven and collaborative approach for bi-directional learning and long-term sustainability," says **Tina Tran**, assistant professor of pharmacy practice. "The participatory nature of our research fostered ownership, built consensus, and ensured relevance to both local realities and global standards."

Amanda Bednar and Amanda Hill

Turn down that racket

Pop ... pop ... pop ...

The ball bounces back and forth as players take turns serving in a friendly pickleball match.

But it's not all fun and games.

A few years ago, a pickleball court in the Chestnut Hill neighborhood of Philadelphia made headlines in The Philadelphia Inquirer when people living nearby began complaining about the incessant noisiness of the ball hitting the racket. It was then that researchers in Temple's College of Engineering began investigating sound at the facility.

Associate Professor of Mechanical Engineering **Haijun Liu** and PhD candidate **Subhrodeep Ray** are on the cusp of a solution in the form of an absorptive sound barrier.

Liu and Ray measured the decibel and frequency levels of the sound from the court while also conducting interviews with pickleball court neighbors across the country.

"In talking to people not only in Philadelphia but in Arizona and California, we learned that the continuous popping sound is a big issue," says Ray. "Some compared it to a form of torture."

While current noise reduction products exist, Liu and Ray found they aren't optimized for the unique problem of pickleball noise.

The two worked to solve the problem for both parties: a new type of barrier that effectively absorbs noise without compromising aesthetics or safety.

Their sound barrier, made of acrylic plastic, consists of a perforated front panel and a solid back panel with an air gap between the two.

The perforation size and spacing, in addition to the spacing between the two panels, has been optimized to reduce the sound of the specific frequency emitted by a pickleball hitting the racket.

As pickleball approaches 14 million players in the United States according to the USA Pickleball Association—more than double from the time the Chestnut Hill dispute began in 2022—Liu and Ray's sound barrier may ease tensions between players and court neighbors across the nation.

Jonny Hart, *KLN '18*

More than meets the

As AI rapidly grows—a recent U.N. Trade and Development report projects the global AI market soaring to $4.8 trillion by 2033—the technology seems equipped to handle any task. Driving cars. Analyzing medical images. Making music. Having a conversation.

But a new study from **Vlad Ayzenberg**, *CLA '12*, assistant professor in Temple's Psychology and Neuroscience Department in the College of Liberal Arts, highlights a notable limitation of the technology and stark contrast between AI and humans as young as 3 years old.

Ayzenberg and researchers from Emory University compared the visual perceptual abilities of preschoolers and state-of-the-art AI models and found that these children outperformed the best computer vision models currently available. The only models that performed better were those with more visual experience than humans are capable of experiencing. The study, "Fast and robust visual object recognition in young children," was published in July in Science Advances.

For the study, 3- to 5-year-olds were asked to identify objects from images presented at speeds of 100 milliseconds while their attention was disrupted by factors such as noise.

According to Ayzenberg, the study illustrates how cognitive and neural insights from children can be used to improve current AI models and inversely how AI models can eventually be used to gain insights into the functioning of the human mind.

"AI models are useful, but they make mistakes that no human would," he says. "If we can understand how young children are able to visually perceive objects, we can then make the models more efficient."

Maria Klecko

Joseph V. Labolito

Assistant Professor Vlad Ayzenberg found visual object recognition to be stronger in young children than in state-of-the-art AI models.

Ryan S. Brandenberg, *CLA '14*

A concrete solution

Concrete is everywhere. As the world's most widely used construction material, it forms bridges, buildings, roads and other infrastructure. But cement, concrete's primary ingredient, accounts for up to 90% of the material's greenhouse gas emissions.

Recent scholarly research from **Mehdi Khanzadeh Moradllo**, associate professor of civil and environmental engineering in the College of Engineering, could help expand the use of a more eco-friendly concrete alternative—carbonatable concrete.

Current methods for producing carbonatable concrete make it difficult to achieve high strength and durability, which is why carbonatable concrete is primarily used to produce CMU blocks (also known as cinder blocks) and other small-scale building materials that are non-load bearing.

In his latest research, Khanzadeh presents breakthrough findings that could one day lead to the sustainable material being more widely used in construction.

"I try to keep in mind, even if this is successful, is it going to be applicable?" Khanzadeh says. "Is this material going to be scalable? This is especially important for something like concrete."

Jonny Hart, *KLN '18*

"We use concrete so much, the process for making an eco-friendly version needs to be accessible to everyone."

—Mehdi Khanzadeh Moradllo, associate professor of civil and environmental engineering

Media matters

Joseph V. Labolito

Lead with play. That's advice from Klein College of Media and Communication Professor of Instruction **Sherri Hope Culver**, who outlines what children's media creators should consider when producing content.

Her guidance comes at a time when the rise of streaming platforms has made more content available for children and parents than ever before.

"Other than family, what is the biggest influence in a child's life? The thing that they probably spend the most time with is media," says Culver.

Culver's recent scholarly report "The Quality Question: Why Children's Media Must Aim High" provides a thorough overview of 15 specific guidelines for global children's media leaders as they work to create all types of media, from TV to podcasts to video games.

She conducted the research during fall 2022 after being named one of 16 Fulbright global scholars. For the report, she traveled to England, Brazil and Australia, where she interviewed 80 media executives, TV producers and academic thought leaders to help inform these new guidelines.

"As a society, we always say how children are our future, and we want to do right by them, yet we create children's media that we know is not the best for kids," says Culver. "This report is meant to inspire us to aim to be better."

Stephen Orbanek

Healing mode: ON

A type of immune cells called macrophages, found throughout the body's tissues, are often referred to as the body's clean-up crew. That's because they can switch between two modes: one that finds and destroys germs and clears the dead cells after injury and the other that helps with wound healing. How the switch is activated is not fully understood.

Now, researchers at the Lewis Katz School of Medicine in the lab of **Raj Kishore** have discovered that a new type of genetic material, called circular RNAs, specifically circ-cdr1as, may play a role. Their study revealed that this circular RNA regulated macrophages—keeping them in the anti-inflammatory mode after a heart attack, helping the heart recover.

"We are one of the very first to understand this new mechanism of how this cell switched into healing mode," says Kishore, Vera J. Goodfriend Endowed Chair in Cardiovascular Research, professor and chair in the Department of Cardiovascular Sciences, and professor in the Aging + Cardiovascular Discovery Center at Katz.

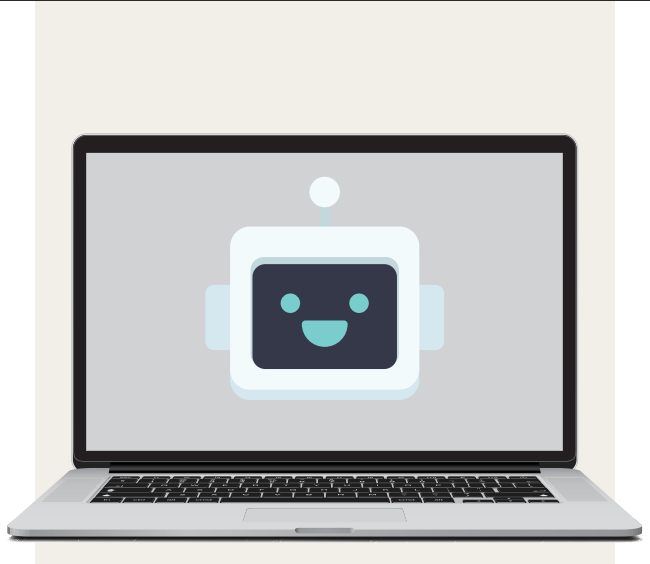
The research team investigated how much circ-cdr1as was present in heart cells after a heart attack. The researchers then overexpressed—or boosted—the circ-cdr1as in immune cells, injected them into the damaged part of the heart and viewed them using a fluorescent marker.

In addition, they tested what happened when they delivered circ-cdr1as more broadly through a virus that can carry this genetic material into cells. Finally, they explored how circ-cdr1as work by turning certain related genes on and off.

Kishore found that circ-cdr1as levels dropped in macrophages and heart muscle cells after a heart attack. When they restored circ-cdr1as in macrophages and put those cells back into the heart, the macrophages stayed in their healing, anti-inflammatory mode. This improved heart function and reduced the size of the damage.

"This study is exciting because it shows we are heading in the right direction," says Kishore.

Katie DuBoff



AI won't take your job; it will make you better at it

As AI advances and becomes more common in everyday life, employees in nearly every industry grow fearful that the technology will come for their jobs.

But, according to research from **Xueming Luo**, Charles Gilliland Distinguished Chair Professor of Marketing in the Fox School of Business, AI may instead enhance employee creativity, particularly among higher-skilled employees. And AI collaboration can help higher-skilled employees develop positive emotions in the workplace.

"In a nutshell, the myth is that AI will literally destroy all human jobs. But we try to demonstrate that this is not the case," Luo says. "I think industries are going to find a new equilibrium. They will look to see where AI fits the most, not that AI can do everything."

In their study, "When and How Artificial Intelligence Augments Employee Creativity," published in the Academy of Management Journal, Luo and his co-authors analyzed whether call center employees might benefit from AI collaboration.

But call centers aren't the only industry where human-AI collaboration could thrive. Any job involving repetitive, codifiable tasks could benefit from AI assistance, Luo says. Healthcare is another industry that's primed for AI assistance.

Luo even sees AI collaboration making its way into leadership roles in the near future. He believes managers will soon use AI assistance to handle the analytical, fact-based parts of their jobs, leaving the interpersonal and trust-building tasks to humans.

Jonny Hart, *KLN '18*

Striking a chord

If you've ever wept to a sad song or spent hours dancing at a concert, you know how powerful music can be.

Temple Professor of Music Therapy **Wendy Magee** at the Boyer College of Music and Dance is tapping into that power by using music to assess consciousness in children and youth with brain injuries.

In a recent paper titled "The development and face validity of the music therapy sensory instrument for cognition, consciousness, and awareness (MuSICCA)," Magee and her collaborators demonstrate the face validity of a consciousness assessment tool known as MuSICCA. Face validity is the degree to which a test appears to measure what it is intended to measure.

The tool uses music to assess consciousness in children and youth aged 2-18 who have experienced massive brain injuries and disorders of consciousness, usually as the result of an accident. Relying on live music that is meaningful to the child, including their name and sounds that excite them, the MuSICCA gauges the child's reaction and responsiveness to their environment.

This study demonstrates sufficient face validity for the MuSICCA to be considered an assessment of consciousness and awareness that seems appropriate for use with children and young people.

Since children in this population often have cognitive or sensory issues, motor disorders, and no verbal communication, it can be challenging to assess their levels of consciousness.

"Having a music-based assessment is really going to bring something to the team's understanding of how a young person can potentially respond, how we might engage them, how we can get the family involved," says Magee.

Kiki Volkert

Smarter Robots

Inside the Temple Robotics and Artificial Intelligence Lab, Philip Dames is reshaping how robots perceive, navigate and collaborate in the real world.

STORY BY **JONNY HART**, ***KLN '18*** • ILLUSTRATION BY **ROBERT FRAWLEY**

It's a busy Sunday morning at the grocery store, and dozens of shoppers are weaving through the aisles of stocked shelves. Near the dairy aisle, an autonomous floor-scanning robot pauses for a bit too long. It has wedged itself between a refrigerator door and a shopping cart, creating a bottleneck that forces annoyed customers to reroute around it.

The scene catches the attention of Philip Dames, associate professor of mechanical engineering. Moments like this fuel the work he leads as director of Temple's Robotics and Artificial Intelligence Lab (TRAIL). He's used to robots getting in the way.

"Robots are pretty socially incompetent a lot of the time," Dames says. "One thing we're studying is how robots can act more naturally and use social context to integrate into the flow of the crowd."

Dames spends most of his time working with robots, as is evident from a glance around his lab. TRAIL's space on the first floor of the College of Engineering building contains a computer cluster, where Dames

> **"We're trying to build robotic systems** that can help people in different workplaces."
>
> **–Philip Dames**
> Associate professor of mechanical engineering

and his student researchers program robots and run simulations testing different robot behaviors. There's a work bench where they tinker with robotic arms, wheels and other components.

And then there are the robots themselves–dozens of small drones, circular robots that resemble big and small Roombas, and four-wheeled robots that the TRAIL team drives through the building's hallways to test how they respond to people in motion.

Dames is helping this fleet of robots read the room, literally and figuratively. He is outfitting robots with cameras, microphones and sensors to help them gather information about their environment. And he's programming robots to integrate contextual information into their behavior to become more seamless companions and complete more complex tasks.

"We largely work on projects related to multirobot coordination and autonomous operation in the real world," he says. "We're trying to build robotic systems that can help people in different workplaces."

Assembling a robot dream team

Dames has spent nearly 10 years researching how a team of robots can best work together to accomplish tasks. For this work, he's borrowing a concept from the sports world.

"In sports, moneyball involves using data to quantify how much different players contribute to team success," Dames says. "You want to find players that are good value for the money."

The concept has spread to industries beyond sports, challenging decision-makers to scrutinize intuition-based assumptions they've historically operated on. Dames is applying the concept to the multirobot, multitarget tracking problems, where he is analyzing how the composition of robot teams impacts success at tracking a target.

The research could have applications in infrastructure inspection, or search and rescue missions.

"In infrastructure inspection, the target you're tracking might be an area of damage that needs to be addressed. Or in a disaster response context, the target you're tracking might be a missing person," he says. "Basically, you're using a team of robots to search for targets in a defined space. We want to understand what size and composition of a robot team can best accomplish that task."

Dames' team is running thousands of computer simulations testing what size team is most optimal for searching a given space. Later on, he wants to test how different robot capabilities contribute to the team's success.

"Then we can ask, is it better to have robots that see further or drive faster?" he says. "We want to understand which robot features are the most helpful for a given task."

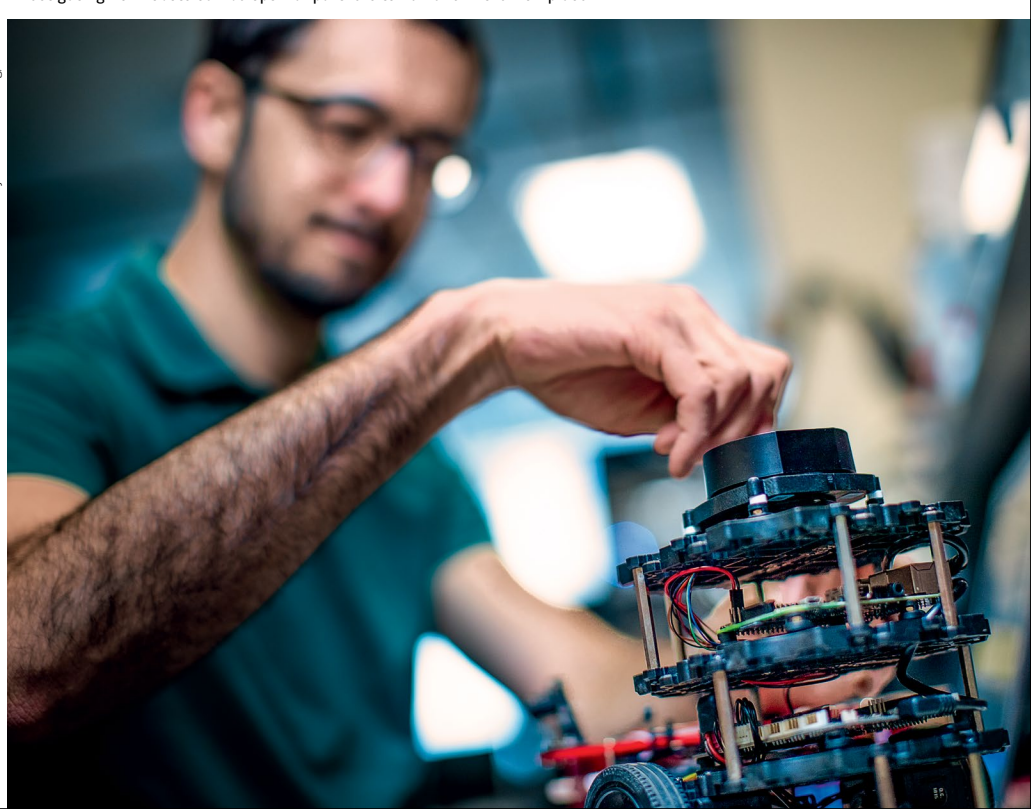
He's found that the ratio between the number of robots and the number of targets they're tracking is the most important factor in the team's success. But simply adding more robots isn't always the best approach for every task.

Dames also works on multirobot path planning problems, where you might have a fleet of robots working in a warehouse, staging and organizing orders before they get shipped to their destination. The more robots you have in a contained space, the more time they will spend dodging each other, causing delays, Dames explains. He wants to figure out the critical density where adding more robots leads to a deterioration in performance.

"Practically speaking, you could use this research to determine how many robots you should buy for your given space," he says. "Or if you already have a team of robots, you can look at how to design your warehouse or store to maximize the performance of your robot team."

Robots are already working alongside humans in various industries, and that trend is expected to continue. Philip Dames is investigating how robots can be optimal partners to humans in the workplace.

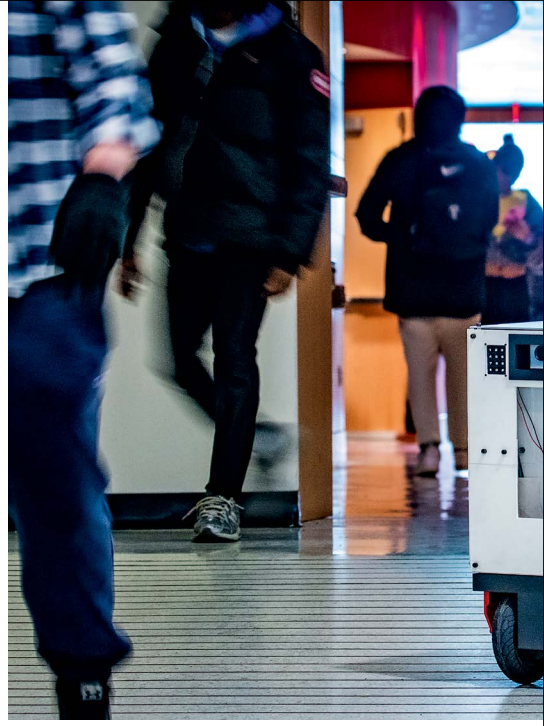
Ryan S. Brandenberg, *CLA '14*



Making robots more socially aware

Another area of Dames' work is inspired by the rising popularity of robots in places like grocery stores, airports and shopping malls. It's not uncommon to see autonomous robots in these spaces completing tasks alongside humans. But as scenes in grocery stores and other public spaces make clear, robots and humans still struggle to navigate the environment together.

"A lot of traditional robotic navigation approaches focus on geometry and safety," Dames explains. "We want them to be safe, but these approaches can lead to very conservative behavior where robots will just stop and wait for everyone to get out of the way. They become tripping hazards, and they're not really part of the flow. In robotics, we call this the frozen robot problem."



Solving this problem is part engineering, part psychology, and Dames is collaborating with Donald Hantula, associate professor of psychology and neuroscience in the College of Liberal Arts, to study how humans perceive and interact with robots in shared spaces.

The pair are conducting experiments in which participants watch videos of humans and robots, and the participants are asked to stop the video when the robot seems too close to a human. They're also experimenting with humans and robots walking in groups and tracking how much space humans want from robots, especially in constrained spaces.

"If you drop a person in Times Square, they can still move through it, even if it's not easy," Dames says. "A robot, on the other hand, might just sit there until the crowd disperses. We don't want robots to be too aggressive, but we also don't want them to be so conservative that they end up being an impediment."

Dames is looking for that middle ground where robots move fluidly, but safely, through the environment without interrupting humans. He is collaborating with Slobodan Vucetic, professor of computer science in the College of Science and Technology.

Dames and Vucetic are using machine learning algorithms to predict the flow of pedestrians, and they can use those models to train robots to better navigate pedestrian traffic.

Ryan S. Brandenberg, *CLA '14*

Philip Dames uses the busy hallways inside the College of Engineering as a testing ground for autonomous robots. He hopes to design robots that seamlessly navigate spaces alongside humans.

"The big question we're asking here is: How can we make robots that can move in a more socially competent way?" Dames says. "How can we design the behavior of robots to be natural, predictable and comfortable for people? This will only become more important as robots start to occupy retail environments, restaurants, hotels and even sidewalks."

Designing better robots for the future

In 2015, the friendly hitchhiking robot, hitchBOT, made its way across Canada and parts of Europe, only to be destroyed shortly after arriving in Philadelphia. The incident highlighted the anti-robot bias that many robot designers know well.

"My goal isn't to make everyone like robots," Dames says. "But I don't see robots going away, at least not in the short term. So, how can we make them better if they are going to be here?"

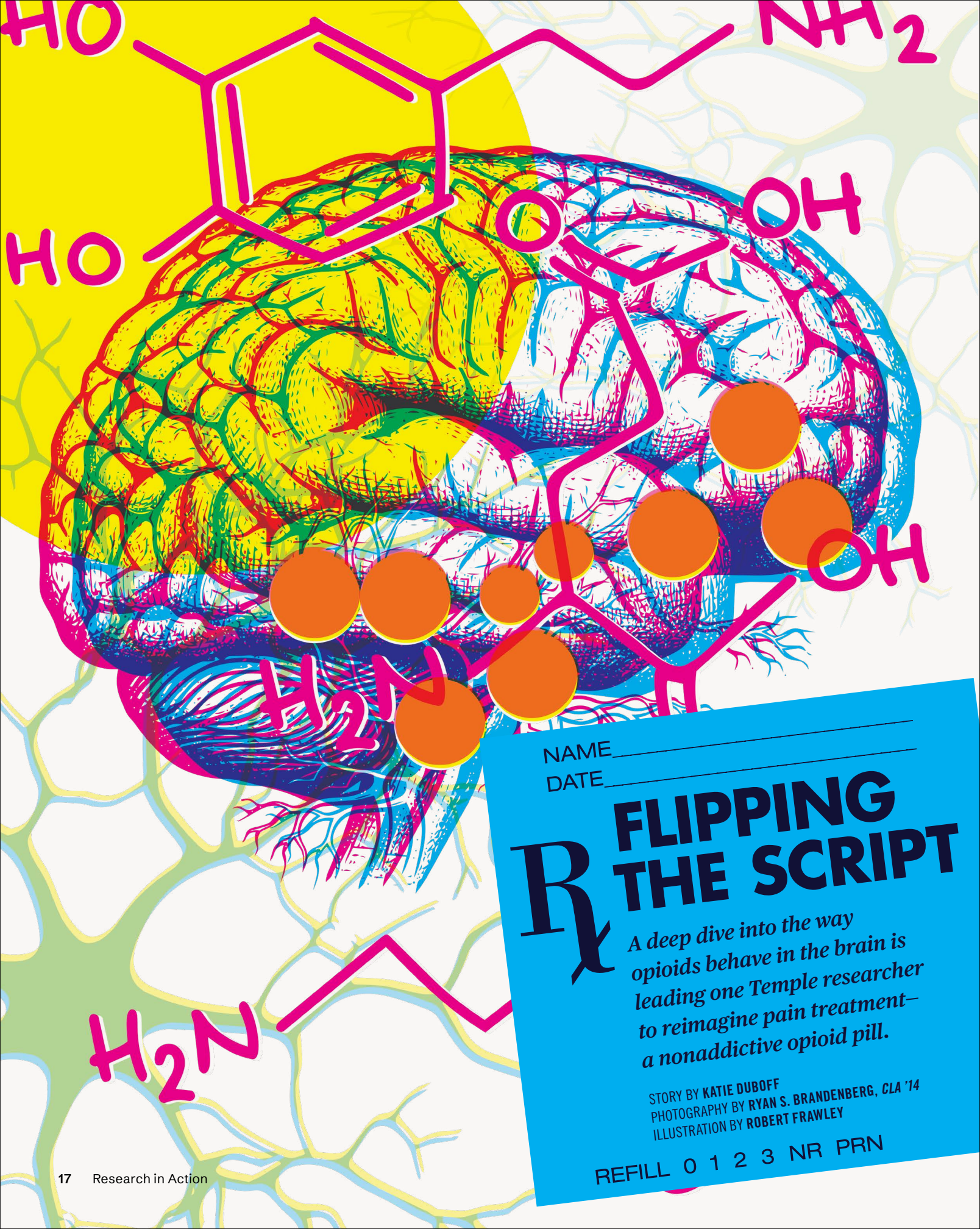
That attitude drives Dames to continue improving robots. For one of his next projects, he wants to explore selective attention, the concept that describes how humans focus on certain details and tune out others depending on the task. Dames wants to apply this to robotics by adjusting the level of detail a robot operates on given the task they are performing.

"Consider a bookshelf. If a robot's goal is simply to move through a space, then a bookshelf is a big box that the robot wants to avoid," he says. "But if its goal is to retrieve a certain book, now it needs a lot more information. And if it needs more information, it needs more computing power."

Dames is also excited to expand on the psychology research he and Hantula have started. By better understanding how humans learn, move and make decisions, he hopes to design robots that are more intuitive teammates and companions. The work might just help future robots move through busy public spaces as effortlessly as the people around them.

"I'm excited to think more about neuroscience and psychology in my work," he says. "If we can bring those concepts to robots, directly or indirectly, we can make them smarter and help them navigate this complex world that we live in."

> **"I don't see robots going away**, at least not in the short term. So, how can we make them better if they are going to be here?"
>
> **–Philip Dames**
> Associate professor of mechanical engineering



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Rx FLIPPING THE SCRIPT

A deep dive into the way opioids behave in the brain is leading one Temple researcher to reimagine pain treatment—a nonaddictive opioid pill.

STORY BY **KATIE DUBOFF**
PHOTOGRAPHY BY **RYAN S. BRANDENBERG**, *CLA '14*
ILLUSTRATION BY **ROBERT FRAWLEY**

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When Marc Graver was in his mid-20s, a single opioid pill shaped how he looked at pain management for the rest of his life. Pain wasn't the problem—opioids were.

Recovering from hernia repair surgery, Graver followed his prescription instructions and took a pill for the pain. Minutes later, the room began to spin.

"I remember this like it was yesterday," he says. "I fell out of bed and ended up on the floor, unable to move. Trying to get back up felt like I was climbing a mountain without any ropes."

Graver lay there until the drug wore off.

"One pill had affected me so much that I vowed to never take opioids ever again," Graver explains.

For nearly four decades, he has kept true to his word, relying instead on over-the-counter pain relievers through everything from dental bone grafts to gallbladder surgery.

Graver's experience with opioids never led to addiction—but the paradox of powerful pain relief paired with unpredictable effects left a strong impression on him.

Today, Graver works inside a research environment dedicated to unraveling this paradox: How can we separate the wonder from the woe? Since 2014, he has served as a senior administrator in the Center for Substance Abuse Research (CSAR) at Temple University's Lewis Katz School of Medicine, where he supports scientists who are working to unlock how opioids interact with the brain—including neuroscientist Anjali Rajadhyaksha.

Rajadhyaksha's lab is focused on how the brain works in addiction and mood disorders, and why some people may be more at risk for these conditions than others. Her work centers on a bold question: Could there one day be an opioid that delivers relief without creating dependency?

"Opioids are definitely the best pain management medications out there," says Rajadhyaksha, director of CSAR and a professor in the Department of Neural Sciences at Katz. "I think that opioids are going to remain the mainstream medications for pain management. So, our idea is to remove the addictive properties of opioids while sparing their pain-relieving properties."

HOW OPIOIDS WORK IN THE BRAIN

Opioids are natural or synthetic chemicals that bind to receptors in the brain and block pain signals between the brain and body, making them highly effective at reducing pain. Doctors commonly prescribe them for pain management after surgery, injury, during cancer treatment and for some chronic conditions. At the same time, this powerful pain relief can come with significant risks, including the potential for addiction because opioids alter the brain's reward circuits, making it difficult to stop taking them after repeated use.

Neurons, or nerve cells, are the basic units in the brain and nervous system that send signals throughout the body to control thinking, emotions and movement. Drugs interfere with how the brain sends, receives and transmits these signals. Opioid addiction, or opioid use disorder, is a complex and chronic brain disease marked by compulsive use of opioids despite their harmful consequences. Over time, continued opioid use alters the brain's chemistry and

Anjali Rajadhyaksha works with others in her lab toward developing opioids that relieve pain without the addictive side effects.

can lead to physical dependence, meaning the body adapts to the drug, causing intense withdrawal symptoms if use is reduced or stopped–making it even harder to stop taking the drug.

"Any disease is complex, but neurological diseases, especially addiction and neuropsychiatric disorders, are extremely complicated," Rajadhyaksha says. "Understanding what's going on in the brain to shed light on these disorders has been the driving force and motivation for me."

The brain has a reward system that is wired to release small, healthy amounts of dopamine–a key neurotransmitter and hormone–during pleasurable activities like eating, socializing and sex. This reward circuit drives the brain's motivation to repeat those behaviors. Addictive substances, including opioids, can cause the brain to release excessive amounts of dopamine, creating a powerful chemical signal to reinforce the link between consuming the drug and rewarding pleasure.

When it comes to easing patient suffering, Rajadhyaksha points out that currently the only choice for those seeking relief from severe pain without opioids' habit-causing properties is to take pain medications that are not nearly as effective–or live with the pain, like Graver did.

"One of the challenges is to find an effective opioid replacement," she says. "Researchers have been looking at non-opioid pain medications, and while some new options exist, they remain suboptimal treatments for pain compared to opioids."

A HUB FOR ADDICTION RESEARCH

Researchers at CSAR have been at the forefront of understanding the biological basis of addiction and substance use disorders since its founding in 1998.

"CSAR is very well known for the science and research and its work in substance use disorders and addiction, especially opioids," says Rajadhyaksha. "Primarily, we are all

Researchers at CSAR use multidisciplinary approaches including molecular biology, genetics, neuroscience and behavioral science to further the understanding of addiction and drug interactions. The center provides rich research opportunities for students such as PhD candidate Marco Ghilotti and undergraduate Emily Vu.

> "Our idea is to remove the addictive properties of opioids while sparing their pain-relieving properties."
>
> —Anjali Rajadhyaksha
> Director, Center for Substance Abuse Research

neuroscientists interested in how opioids affect the brain and the pharmacology of opioids. Understanding the science behind addiction can help us create therapies to change lives, which would make a positive difference for so many given the huge opioid epidemic that has been inflicted."

Rajadhyaksha envisions a world in which a patient can recover from surgery, serious illness or chronic pain without fear of getting addicted to opioids. She is working to make this dream a reality and garnering a lot of attention from peers and the media along the way. Her research has been published widely in scholarly journals and featured in The Atlantic, CBS News Philadelphia, The Philadelphia Citizen and more.

A NEW PERSPECTIVE

Before turning her attention to untangling opioids' pain pathways in the brain, Rajadhyaksha's interest began with cocaine addiction.

"When I started my lab 20 years ago, scientists were just starting to think about addiction as a brain disorder from the point of view of molecules and genes," says Rajadhyaksha. "I got fascinated by how drugs change the brain and how are they doing it at a molecular level? And that, today, still fascinates me."

Today, her research explores the brain's endocannabinoid system–a complex network of neuromodulators that regulate a number of the body's functions such as appetite, behavior, cognition, emotion and pain control.

"Our brain actually makes endocannabinoids, or chemicals, in the brain that play a variety of different roles," she says. "Since most of addiction is behavior-related, we started wondering if we alter levels of these endocannabinoids, would it impact opioid-related behaviors?"

To do so, Rajadhyaksha's team uses behavioral assays that measure pain and addiction to examine whether there is a way to reduce an opioid's dependency-inducing effects. Leveraging computational tools, she monitors how genetically manipulating molecules affect brain activity during pain and addiction-related behaviors.

"We identified that if we can inhibit a protein that occurs naturally in the brain called MAG lipase (MAGL) that results in higher levels of an endocannabinoid called 2AG, opioids still had their analgesic properties, or pain-relieving properties, but they were no longer rewarding or addictive," she says.

HOPE FOR THE FUTURE

Rajadhyaksha's studies have also seen no adverse effects. This preclinical breakthrough holds great promise for understanding how connections between the brain and opioids can be rewired. In time, she hopes to turn her bench-side discovery into patient-care applications.

"The next dream, of course, is can we develop a single pill that has an opioid along with a MAGL inhibitor that we can give for pain relief but has no addictive properties? So almost like the first nonaddictive opioid."

While two pills are an option, Rajadhyaksha wants to make the process as simple for the patient as possible.

"In our preclinical work, we did the treatment of the inhibitor followed by the treatment of the opioid. A single pill–one combination drug–would be much simpler for patients to manage at home."

To eventually translate this goal into therapies for patients living with pain, Rajadhyaksha is collaborating with departments across Temple on the next steps–a multidisciplinary approach that includes other scientists and physicians.

Chemists at the School of Pharmacy, for example, are helping her team screen for new compounds or modify their current inhibitors that would have more efficacy in patients.

Clinicians at Temple Health are also proving valuable to Rajadhyaksha's work.

"There's nothing like having close ties with the hospital and the clinical departments," she says. "Having conversations and building relationships with those on the frontlines of patient care is really, really educational. Being able to talk to my addiction medicine physician colleagues to understand what is actually happening when patients experience opioid cravings and withdrawal symptoms is really helpful for somebody like me doing the basic science."

Now, with each gene and molecule that she analyzes, Rajadhyaksha's dream to revolutionize pain management gets closer to reality.

"Substance use disorders and addiction have a devastating impact on individuals, families and our communities," she says. "Understanding the science behind addiction is key to developing effective treatments. We want to take our basic science to patients. That's the motivation for what we do."

This is good news for Graver.

"I enjoy seeing the research play out and seeing how we can make a difference in people who get addicted to opioids," he says. "It would be terrific to be able to treat pain without fear."

Recovery from addiction is possible. For help, please call the free and confidential treatment referral hotline (1-800-662-HELP) or visit findtreatment.gov.

In Philadelphia, Temple University Hospital provides evidence-based addiction and behavioral health care through its Substance Use Disorder Clinic (215-707-1125) and integrated patient-centered addiction treatment within primary care at the Temple TRUST Clinic (215-707-1122).

Double Agents

How an agency-focused approach to education empowered students and broadened our understanding of outcomes in underresourced schools

Story by Maria Klecko Illustration by Hallie Thornton, TYL '12

"Yo, yo, yo!" That's how Mr. Derek welcomed participants to Bell High School's weekly Instagram Live session one Monday morning during the 2020-2021 school year—when schools were closed due to COVID-19 and students were learning online.

These sessions, which Mr. Derek led throughout the year to keep students engaged in school, were often informal as faculty, staff and students discussed nonacademic topics like pop culture and extracurriculars—always in an effort to build community. Once they even sparked a spirited debate about breakfast cereal.

"For the record, Honeycombs are straight trash," declared Mr. Derek, director of student support and family engagement. From there, teachers and students chimed in about this hot take and their thoughts about other cereals. Some pondered which is poured first into the bowl—the cereal or milk—as they teased one another about their responses.

During a time marked by decreased engagement and social unrest due to school closures amid COVID-19, these Instagram Live exchanges offered respite for students and educators and helped maintain a sense of community.

And the encouragement from teachers and administrators never wavered. In the last Instagram Live of one semester, Mr. Derek implored students, "Do not lose your fight. We are all in this together. If you feel like you are going to lose your fight, tap into one of us and let us support you, okay? We got you."

Students echoed the staff's positivity. During another virtual meeting, a ninth grader named Faraji reminded the group, "Every day there is a situation; there is a bright side with a solution."

Monday morning Instagram Live sessions are just one example of Bell's commitment to affirming students and cultivating nurturing relationships that Maia Cucchiara observed during her ethnographic study of two public high schools in Philadelphia serving low-income students.

In the process, Cucchiara and her team discovered how Bell and the other focal school centered students' needs and promoted agency, or, as they describe it, the ability and inclination to act independently, make choices and exert control over one's life. The researchers argue that this focus on agency is what makes the schools such important models.

Equity and respect

Cucchiara first learned the power of promoting student agency as a teacher at an independent elementary school early in her career. Now an associate professor of urban education in Temple University's College of Education and Human Development, she used a sociological lens to examine how Bell and Parker—the two schools that she studied—empowered their students by making them feel seen, giving them a voice, showing they can create change and helping them envision promising futures.

Speak up!

Both schools are nonselective, meaning there are no admissions criteria. Bell and Parker also take a progressive approach to education: They emphasize building relationships as well as active learning that prioritizes students' needs and interests. They aim to help students identify their passions, build agency, and develop the skills needed to succeed in school and beyond.

Based on her findings, Cucchiara advocates for a rethinking of what constitutes school success, arguing that students' ability to exercise agency should be a priority, especially in schools serving marginalized communities.

She argues that cultivating a school culture based on respect and autonomy is crucial for low-income students of color because of the negative messages they often receive in other areas of their lives and the structural barriers they face.

"I've always cared about equity and wanting to play a role in increasing opportunities for students," says Cucchiara, who is the author of *Marketing Schools, Marketing Cities: Who Wins and Who Loses When Schools Become Urban Amenities*, which examines the problematic relationship between public institutions and private markets. Released in 2013, it won the Pierre Bourdieu Award for the Best Book in Sociology of Education from the American Sociological Association's Section on the Sociology of Education.

"What I've observed is when you treat people with respect and take their ideas seriously, they'll rise to the occasion," she adds.

Participation counts

Funded by the National Science Foundation, the project involved approximately 700 hours of ethnographic field work in which Cucchiara and co-author Sherelle Ferguson, assistant professor of sociology at the University of California, Irvine—along with graduate students—visited the schools regularly from fall 2019 through the 2021-2022 school year. During COVID-19, the researchers attended virtual sessions such as schoolwide meetings, Instagram Live sessions and professional development events. Cucchiara chose an ethnographic approach because it allowed her team to become participant-observers as they immersed themselves in the daily life of the schools.

Cucchiara and the team also conducted about 100 interviews with students, teachers, alumni and administrators to understand various stakeholders' experiences with the schools and how unique aspects of the schools' missions and design affected students and educators. For current students and alumni, the researchers explored what attracted them to these schools, how they feel about their educational experiences and how they assess the impact of the schools.

Throughout the interviews, Cucchiara found it striking that alumni uniformly highlighted how Bell and Parker built their self-confidence, self-expression and self-knowledge. They also spoke intentionally about their future, projecting competence.

"These schools are trying to give students new dispositions and ways of seeing themselves and being," says Cucchiara. "Our interviews with alumni show that this is powerful. For example, those who went to college said they felt more willing to talk to their professors because they were taught that they were entitled to build relationships with educators. Additionally, another alum explained that she now teaches others how to advocate for themselves."

> "What I've observed is when you treat people with respect and take their ideas seriously, they'll rise to the occasion."
> —Maia Cucchiara
> Associate professor of urban education

You have a voice

✱ All names have been changed to protect participant confidentiality.

Essential school supplies

In their upcoming book about this research, now under contract with the University of Chicago Press and tentatively titled *The Power of Respect: Promoting Agency in Innovative Urban Public Schools*, Cucchiara and Ferguson explain that promoting agency in school means emphasizing three core components: esteem, ease and efficacy. When students are esteemed, they feel valued and respected and deserving of attention, effort and consideration. Ease refers to a sense of comfort in students' own identity as well as in their interactions with authority figures. Finally, efficacy indicates students' belief that they can make decisions and accomplish their goals.

Both Bell and Parker use various discourses, structures and practices to build student agency. For example, teachers encouraged students to express themselves or make their own decisions, educators praised achievements or commitments to change, adults refrained from raising their voice or insulting students, and student efforts were met with enthusiasm from educators.

At Bell, the principal shouted out students for their accomplishments during morning announcements. Staff meetings also began with shoutouts to recognize individuals for their quality teaching and emotional support.

And adults regularly checked in with students grappling with issues in life. Instead of chastising struggling or disengaged students, teachers at the school incentivized and encouraged them. Ms. Taylor, a special education teacher, developed a system called May Madness in which students who were on the verge of passing could win prizes for participating in class or completing work, and teachers regularly affirmed students who reached out for support or improved their work habits.

chart your path

Get up to speed on Maia Cucchiara's latest research

Currently, Cucchiara leads an interdisciplinary team from the College of Education and Human Development on an evaluation of the Philadelphia Healthy and Safe Schools (PHASeS) program, housed in the Center for Urban Bioethics at Temple's Lewis Katz School of Medicine.

PHASeS works with a number of K-8 schools in North Philadelphia, embedding trauma specialists in the schools and providing additional resources to help the schools become trauma-sensitive spaces. Despite growing policy and educator interest in trauma-informed practices, there have been few rigorous assessments of their impact. For this reason, the team's evaluation—which uses quantitative and qualitative methods to track how PHASeS is implemented and its impact on students, educators and the school environment—will make an important contribution to both scholarly and policy conversations.

So far, the results have been positive. Findings suggest greater teacher and staff awareness of trauma-informed care improved educator well-being and reduced burnout. Educators also report that the intervention has had a positive impact on student learning and classroom discipline.

Overall, the school used a restorative justice approach to discipline that focused on repairing harm and rebuilding relationships. The Community Council exemplified this practice. At these meetings, a group of students, supported by a teacher, heard cases of minor transgressions and worked with those involved to find solutions.

Similar to Bell, Parker emphasized building positive relationships with students and helping them learn about themselves. In Parker's project-based curriculum, students collaborated to solve real problems. They reflected on their progress and had exhibitions multiple times each year to share what they learned. Nearly all Parker students reported that this practice helped them feel more comfortable in their post-high-school lives.

Additionally, at Parker, students spent four hours each day in advisories, working closely with one teacher. These advisories were designed to support project-based work and, importantly, to build community. Students began each morning by participating in a circle, a ritual the school viewed as essential to its relational approach. In circle, the students shared aspects of their lives, successes and challenges. Teachers used this time to check in with students, especially those who were struggling. The advisory structure allowed students to build close relationships with one another and with their advisor, who was each student's point of contact throughout the year.

Progress report

These two Philadelphia schools, along with a growing number of other progressive schools serving low-income students across the U.S., are aiming to serve such student populations in ways that center their needs and interests and empower instead of confine them. To better understand the landscape, the researchers also visited five progressive schools serving low-income students of color

outside of Philadelphia in New York, Pennsylvania, Rhode Island and Maryland. After meeting with students and faculty, observing classes, and interviewing individuals, Cucchiara and her team found consistency across schools in terms of teacher dedication and creativity as well as respectful, affirming treatment of students.

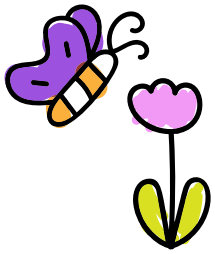
The findings at the two Philadelphia high schools as well as at other progressive schools in the U.S. serving low-income students indicate a need to broaden the understanding of educational outcomes beyond existing measures of achievement such as graduation rates and test scores.

The research team's observations and interviews with students and alumni from Bell and Parker indicate that outcomes such as self-knowledge, skill in navigating systems and institutions, self-efficacy, confidence, and active engagement in vocations and avocations are equally important.

"I want this research to raise questions about what school is for," says Cucchiara. "We talk about education in terms of outcomes, but we also need to pay more attention to what it's like for students to be in school."

"Ultimately, schools should impact in a positive way how students see themselves and their possibilities. I want schools to teach students that they matter just as much as anyone else and give them the tools to act on it."

you matter.



"Ultimately, schools should impact in a positive way how students see themselves and their possibilities."
—Maia Cucchiara
Associate professor of urban education

0 LEVEL

30 M

Maximum depth for recreational scuba divers

93 M

Statue of Liberty

The Engine You Cannot See

A Temple biologist explores the unseen depths that make life on Earth possible.

Story by Lina Chowdhury Duffy, *KLN '25* Illustration by Hallie Thornton, *TYL '12*

300 M

Deepest scuba dive

324 M

Eiffel Tower

351 M

Comcast Tech Center

Mapping the deep ocean begins in a way that surprises most people: by driving a research vessel slowly back and forth across the water.

"You cannot map the seafloor with satellites," Temple University Biology Professor Erik Cordes says. "You have to take a ship out and drive over every square mile." Each line of sonar becomes another thin stripe on the screen, revealing reefs and habitats that have never been documented. The deep ocean is the planet's largest living system and its least understood. It begins where sunlight fades out entirely, thousands of feet below the surface, in a realm defined by cold temperatures, intense pressure and ecosystems adapted to near-total darkness. Stretching across nearly 60% of Earth's surface and making up 95% of the planet's available living space, it stores carbon, regulates climate and supports the global food web. Yet as industrial activity moves into deeper waters, the ecosystems that sustain those functions remain largely unmapped and unprotected.

Cordes has spent more than two decades studying deep-sea environments. His work asks a deceptively simple question with global implications: How do we explore and benefit from the ocean's resources without destroying the systems that make them possible? "Most people will never see the deep sea," Cordes says, "but it affects every one of us. It keeps carbon out of the atmosphere, supports our fisheries and shapes the planet's climate."

Cordes' lab at Temple is one of the few in the world focused on both the science and stewardship of deep-sea ecosystems. His team uses seafloor mapping, predictive models and submersible surveys to locate and study coral communities thousands of feet below the surface. They are documenting biodiversity in uncharted regions, testing artificial coral structures to restore damaged reefs, and advising international agencies and foreign governments on how to manage deep-sea resources responsibly.

"The science is only one part of the story," Cordes adds. "The other part is how we translate it—how we make sure it reaches the people making decisions about offshore development."

Understanding the deep-sea engine

When Cordes describes the deep sea, he calls it "the engine you cannot see."

Organic material constantly rains down from the surface in what scientists call marine snow. On continental slopes and plateaus, that material settles onto coral structures that have been growing for centuries or even millennia. Those coral communities transform waste, recycling nutrients that eventually return to the upper ocean—the sunlit, biologically productive layer where most marine life and fisheries are concentrated—and feed the fisheries that coastal economies depend on.

In 2018 and 2019, Cordes and a team of collaborators discovered a 200-mile-long coral reef on the Blake Plateau, off the Carolinas along the U.S. East Coast. "You would think we'd already explored that area," he says. "But that's how little we know. We are still mapping these massive reef systems we didn't know existed."

Those reefs, located beneath the Gulf Stream, do more than shelter deep-sea life. They help maintain the productivity of surface ecosystems.

"A reef is part of the engine that feeds people," Cordes explains. "It keeps food on our plates and carbon out of the air."

Deep-sea corals also play a vital role in long-term carbon storage. Their skeletons lock carbon in for thousands of years, and the surrounding organisms keep additional carbon trapped at depth rather than cycling it back into the atmosphere. Losing those systems, Cordes says, would weaken one of the planet's natural climate regulators: "A lot of the carbon and heat we're generating ends up in the ocean. The deep sea is preventing our planet from overheating worse than it already is."

From disaster to restoration

Cordes was part of the scientific effort that followed the 2010 Deepwater Horizon oil spill. His research off the coast of Louisiana, where he had been studying deep-sea ecosystems for years, contributed to understanding how those environments responded and what restoration might require.

Erik Cordes and his team operate the DSV Alvin research vessel across the seafloor to survey deep-sea coral mounds on the Blake Plateau off the Carolinas. Image courtesy of Ivan Hürzeler and the Deep SEARCH program.

443 M

Empire State Building

500 M

Maximum depth for blue whale

1,000 M

Sunlight ends

1,857 M

Grand Canyon

4,267 M

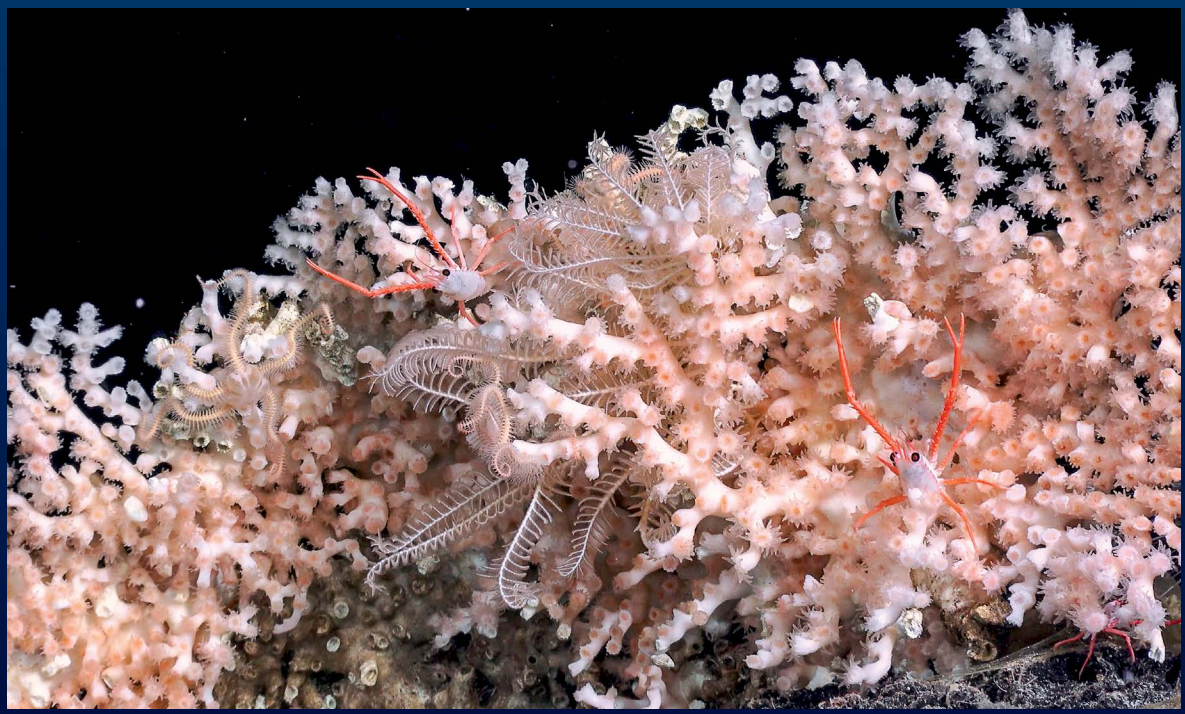
Average ocean depth

8,850 M

Mt. Everest height

11,034 M

Mariana trench



Above: A remotely operated vehicle exploring and mapping the seafloor off the Pacific coast of Costa Rica reveals a group of scabbardfish schooling. Image from Erik Cordes and ROV SuBastian / Schmidt Ocean Institute.

Below: Building predictive models to identify where deep-sea corals are likely to occur, Erik Cordes' team finds a coral reef at 800 m depth on the side of an atoll in the Phoenix Islands. Image from Erik Cordes and ROV SuBastian / Schmidt Ocean Institute.

"We were already working in the Gulf at the time of the spill," he recalls. "After Deepwater Horizon, we became involved in the deep-sea assessment work, and that eventually moved into restoration–looking at what these communities needed to recover and what was even possible at that depth."

Until then, restoration was largely confined to shallow or coastal waters. "It's really never been done in the deep sea," Cordes says. "We're borrowing ideas from shallow-water restoration, but it's a very different world down there."

At depths beyond 3,000 feet, corals cannot survive under normal atmospheric pressure. Traditional restoration methods–growing coral fragments in nurseries and transplanting them–do not work. "We tried that a little bit," he says, "but the success rate wasn't high. You get to a point where you're removing more corals than you're putting back, and then you become part of the problem instead of part of the solution."

Instead, Cordes' team began developing artificial reefs in the lab using 3D printing.

"We cast them into different forms and put them out to mimic what the real corals were doing in the environment," he explains.

Exploration and governance

Only about 30% of the seafloor has been mapped at high resolution, leaving large areas of deep water essentially unknown. Cordes' team builds predictive models from the maps that do exist to identify where deep-sea corals are likely to occur.

"We can predict where they're going to appear," he explains. "That helps us find new reefs at the bottom of the ocean and guide our dives."

That same need for baseline information underpinned his partnership with scientists in Argentina, where his team helped expand deep-sea research capacity. Supported by the Schmidt Ocean Institute and the Coral Research and Development Accelerator Program, the team is surveying deep waters off the Argentine coast and training local researchers in seafloor mapping, species identification and remotely operated vehicle operations.

The work reflects a broader need he sees worldwide: building scientific baselines before offshore development accelerates. In Colombia, Cordes participated in a workshop organized by the Deep Ocean Stewardship Initiative and its Offshore Energy Working Group, which he founded in 2015. The goal was to advise the Colombian government on managing its expanding oil and gas activity in the Caribbean and its potential move into the Pacific. The discussions brought together representatives from the Colombian government and local universities.

"Development is starting to move into deeper water," he says. "We're helping them think about how to manage their offshore resources before industry moves in."

> **"We're finding extraordinary things down there. But if we lose those habitats before we understand them, we won't even know what we've lost."**
>
> **—Erik Cordes**
> **Professor of biology**

Erik Cordes leads numerous deep-sea expeditions, including a remotely operated vehicle dive on board the EV Nautilus research vessel. Image courtesy of Alex DiCiccio.

Science with purpose

Cordes also devotes significant effort to communicating science beyond the academic community. He teaches a course on science communication and collaborates with artists, filmmakers and musicians to make deep-sea research more accessible.

During the Argentina expedition, the Schmidt Ocean Institute livestreamed the dives online. One of the dives garnered over a million viewers, allowing people around the world to watch the discoveries in real time. "People were saying, 'This is what happens when you fund science.' It became a national moment," he says. "When people can see what's down there, they start to care. It builds public understanding and political will."

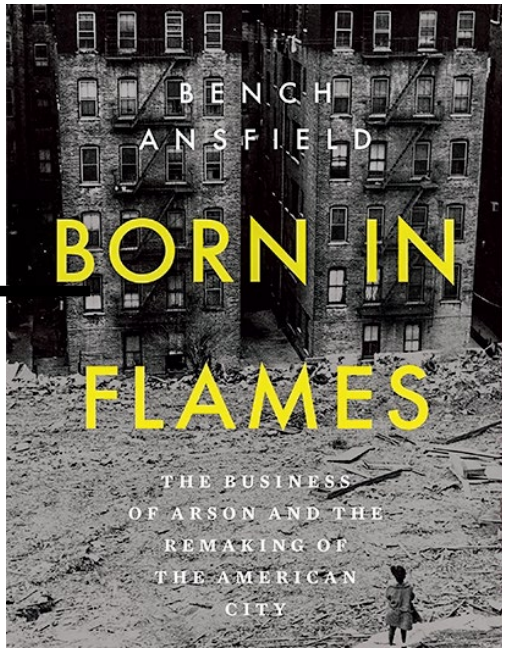
Recently, his lab partnered on a sculpture and augmented-reality installation at the entrance of Temple University's Bio-Life Building, which lets visitors experience a coral reef through both sight and sound.

A QR code allows visitors to look through their phones and see fish swimming through the sculpture, hear the sounds of the deep ocean and see particles of marine snow falling. "It's a way to bring the deep sea to people who will never get to go there," he explains. "We want people to understand that it's not an empty space. It's full of life, and it's connected to everything we depend on." At Temple, Cordes' work contributes to a growing research focus on sustainability and environmental resilience. Through field expeditions, restoration studies and international collaborations, his lab is helping build the scientific foundation needed to guide policy decisions before industrial pressures reach sensitive ecosystems. The work also gives students–from undergraduates and graduate students to postdoctoral researchers–hands-on experience with one of the planet's most complex environmental challenges.

"We're finding extraordinary things down there," he says. "But if we lose those habitats before we understand them, we won't even know what we've lost."

extra! extra! extra!

Sparking an idea



In *Born in Flames: The Business of Arson* and the *Remaking of the American City*, Assistant Professor of History **Bench Ansfield** examines what ignited the 1970s landlord arson wave in the Bronx and other U.S. cities.

According to **The New York Times**, which named the work one of its 100 Notable Books of 2025, "Deeply researched and masterfully told, *Born in Flames* is a definitive account of how race, risk and exploitative real estate have shaped the American city."

New tails

Led by Laura H. Carnell Professor of Biology **S. Blair Hedges**, researchers in Temple's College of Science and Technology identified 35 new species of forest lizards on Caribbean islands. Of the new species that have been discovered, more than half of them are at risk of extinction. Some may even already be extinct.

"They're disappearing, and they live in the same habitat as many other species, so it's kind of like a canary in a coal mine," Hedges explains in an interview with **E&E News by Politico**. "That indicates that there's trouble with the environment across many islands."

Top ranks

As an R1 institution, Temple cultivates the highest level of university research activity, and among Temple's faculty you'll find some of the most impactful researchers in their fields.

Featured on **Clarivate's Highly Cited Researchers 2025** list are three Temple researchers: **Gerard Criner**, chair and professor of thoracic medicine and surgery and director of the Temple Lung Center at the Lewis Katz School of Medicine; **Sudhir Kumar**, Laura H. Carnell Professor of Biology and director of the Institute for Genomics and Evolutionary Medicine (iGem) at the College of Science and Technology; and **Sergei Pond**, professor of biology in the College of Science and Technology. **Glen Stecher**, a senior programmer at iGem, was also recognized on the list.

The global data and analytics company compiles an annual list of researchers who've authored multiple research papers that rank in the top 1% of citations for their field and publication year.

Ally Micek, *FOX '19*, competed as a member of Temple's women's fencing team.

Joseph V. Labolito

She's got game

It has been proven time and time again that youth sports participation helps develop leadership skills and qualities in young people. But since leadership traits are stereotypically associated with masculinity, what does this mean as it relates to young women athletes and their takeaways from youth sports?

Associate professors **Elizabeth Taylor** and **Gareth Jones** of Temple's School of Sport, Tourism and Hospitality Management (STHM) studied the impact sports participation has on these female athletes. They found that female athletes are comfortable displaying leadership in some settings but not others.

"They felt like they could be aggressive," Taylor told **WHYY**. "They could be independent, but when we asked about how do you show leadership in the classroom, or how do you show leadership on the job ... They talked about how they felt the need to kind of work harder, while also softening those agentic traits."

Teaming up

A collaborative effort between Temple Athletics and STHM, the Athletic Innovation, Research and Education (AIRE) Lab is rethinking how academic research can be used to support athletic departments and student-athletes.

Its mission is to drive innovation in the management of athletic programs and college athlete development.

Assistant Professor **Jonathan Howe** and Associate Professor **Elizabeth Taylor** from STHM serve as co-directors of the lab and hope to integrate applicable academic research that is happening at Temple and STHM directly into Temple Athletics, which will ultimately help optimize the department and lead to a better experience for Temple's student-athletes.

"For me, the AIRE Lab allows us to break down some of the long-standing barriers we've had at the higher education level," Howe told **Inside Higher Ed**.

"Our hope is that this study can help reduce barriers and that these individuals will have more independent forms of transportation so that they can live independently and engage with their communities."

—Beth Pfeiffer, health and rehabilitation sciences professor in the Barnett College of Public Health, told **The Philadelphia Inquirer** upon receiving a $7.5 million grant from the Patient-centered Outcomes Research Institute to compare travel training approaches for helping young adults with intellectual and developmental disabilities learn to use public transportation.

Value Added

A new study from Fox School of Business faculty members Joydeep Srivastava (far left), Susan Mudambi and Subodha Kumar outlines how storytelling design is key for retaining reader engagement.

Betsy Manning, *KLN '87, CLA '08*

This headline worked, didn't it?

Since the dawn of newspapers in the 17th century, journalists and storytellers have relied on the same primary mechanism to capture a reader's attention: the headline and lede.

Today, those two elements of journalism remain as important as ever, especially since the rise of the internet and the advent of search engine optimization. However, a new study from Temple University's Fox School of Business finds that while headlines grab attention, it is storytelling design that ultimately determines whether an audience stays with a story.

"At a time when we are bombarded with more messages than ever before, this study is key as it provides a blueprint for how to both grab and retain an audience member's attention," said **Susan Mudambi**, professor emeritus of marketing, who co-authored the study with **Joydeep Srivastava**, the Robert L. Johnson Professor of Marketing and Supply Chain Management; **Subodha Kumar**, the Paul R. Anderson Distinguished Chair Professor of Statistics, Operations and Data Science; and **Debashish Ghose,** *FOX '23*.

For this large-scale observational study, the researchers examined how narrative form, emotional sequencing and reading complexity affect reader engagement when it comes to traditional and satirical news stories and looked at how these stories were posted by the same publisher on social media. Using advanced AI systems known as large language models, they then manipulated the narrative format, emotional sequence and reading level within the stories and created new versions.

The study shows that reader engagement depends on how each of the storytelling features interact. In traditional news, simple language broadly helps with reader engagement, but that does not mean complex language cannot work. When it is paired with a high level of narrativity and the story flows from bad to good, it can be successful.

For satirical publications, the researchers found that engagement rises when narrativity, emotional sequence and reading level match the audience's initial motivation for diving into the story.

For journalists and news organizations, the study provides a framework to consider when crafting both traditional and satirical news stories. It also offers guidance on what journalists should consider when working on longer-form, magazine-style pieces.

Stephen Orbanek

From reward to requirement: The new tipping culture

In recent years, tipping has expanded far beyond sit-down restaurants. What was once a way to reward good service has become an expected step in many transactions, sparking frustration, confusion and even guilt. A new study by **Lu Lu**, associate professor in the Fox School of Business and the School of Sport, Tourism and Hospitality Management, is helping unpack this cultural shift, revealing how consumers are emotionally reacting to pre-service tipping in an evolving service economy.

THE PREMISE

According to findings from the Pew Research Center in 2023, about 72% of American adults felt they were expected to tip more and tip in more situations compared with five years prior, even in cases in which service isn't directly provided.

THE QUESTION

How are consumers responding to pre-service tipping

THE EXPERIMENTS

The research team conducted two online experiments with more than 730 participants.

In the first study, participants were shown one of four coffee shop scenarios and asked about their emotional response, **whether the scenario felt realistic, how much the employee deserved a tip and how satisfied they were with their decision.**

In the second study, researchers added two more factors: **the timing of the tip prompt (before or after service) and the visibility of employee effort.**

TWO CONCLUSIONS

1 **Pre-service tipping often triggers negative emotions—** such as discomfort and uncertainty–especially when customers can't see the service being performed, when the request feels premature or when they sense they are being watched.

2 **But when participants can see employees making drinks, the process feels more open,** and tipping prompts feel fairer.

THE IMPLICATIONS

"Consumers want to know what they're tipping for and whether the service will deliver a quality experience."

—Lu Lu, associate professor in the Fox School of Business and School of Sport, Tourism and Hospitality Management

Research in Action
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