_ONLINE
EXELmagazine.org

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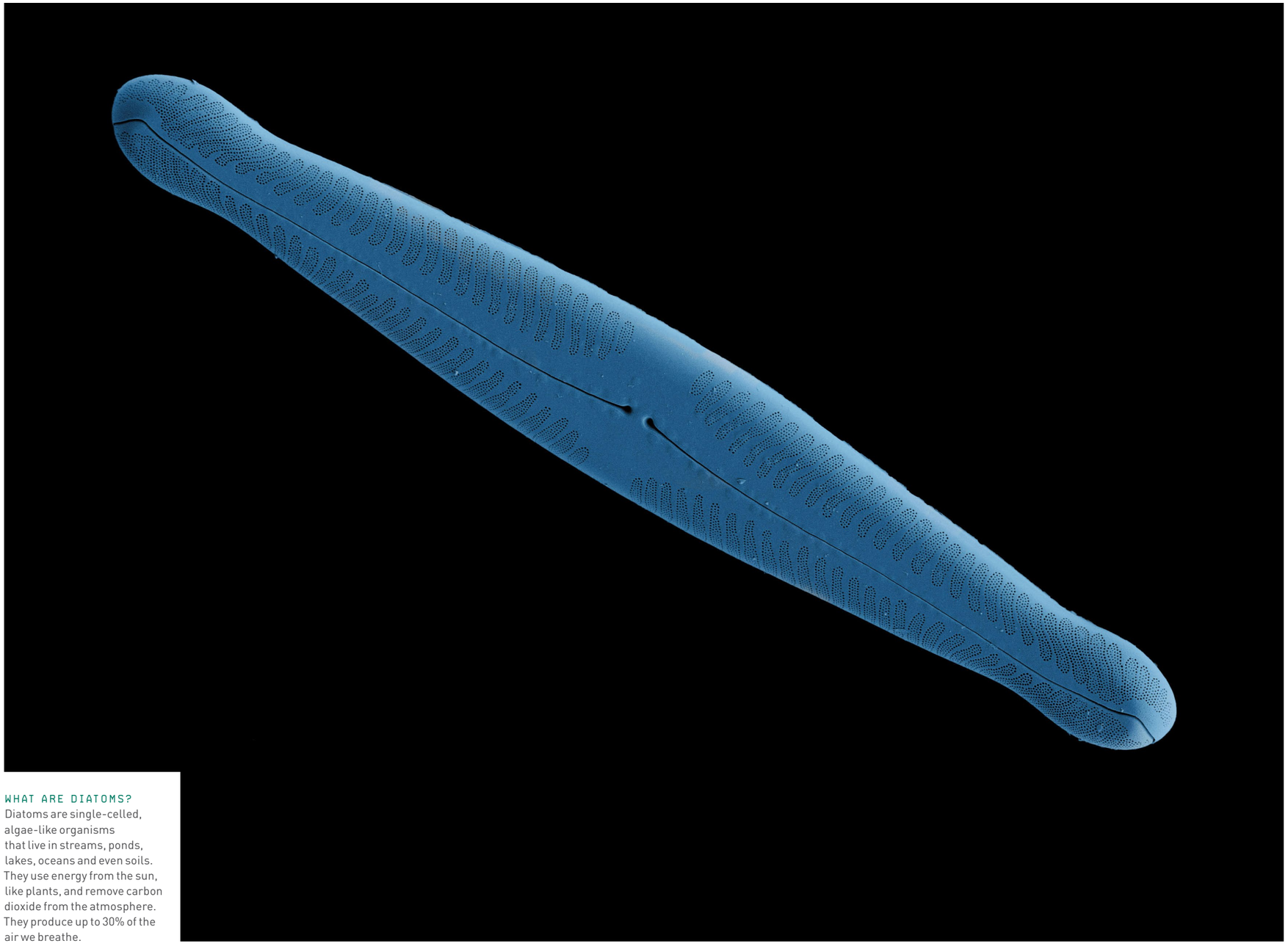
_INNER WORKINGS, SCRUTINIZED

A queen's timepiece, locked tight for centuries... Drexel's poweful 3D microscopy peers inside without turning a screw.

DIATOMS

_ONLINE
See the diatom repository at **diatoms.org**.



PINNULARIA FROM SHEELER LAKE IN KEYSTONE HEIGHTS, FLORIDA

WHAT ARE DIATOMS?
Diatoms are single-celled, algae-like organisms that live in streams, ponds, lakes, oceans and even soils. They use energy from the sun, like plants, and remove carbon dioxide from the atmosphere. They produce up to 30% of the air we breathe.

_THE DEMOCRATIZATION OF DIATOMS

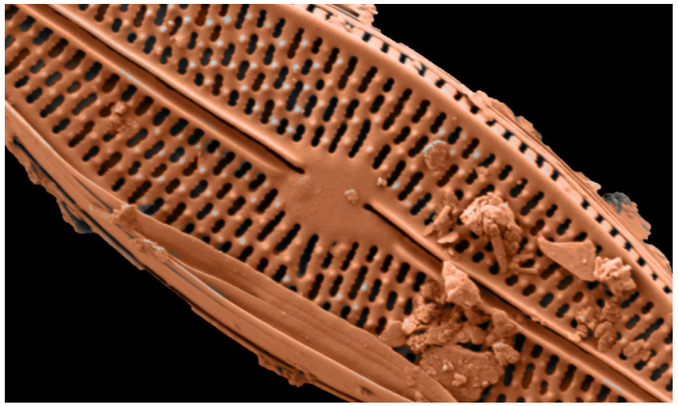
The Academy of Natural Sciences of Drexel University, home to the largest collection of diatoms in the Western Hemisphere, is collaborating on Diatoms.org, an online database that will serve environmental scientists around the globe.

In the centuries since Carl Linnaeus published his "Systema Naturae," taxonomists who name, define and classify biological organisms have become an endangered species.

Dwindling ranks of trained taxonomists pose a challenge for researchers who document biodiversity and maintain inventories used for monitoring environmental conditions and protecting wildlife. The trend is unfolding just as scientists are scrambling to study and record how environmental degradation and climate change affect varied species of plants and animals.

"There are fewer and fewer taxonomists, because there is not much support for that expertise," explains Marina Potapova, curator of the Diatom Herbarium at the Academy of Natural Sciences of Drexel University and an associate professor in the College of Arts and Sciences.

With that expertise in decline, Potapova and other biologists are supporting ongoing discovery in the field through a technological assist. They're building a repository of data on diatoms, which are microscopic, algae-like organisms (part of an ancient single-cell kingdom that is neither plant, animal nor true fungus, known as *protists*) that live in fresh and saltwater. Because they are very particular about the quality of water in which they dwell, diatoms are used by ecologists to monitor changes in aquatic ecosystems that affect water nutrients, suspended sediments, flow rate and elevation.



WHY DO DIATOMS MATTER?
Diatoms produce long-chain fatty acids, creating a feast for the ecosystem of zooplankton, aquatic insects, fish and whales.

Potapova and a group of diatom researchers established Diatoms.org, a robust digital platform for recording the diversity of diatom species in North America. The website will serve as a clearinghouse for information about new and previously known diatom species. It received foundational support from the U.S. Environmental Protection Agency, the U.S. Geological Survey and the Institute of Arctic and Alpine Research at the University of Colorado Boulder, which maintains it.

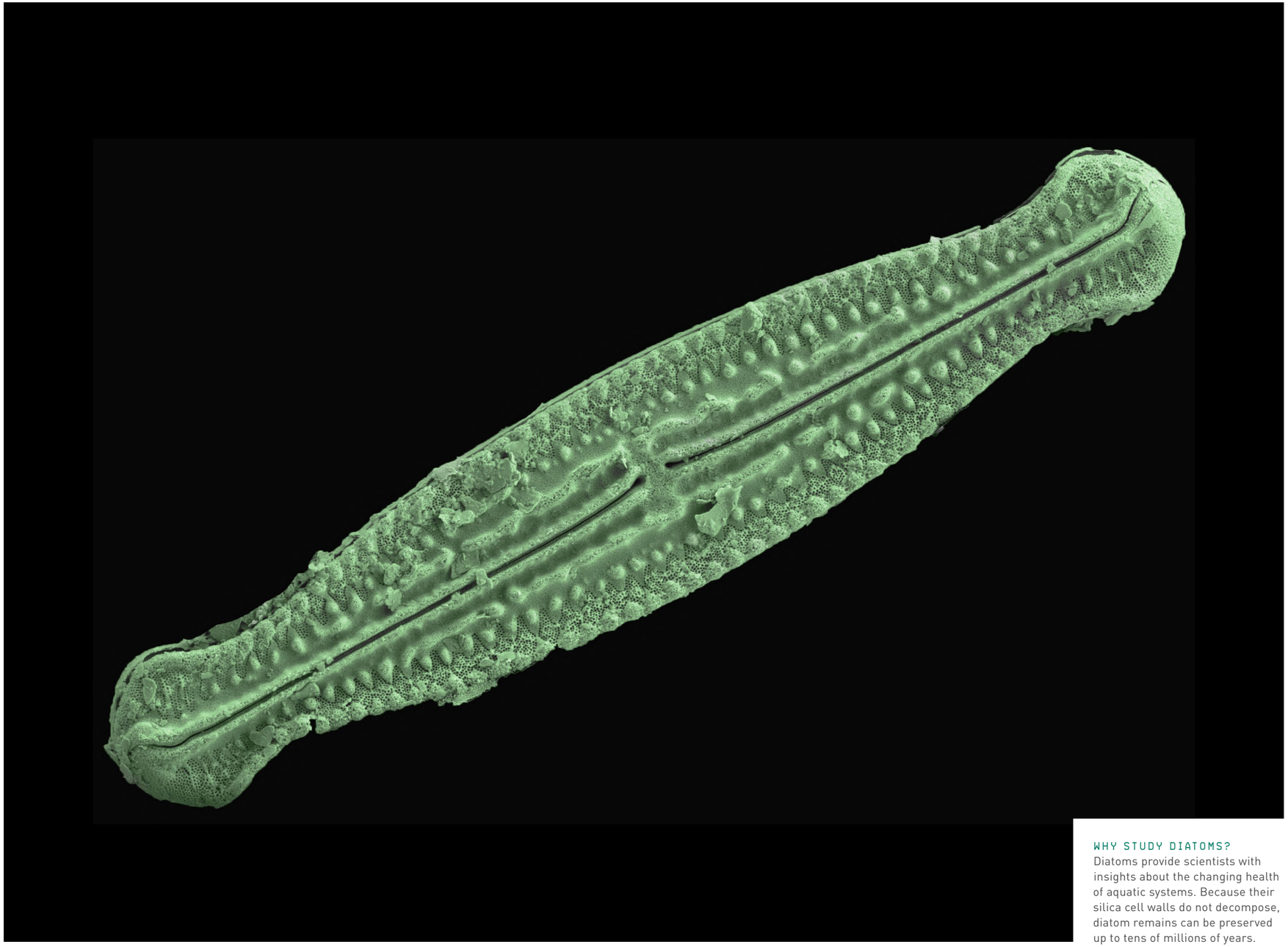
The project puts a modern spin on old-school science, largely by advancing a uniform set of standards for describing and recording diatom species — of which anywhere from 20,000 to 2,000,000 may exist — as new varieties are discovered each year.

Applying consistent standards for species identification serves the interests of science, Potapova says, noting that taxonomists have not historically followed uniform conventions. An editorial board on which Potapova serves reviews submissions of new or previously identified species.

"Right now, all this taxonomy is all spread out and balkanized in different books," Potapova says. "Just a few laboratories around the world have enough resources to buy all these books. What we're trying to do is also democratize the science."

While satisfying a need in the scientific community, the website also provides the general public with digestible information, explaining diatoms' role as an early indicator of waterway health, offering sortable directories of fresh and saltwater species, and featuring images of the tiny see-through silica shells they leave behind that illustrate their ornate beauty.

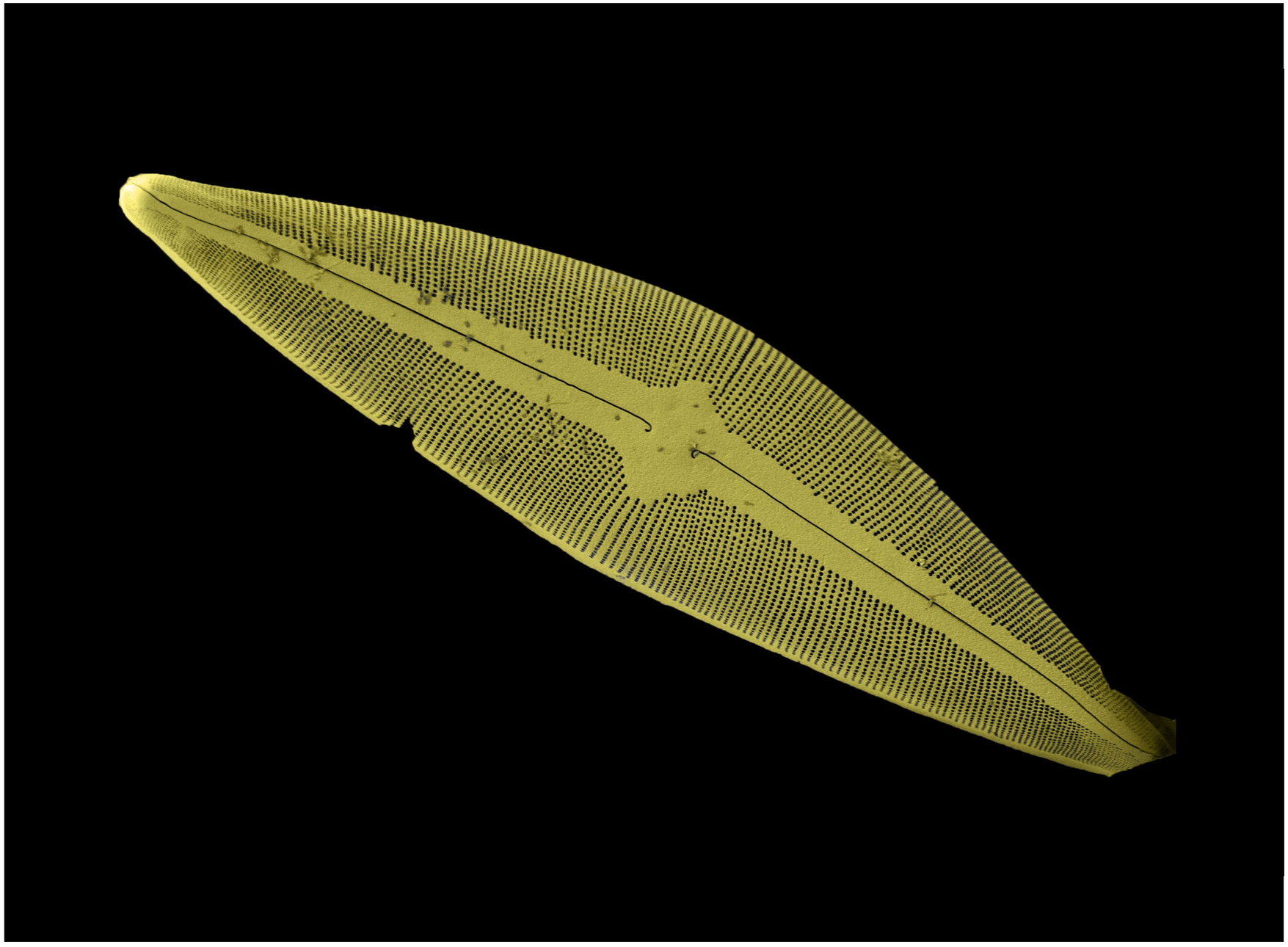
The website has proven its research value, Potapova says, and has already received "tons" of citations in academic journals.



WHY STUDY DIATOMS?
Diatoms provide scientists with insights about the changing health of aquatic systems. Because their silica cell walls do not decompose, diatom remains can be preserved up to tens of millions of years.

(LEFT) *PINNULARIA* FROM WRIGHTS POND IN MECHANICSVILLE, VIRGINIA; (ABOVE) *BRACHYSIRA* FROM GOOBER POND IN WHITING, NEW JERSEY

DIATOMS

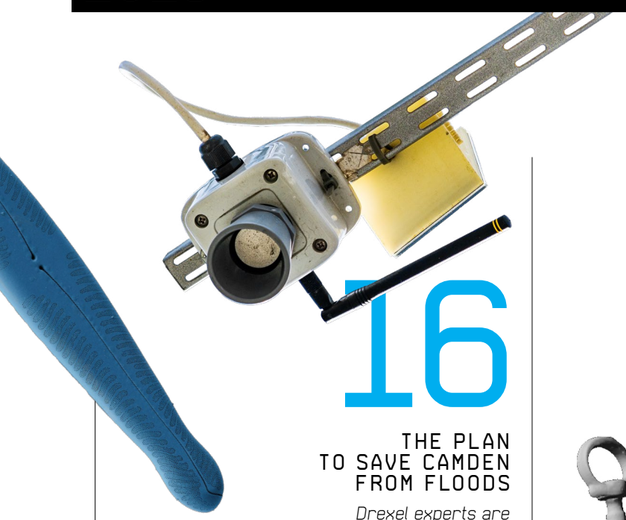


DATABASE OF BEAUTY

The new diatoms.org database is an opportunity to establish consistent standards for species identification. It also opens a window into the delicate, intricate beauty of this microscopic species.

(LEFT) *CYMBOPLEURA* FROM NOYES POND IN HANCOCK, MAINE; (RIGHT) *EUNOTIA* FROM SLAB POND IN MEDFORD, NEW JERSEY

2025



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THE PLAN TO SAVE CAMDEN FROM FLOODS
Drexel experts are helping a city on the edge of the climate crisis bring its stormwater infrastructure into the 21st century. _by Ben Seal

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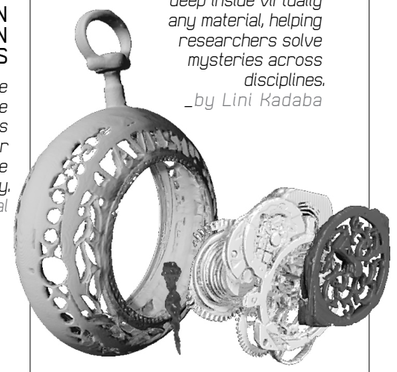
A powerful new instrument in Drexel's science portfolio peers deep inside virtually any material, helping researchers solve mysteries across disciplines. _by Lini Kadaba



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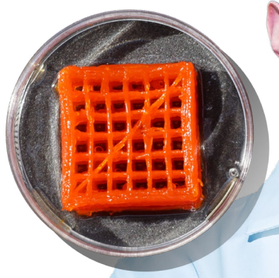
BREAKTHROUGH IN THE BAY OF BENGAL
During an intensive summer in India, two Drexel first years learned the rhythms of research, the value of mentorship and the power of going off-script thanks to Drexel's revitalized undergraduate research program. _by Nat Kaemmerer



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THE MAKING OF A SCIENTIST CEO
From a spark of curiosity in high school chemistry to co-founding a cutting-edge nanomaterials startup, Greg Schwenk's path to becoming CEO of One-D Nano was fueled by Drexel's entrepreneurial ecosystem. _by Natalie Kostelni

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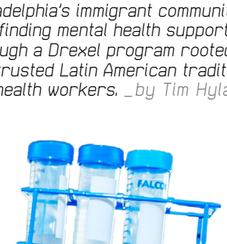
SILENCE, STIGMA AND THE POWER OF PROMOTORAS
Philadelphia's immigrant communities are finding mental health support through a Drexel program rooted in the trusted Latin American tradition of lay health workers. _by Tim Hyland



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THE SCIENCE SHOP IS OPEN
Using a community science model pioneered in Europe, the Academy of Natural Sciences of Drexel University is reimagining where research questions begin. _by Ben Seal

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CANCER SCIENCE WITHOUT SILOS
With Drexel experts from non-medical fields joining the Sidney Kimmel Comprehensive Cancer Center, oncologists have the integrative strength to move novel treatment into action. _by Lini S. Kadaba

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Science aligned with learning.

10
_PUBLIC HEALTH
Clean water, seizure meds, cancer diets, autism screening, **fish oil and autism**, toxin-free lawns, foster care.

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_CULTURE/SOCIETY
Intergenerational housing, phishing, creative flow, telehealth, Instagram self-help, ancestral age, mascara R&D, **vape marketing**.

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Drexel experts are investigating new applications for **artificial intelligence** and working with government agencies to ensure the technology is effective, accountable and safe.

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_TECH/SCIENCE
Dye filter, self-healing concrete, bridge monitor, kirigami antenna, **lighter satellite loads**, thermal coatings, ozone, ballooning for science.

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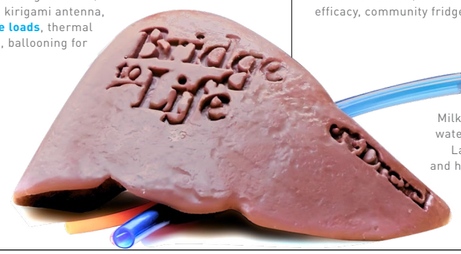
_MEDICINE
Covid severity, brain biome, wandering minds, **mock organs**, hormones and hearing, alzheimer's code, vaccine efficacy, community fridge.



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Milky Way snapshot, Schuylkill water shortage, study of ducks, Latin America flooding, ants and heat, brains on beauty, map of environmental needs.

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The beauty and science of microscopic diatoms are now preserved in a database created with the Academy of Natural Sciences of Drexel University.

E X E L
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EXEL Magazine is published biennially by the Division of University Marketing and Communications
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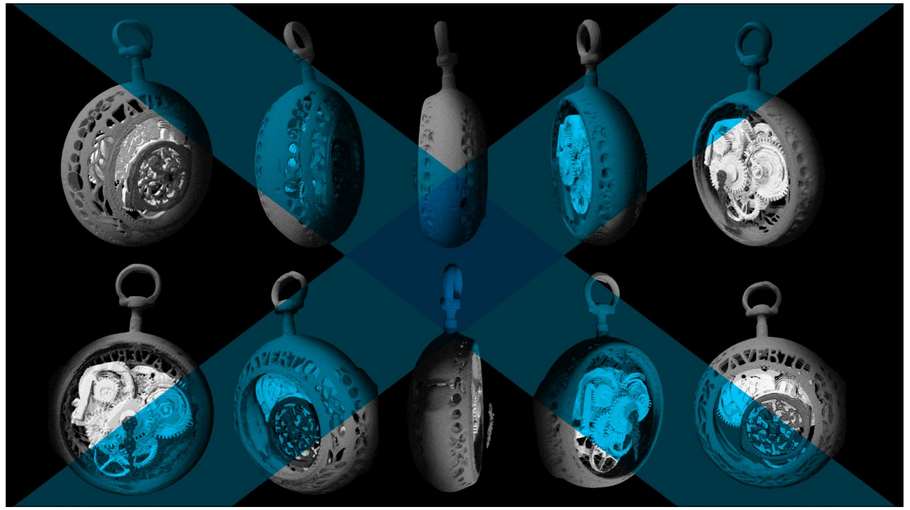
_REAL-WORLD RESEARCH

Science with a social conscience, aligned with learning.



_ABOUT THE COVER
This antique timepiece was scanned using Drexel's Zeiss Xradia 620 Versa nanoCT microscope, which produces detailed 3D images without damaging the object. The scans were expertly edited by Bita Soltan Mohammadlou, a doctoral student in mechanical engineering at the Drexel Nanomaterials Institute.

IT IS A TREMENDOUS privilege to be writing to you as Drexel University's newest president. Since stepping into this role in July, I have been struck by the clarity of Drexel's mission: to connect knowledge and practice, research and impact, education and opportunity.

That mission resonates deeply with me. Growing up just outside of Milan, conversations about higher education never came up at the dinner table. My parents, though two of the hardest-working people I have ever known, never attended college.

So when I was offered a scholarship to pursue a PhD in economics in the United States, I was elated. It changed the trajectory of my life. The ways I have been able to engage in my research and guide our next generation of scholars since has been exceptionally fulfilling. Joining Drexel has reinvigorated that desire in me to work toward ensuring talented students get the educational opportunities they deserve, no matter their background.

Anthony J. Drexel founded this institution with a mission to make education accessible to all. Expanding on that notion, we continue our efforts at Drexel of championing an *experiential* education for all. This includes experiences in the classroom, in the field, in the workplace, and in labs — across the city, state, country and world. The important, innovative work highlighted throughout this publication showcases Drexel's great contributions to society and the influence we can collectively have on the globe as an R1 research university.

Our faculty work tirelessly to move the needle on their scholarship, and, as you will read here, they frequently do so in partnership with neighborhood organizations, nonprofits and local institutions. At the same time, they teach, advise and mentor our students, who garner research experience — sometimes starting the summer before their first year on campus — sparking lifelong curiosity and purpose. You will read about the Drexel community's work fighting flood damage that threatens homes, addressing mental health stigma, and connecting cancer research to lived experiences, among many more examples.

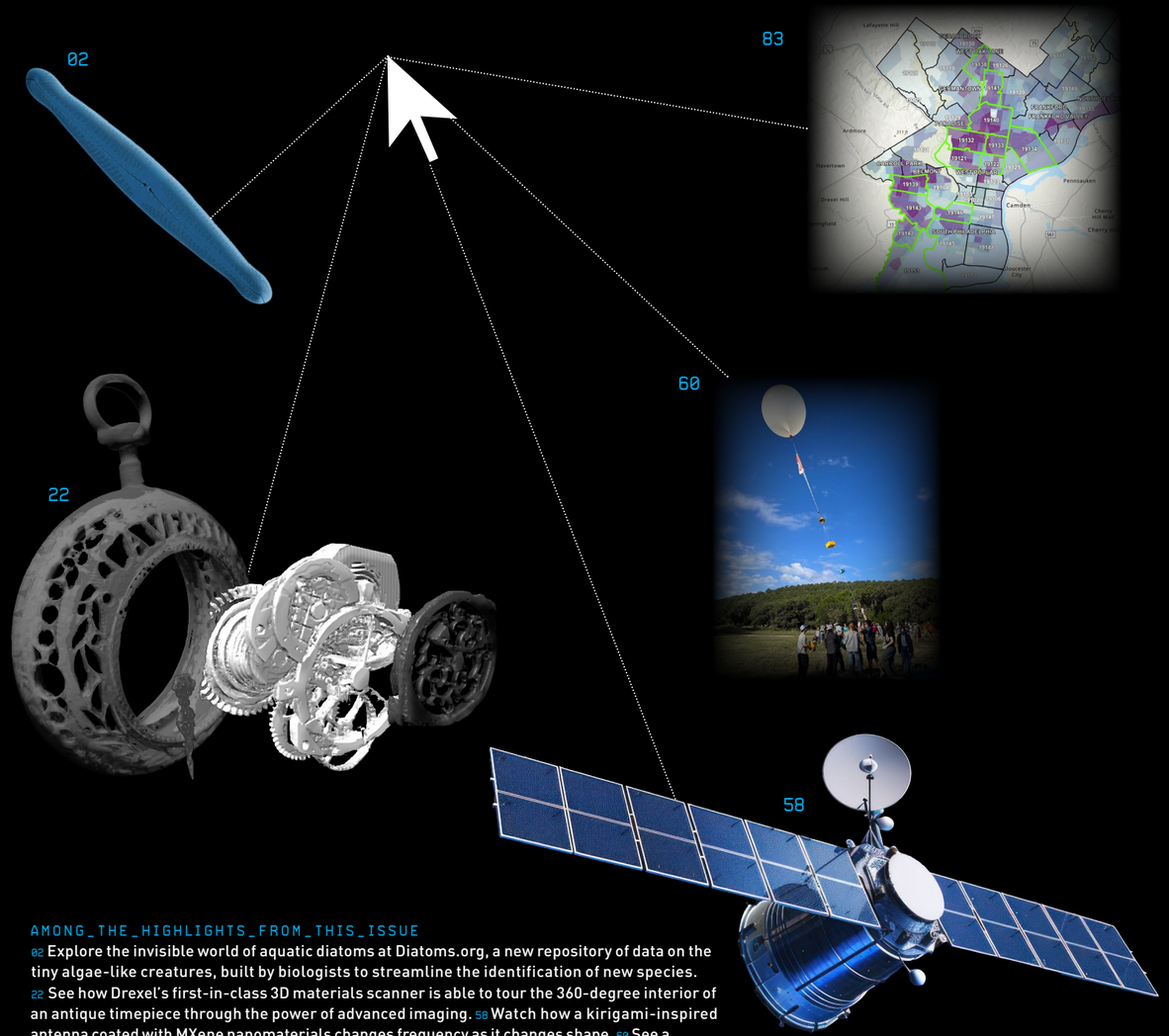
We present this edition not only as a précis of Drexel's research achievements, but also as a window into our distinctive approach to scientific education. As higher education continues to evolve, our model affirms the value of connecting research, teaching and community engagement in ways that prepare students to lead and contribute meaningfully to our world.

Sincerely,

Antonio Merlo / President

_EXPLORE *EXEL* ONLINE

Visit EXELmagazine.org for exclusive coverage of Drexel's growing research enterprise with online-only videos and extra content.



AMONG_THE_HIGHLIGHTS_FROM_THIS_ISSUE
02 Explore the invisible world of aquatic diatoms at Diatoms.org, a new repository of data on the tiny algae-like creatures, built by biologists to streamline the identification of new species. 22 See how Drexel's first-in-class 3D materials scanner is able to tour the 360-degree interior of an antique timepiece through the power of advanced imaging. 58 Watch how a kirigami-inspired antenna coated with MXene nanomaterials changes frequency as it changes shape. 60 See a slideshow narrative of the Drexel team tackling the Nationwide Eclipse Ballooning Project, which challenged more than 50 student engineers across the country to conduct a research mission during the 2023 and 2024 solar eclipses. 83 Explore the Environmental Justice Index, a powerful interactive tool that pinpoints the neighborhoods in Philadelphia that face the greatest environmental burdens.

SANITATION

_A BLUEPRINT FOR CLEAN WATER

*A collaboration between Drexel researchers, FMC Corp. and nonprofit partners is **delivering safe drinking water** to rural India – and establishing a model for future impact.*

In parts of rural India, something as basic as clean drinking water can shape a person's entire future. A partnership between Drexel, FMC Corp. and the nonprofit Community Pure Water is helping by bringing safe water to 56 villages across six states, and showing how universities and companies can team up to make a lasting impact.

"Access to safe, affordable and reliable water, sanitation and hygiene is essential to improving living standards in rural communities," says Ravi Annavarapu, president of FMC India, an arm of the global agricultural sciences company based in Philadelphia. "When farming families and villages are healthier, all aspects of life begin to improve."

Over three years, FMC India provided $1 million to establish reverse-osmosis water purification centers, which were installed by Community Pure Water, a nonprofit that provides drinking water in rural Indian communities. The University orchestrated the academic–industry collaboration, shaping the success of the initiative with a sustainable funding model and research and assessment to ensure meaningful results.

To measure the project's impact, an interdisciplinary team of Drexel researchers assessed both the health benefits of the water purification centers and community perceptions of FMC's corporate responsibility efforts. Experts from the Academy of Natural Sciences of Drexel University, Dana and David Dornsife School of Public Health, Bennett S. LeBow College of Business, and the School of Education conducted pre- and post-

The University orchestrated a collaboration between FMC-India, which provided water purification devices, and Community Pure Water, which installed them. Faculty gauged villagers' reactions and fine-tuned the rollout.

installation evaluations over three years. Their findings showed measurable progress in expanding access to safe drinking water and increasing recognition of FMC's leadership in the effort.

"The success of this demonstrates that we can confidently use the operational model we established here with other partners in the future," says Raj Suri, senior vice provost for academic industry partners at Drexel.

The research suggested some improvements, such as finetuning messaging, optimizing training of FMC's field personnel, and enhancing water plant operations — leading to a replicable model for future industry–university partnerships that tackle global challenges.

A data dashboard, created through the partnership, will allow FMC to track the water plants and refine future efforts.

LeBow researchers found that while perceptions of FMC's corporate social responsibility were positive, the messaging needed refinement to drive greater adoption.

"It was important to bring in the leaders of these villages from the beginning," says Cuneyt Gozu, associate clinical professor of organizational behavior at LeBow. "Many villagers can't read, so the pamphlets and fliers that were created were of little use; however, they trust village leaders. Once we changed the approach and channel, the data got better."

With stronger outreach and increased trust, more villagers turned to the treated water supply over time, reinforcing the initiative's long-term benefits.

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_1 SITE A structure that houses the water purification system. **_2 CONTAINMENT** Several full water containers ready to be delivered throughout the village. **_3 PURIFICATION** The mechanical system that purified water, making it accessible and potable for residents of the village. **_4 EDUCATION** Volunteers and villagers discuss how the system works.

_5 COLLECTION Containers used to collect and deliver water from water centers. **_6 COMMUNICATION** Researchers learned that communications from leaders were more important for adoption than signage and posters.

_RAJ SURI
Suri is senior vice provost for academic industry partnerships in the Bennett S. LeBow College of Business.

_CUNEYT GOZU
Gozu is an associate clinical professor of organizational behavior in LeBow.

PHARMACOLOGY

_RISKS OF SEIZURE MEDS

Some medications used to manage seizures and psychiatric conditions may ***increase the risk of neurodevelopmental disorders*** *for children during pregnancy.*

Mothers-to-be who rely on medications to manage seizures and psychiatric conditions during pregnancy face a difficult dilemma: The drugs that help manage their health may also pose risks to their unborn child. Data published in *Nature Communications* from researchers at the Dana and David Dornsife School of Public Health indicate that exposure to valproate, topiramate and carbamazepine leads to some additional risk of autism or intellectual disability — though the absolute risk is low.

"Our findings suggest that while certain medications may pose some risk, lamotrigine may be a less risky option," says co-senior author Brian K. Lee, a professor in the Dana and David Dornsife School of Public Health. "Active monitoring of any antiseizure medication is critical to ensure safety and effectiveness, particularly during pregnancy."

The study analyzed data from over three million children in the United Kingdom and Sweden — including 17,495 who were exposed to antiseizure medications before birth. Children exposed to topiramate in the womb were 2.5 times more likely to be diagnosed with intellectual disability by age 12, raising their risk to 2.1% compared to unexposed children.

Nonetheless, the researchers do not suggest avoiding these medications entirely. Instead, they encourage patients to discuss their options with their doctor to find the safest and most effective treatment.

Previous findings have also linked valproate, topiramate and carbamazepine with neurodevelopmental diagnoses in offspring, such as autism, intellectual disability and ADHD.

Despite the study's large sample size, the authors emphasize the need for further research across multiple countries to assess the safety of these drugs, especially as new treatments emerge.

_BRIAN K. LEE
Lee is a professor in the Dana and David Dornsife School of Public Health.

CANCER

_DIET DILEMMAS IN GI CANCER CARE

Nutrition guidance could make all the difference for patients with GI cancer and their caregivers, who face major hurdles in maintaining a healthy diet.

_BRANDY-JOE MILLIRON
_ANN C. KLASSEN
Milliron is an associate professor in the College of Nursing and Health Professions and Klassen is a professor in the Dana and David Dornsife School of Public Health.

Eating well during gastrointestinal (GI) cancer treatment is easier said than done. Side effects like fatigue, nausea and loss of appetite can make proper nutrition a struggle — not just for patients but also for their caregivers, who often provide meal support while juggling their own physical and emotional stress.

A study published in *Cancer Control* from researchers in the College of Nursing and Health Professions (CNHP) and the Dana and David Dornsife School of Public Health explored the dietary challenges and support systems available to GI cancer patients and their caregivers.

Findings indicate that caregivers often feel underprepared for the role, lacking confidence in managing treatment side effects and unsure how to help patients eat healthily. They often neglect their own emotional and physical needs.

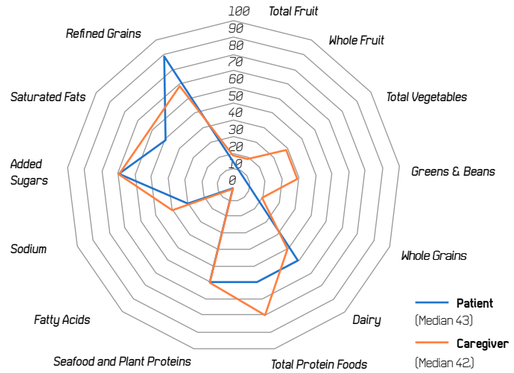
"In addition to barriers, we also found areas that supported healthy eating for both patients and their caregivers, including a heightened awareness and appreciation for nutrition, the influence of key support people and positive coping strategies," says lead author Brandy-Joe Milliron, an associate professor from CNHP.

Twenty-seven patient–caregiver pairs undergoing outpatient chemotherapy completed surveys, dietary assessments and interviews to assess caregiver preparedness, symptom management and barriers to maintaining a healthy diet.

Dietary quality showed room for improvement, with healthy eating scores of 43 out of 100 for patients and 42 for caregivers.

Understanding their experiences and habits can help health care professionals support caregivers in improving nutrition to ease treatment side effects — benefiting both patients and caregivers by reducing distress and improving overall health.

Prior research, including the researchers' own, confirms that patients with cancer and their families often search for meaningful actions they can take to regain control of some aspects of their lives during this challenging time, adds Dornsife School of Public Health Professor and senior co-author Ann C. Klassen. Tailored nutrition counselling during cancer treatment can offer caregivers psycho-social support, knowledge and problem-solving skills.



_MENU MAP
This radar plot shows how closely patients and caregivers followed recommended dietary guidelines. Each point represents a different food group, with scores closer to the outer edge indicating better alignment with the guidelines. On average, patients scored 43 out of 100, and caregivers scored 42, suggesting room for improvement in overall diet quality.

AUTISM

_THE POWER OF EARLY AUTISM SCREENING

Standardized screenings, rather than usual care, are better at ***identifying children with a high likelihood for autism*** *at a younger age.*

For children with autism, early diagnosis can make a lifelong difference — but how early depends on how doctors screen for it. Researchers from the A.J. Drexel Autism Institute found that using a standardized autism screening tool during routine pediatric visits helps identify more children on the spectrum at a younger age, even those with subtle symptoms.

Published in *The Journal of the American Academy of Child & Adolescent Psychiatry*, the study compared the effectiveness of standardized autism screening using the Modified Checklist for Autism in Toddlers, Revised, with Follow-Up (M-CHAT-R/F) to usual care, which relies on unstandardized screenings or clinical judgment for referrals.

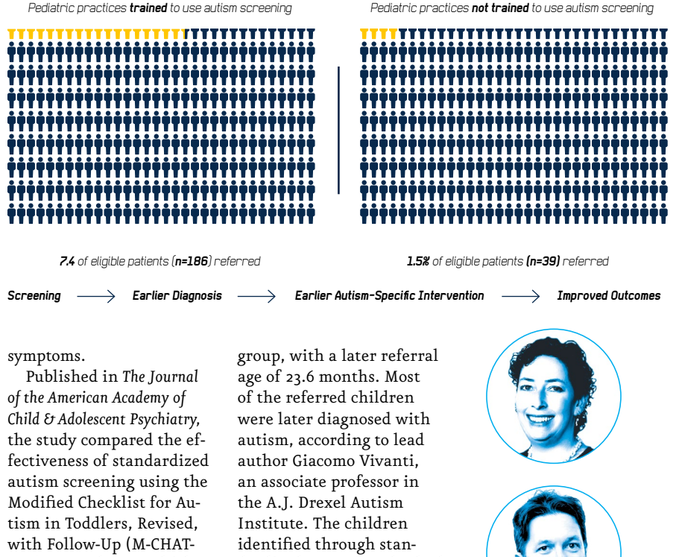
Thirty-one pediatric practices were randomly assigned to use either the M-CHAT-R/F screener or usual care during 18-month well-child visits. Toddlers flagged for autism likelihood were referred to the research team for diagnostic evaluation.

The difference was striking. In practices using standardized screening, 186 children in both groups were referred for a diagnostic evaluation at an average age of 20.6 months. In contrast, only 39 children were referred in the usual care group, with a later referral age of 23.6 months. Most of the referred children were later diagnosed with autism, according to lead author Giacomo Vivanti, an associate professor in the A.J. Drexel Autism Institute. The children identified through standardized screening also had a wider range of clinical presentations, including milder delays in areas like language and cognition.

"The earlier identification of autism allows for autism-specific early intervention at a younger age, which improves outcomes across the rest of their lives," says principal investigator Diana Robins, director of the Autism Institute and creator of the M-CHAT-R/F.

The authors hope that studies like this influence both policy and practice to give all autistic children the opportunity to get needed supports and services early in their lives.

_AUTISM REFERRALS
Pediatric practices using standardized autism screenings referred 147 more children for evaluation, leading to earlier and more accurate diagnoses.



_DIANA ROBINS
_GIACOMO VIVANTI
Robins is director of the A.J. Drexel Autism Institute and Vivanti is an associate professor.

AUTISM

_SEAFOOD FOR THOUGHT

Eating whole fish during pregnancy – rather than omega-3 supplements – may be one of many factors linked to a ***lower likelihood of autism.***

_KRISTEN LYALL
Lyall is an associate professor and chair of the Department of Epidemiology and Biostatistics.

Federal guidelines for Americans recommend that pregnant people eat at least two to three servings of seafood per week to support fetal brain development. Yet in the United States, prenatal fish consumption is generally low.

Research from Drexel's A.J. Drexel Autism Institute, Harvard Medical School, and Harvard Pilgrim Health Care Institute continues previous work that has found eating fish, but not omega-3 supplement use, may be associated with a lower likelihood of autism diagnosis and related traits in children. Autism is a developmental disorder with many causes; genetics play a strong role.

Researchers analyzed data from 10,800 pregnancies across 23 National Institutes of Health (NIH) research sites for fish consumption and 12,646 pregnancies across 35 sites for omega-3 supplement use, comparing these factors with clinician-diagnosed autism and autism-related traits reported by parents or caregivers. Information was collected between 1999 and 2020.

Despite the health benefits of fish consumption, about a quarter of study participants reported eating no fish during pregnancy, and even fewer reported taking omega-3 supplements.

Kristen Lyall and co-author Emily Oken, MD, a professor in Harvard Medical School and Harvard Pilgrim Health Care Institute, believe these findings indicate a need for better public health messaging.

"This study provides yet more evidence for the safety and benefit of regular fish consumption during pregnancy," says Oken. "Other proven benefits include lower risk for preterm birth and improved cognitive development. Pregnant people should aim to consume a variety of fish types at least twice weekly."

The study was funded by the NIH's Environmental Influences on Child Health Outcomes program and published in *The American Journal of Clinical Nutrition*.

_HOME TURF

A group of students put organic turf management to the test – and their research is ***transforming how Drexel maintains its green spaces.***

LUSH, GREEN LAWNS may look pristine, but keeping them that way can come at an environmental cost. A group of Drexel students set out to address the problems that toxic synthetic herbicides pose — starting with their own campus.

The students piloted an organic turf management project at one of the University's campus parks, testing natural alternatives to reducing pests and weeds.

Their results — denser grass, healthier soil and positive student reception — helped persuade the University to transition to a fully organic turf model across campus in 2024. Other universities that have made the switch report lower costs over time due to reduced fertilization and irrigation.

The project was spearheaded by Toxic Free Philly Drexel, a student organization founded by Kacy Gao, biological sciences '25, and affiliated with the citywide organization Toxic Free Philly, as well as Re:wild Your Campus.

The team collaborated closely with Drexel's Grounds Maintenance Director Scott Dunham to test the efficacy of their organic turf model.

"We thought that by looping in students with this research, it would make Drexel administrators more receptive to the idea and more confident in the organic turf transition," Gao says.

To replace synthetic chemicals, the team swapped in organic applications like gypsum, a soil conditioner, and adjusted overseeding and aeration practices to promote grass growth that could outcompete weeds. Their efforts led to increased turf density and a more balanced soil pH.

The students developed their own research methods with input from Anneclaire De Roos, associate professor of environmental and occupational health in the Dana and David Dornsife School of Public Health.

They used the Braun-Blanquet ecological survey method to assess turf density and weed coverage. By randomly tossing a one-square-meter PVC frame onto their test and control lawns on campus, they recorded how much of each square was filled by turf, weeds or bare soil.

They're continuing to refine the University's organic turf management strategy with Drexel Grounds and support from The Environmental Collaboratory's Climate Hub Student Project Fund.

_KACY GAO
Gao, biological sciences '25, steered the project as project lead of Toxic Free Philly Drexel.

_GREEN PARTY
_1 On a research day, the scientists toss a one-square-meter PVC pipe to measure turf and weed density. _2 Kacy Gao announces the expansion of the project at Civic X EarthFest. _3 The group of students responsible for the study celebrate on the turf at Lancaster Walk on Drexel's University City campus in West Philadelphia. In the spring, Drexel received a Green Grounds Certification from the advocacy group Re:wild Your Campus for efforts to promote sustainable groundskeeping.

_THE INTERSECTION OF FOSTER CARE AND DISABILITY

The number of at-risk youth with intellectual and developmental disabilities in foster care is growing, raising urgent questions about equal treatment in health and support services.

_LINDSAY SHEA
Shea is an associate professor and the director of the Policy and Analytics Center in the A.J. Drexel Autism Institute.

YOUTH WHO SPEND time in the foster care system face increased risks for mental health challenges, trauma and poorer outcomes in adulthood than their peers. For those with disabilities — including autism spectrum disorder (ASD) and intellectual disability (ID) — the situation is even more critical. Yet little is known about how these young people access and use essential services that can improve their lives.

Understanding access and service use matters because the number of foster youth with intellectual and developmental disabilities (I/DD) has grown significantly in recent years. Overall, children in foster care are two to five times more likely to have ASD or ID than other children nationwide.

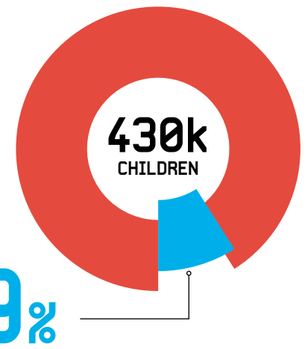
To assess the situation, researchers at Drexel's A.J. Drexel Autism Institute, along with colleagues from George Mason University and the University of North Carolina at Chapel Hill, analyzed 2016 national Medicaid claims data.

Because Medicaid is the largest insurer for both youth with I/DD and those in foster care, it plays a critical role in connecting them to needed services, though differences between local and federal governments may interfere with these systems working together effectively.

Their study, published in the *Journal of the American Medical Association* (JAMA) *Pediatrics*, offers a first-of-its-kind, intersectional analysis of how foster care involvement has evolved for youth with I/DD.

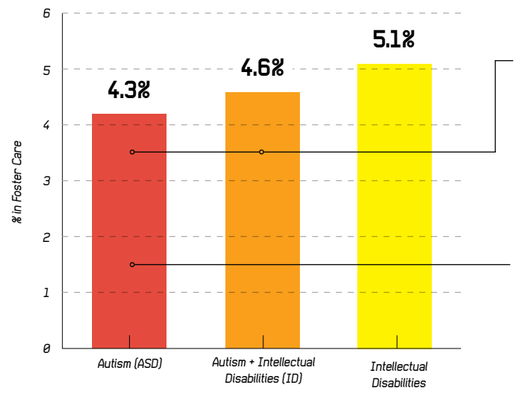
"Understanding the involvement of youth with intellectual and developmental disabilities in the foster care system is an important first step in identifying priorities for needed policy and program change," says Lindsay Shea, associate professor and director of the Policy and Analytics Center at the Autism Institute, and lead author on this study.

Autism research has not kept pace with the need for including varied experiences, showcasing a true picture of the lives and needs of autistic people and those who care for them. However, using secondary data sources like Medicaid claims offers a powerful way to observe experiences and stories that have not been told before. The findings highlight opportunities to strengthen supports for youth with I/DD in foster care — helping to close gaps and improve outcomes for this population.



More than 9% of the 430,000 children in the U.S. foster care system had intellectual developmental disabilities, according to 2016 data.

_FOSTER CARE PARTICIPATION RATES

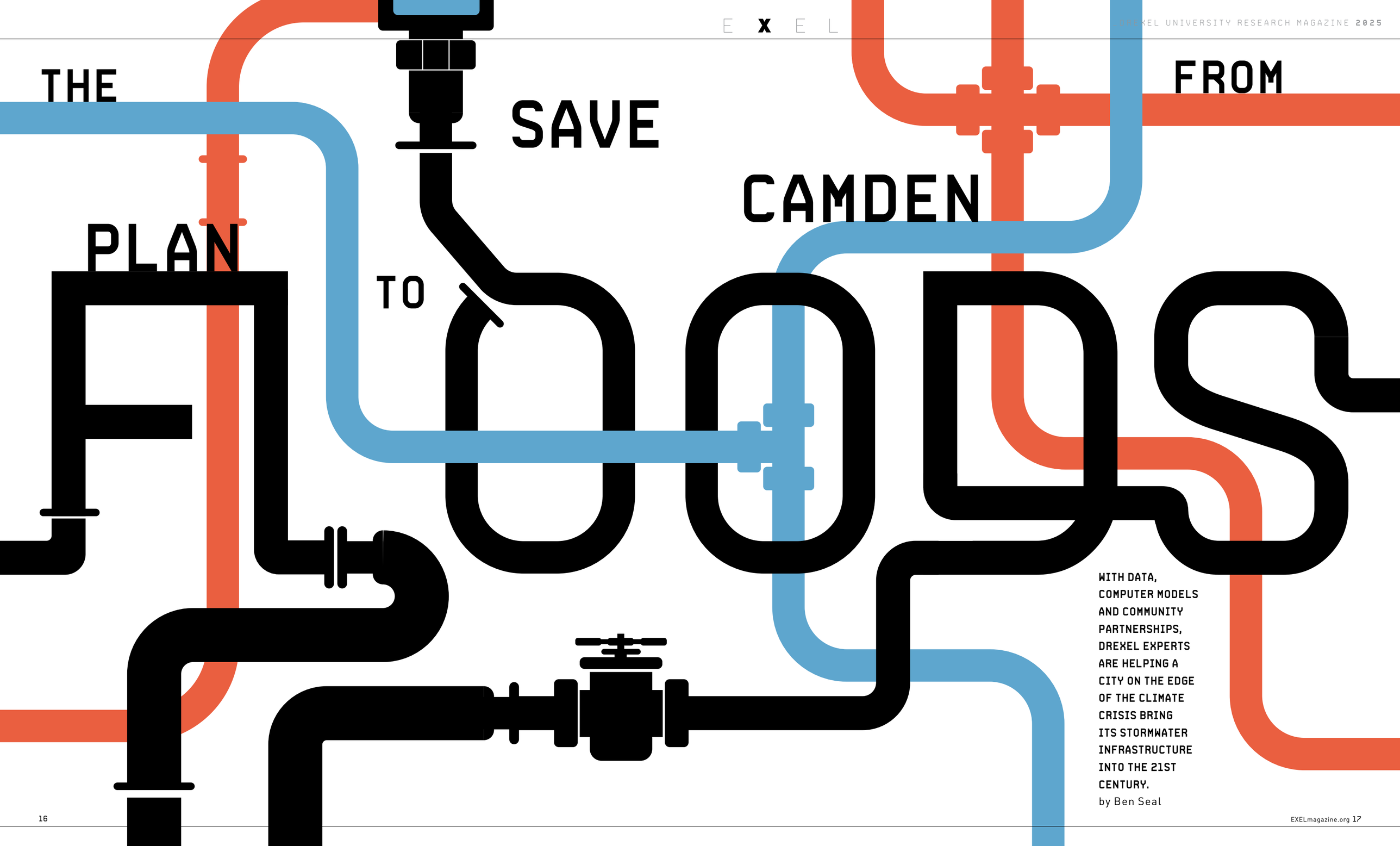


2x+
Teenagers were **more than twice** as likely to be in foster care compared to children under age 5.

37%
Black children with ASD or ASD+ ID were **37%** more likely — and up to 2.3X with ID alone.

35%
Girls with ASD are **35%** more likely to enter foster care than boys with the diagnosis.

THE PLAN TO SAVE CAMDEN FROM



WITH DATA, COMPUTER MODELS AND COMMUNITY PARTNERSHIPS, DREXEL EXPERTS ARE HELPING A CITY ON THE EDGE OF THE CLIMATE CRISIS BRING ITS STORMWATER INFRASTRUCTURE INTO THE 21ST CENTURY.

by Ben Seal

LAT

THE NORTHERN TERMINUS OF CAMDEN, NEW JERSEY, WHERE THE CITY'S GRID of streets gives way to the banks of the Delaware River, a pipe some 8 feet in diameter empties into the waterway.

This is the largest of two dozen outfalls for the county's combined sewer system, a relic of 19th century infrastructure that persists in some older cities. Early planners designed them to carry household sewage and stormwater through the same pipes to the treatment plant, with overflows into a nearby body of water only during high flow conditions — a great improvement over open cesspools that had previously been standard.

But when it rains here, Camden's pipes don't just overflow, they also cause water to back up into streets and basements.

This has long been an ecological dilemma, but the stage is set for it to become a major public health hazard, too. The problem is exacerbated when heavy rainfall coincides with high tide — or worse, a storm surge.

As sea levels rise and superstorms gather, the stormwater infrastructure could become overwhelmed on a more regular basis, adding to the plight of a community already afflicted with frequent street flooding and a host of environmental injustices wrought by a history of industrial pollution, including poor air and water quality, and industrial brownfields. The burden could soon become untenable.

THE SEARCH FOR SOLUTIONS

On a brisk, sunny day in late January, as winds whip past in heavy gusts, Drexel Professor Franco Montalto and Research Scientist Haseeb Payab stand overlooking the outfall, pondering solutions.

It's high tide, so only a portion of the pipe is revealed. The river's edge, iced over in mid-winter, looks placid, but its waters reveal the depth of Camden's challenges: an outdated sewer system, a community plagued by the system's shortcomings, and a dearth of investment and expertise to bail its way out.

For nearly 15 years, Montalto, a civil and environmental engineer, has worked with the Camden County Municipal Utilities Authority to tackle flooding and water-quality concerns. Using flood sensors and computer models, he and his team have provided the county with its first detailed understanding of the scope of its flooding — and the infrastructure changes needed to address it. By factoring in anticipated sea level rise and extreme rainfall, the models give the city hard data to address present-day concerns and prevent future crises.

Today, Montalto and Payab are scouting for opportunities to divert stormwater in the Cramer Hill section of Camden, where street flooding is a regular nuisance. Signs of the problem are everywhere: damaged home siding, cracked and cratered pavement, debris blocking drains.

Payab explains why their work is so crucial to dealing with Camden's flooding. Seeking a solution, he says, is like going to the doctor and saying you feel pain. Without testing to identify the source, it's impossible to offer a salve.

"Only once you run the models do you know what the specific problem is," he says.

Camden's flooding could stem from its low elevation and topography, aged and infrequently maintained assets, a proliferation of impervious surfaces, or a lack of green space to safely absorb rainfall. Perhaps it's a bit of everything. Any fix based on an incomplete picture will be, at least partly, shots in the dark.

"It's inefficient, ineffective and costly if you don't know the real origin of the problem," Payab says. "Modeling helps."

As they walk down River Avenue, which slopes toward Von Nieda Park, Montalto notes the area on a map. The map shows that, in the event of a once-in-a-decade storm, the majority of this area will be under water. Many storm inlets are completely clogged, making it clear why even modest rainfall leads to pooling and rushing water.

They stop at Von Nieda Park, which is built on a former creek and now includes a depression that collects water during storms. More parks like this, Montalto says, could act as green infrastructure, offering public spaces on dry days and stormwater sinks on wet ones. Fresh off a recent trip to Copenhagen, he describes that city's ambitious cloudburst management plan, which separated storm and waste water and introduced multi-purpose parks like this one. Copenhagen is rolling out 300 projects to deal with heavier downpours — an investment of well over $1 billion.

By contrast, Camden has a budget one-fourth that size, a 28.5% poverty rate, and a deficit chipping away at public services. Camden can't dream of funds like that — but with targeted, data-backed plans, the city can pursue smaller interventions.

"There will be the New Yorks of the world that have a whole section of the mayor's office focused on these issues, but then there are communities like Camden, that are much more numerous, that don't have the capacity to go at it," Montalto says. "They're facing the same risks, but they haven't quantified those risks and they don't have the resources to fully evaluate options."

This is where Montalto and his colleagues come in — both those at Drexel and in the broader academic community.

"Universities can be a knowledge broker," he says. "Through student projects and research, we can provide the analysis. We can provide some high-level ideation on potential alternative courses of action. We can bring the latest and greatest science to bear on local problems in places where there might not be a chief resiliency or sustainability officer."

THE OLD COLLEGE TRY

On that same afternoon in the Waterfront South neighborhood of Camden, Nirajan Adhikari, a College of Engineering doctoral student working with Montalto, and Philip Orton, a research associate professor at Stevens Institute of Technology in Hoboken, New Jersey, brace against the wind ripping across the roof of the five-story headquarters of the Camden County Municipal Utilities Authority, the regional water resource recovery utility.

_ABOVE
Drexel's Haseeb Payab and Franco Montalto survey an outfall waterway in Camden.

Orton and Montalto are members of the Consortium for Climate Risk in the Urban Northeast, which formed in 2010. The group of experts and scholars from universities and research organizations seeks to partner with cities to address problems like these. In 2023, they released a research agenda to help the Philadelphia area build resilience to extreme weather. They foresee the region battling sea level rise, hotter and wetter weather, and risks of drinking water contamination from salinity and chemicals.

Orton and Adhikari are here to check a solar-powered camera on the fritz that's recently stopped surveilling the streets below. The researchers have also installed sensors that train ultrasonic beams on the pavement to record floodwaters during storms, which they'll use to refine their models. But the sensors only track the height of flooding at a specific point; the camera offers a visual of the scene when flooding is identified so the team can better understand how it manifests. Most days, Orton is in a classroom teaching about sea level rise and storm surge, but today's work is all technical — attaching wires and fiddling with hardware to get the camera back in action.

At street level, Montalto shows off one of the flood sensors, which is attached to a pole supporting a traffic light overhead. He first got involved in Camden to show his hydrologic modeling class how they could solve real-world problems, combining classroom learning with hands-on field experience in line with Drexel's experiential learning model. He and his students have also done similar work in Philadelphia's Eastwick neighborhood.

But, as he points out, models are only as effective as the data they're fed. And Camden lacked the granular data that could paint a holistic picture of flooding.

Only in the past several years have researchers had at their fingertips the computational capacity to run accurate simulations featuring every pipe in different portions of the city and water levels matched to a range of conditions, says Montalto.

"We know people's basements back up and streets become impassable," says Scott Schreiber, the utility's executive director and a close collaborator on the project. "But because there are so many issues that plague the city, flooding during a rainstorm doesn't always rise to a crisis, so there isn't reliable information."

The utility's relationship with Montalto offers "cutting-edge science" that can change that reality, Schreiber says.

DATA INTO ACTION

With the newfound data, Camden has been able to plan a series of infrastructure changes.

The first major change will take place on Harrison Avenue, a waterfront thoroughfare between two combined sewer outfalls, where frequent floods render the nearby park and community center inaccessible.

Montalto's research has already helped to secure $2.1 million from the Federal Emergency Management Agency — with another $20.9 million anticipated — to install a 54-inch stormwater-only pipe. That would be enough to handle the powerful once-a-decade storms Camden will face in its climate-altered future. Harrison Avenue will also get bike lanes and greenery when the project breaks ground this year.

Next up is the so-called "Pennsauken Disconnect," a project supported by research from Montalto's team that's now

_WATCHING FOR WATER
One of a number of flood sensors Montalto's team has set up around Camden.

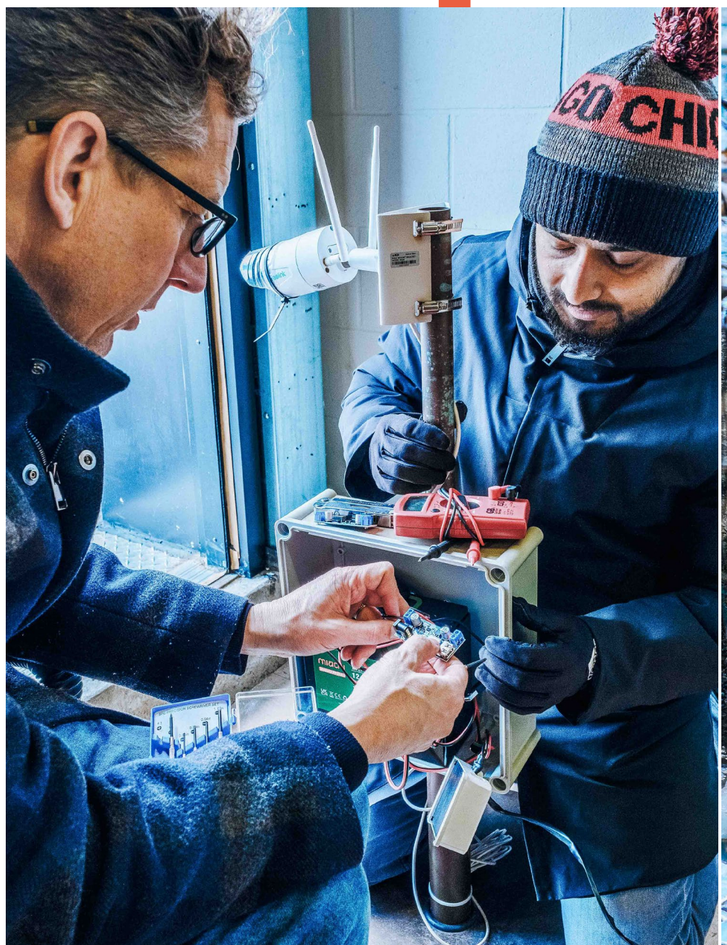
in the design phase. It will divert stormwater from the municipality to Camden's north that currently flows downhill into the city and contributes to combined sewer overflows and flooding.

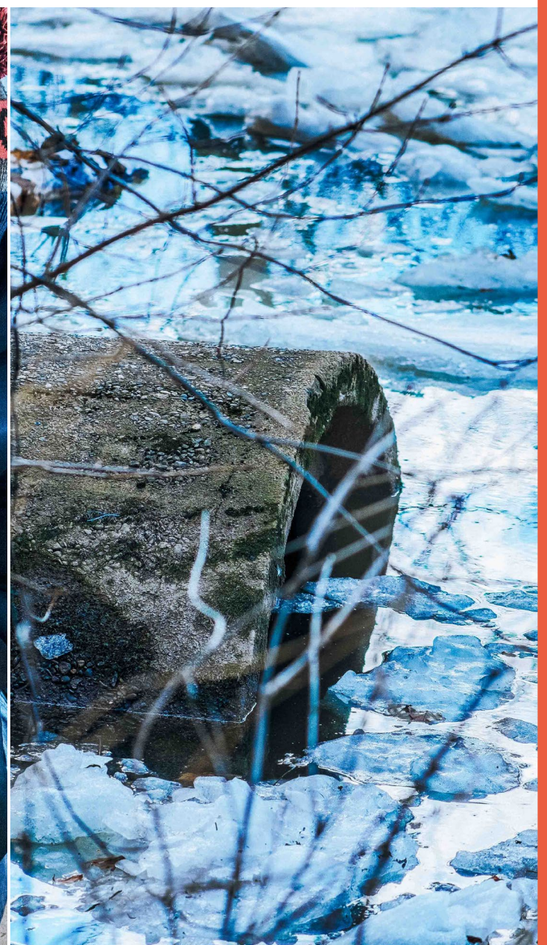
Drexel researchers are in the process of developing a suite of recommendations for the Cramer Hill neighborhood, too.

In each case, the goal is to scrap portions of Camden's Civil War-era infrastructure and replace them with a water management system fit for an uncertain future.

"These are generational investments," Schreiber says. "A pipe can last 70 to 100 years. We know the world's going to be different in 70 or 100 years and we know we want a massive investment like this to stand the test of time. I won't be around, but I don't want the people coming after me to think, 'What idiots. They didn't contemplate climate change despite the fact everyone knew it was coming?' It's important that we don't leave a problem for our heirs."

"WHERE I LIVE...IF THERE WAS ONE DAY WITH SEWAGE RUNNING DOWN THE STREET, THERE WOULD BE IMMEDIATE INTERVENTION. IN CAMDEN, IT'S JUST PART OF LIFE, AND THAT'S TOTALLY UNFAIR." - SCOTT SCHREIBER





_BELOW LEFT
Philip Orton and Nirajan Adhikari repair a camera they use to monitor floods.

_BELOW RIGHT
Flooding is regulated through a network of overflow outlets that empty into waterways.

To that end, Montalto has also been working on climate modeling in collaboration with the Center for Environmental Transformation, a small community nonprofit using a $500,000 grant from the National Fish and Wildlife Foundation (NFWF) to develop a coastal resiliency plan for Camden that accounts for various potential changes in sea level.

Using Montalto's models, the organization is identifying a series of greenscaping solutions that harmlessly redirect the flow of water, whose construction the NFWF could support in future funding rounds. The attention this time is above ground, where changes to riverbanks and green spaces could prove critical, says executive director Jon Compton. He knows Camden can't stop water from rising at its edges or falling from the sky, but it can control what happens once that water arrives.

"One thing Franco has said that's been very helpful is that our goal with the project is not to eliminate flooding, which is usually impossible, but to allow the city to flood safely," Compton says.

RESIDENTS CLEAR A PATH

Christina Allen, a Waterfront South resident, knows too well what it looks like when Camden floods today.

At 31, she's lived in the same house her whole life — a house so frequently invaded by water that she needs to light incense to overcome the smell of mold when she enters the basement. As a kid, she used to secretly hope for flooding the way others hoped for snow days, knowing she wouldn't be able to make it to school if heavy rains came. Now, she's more troubled by the impassable roads.

"When I know it's gonna rain a lot, I make sure I get home before it starts flooding," Allen says. "It's like a pool."

Allen is among a group of Camden residents doing their part to reduce flooding. She uses Cleanlet, an app created by Montalto's team, to identify clogged inlets in the neighborhood that she can clear out with tools provided by Drexel and its partners.

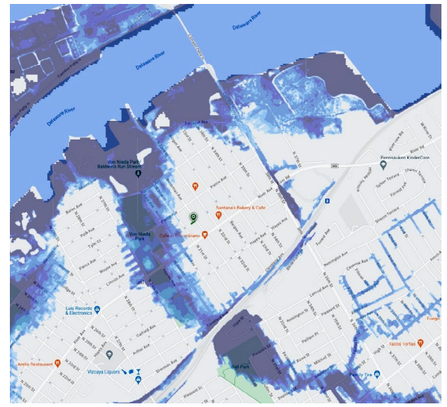
The app's users can exchange their effort for gift cards — a modest motivator that Allen says is less important than helping out her community.

All the inlets in Allen's neighborhood are mapped on the app, which can work for any municipality; a town at the Jersey Shore just gave the team data on 250 inlets it hopes to keep clear in the future.

The challenges Allen and her neighbors face are unfortunately common in cities without the means to build their way out of environmental crises. But with academic experts in their corner, Camden and its counterparts can identify the solutions they need and find state and federal support to put them in place.

As Schreiber points out, wealthier communities across New Jersey wouldn't tolerate these issues, so why should Camden have to?

"Where I live in Haddon Heights, if there was one day with sewage running down the street, there would be immediate intervention," he says. "In Camden, it's just part of life here, and that's totally unfair. You're talking about quality of life, the dignity that someone feels when they walk down the street during a rainstorm. These things need to be addressed."



_CRAMER HILL, CAMDEN
The section of Camden most vulnerable to storm system flooding is around Von Nieda Park.

_In Philly, a Dashboard for Climate Action

Across the river in Philadelphia, meanwhile, a new report and a Google-backed data dashboard are putting climate justice in the public's hands.

Leading the charge is the Philadelphia Climate Justice Collective (PCJC), a coalition of four community-based organizations: Nueva Esperanza, Mantua Civic Association, Overbrook Environmental Education Center, and the Southeast Asian Mutual Assistance Associations Coalition (SEAMAAC).

Working with Drexel's Environmental Collaboratory (TEC) — a university-wide initiative that connects researchers, students and community partners to co-design data-informed, justice-centered environmental solutions — the group published a report late last year filled with neighborhood-specific climate recommendations.

The report tackles urban challenges like heat islands, respiratory health and aging infrastructure, while building community leadership to drive local change. Each group designed its own approach to gathering feedback and setting priorities, ensuring the work reflects real community needs from the ground up.

One recommendation has already gained traction: a public-facing Climate and Environmental Accountability Dashboard to track local environmental health and government action. The idea recently received a $500,000 boost from the Environmental Justice Data Fund of Google.org to build out the dashboard as a community-owned advocacy tool.

The Collaboratory heralds the project as a true community-led process. "It is intended to guide a just climate transition by addressing systemic barriers, promoting resilience and elevating community leadership," says TEC Executive Director Mathy Stanislaus.

Inner Workings, Scrutinized

What can cutting-edge imaging tell us about a queen's timepiece, dinosaur bones and next-gen batteries?

A powerful new instrument in Drexel's science portfolio peers deep inside virtually any material, helping researchers solve mysteries across disciplines.

BY
LINI S. KADABA

INSIDE THE GLASS-FACED confines of Drexel's Bossone Research Enterprise Building on Market Street, a top-shelf scientific instrument scans biomaterials and solids, and stretches and tests materials, revealing in spectacular 3D detail the answers to myriad research questions. ¶ It also comes in handy to satisfy a curiosity. ¶ On this day, Lynn Clouser Waddell has come to the building to solve a historical mystery. Cladding her hands in blue Latex gloves, she opens the lid of a gray archival box. Nestled in white tissue paper sits a stunner — a gold, jewel-encrusted chatelaine timepiece from Drexel's Founding Collection. ¶ "This one is thought to have been owned by Marie Antoinette," says Waddell, who oversees the University's collection of art and antiques. The circa 1780 keychain with a lady's pocket watch, worth more than $250,000, has bright carnelian cameos, diamond-set hands and an inlay decorated in lapis lazuli, pearls and other semi-precious stones. It was gifted to the University in 1892 by the wife of George W. Childs, a business partner and close friend of University Founder Anthony J. Drexel.

Did the chatelaine watch really belong to the queen best known for callous remarks about cake?

Documentation suggests it did. But Waddell would love a no-room-for-doubt answer. Is there a tell-tale inscription inside the case?

"We haven't been able to open it," Waddell says. "It's jammed. I don't want to force it."

That may have been the end of her hunt had it not been for her visit to the suite in Bossone that houses Drexel's Materials Characterization Core (MCC) lab, one of a number of shared equipment hubs across campus that make up the University's Research Core Facilities.

The lab recently acquired a $1.65 million X-ray nano-computed tomography (CT) microscope that can provide Waddell with a definitive provenance. The state-of-the-art Zeiss Xradia 620 Versa, which recently replaced a less powerful micro-CT that had been in use since 2006, can peer inside a material or object without damaging it, faithfully revealing tiny internal structures from multiple points of view. Imagine scanning a whole apple and seeing the apple seeds in high-resolution 3D *without* ever cutting open the fruit.

"The new instrument has many more capabilities," says Antonios Zavaliangos, the A.W. Grosvenor Professor of Materials Science and Engineering and the principal investigator on the National Science Foundation's (NSF) Major Research Instrumentation Program grants that helped fund the CT microscope. "With the range of detail we can see, more and more people are interested in using this machine," he says.

X-ray microscopy is becoming the go-to tool to study an ever-increasing number of materials. Advances in artificial intelligence and machine learning, hallmarks of the next-gen industrial revolution, increase "the need for accurate 3D digitization of material architectures and realistic data-driven computer modeling," Drexel's grant proposal points out.

Take the watch. It is the first time that an historical object is being scanned with Drexel's nanoCT, says Kate Vanderburgh, who was then the research instrumentation specialist responsible for overseeing the instrument and training users.

"This is our opportunity to see inside," Waddell adds. "The fact that we have an art collection at an R1 research university does open up possibilities for us to research provenance in a very different way."

Only a couple dozen universities around the country can boast this specific newer model in their inventory and it's the only one within 200 miles of Philadelphia, says Craig Johnson, operations director for Drexel's Research Core Facilities. "An instrument with this kind of specifications is rare," he says.

Already, the nanoCT, a 6,000-pound, lead-encased chamber the size of an industrial freezer, is finding broad usage. Last year alone, it was reserved for more than 40 hours per week, Johnson says. Drexel engineers are using the instrument to explore the microstructure of a variety of materials, all with the goal of better understanding why something works or fails. Projects underway are investigating next-generation batteries, novel biomaterials and better pharmaceutical tablets. External clients, such as the University of Pennsylvania and local companies, are scheduling time with it to analyze sea-life specimens and sensors. The Academy of Natural Sciences of Drexel University has used the instrument to help identify new species, understand ocean acidification and shed light on bone fusions through close-up looks at dinosaur bones.

"That's the amazing thing about this technology," says Aleister Saunders, Drexel's executive vice provost for research and innovation. "You can use it in so many different ways. Here we are talking about the benefits to basic research on new materials to our collections, and what does it also tell us about history and craftsmanship?"

"AN INSTRUMENT WITH THIS KIND OF SPECIFICATIONS IS RARE."

– CRAIG JOHNSON

ON THIS HOT August day, Room 106C of the lab is a climate-controlled 72-degrees Fahrenheit. Waddell unhooks the watch from the chatelaine and hands it to Vanderburgh, who will scan it to demonstrate the nanoCT's power.

"I think it's fascinating to see beyond what our naked eye can see," Vanderburgh says, "and how much information it can tell us about a material."

She wraps a piece of clear packing tape around a block of Styrofoam that is holding the watch upright to ensure it doesn't wobble during the X-ray.

"Don't hurt it," Waddell says, half-jokingly.

"Yeah, no pressure," Vanderburgh quips. She places the block on the sample holder pedestal and turns toward the machine.

At first glance, it looks rather plain and nothing like the traditional microscope in biology class, this big, white box with a computer monitor to the side and a light on top that turns red to indicate X-ray beams are actively bombarding a sample. But then, this machine shows what it can do.

Like a medical scan on steroids, the nanoCT has an X-ray so powerful it would burn living tissue, with advanced optical detectors that reveal the target's internal microstructure down to 350 nanometers. That's really, really small.

The brother to the nanoCT is the micro-CT, which has a resolution of about five microns, Zavaliangos says. "That is about maybe 14 times smaller than the diameter of a hair," he says.

The nanoCT significantly ups the game. "We go about 150 times smaller than a diameter of a hair," he explains.

The new instrument has plenty of other bells and whistles. It can image items as large as a grapefruit.

^To put Drexel's 3D nanoCT microscope to the test, researchers scanned a bejeweled timepiece from 1780 believed to have belonged to Marie Antoinette. If there were any markings inside to establish the watch's provenance, the state-of-the-art microscope would be able to reveal them.

JEFF FUSCO

By comparison, the micro-CT that it replaced can only image something up to the size of a fig. Because of the instrument's wide voltage range (30kV–160kV), it can scan more materials, from polymers and wood to dense metals.

"I haven't had a sample I can't see through yet," Vanderburgh says proudly. That includes iridium, the second-densest material known to humans, she says.

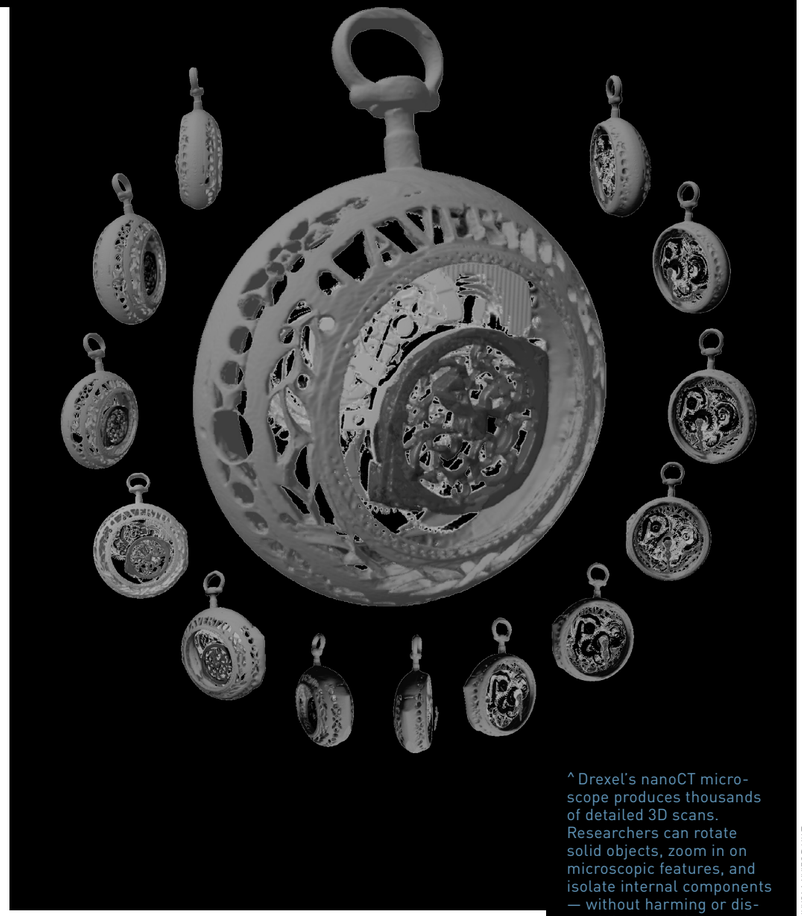
Scientists also can use the nanoCT to study samples *in situ*. As a device stretches or compresses a material, the machine can capture how the microstructure reacts under stress and over time. Plus, all this work gets done in a fraction of the time the older instrument took, largely because of better detectors.

The scan itself comprises a series of X-ray projections from different angles, each a thin slice of the mounted sample as it rotates and moves up and down between the X-ray source and the detectors. More slices, which can number into the thousands, equate to higher resolution.

Imagine going to a deli counter, Vanderburgh says. "They have a whole hunk of ham, and they slice individual thin slices," she says. Then the reconstruction software Dragonfly takes the pieces and stacks them together to generate a cool 3D image that can be digitally rotated, pulled apart into segments and zoomed through to explore minute detail. In other words, put together all that lunch meat, and presto! There's the whole ham.

"It can tell us information about a material at such a fundamental level," Vanderburgh says, "and give us such a better, global understanding of the entire sample."

The key is the microstructure, Zavaliangos says. This internal geometry of a material controls its properties. "When we want to produce a new material, or to optimize an existing one, or to understand why a material failed," he says, "understanding the microstructure is a step of paramount importance. Instruments like the nanoCT and other instruments of the centralized facility are essential tools for the progress that materials science has enabled with discoveries for all parts of our lives."



^ Drexel's nanoCT microscope produces thousands of detailed 3D scans. Researchers can rotate solid objects, zoom in on microscopic features, and isolate internal components — without harming or dissembling the object.

BITA SOLTAN MOHAMMADLOU

"IF YOU JUST TAKE A 2D IMAGE, YEAH, IT'S USEFUL, BUT IT DOESN'T GIVE YOU A COMPLETE PICTURE. THE STRUCTURE IN 3D IS CRITICAL FOR THESE INVESTIGATIONS."

– LING LI

Zavaliangos, for one, studies the mechanical properties of solids produced from powders, looking to improve the manufacturing process for pharmaceutical tablets. "We are trying to understand the internal structure of the tablet," he says. "What happens if you go from one shape to another? What really drives these changes? How can they be minimized or amplified?

"If you do any other technique than tomography," Zavaliangos adds, "it only shows you what's going on on the surface."

Other Drexel researchers are using the technology to probe energy-related devices, biomedical specimens and advanced materials.

A group working with former Drexel chemical engineering professor Vibha Kalra (now at Cornell) used it to explore novel material architectures to develop more efficient energy storage devices and next-gen batteries. Other faculty are measuring battery behavior during operation and conducting *in situ* experiments.

Kara Spiller, the URBN Professor of Biomedical Innovation, harnesses immune cells involved in tissue repair to create new biomaterials for regenerative medicine in the growing field of immune engineering. Thanks to the nanoCT's capabilities, the co-PI on the instrument grant can analyze high-res, 3D images of a mouse model's whole lungs to understand the effects of a novel treatment for pulmonary fibrosis. "This is important because fibrosis is not uniform," she says. "We need to analyze the whole lungs."

The equipment in the MCC is also important to researchers in Drexel's NanoBiomechanics Lab, which investigates the role of extra-cellular matrix (ECM) biomolecules in the development of diseases such as osteoarthritis. The nanoCT offers critical insight into erosion of cartilage in a mouse model and the promise of engineered hydrogels, information that can dramatically enhance scientific understanding of how cells and tissues interact with implants.

This technique has also demonstrated great potential in the field of nanomaterials. Each week, Bita Soltan Mohammadlou, a mechanical engineering doctoral student in the Drexel Nanomaterials Institute (DNI), schedules time on the nanoCT to investigate the internal structure of MXene-based samples. Distinguished University and Charles T. and Ruth M. Bach Professor Yury Gogotsi, who directs the institute, co-discovered the versatile 2D nanomaterials with Distinguished Professor of Materials Science and Engineering Michel Barsoum 14 years ago.

In her research, she studies the mechanical properties of MXenes using different characterization techniques. More recently, she has shown the benefits of connecting scanning electron microscopy that analyzes the surface of MXene-coated textiles, composites and aerogels with cutting-edge tomography that sees internal features such as microstructure, distribution and defects. This allows for more precise analysis of materials and ultimately guides optimization and development of their synthesis and applications.

"This is the first time nanoCT has been systematically applied to analyze different MXene systems," says Soltan Mohammadlou, who has written a paper that highlights the transformative potential of the technology in the study of these 2D nanomaterials. "So, it's a very advanced and exciting technique to work on. I can't wait to visualize my data each time."

VANDERBURGH places the holder with the watch inside the instrument. From the computer, she moves the X-ray source closer to the sample for better resolution and sets the machine to its maximum power of 160 kilowatts, given the object's high density. Soon, an X-ray of circles layered atop each other appears on the monitor.

"Oh, I see the gears," says Waddell, her face lighting up. "The mechanism is beautiful."

No one spots any engraving on the inside. But this is a single image, what Vanderburgh calls a preview to check the positioning of the watch before the complete scan with its many slices takes place. That will show more detail and, fingers crossed, an inscription.

Certainly, Grace Goetcheus, a doctoral student in the Biodiversity, Earth and Environmental Science (BEES) department and one of the many students trained on the nanoCT, was impressed at the detail when she scanned fossilized tail vertebrae of juvenile dinosaurs. Based at the Academy of Natural Sciences, the 26-year-old from Maryland is searching for clues as to why diplodocids, a group of long-necked sauropod dinosaurs, have a high prevalence of fused vertebrae in their tail — work that could provide insight into human spinal fusions.

Is it, Goetcheus asks, because of normal injuries? Or is it because of the gigantic size of sauropods, the largest terrestrial animals to ever live? "You can see that a fracture occurred externally," she says, citing the new bone growth around a break known as a callus. "But with the CT machine, you can zoom in to specific, smaller areas and see where the line of the old bone is and where all that new bone has grown to create that external callus." An examination of the juncture of two fused vertebrae suggested the ligaments ossified, which usually occurs later in life in humans but in this instance was appearing among young sauropods — and potentially as an adaptation to gigantism, she says.

Kyle Luckenbill, collection manager and imaging specialist at the Academy, has been scanning specimens in collaboration with visiting researchers. These scans will be uploaded to Morphosource.org in support of the oVert project, a multi-institution, NSF-funded initiative to digitize vertebrate museum specimens and make the images available at no cost to the public and to researchers. He says that during the process, South American catfish in the collection with widespread geographical ranges that had initially been thought of as the same species were confirmed to have different bone structures, setting them apart from each other. One highlight of the technology, Luckenbill adds, is its non-destructive nature — one needn't alter the specimen with preparations traditionally used to examine the skeleton.

"It comes out," he says, "the same way it went in."

For BEES Associate Professor Jocelyn A. Sessa, the Academy's associate curator of invertebrate paleontology and a co-PI on the instrument proposal, having an instrument like this in the Mid-Atlantic means saving time and energy. She used to travel all the way to the American Museum of Natural History in New York to access tomography, crucial to her research on the small, delicate sea snail shells that appear to be bioindicators of the ocean's changing acidity. It hampered her work, she says. Now, she need only go to Drexel's campus. "This," Sessa says, "was part of our pitch for the grant."

AS FAR BACK AS 2015, Zavaliangos was looking to replace the Bruker Skyscan 1172 micro-CT that he and others used often with the latest technology. He submitted proposals twice to no avail. "At some point, I gave up," he says.

But a colleague, Professor Antonios Kontsos, convinced him to try again, and the third time proved the charm. The $1.23 million, 2022 grant covers 75% of the instrument's costs with Drexel funding the remainder. "The whole [MCC] facility is full of instruments won through these types of grants," Zavaliangos says.

Opened in 2006, the 3,500-square-foot MCC houses nine major instruments, including several electron microscopes, X-ray diffractometers, an X-ray photoelectron spectrometer and, of course, the nanoCT. Each has a sweet spot. The X-ray microscope handles a centimeter to just under a micron, while the scanning electron microscope covers 1 mm to a few nanometers. The transmission electron microscope shifts even smaller, from microns to two-tenths of a nanometer.

"Tiny is what we do here," Johnson says.

^ This set of scans of the chatelaine watch has been colorized to show the individual gears and parts using Dragonfly reconstruction soffware.

BY A. SULTAN MOHAMMADLOU

The facility is open 24/7 to users from within or outside Drexel, who can reserve the instruments on an hourly basis via iLab. A key requirement of NSF's instrument program is broad usage not only within the University but across the region.

"We're becoming a place that attracts researchers from other places to enable their research," Zavaliangos says.

One of those is Ling Li, a materials science associate professor at Penn whose graduate students trained last year on the nanoCT. Tomography, he says, is essential to his team's understanding of how nature designs materials, such as the eye-covered shells of mollusks that act as a surveillance system or the porous, lightweight structure of starfish. "If you just take a 2D image, yeah, it's useful, but it doesn't give you a complete picture," Li says. "The structure in 3D is critical for these investigations."

Another is Dash Papula, a chemical process engineer at the Fredericks Company in Huntingdon Valley. The "shiny new toy," as he describes the nanoCT, helped the small manufacturing company that makes sensing devices identify a suspected physical deformity inside a piece of metal used in one product.

"The material is so small, that if we were to cut it open there would be a large risk of introducing defects that weren't there in the first place," Papula says. "That's one reason we wanted to do this nondestructive testing that the nanoCT provides."

And so it goes, a seemingly endless list of possible projects in need of the latest X-ray tomography.

"This is an amazingly versatile equipment that we have used in the most incredible ways you can imagine," Zavaliangos says. "It's for things we wouldn't see otherwise."

TWO HOURS have passed, and the chatelaine watch has now been fully scanned, slice by slice, 1,601 projections in all. Vanderburgh clicks through the images like a flipbook.

The reconstructed 3D rendering is ethereal. Lace-like gears in black, gray and white form concentric circles. (The darker the area, the denser.) From the front, a decorative gear with a filigree pattern is visible. "The watchmakers are artists," Waddell says, "and have a lot of fun."

Vanderburgh rotates the image and zooms through from front to back. The two have searched for an engraving.

Alas, there is none.

"There's some disappointment," Waddell allows. "It would have been amazing — a stop-the-presses moment for me." But, she says, that's no reason to discount Marie Antoinette's connection to the watch. "There are a lot of links."

Ditto with the nanoCT. The demo has Waddell's mind spinning with ideas for exhibitions that combine art and science. On the spot, she imagines displaying the watch with the scans of its insides, perhaps even a 3D-printed version of the mechanism that visitors can pull apart and examine. The collection also has other artifacts that merit a look inside. "There's lots of opportunities," she says. "We have tons of miniatures, including a fully functioning piano. It would be really cool to see how it's put together."

In the meantime, the demo served its purpose, showcasing the nanoCT's keen eye.

"You know it's a watch," Johnson says. "Suddenly, you can see the gears inside that you couldn't see before. You understand almost instantly the power of the tool."

On top of that, the dataset — that 3D reconstruction — can be manipulated. "With your mouse, you can turn the watch around in circles," he says. "You can flip it over. You can see a cross section. You can pick one gear and get rid of everything else.

"I really love this," raves Johnson, who could be speaking for any number of nanoCT's users. "It's neat."

"THIS IS AN AMAZINGLY VERSATILE EQUIPMENT THAT WE HAVE USED IN THE MOST INCREDIBLE WAYS. IT'S FOR THINGS WE WOULDN'T SEE OTHERWISE."

– ANTONIOS ZAVALIANGOS

DREXEL'S OWN AI SERVER FARM

Drexel is building its own 'AWS' to harness the massive data gleaned from research machines like the nanoCT.

The major scientific instruments operated by Drexel's Research Core Facilities churn out vast troves of data. Just the X-ray nano-computed tomography (CT) microscope alone produces thousands of high-definition, 3D images per scan.

As of now, all of that raw output is stored locally and must be transported via USB drives, external hard drives, or the cloud to a secondary location for processing on a computer. This is an often slow, cumbersome and expensive undertaking, says Craig Johnson, operations director of Drexel's Research Core Facilities, the University's hub of research equipment.

That will change this year. Josh Agar, formerly an assistant professor in the Mechanical Engineering and Mechanics Department at Drexel, and his colleagues are building out a new way to automatically and swiftly curate the ever-increasing mounds of research data, including the loads generated by Research Core Facilities' instruments.

Known as the Platform for Accessible DISE — **D**ata-**I**ntensive **S**cience and **E**ngineering — it will increase storage space eight-fold to 4 petabytes, equal to 4.5 quadrillion bytes or 2 trillion pages of printed text. It will make it easy for scientists in materials science, physics and other areas to transmit their data to an artificial intelligence cluster of high-powered computers, all working together at very high speeds to group similar datapoints and identify patterns. Researchers also will be able to search historical results and train machine-learning models to conduct real-time computations and analyses.

Think of it as Drexel's own AWS (Amazon Web Services — Amazon's vast on-demand cloud-computing server network).

"DISE will provide the holy grail to advance information sciences," Agar, the principal investigator, wrote in the National Science Foundation proposal that resulted in a $4 million award in 2023 to develop special software for scientific workflows.

"We're really pushing the limits of performance," he says, "and boundaries of data and research stewardship." Scientists will be able to ask new research questions, and Drexel will be able to train the next generation of machine learning researchers.

Most clusters, Agar notes, are schedulers, which require waiting in a queue for tasks to get done. DISE will use an orchestration system (the open-source Kubernetes) that allows different applications to run on a set of computers. The resulting automation will lead to better data management, Agar says. The platform also will use a state-of-the-art graphics processing unit to perform calculations — the same way cloud services are done.

DISE, to be based at the University Research Computing Facility hub on Drexel's University City Campus, is rolling out this year to handle AI workloads. Other more complex aspects may take two to three years to develop. Drexel is collaborating with researchers at Oak Ridge National Laboratory, Morgan State University, and MIT, among others, on the project.

Johnson already sees great potential ahead.

"AI will be really important for analyzing the data that comes out of here," he says, citing imaging, *in situ* diagnostics and materials synthesis. "The industry is at the forefront of using AI/machine learning to make new discoveries out of scientific data that weren't possible before." — *Lini Kadaba*

_EXPERIMENTS IN CO-LIVING

Drexel researchers are using storytelling, community and art to ***build a model for intergenerational housing*** *– placing lived experience and community voices at the center of the research process.*

At Drexel's West Philadelphia campus, research is happening among the rowhomes. It's unfolding in living rooms, at block parties and stitched into community quilts — all part of an arts-centered data collection project co-led by scholars and residents.

The participants are exploring intergenerational co-housing as a strategy to support aging in place, housing affordability and community cohesion. With backing from a $1 million National Science Foundation (NSF) Civic Innovation Challenge grant, Drexel faculty enlisted neighborhood elders as co-investigators — breaking down barriers to science and demystifying how it's made.

A pilot homeshare is already under way in Mantua, a historically Black neighborhood just north of Drexel's campus, where Drexel alumnus and Liberty Scholar Ibrahim Kamara and longtime Belmont resident Dianne Wadley have agreed to live together, sharing expenses, upkeep and company. Ultimately, the project will include 18 new duplexes by Lomax Real Estate Partners, creating affordable homeownership opportunities for local families.

The heart of the research is 50 firsthand interviews, collected and coded by community researchers who are local elders, and analyzed collaboratively with Drexel researchers. Their goal is to assess community acceptance of homesharing.

"There's a wide range of perspectives about the potential for this," says Damaris Dunn, postdoc working in Drexel's Justice-oriented Youth Education Lab (JoY Lab) who has a PhD in educational theory and practice from the University of Georgia. "The elders see the value of intergenerational relationships because they're interacting with postdocs, undergraduate students and graduate students on a regular basis. They also live intergenerationally, so they deeply understand the value."

> *As a community researcher, I've had the privilege of listening to other community members and being in the position to be recognized as an important contributor to the work. As a result, the research is authentic and maximizes the project's chances for success.*
>
> *– K. Rose Samuel-Evans, 69, of Mantua is one of three elder community researchers, along with Rebecca Rose Metzger and Tamara Hawkins*

The project could be a national model for how campus communities co-exist with homeowners in adjacent neighborhoods. The team is developing a toolkit for community-driven research that could serve other campus neighborhoods. They've presented their work at conferences and academic venues, sharing both their process and outcomes.

A distinctive element of their work is the use of art — poetry, storytelling, dance and quilting — as a research tool. "We think about quilting as a methodology," Dunn explains. "How do we weave all of these stories together?"

To bring that idea to life, the team enlisted professional quilter Sharon Tindall to create a wall-sized piece reflecting the project's themes, with individual squares contributed by community members.

"Again, using art to tell our stories," says School of Education Professor and Department Chair Ayana Allen-Handy, who is principal investigator on the NSF grant with Chris Wright, associate professor in Drexel's School of Education. "This story of intergenerational cohabitation — even if not all of us are co-housing in the same house, we're still curating a community across our differences."

Though the NSF grant was awarded in 2023, this work builds on nearly a decade of community-led arts and placemaking through Drexel's Writers Room, founded by Rachel Wenrick, executive director of arts and civic innovation. Nearly 8 years ago, Writers Room began partnering with the Justice-oriented Youth Education Lab, led by Allen-Handy, along with colleagues and students across the University and with the Mantua Civic Association. They formed Second Story Collective (2SC) to design a model for co-created housing, particularly in Black communities surrounding Drexel.

2SC vets homeshare participants and produces arts programming for them. The homeshare application includes background checks, tenant clearances and landlord licenses for participating homeowners. It's open to Drexel students and alumni, and to homeowners in West Philadelphia. Arts programming is tailored to residents' interests: Kamara, for instance, is an aspiring filmmaker and plans to document the experience.

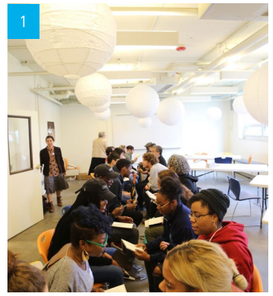
Writers Room has also raised funds for home repairs and implementation from the Pennsylvania Council on the Arts, Department of Community and Economic Development, and the Pennsylvania Housing Finance Agency.

"They're excited by the potential for scaling this model across our city, our state and our country," says Wenrick. "City, state, corporate, foundation and federal funders are providing critical support because it's a co-created community-university program."

Aging-in-place expert Diana Nicholas, an associate professor in the Antoinette Westphal College of Media Arts & Design, is helping homeowners prepare. She uses her collaboratively developed Mantua Creative Standard for Aging in Place (MCSAP) tool to recommend safety and accessibility improvements. Working with Rebuilding Together Philadelphia, she identifies appropriate modifications — such as enhancing the convivial space of the kitchen and ensuring easy-to-reach food storage.

Through community engagement, creative inquiry and deep neighborhood ties, the initiative is preserving the stories of the people who call West Philadelphia home — and making it more of a home to all.

_AYANA ALLEN HANDY
_RACHEL WENRICK
Allen-Handy is professor in the School of Education and director of the Justice-oriented Youth (JoY) Education Lab in the School of Education. Wenrick is executive director of Arts and Civic Innovation and founding director of Drexel's Writers Room.



_1 Through public talks and workshops, such as this HOME Symposium workshop in 2018, 2SC explores potential futures of housing in West Philadelphia. _2 Longtime resident Dianne Wadley and Drexel graduate Ibrahim Kamara are piloting the first homeshare in Wadley's home in Mantua. _3 A rendering of Village Square at Haverford (by WRT), a future affordable housing development envisioned by Lomax Real Estate Partners.

_4,5 Some squares from a community quilt being sewn by Sharon Tindall. Community members provided ideas and inspiration from their lives. _6 Damaris Dunn, Rebecca Rose Metzger and K. Rose Samuel-Evans prepare for a meeting of the West Philadelphia Community Dialogue Project, which is responsible for the research art of 2SC's work.

PHOTOS COURTESY OF 2SC AND JOY LAB

CYBERSECURITY

_PHISHING GETS FREE REIN

*Despite widespread cybersecurity training, **most companies make phishing difficult to report** – giving scammers free rein.*

PHISHING SCAMS FLOOD in-boxes every day, tricking victims into clicking malicious links — but what happens next? Usually, not much. Despite the threat, companies rarely make it easy to report phishing attempts, and even fewer take action to shut them down.

To assess how bad the problem is, researchers from Drexel's College of Computing & Informatics and Arizona State University launched their own simulated phishing attacks. They found that most organizations offer little support for reporting scams, leaving phishing sites to operate unchecked.

To conduct their work, they created a set of test phishing websites — in accordance with ethical research requirements and with prior notification to the domain registrar and hosting service provider — spoofing the site of Fortune 100 companies.

Over the course of two months, the team reported phishing attacks over a dozen times — a challenging process, they often found, due to logistics with forwarding emails to a dedicated reporting address. They then tracked how many of their bogus sites were accessed — an indicator that the companies were investigating the report — and how many were ultimately blocked.

Their findings, presented at the International Symposium on Research in Attacks, Intrusions and Defense, revealed that less than half of Fortune 100 companies offer any channel for reporting these scams. They also discovered that nearly 30% of reported websites were never accessed as part of an investigation and only 3% were ever blocked from access. Their report is one of the first comprehensive studies to look at the attitudes and actions around phishing reporting.

"Although users are constantly trained and instructed on how to identify and report phishing emails, the reaction they receive in the actions taken — or, more often, not taken — by the companies to which they report creates a negative feedback that discourages them from reporting future emails," says Eric Sun, an assistant professor in the College of Computing & Informatics who helped to lead the research.

_ERIC SUN
Sun is an assistant professor in the College of Computing & Informatics.

PSYCHOLOGY

_THIS IS YOUR BRAIN IN THE ZONE

*If you're trying to **maximize your creative productivity,** then you better not think about it.*

_JOHN KOUNIOS
Kounios is a professor in the College of Arts and Sciences.

HERE'S HOW YOU — and your brain — can reach optimal creative activity: Don't try so hard.

A neuroimaging study from Drexel's Creativity Research Lab is the first to reveal how the brain gets to the creative flow state: by letting go.

The College of Arts and Sciences researchers studied the brain activity of 32 experienced and amateur jazz guitarists while they improvised their playing. The resulting 192 recorded jazz improvisations, or "takes," were subsequently played for four jazz experts individually so they could rate each for creativity and other qualities. The researchers then analyzed the electroencephalograms (EEGs) measuring electrical activity in the brain to discover which brain areas were associated with high-flow takes (compared to low-flow takes).

They found that creative flow can be achieved by training people to release control when they have built up enough expertise in a particular domain.

"A practical implication of these results is that productive flow states can be attained by practice to build up expertise in a particular creative outlet coupled with training to withdraw conscious control when enough expertise has been achieved," says John Kounios, professor in the College of Arts and Sciences and director of the Creativity Research Lab. "This can be the basis for new techniques for instructing people to produce creative ideas."

Kounios led the study, later published in *Neuropsychologia*, with David Rosen, an alumnus from the college and a Johns Hopkins University postdoc. Their findings support one of two prevailing theories about how flow is involved when people produce creative ideas — that it's expertise plus release rather than a state of hyperfocus.

_FLOW JAM
Kounios' lab measured creative flow by attaching brain activity monitors to a student researcher as he played guitar.

BUSINESS LAW

_THE PROMISE AND PERILS OF TELEHEALTH

*Digital mental health care practices are expanding access – but without regulation, **could they compromise quality of care?***

THE COUNTRY IS in the throes of a mental health crisis. More than one-third of adults report struggling with mental health or substance abuse, yet fewer than half receive treatment. The reasons are depressingly familiar: too few mental health professionals, high costs and limited insurance coverage.

In recent years two forces — private equity investment and telehealth — have made waves as potential solutions. Virtual care promises to reduce barriers for those in underserved or remote areas, offering a way to connect patients with care without the need for travel or extended wait times. The potential is vast: lower costs, higher volumes and increased convenience for patients who might otherwise forego treatment.

But can the private-equity model, which historically has aimed for quick profits and high returns, balance financial incentives with quality care?

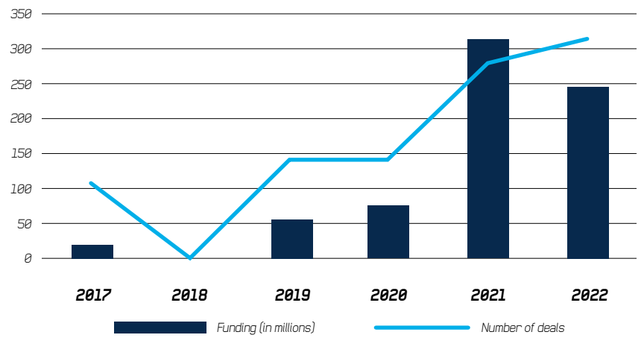
Barry Furrow, professor of law and director of the Health Law Program in Drexel's Thomas R. Kline School of Law, dove into the question in a study in the *American Journal of Law & Medicine*. His findings suggest that while both private equity and telehealth could expand access to care, their unchecked growth may come with unintended consequences for patients and the quality of care they receive.

One insight from Furrow's analysis is that private equity sees telehealth not just as a way to expand access, but as a cost-cutting strategy. Virtual therapy platforms require fewer licensed professionals, and some investors are betting that artificial intelligence-powered chatbots could eventually replace human therapists altogether. While this might lower costs, it also raises thorny questions about the quality of care — and whether it's ethical to rely on algorithms for something as deeply personal as mental health treatment.

While both private equity and telehealth could play a role in solving the mental health crisis, Furrow advocates for stronger oversight and regulation.

He proposes measures like mandatory accreditation for behavioral health facilities, rigorous testing for digital health tools, and closer scrutiny of private equity acquisitions in the sector. Without these safeguards, he warns, vulnerable patients could become casualties of an unchecked race for profits.

_VC DEALS FOR AUTISM-FOCUSED DIGITAL HEALTH



_BARRY FURROW
Furrow is a professor of law and director of the Health Law Program in the Thomas R. Kline School of Law.

SOCIAL MEDIA

_DM A FRIEND FOR HELP

*Researchers examined what happens when young adults ask for **support through social media.***

_AFSANEH RAZI
Razi is an assistant professor in the College of Computing & Informatics.

INSTAGRAM, THE MOST popular social media platform among 13- to 21-year-olds in America, is often accused of causing mental health harms to young users. However, the same population also uses the app to seek, and find, help.

A first-of-its-kind study led by Drexel researchers examined these asks for help and how they were received.

They found that young people on Instagram are more likely to share negative experiences — ranging from everyday stress to severe mental health issues — with friends and online acquaintances in private messages on Instagram. Most of the time, these disclosures are met with positive peer support.

"Due to logistical challenges and privacy concerns there has been very little research on how this age group interacts in private online conversations — particularly to exchange support," said Afsaneh Razi, an assistant professor in the College of Computing & Informatics, who was a co-author of the paper. "This study is the first of its kind to provide insight and lay out a framework for how the platform could offer support for young people who are looking for help in everyday difficulties."

From a dataset of 7 million Instagram messages, researchers analyzed messages seeking help to understand how and why youth initiate peer support conversations in private messages and the types of support they received.

Mental health concerns came up in most of the conversations; the topic was usually introduced in casual conversations or one-on-one chats before evolving into a disclosure and an ask for help. Further research could demonstrate the demographics of these younger users; how teens can grow support networks both online and in person; and how social media platforms could integrate tools to provide guidance and resources in a conversation, possibly through artificial intelligence.

The findings, which were supported by the National Science Foundation, were published by the Association of Computing Machinery at the 2023 CHI Conference on Human Factors in Computing Systems. The authors also included Jina Huh-Yoo and Pamela Wisniewski, and Drexel students Diep N. Nguyen and Sampada Regmi contributed.

7MIL.
Instagram messages revealed how youth use private DMs to seek and offer peer support.

EPIGENETICS

STUDENT RESEARCH

MARKETING

_ANCESTRAL AGE AND YOU

*A **surprising connection** could provide clues about your "real" age.*

_AGUS SURACHMAN
Surachman is an assistant professor in the Dana and David Dornsife School of Public Health.

We all know that eating well, exercising and attending regular doctor appointments can support a long, healthy life — but some factors might be outside our control, such as whether you had a grandparent who went to college.

Researchers in the Dana and David Dornsife School of Public Health, the University of California and the University of North Carolina found that grandchildren of college-educated grandparents showed slower biological aging (i.e., younger biological age relative to chronological age) than those whose grandparents did not graduate from college based on their epigenetic-based "real" age, which considers the age of cells and proteins linked to DNA in the body.

If your grandparents went to college, you are likely to have a younger biological age than most.

In the study, published in the journal *Social Science and Medicine*, they studied data across three generations: education of parents and grandparents plus health data from parents and their children. They found a statistically significant association between grandparents' education level and aging in their grandchildren.

Previous studies in this area found that exposure to traumatic experiences — such as the Holocaust or Tutsi genocide — can influence genes among survivors and their children. The data in this study fills an important gap by examining a general population and a common crude index of social stress exposures: education level.

"In the United States, we tend to overemphasize individual responsibility when it comes to health — and there's a lot of blaming people for their poor health," says lead author Agus Surachman, an assistant professor in the Dornsife School of Public Health. "But the reality is that health is much more complex than that. Some factors are simply beyond our control, such as the genetics and the inherited epigenetics we are born with. I hope this helps us give more grace and compassion to ourselves and our communities."

_A FORMULA FOR SUCCESS

*How Drexel's seed fund and a **crash course in venture capital** helped a grad turn a classroom idea into a market-ready startup.*

When Paige DeAngelo, BA '23, first pitched her company, Aer Cosmetics, for a chance at $150,000 in R&D seed funding from Drexel, she wasn't making her case to seasoned investors — she was presenting it to peers she had been in classes with a few months before.

DeAngelo, who invented her vegan, cruelty-free mascara tablet that comes in a refillable tube while still an undergraduate, is one of several inventors who have received funds from Drexel's Innovation Fund. The fund provides early-stage support to research ideas with commercial potential from faculty, professional staff, students and alumni. To compete for the funds, would-be entrepreneurs pitch to students in Drexel's Venture Capital Due Diligence course in the Charles D. Close School of Entrepreneurship. Students in the course then analyze the startups' finances, marketing plans, market opportunity and team skills.

DeAngelo's startup was at a critical moment. A manufacturing issue had caused the mascara tablets to dry out in the tube, hardening around the brush and rendering the kits unusable. DeAngelo had researched a solution but needed funds to fix it.

She fielded hard questions from the class teams, working through financial projections, balance sheets, investor evaluations — essentially learning the same due diligence process that professional investors use.

The course is open to all Drexel students, who then evaluate pitches and their findings about the startup in real time alongside Vice Dean for Educational Affairs Chuck Sacco and Associate Director of External Relations Robert Morier, who developed the class. The instructors break the process down into several components, teaching students what to look for when making an investment and coaching them through the presentations.

"The students are the analysts, Chuck and I are the co-partners, and then we have an external investment committee that ultimately makes the decision," Morier explains. "But we empower the students to understand that they're a big part of this."

A University investment committee makes the final funding decision from the class's recommendations.

"The Innovation Fund took my business from an idea to a reality very quickly," DeAngelo says. "I was just a college student running with an idea and surviving on what pitch competitions I could win, but when I received the Innovation Fund award, I had to really sit down and learn how to be a business owner."

Working with student analysts helped DeAngelo refine her strategy and push Aer forward. The final product now includes an extra bottle of solution to ensure the tablets stay fresh.

"Every day it feels like a new story, new problem, new solution, new everything," DeAngelo says. "But I love it. I really do."

_PAIGE DEANGELO,
DeAngelo, BS communications '23, is an alumna and owner of Aer Cosmetics, a mascara brand she invented while an undergraduate.

_INNOVATION FUND
Launched in 2023, the fund provides $150,000 in early-stage investment to student, alumni and research-driven startups, acting as a friends-and-family investor for up to four ventures annually. As an evergreen fund, all returns are reinvested to fuel future Drexel-founded innovations.

_ONLINE
To learn more, visit **drexe.lu/4kuy3NQ/**

_THE TRUTH ABOUT VAPING

*Young **adults who recognize e-cigarette marketing tactics are more likely to reject vaping,** pointing to awareness as a key prevention tool.*

Vape companies know exactly how to hook young people — with slick designs, trendy flavors and by using social media influencers to promote their products. The public health challenge, then, is to help young adults see through the sales pitch.

A new study led by Drexel public health researchers and researchers from The National Institute on Minority Health and Health Disparities demonstrates that awareness is a powerful defense: Young adults who recognize e-cigarette marketing tactics are more likely to reject vaping altogether.

Although tobacco control researchers already knew that exposing cigarette industry marketing practices can influence smoking trends among young adults, the current study shows that this public education strategy may also be applicable to addressing the vaping epidemic. Roughly one in 10 Americans 18 to 24 years old use e-cigarettes.

"Our data shows that many young adults may not know about the e-cigarette industry's marketing practices, which are quite similar to the insidious marketing practices that were once used to sell cigarettes," says lead author Lilianna Phan, an assistant professor with a joint appointment in the Dornsife School of Public Health and the College of Nursing and Health Professions. "Exposing e-cigarette marketing practices to young adults should continue to be investigated as a potential public education messaging strategy as it may help shape attitudes against vaping. These attitudes, in turn, could help protect against initiating vaping for susceptible young adults."

_LILIANNA PHAN
Phan is an assistant professor with a joint appointment in the Dornsife School of Public Health and College of Nursing and Health Professions.

The paper, published in the *BMJ* journal *Tobacco Control*, provides insights for policymakers and public health efforts, and also supports strategies that prevent new vape users from starting.

BREAK THROUGH ↓ (IN) THE BAY (OF) BENGAL

→ During an intensive summer in India, two Drexel first years learned the rhythms of research, the value of mentorship and the power of going off-script thanks to Drexel's revitalized undergraduate research program.

BY NAT KAEMMERER

PHOTO BY JEFF FUSCO

← _ZAKIR JIWANI AND JOSIAH SADDICK

AT FIRST, THE TWO RESEARCH NOVICES diligently followed the advice of their older colleagues.

But then Josiah Saddick and Zakir Jiwani, frustrated by their stalled progress on a bone scaffolding experiment in a biomedical lab halfway around the world, began to wonder — would they get further if they did the complete opposite of what they'd been told?

It was a half joke. But then they did it. They doubled the concentration. Changed the temperature. Stopped asking for permission. And finally, something clicked.

"We decided to go off-book completely, just to see what would happen, and it ended up working out in our favor," Saddick says. "Based on other research, we shouldn't have been successful, but that was actually what was holding us back."

Their impulse paid off with a stable, therapeutic mixture for a 3D-printable bone scaffold implant — a feat not even the PhD students in their lab had achieved.

That success capped a whirlwind summer for the two Drexel engineering majors, who had gone from rising second years fresh off their first year of college to co-investigators in an international lab — working shoulder-to-shoulder with PhD researchers at India's top university, the Indian Institute of Technology Madras (IITM) in Chennai.

The 10-week immersion in research, collaboration and culture was made possible by a renewal of Drexel's STAR Scholars program and its international research version, iSTAR.

FROM CLASSROOM TO CHENNAI

Each summer, Drexel's STAR (Students Tackling Advanced Research) Scholars program places first-year students in experiences that have them tackling serious research alongside faculty mentors. iSTAR takes the program global, matching undergraduates with challenging projects at institutions abroad, studying breast cancer, artificial intelligence and more.

In 2024, iSTAR relaunched after a pandemic pause, and thanks to personal and institutional ties between Drexel and the IITM, the program picked up nearly where it left off.

Pennoni Honors College's Undergraduate Research and Enrichment Programs (UREP), which runs STAR Scholars, placed the pair of aspiring engineers in IITM's Department of Applied Mechanics & Biomedical Engineering in Assistant Professor Swathi Sudhakar's Nano-Molecular Lab. Saddick is a mechanical engineering major and Jiwani studies computer engineering, so biomedical engineering was a new area for them.

Their assignment: Develop a biocompatible material for a 3D-printed bone scaffold structure that can support new bone growth — a promising alternative to surgical implants for patients suffering from large bone defects, osteosarcoma or osteoporosis, which make it hard for the body to grow new bone tissue.

They arrived in Chennai just weeks after wrapping up their first year at Drexel, stepping off the plane and smack into a wall of humidity. After a nearly sleepless first 48 hours and a close call with a currency rip-off, the reality of life as advanced researchers set in as quickly as the sticky air.

"We originally thought we were going to hop on a project they already had, but they gave us a project to start up and continue with," Saddick says. "It essentially opened us up to the global scientific community as we got insight into the world of a PhD student. We went from normal classes to PhD-level research."

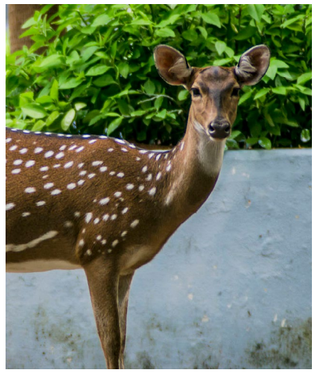
For Jiwani, 19, it was a continuation of an already global education. Born in South Africa, raised in the Democratic Republic of Congo, and educated in Kenya, he had traveled to India before, though not to Chennai. But it was 19-year-old Saddick's first time flying.

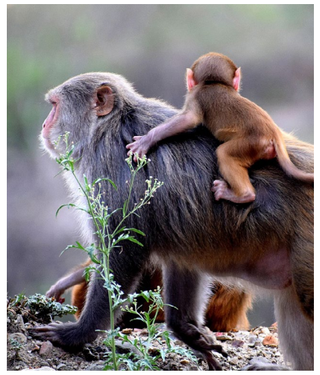
"As an engineer, I was just amazed, just looking at the wings. I've studied aerodynamics and it was pretty exciting to experience it for once," says Saddick, a first-generation Guyanese American student who grew up in Upper Darby, Pennsylvania. "But I had to learn how to get comfortable on a plane."

They knew to expect long hours, intense lab work and cultural adjustments. Less expected were the gazelles, monkeys and deer on campus. The University, situated next to the free-range Guindy National Park in the southern state of Tamil Nadu, occupies a sprawling campus full of trees and wandering wildlife, including Blackbuck antelope with tall, spiraling horns. You have to be alert, says Jiwani.

"We would just be going to the labs, or for food, and then there would just be monkeys in the trees," Jiwani says. "One day Josiah was carrying snacks across campus and was surrounded by monkeys."

_FREE-RANGE CAMPUS Chital deer and monkeys are a common sight on IITM's campus, which is adjacent to a free-range nature preserve.





_CROSS-CULTURE COLLABO Jiwani (second from left) and Saddick (far right) pose with their lab mates during the summer-long research project in Chennai.

MENTORSHIP, MULTIPLIED

Though iSTAR began in 2012 and had seen several students off to countries in Europe, the program may never have reached India had it not been for Sriram Balasubramanian, associate professor in Drexel's School of Biomedical Engineering, Science and Health Systems.

One of just a few faculty members who hosts high school students in his lab, Balasubramanian began recruiting Drexel undergraduates in his lab at the Children's Hospital of Philadelphia even before he joined the University in 2010. He's mentored dozens of STAR Scholars over the years, helping them connect to conferences and opportunities with hospitals, universities and companies.

Chennai is his hometown, and when they arrived, he served as guide to the bubbling tech hub of 10 million, India's fourth-largest city. He helped them get furniture for their rooms, securing better prices on mattresses than a tourist could ever hope, showing them the best places to eat, and steering them through the unspoken expectations of lab life at India's top-ranked university.

"They're expecting you to get the work done, even if they aren't checking on you," he says. "India is also a completely different country and culture. Every state speaks a different language, so I'm able to help them communicate. It's almost critical to have a faculty member be there as a guardian or caretaker no matter the country."

To be mentored by Balasubramanian means learning how to become a mentor, too — he hosts tiers of students of different ages, believing that when one is both *mentoring* and *being mentored*, you gain a new appreciation for what it takes.

"High school students are getting mentored by the STAR Scholars, who are getting mentored by master's students and PhD students," he explains. "Within the lab, they learn with each other and can look at students senior to them and see what they could be doing in a couple years."

By week two, Saddick and Jiwani were fully immersed, logging 40-hour workweeks, traversing the massive campus on rented bikes like locals, and bonding with their PhD lab mates over tea breaks, frequent breaks for sweets and beach excursions along India's Bay of Bengal. The research community at the IITM — rigorous but generous with their help — welcomed them in.

"They have some amusement park rides…it was like your typical boardwalk experience, but the rides had no seatbelts," Saddick recalls. "There was a bar, but you could feel yourself in free fall for a few moments. Zakir [Jiwani] and I were kind of freaking out, which they found hilarious, but it was a bonding moment."

TRIAL, TRIAL AND TRIAL AGAIN

By week eight or nine, the undergrads were racing to make headway before their time in India ran out.

Their assignment was going slower than they expected.

Bone scaffolds help damaged bones regrow without the need for painful bone grafts from elsewhere in the body, saving patients from complex, expensive surgeries and the risk of fatal infections. Their challenge was to concoct a mixture for the scaffolds that was strong enough to extrude while also being biocompatible.

"When we mixed the solutions, we were looking for a Jello-like consistency that solidified almost like hair gel," Saddick says. "The first solutions would somewhat reach that consistency, but they had very low viscosity… when we freeze-dried them, they wouldn't be strong enough to undergo the testing."

Their supervisors had given them a base mixture to work with made of natural proteins from corn and crustaceans, and they were tasked with adding in curcumin, the active compound in turmeric, as a biodrug additive to help reduce inflammation and prevent infection.

The catch? Curcumin metabolizes too quickly in the body to be useful as a therapy. Their supervisors had a theory that binding it with zinc would stabilize it enough to make it useable in the scaffold.

The process took several days, from mixing the gel to putting

> "It essentially opened us up to the global scientific community. We went from normal classes to PhD-level research."

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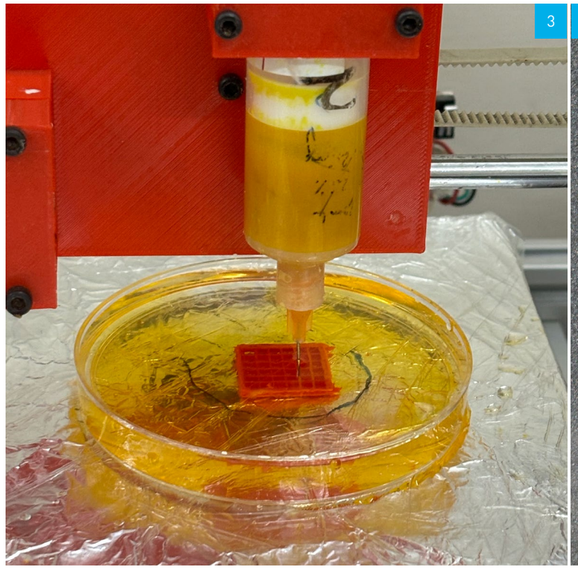

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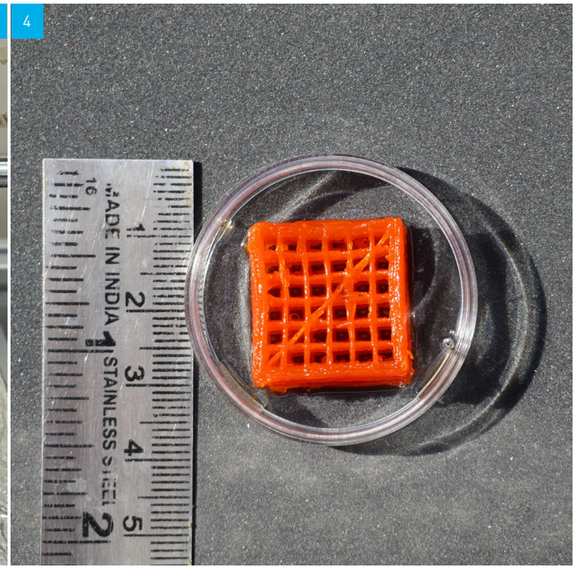

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Courtesy Josiah Saddick and Zakir Jiwani

_1 To create the bone scaffold material, student researchers mixed proteins from corn and crustaceans, plus curcumin they stabilized with zinc. _2 The yellow tint of the scaffold is derived from curcumin, a derivative of turmeric that the researchers believe will improve bone healing. _3 After many failed experiments, Saddick and Jiwani landed on a combination of ingredients stable enough to be used to 3D print a square-inch cube scaffold. _4 Close-up of the scaffold.

it through two freezing processes at 0°C and then at -80°C. If the scaffold broke apart, they'd start again. The failures stacked up.

"It was very discouraging at first to go on for like three weeks on an experiment and get no results," Jiwani recalls. "STAR is designed as an entry way into research, but what most people don't realize is that they're trying to do the work that takes a PhD student one year, and they're trying to fit that into three months."

Still, they kept iterating. They went back to the books, talked to their colleagues who would quiz them on their knowledge, and as their confidence grew in the lab, they became bolder in trying unconventional approaches.

"We had five or six trials, and if we didn't have that support, we probably wouldn't have succeeded on the last one," says Saddick.

One day, after weeks with no solid results but reluctant to ask for an extension, Saddick and Jiwani made a pact: they wouldn't leave the lab until something worked.

The hours slipped by as they ran trial after trial, late into the night, until they were the only ones still there. Around 4 a.m., they finished one last batch. It gelled — a good sign — but the real test would come the next day, after freeze-drying.

"We put so much time into it," Saddick says. "We were just so excited. We finally had success, and we had to make the most of this time we had left."

Twelve hours later, their breakthrough held. The scaffold was stable, printable — a first for their lab. "We tried the 3D printing aspect right afterward and it worked perfectly," says Saddick.

Their scaffold project became the basis for a new phase of research after the pair returned to the United States, with their Indian PhD colleagues taking up animal testing — and now asking *them* for pointers.

"Everyone was like, 'You should show us,'" Saddick says. "And we felt equal at that point."

That collaboration — students learning from PhDs, then teaching in return — is exactly the kind of mentorship Balasubramanian and the STAR program fosters. iSTAR and STAR Scholars often continue working with their mentors as co-ops or for academic credit, or present to colleagues or at research conferences while still undergraduates.

"STAR Scholars are just exceptional," Balasubramanian reflects. "They finished high school the year before, and they're almost like grad students already. Their participation in the lab helps their position for future careers and also creates a nice group to work with."

Since returning, the pair have also continued to do some computational work that they started in India, developing generative AI tools to help identify which implants should be used in specific cases. "It would help alleviate the strain that's placed on Indian rural healthcare… to cut down a diagnosis that takes up to three days to about 20 minutes," Jiwani says.

While Jiwani and Saddick were celebrating their research breakthrough, the success of their summer in Chennai reflected a much larger achievement — the deepening of a strategic partnership with India.

A PASSPORT TO PARTNERSHIPS

For Jaya Mohan, who directs UREP, iSTAR offers a model of global engagement that's both meaningful and scalable — and that aligns with Drexel's broader international and educational goals.

"Ultimately, my goal is to have iSTAR be tied really closely to the University's goals for global engagement," says Mohan, who has seen students return from STAR experiences more connected and able to contribute to research at a high level. "It's an easy stepping stone into having additional conversations about what else a partnership between Drexel and this institution looks like."

"Being in this academic environment with people who are really, really good at what they do was eye-opening… You're always at the cutting edge of that field."

India is central to those ambitions.

The country is currently the top sender of international students to the United States, particularly at the graduate level, and it's investing heavily in science and technology — Drexel's own areas of strength.

IIT Madras is Drexel's primary partner in the country — not just through iSTAR, but through guest lectures and research collaborations. The universities are working on new joint master's degree programs in biomedical engineering and materials science that could launch as early as fall 2026, with students spending time at both institutions.

Similar collaborative graduate programs already exist between other Drexel colleges and various Indian universities, including the Sri Sivasubramaniya Nadar School of Advanced Career Education, Chennai; SRM Institute of Science & Technology, Chennai; Maharashtra Institute of Technology-Art, Design & Technology University, Pune. The goal is for students to get a cultural as well as a scientific education to prepare them for the interconnected world.

"Cutting-edge scientific research is done increasingly through international collaborations, rarely in isolation within one country," says Vice Provost for Global Engagement Rogelio Miñana, who has been helping to deepen Drexel's global connections. "Considering that most leading companies in health, science and technology are multinational, having this type of global experience gives students a clear edge in the job market."

At the IITM, researchers are designing technologies for delivery across India — including in rural regions where access to care and infrastructure can be limited. That mindset resonates deeply with Drexel's ethos of applied, human-centered science.

"This idea of doing science for the greater good in a way that is affordable and easily disseminated teaches students not only about scientific research, but about the human values and the higher purpose behind the science," Miñana says.

And, it's powerful cultural exchange. Drexel students aren't just gaining lab experience — they're immersed in new ways of thinking, working and collaborating. They return more confident, more curious and more capable of producing useful science.

It's set the stage for a transformation in Jiwani. Being immersed in a top-tier research university changed him, says Jiwani. After returning to Philadelphia, he was inspired to explore opportunities in Drexel's nanomaterials lab and more research-heavy paths.

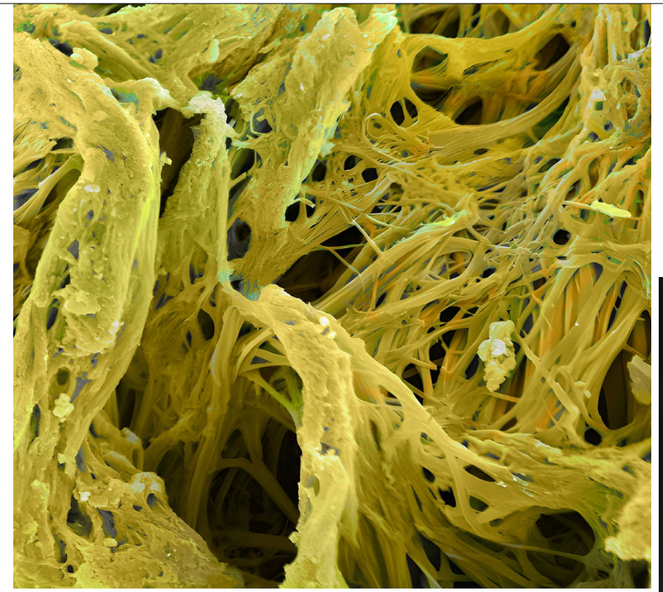
"I was able to develop not only academically but also as a person, in terms of integrity and my interpersonal skills," he says. "Being in this academic environment with people who are really, really good at what they do was eye-opening… You're always at the cutting edge of that field."

THE Making OF A Scientist CEO

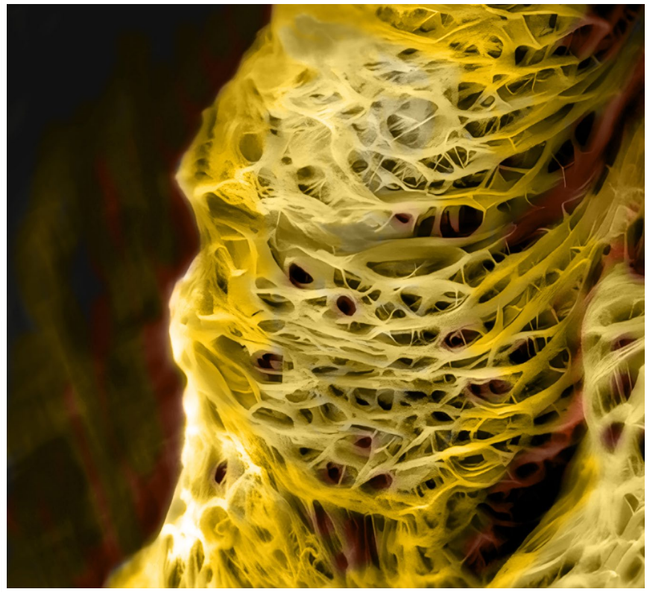
BY NATALIE KOSTELNI

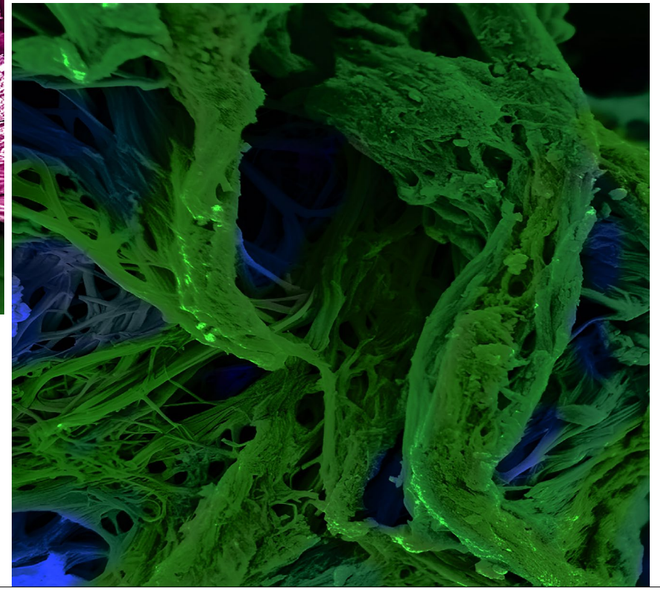
PHOTO BY JEFF FUSCO

FROM A SPARK OF CURIOSITY IN HIGH SCHOOL CHEMISTRY TO CO-FOUNDING A CUTTING-EDGE NANOMATERIALS STARTUP, **GREG SCHWENK**'S PATH TO BECOMING CEO OF ONE-D NANO IS A STORY OF TECH TRANSFER INNOVATION FUELED BY DREXEL'S ENTREPRENEURIAL ECOSYSTEM.



_TINY BUT MIGHTY Scanning electron microscopy (SEM) images of the world's thinnest 1D nanofilament — just six angstroms wide. This inorganic cellulose, likened to ultra-thin spaghetti, boasts an unprecedented surface area and unique structural properties with potential applications in environmental cleanup and green hydrogen production.





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THOUGH JUST 32, Greg Schwenk's passion for chemistry has taken him a great distance in life. What began as a spark of interest in high school in the rural town of Elmhurst, near Scranton, Pennsylvania, took deeper root during his undergraduate years at the University of Scranton and flowered as a doctoral student at Drexel. There, with a little risk taking and the right mentors, Schwenk (PhD inorganic chemistry '22) turned his academic pursuits into a startup that has the potential to transform industries and tackle big environmental challenges.

While studying inorganic chemistry at Drexel, Schwenk found himself surrounded by opportunity. He became a postdoctoral researcher in the College of Engineering lab of Professor Michel Barsoum — a leading researcher in nanomaterials — just as Barsoum was exploring a potentially groundbreaking new one-dimensional nonfilament material he had discovered in 2021 with Hussein O. Badr '23 (then a doctoral student, now a post-doc at Stanford University).

Jump forward to this year, when Schwenk and Barsoum announced they would co-found One-D Nano, a startup focused on commercializing the material, with Schwenk as CEO and Barsoum as technical advisor.

"It wasn't always sunshine and rainbows, and there were challenges along the way, but many of the teachers I had shaped my analytical mindset and love for discovering new things," Schwenk says of his journey from student to CEO. "I consider myself incredibly lucky to have had amazing academic role models and early experiences that laid the foundation for where I am today."

Chemistry, for Schwenk, represents an opportunity to improve lives, and his goals are already earning him recognition. In July 2024, he was awarded a prestigious Activate Fellowship, becoming one of only 62 fellows selected from more than 1,000 applicants. This fellowship supports scientists who are on a mission to turn breakthroughs into high-impact businesses.

The Activate Fellowship offers Schwenk over $500,000 in non-dilutive funding — support that doesn't require giving up any ownership in the company — to cover his salary, research expenses, health benefits and travel. Additionally, the fellowship provides access to a network of educational resources and support from a community of scientists, engineers, investors and fellow scientist-entrepreneurs.

COURSES AND CONNECTIONS

Schwenk's involvement with the groundbreaking 1D nanomaterial was serendipitous. In 2021, while working in the University's Materials Characterization Core lab, he met Badr and struck up a conversation about the new nanomaterial Badr was developing with Barsoum. Intrigued, Schwenk cold-emailed Barsoum, expressing interest in working in his lab. The outreach worked.

By September 2022, Schwenk had defended his thesis and, just two days later, began working with Barsoum's Layered Solids Group on what he describes as a "paradigm-changing" material.

"The research process was intense but rewarding," Schwenk says. "We knew we were onto something special, and the support from the research community at Drexel was invaluable. Our work speaks volumes about the collaborative and supportive research culture at Drexel."

Barsoum, already known for his earlier discovery, with Distinguished University and Charles T. and Ruth M. Bach Professor Yury Gogotsi, of MXenes — a family of two-dimensional nanomaterials made from titanium and carbon atoms — describes the 1D nanofilament material as "something even more fascinating." The 1D nanostructures, which he likens to ultra-thin spaghetti, are an inorganic cellulose that offers unique properties with promising industrial applications.

"It's six angstroms by six angstroms — very thin spaghetti; world-record thin," he says. "It's the first inorganic material of this kind ever made. If you take a gram of this and connect it end to end in a chain, it will span 400 million miles."

With a very high surface area and structural qualities similar to biological materials, the 1D nano material has remarkable properties "we have never seen before," Barsoum says. He imagines the material being used to address major environmental and industrial challenges. For example, it can absorb harmful dyes from textile waste and, using sunlight alone, degrade them into less harmful byproducts. Green hydrogen production is another focus, tapping into the material's potential to produce sustainable energy.

PROGRAMS AND PARTNERS

The commercialization path for these 1D nanostructures is complex, given their diverse potential applications. Finding a focus has been both exciting and challenging for Schwenk and One-D Nano. To help shape their strategy, Schwenk participated in the NSF I-Corps Program, a government program that Drexel participates in to help scientists assess the commercial potential of their inventions.

"Startup companies have limited resources, and determining what problem to solve first is so critical," Schwenk says. "Without a well-articulated focus that is validated with potential customers and industry stakeholders, you will find no investment. That is when I looked to Drexel Applied Innovation for help. Through working with them, my streak of powerful mentors continued."

> "OUR WORK SPEAKS VOLUMES ABOUT THE COLLABORATIVE AND SUPPORTIVE RESEARCH CULTURE AT DREXEL."

Over the course of six months, Schwenk worked closely with Shintaro Kaido, then-head of Drexel Applied Innovation, which oversees tech transfer for the University. This office partners with University faculty, professional staff, students and external innovators to connect academic inventions to real-world applications. By guiding discoveries into the marketplace, Drexel Applied Innovation seeks to create new products and services that address societal needs.

After he went through the I-Corps program, Schwenk was introduced to the Activate Fellowship as one way to advance One-D Nano's mission and pursue his desire to be a "scientist-entrepreneur."

FUNDS AND SUPPORT

Programs like Activate and NSF I-Corps have been important in the United States for fostering the scientist-entrepreneur model and ensuring that valuable academic discoveries become available to the world. The increased support of scientist-led startups by top venture capital firms and federal programs marks a shift in the landscape. The model enables more Drexel faculty, post-docs and students to pursue high-growth entrepreneurial pathways while advancing research that impacts society.

Since 2015, Activate has worked to support scientists at research institutions as they pursue entrepreneurship. So far, it has guided 249 fellows and 196 startups across energy, electronics, manufacturing and more. Collectively, Activate Fellows have raised $2.3 billion in additional funding to fuel their work.

"Greg is a great example of the scientist-entrepreneur Drexel can and wants to cultivate," says Kaido, who mentored Schwenk while he was at Drexel. "Drexel wants to grow the pipeline of scientist-entrepreneurs and help more researchers make commercial and societal impact."

Silence, Stigma and the Power of Promotoras

Philadelphia's Latino community is finding mental health support through a Drexel program rooted in the trusted Latin American tradition of lay health workers. BY TIM HYLAND

ILLUSTRATIONS BY EDEL RODRIGUEZ

Marilu* is not a licensed therapist. She isn't a doctor. But to many of the men in her Philadelphia community, she's the only person they truly trust with their pain.

As a *promotora* — a lay health worker who helps Latino families connect to support systems — Marilu has become an unofficial first responder for Spanish-speaking Philadelphians who are suffering from mental health challenges. Men who have never spoken about their emotions before, who have been taught from childhood that showing sadness is a weakness, now come to her in silence.

As deep as their pain is, they don't want their wives or children to see them cry, even as they cry out for help.

"They break down," says Marilu. "They cry, they let out all their pain, everything. And then they ask me, 'Tell me if I'm OK, because my family can't see me like this; I can't let them see me like this.'"

In Latino culture, *machismo* still casts a long shadow. From a young age, Latino boys are taught not to show vulnerability, to stay strong at all costs.

"There's this deep stigma," Marilu says. "Men shouldn't cry, shouldn't look weak, shouldn't appear fragile."

But slowly, Marilu says, something is changing.

"Lately, we're getting there," she adds. "Men are opening up. In secret. But it's a start."

It's an important step forward toward reducing mental health stigma in Philadelphia's Latino communities, made possible in large part by a unique and impactful initiative organized by Drexel's Dana and David Dornsife School of Public Health.

The CRiSOL Mente program, a community multi-level intervention aimed at improving mental health among Latinos, leverages the power of trusted community members like Marilu to bridge the gap between underserved populations and mental health services.

Promotoras are carefully chosen from the communities in need and receive hundreds of hours of training in mental health support, community outreach, screening, patient advocacy, and grief and crisis counseling. Drexel and its nonprofit partners — most notably, the Philadelphia AIDS Consortium and the Esperanza Health Center, along with a coalition formed and led by the Drexel team called the Latino Health Collective — connect them to culturally appropriate care and resources, all of which they leverage to help their communities and create better health outcomes.

The results have been remarkable.

EMERGING FROM CRISIS

The program evolved from an original iteration of CRiSOL that launched in 2019, just months before COVID-19 laid bare longstanding disparities in health care access across the United States. In Latino communities, the unfolding pandemic had a disproportionate impact, not just in terms of infections and fatalities, but also in its psychological toll.

Isolation, job loss, food insecurity and the trauma of losing loved ones posed a mental health burden that many Latino families were ill-equipped to address. Today, the challenges are different but just as urgent, as immigrants also contend with fears of potentially losing their lawful status or seeing friends or relatives deported.

CRiSOL, which stands for *Comunidades Resilientes, Sostenibles y Organizados for Lideres* ("Cultivating Resilient and Strong Opinion Leaders"), arrived just in time, quickly adapting to help Philadelphia's Latino communities cope.

In 2022, the program was rebooted as a five-year, federally funded community intervention focused on mental health, CRiSOL Mente, under the guidance of Ana Martínez-Donate, a professor of community health and prevention in Drexel's Dornsife School of Public Health whose work centers on improving health outcomes among immigrant and underserved populations.

Helping to helm CRiSOL Mente is Mariana Lazo, MD, a research professor at the Dornsife School of Public Health. With a medical degree from Universidad La Salle in Mexico City and advanced degrees in epidemiology from Johns Hopkins University, Lazo brings a wealth of experience in the implementation of interventions and the study of health disparities.

Martínez-Donate and Lazo envisioned a three-pronged approach: placing lay health workers on the front lines of the fight for better health by embedding them in both Latino communities and in health clinics across Philadelphia; breaking down stigma through public outreach campaigns including radio segments, informational sessions and community events; and partnering with Latino-serving organizations to strengthen their role in addressing mental health needs.

With approximately $1.2 million in annual support from the National Institutes of Health, the initiative is now entering its fourth year.

While the program engages on multiple levels, each essential to its success, the Latino lay health workers are the bedrock on which it is built. By serving as bridges between the clinical and community worlds, these workers conduct outreach and education that help to connect people to care even if they are reluctant to reach out. Some parlay their training into full-time jobs with nonprofit partners, where their experience boosts the organizations' capacity to reach those in need.

Lazo is deeply committed to the community volunteer model as a means of establishing trust.

"A lot of the people that we are targeting in this effort are immigrants … and that makes them especially hard to reach," she says. "The lay health workers are influencers or leaders in their community and also know a lot about those communities. This model not only creates greater capacity to address these mental health issues, but it also helps us address the social and economic issues that we know underlie all of these conditions."

HER SILENT CRISIS

While machismo teaches men to suppress emotion, Latina women face a different kind of silence — rooted in the cultural expectation that they must be selfless and composed.

The concept of *marianismo*, drawn from the Catholic ideal of the Virgin Mary, holds that women should be morally virtuous, spiritually resilient and endlessly giving. This value system, in combination with a traditional emphasis on family privacy, means women's mental health struggles often stay hidden, unspoken or are absorbed quietly in service of others.

For first-generation Latinas especially, the pressure to succeed in a new country while preserving cultural roots can create a relentless psychological tug-of-war. Expected to be caregivers, cultural translators, emotional anchors and economic providers, many shoulder the invisible weight of keeping their families afloat — often without acknowledging their own needs.

"Talking about mental health in the community is not easy, since there is so much stigma that the topic cannot be discussed," says Zulma, a *promotora* who has worked with CRiSOL since the first program cycle in 2019. She says her passion for the work is tied in part to the fact that both her family and friends have been directly helped by it. "Due to beliefs, cultures and religion, it is very difficult [to address] … All of this affects well-being: Emotionally, socially, psychologically."

> "I should dedicate 20 hours per week to the program, but in reality it's much more than that, because when the community already knows me as a person who provides them with certain services or support, they will come to me at any time."
>
> **— CLAUDIA ZUMAETA-CASTILLO, MHP**
> **CRiSOL Program Coordinator**

These expectations exact a high emotional toll. Only about 35% of Latinas with mental health issues receive treatment, compared to nearly 50% of non-Hispanic white women, according to the National Alliance on Mental Illness. Untreated mental illness ripples out across families, schools and workplaces. Studies have linked mental distress among Latinas to higher rates of suicide attempts, especially among young women. The Centers for Disease Control and Prevention reports that Latina adolescents are more likely than their white or Black peers to seriously consider or attempt suicide.

By offering listening and support, CRiSOL Mente offers something radical: the idea that caring for others can begin with caring for yourself.

NEW CHALLENGES

Philadelphia is home to an estimated 47,000 undocumented immigrants, according to Migration Policy Institute, and recent efforts to tighten federal immigration enforcement have put many Latinos on alert, regardless of their immigration status.

"Nowadays, if you do not have a work permit, if your legal status is not in order, a person cannot get a job elsewhere, cannot financially support their family, has to build their life in this country, and also has to take care of their family back home," Marilu says. "Many have gone or come to this country paying a lot of money to arrive. They have that debt pending in their country. Added to that is the distancing or family separation. On top of that, there is that feeling of persecution where one does not know when a person will be deported or not; it becomes even more difficult. The person no longer feels stable. The person no longer feels safe."

Although health care providers generally aren't required to report immigration status, many immigrants still see the system as risky terrain. Inconsistent policies and mistrust of institutions leave many hesitant to seek care, even when they need it most.

In the face of numerous challenges, the program has nonetheless succeeded in completing hundreds of individual interventions that otherwise may never have happened, Lazo says. That's because of the *promotoras*.

To identify *promotoras*, the program organizers took a grassroots approach, tapping into existing networks. Potential *promotoras* were referred through a patchwork of channels: fliers, radio shows, social media and referrals from earlier Drexel programs. Most candidates were interviewed by academic and clinical teams to ensure they were a good fit.

They were all, Lazo says, "connected to other Latino immigrants, perceived as trustworthy, comfortable talking to other members of the community, and highly motivated to be an agent of change in their community."

> "Our promotora's have such big hearts, and they want to help their peers. They have seen people struggle a lot, and they understand how much the community needs them."
>
> **— CLAUDIA ZUMAETA-CASTILLO, MHP**
> **CRiSOL Program Coordinator**

In its current program iteration, CRiSOL Mente has trained 10 *promotoras*, providing more than 130 hours of hands-on and virtual trainings, plus more than 100 additional hours of "booster sessions," which provided the *promotoras* the opportunity to report back on their outreach efforts, get feedback from program leadership — and, by extension, build confidence for future interventions.

The impact of that investment speaks volumes. Over just two years, *promotoras* have screened more than 800 individuals for mental health concerns — none of whom had received mental health care in the past year. Nearly half were ultimately connected with clinical support, receiving free care for six months in their preferred language.

As the program enters the final year of its current NIH grant, Lazo says, the team's goal is to reach at least 200 more individuals in need. That effort relies not only on training but also on the dedication of *promotoras*.

For many, this work is more than a job. Claudia Zumaeta-Castillo, a CRiSOL Mente program coordinator who helps train and support the *promotoras*, says the work is so special to her that she often finds herself putting it first — including ahead of her dissertation.

"I prioritize this," she says. "And that's not because anyone is telling me I have to. It's just that this is the work that I really like. I've seen this program grow from what it was to what it is, and sometimes that means being available 24-7. The *promotoras* know they can call me at any time — and they have. If they need me, I'm always there."

Marilu has an "all-hours" ethic when it comes to being available to community members in need.

"It could be in the afternoon, it could be a Saturday, a Sunday, an emergency," she says. "They don't know that I have specific hours; they call me at any time, so I always try to be available for them and be able to help them at all times. That's my job, to bring benefits so that the community can have a better quality of life through these benefits, through these care services."

Talk to anyone involved in the program and you'll hear their enthusiasm — they believe they're making meaningful, lasting progress. Barriers are coming down, men are opening up, and conversations once unthinkable are finally happening.

"I am hoping that other organizations see the value of community health workers and embrace this model," says Lazo. "There is so much commitment. Our *promotoras* have such big hearts, and they want to help their peers. They have seen people struggle, and they understand how much the community needs them. They very much want to help others. …If you hire a community health worker, they will make it happen."

_ANA MARTÍNEZ-DONATE
_MARIANA LAZO, MD

Martínez-Donate is a professor of community health and prevention and associate dean for public health practice and external relations in the Dana and David Dornsife School of Public Health. Lazo, MD, is a research professor in the School of Public Health with appointments at the Department of Community Health and Prevention and the Urban Health Collaborative.

_AI UNDER EXAMINATION

*Drexel experts aren't just investigating **AI applications** – they're working to ensure the technology is effective, accountable and aligned with society.*

Artificial intelligence is no longer a distant frontier — it's an engine of transformation, reshaping industries and driving debates about the future of work.

AI-related software spending is projected to reach nearly $300 billion by 2027, by which time, a quarter of all global organizations are predicted to be in the AI-planning stages, according to the consultancy Gartner. As AI's influence accelerates, so do urgent questions about its risks, regulations and use cases.

At Drexel, researchers are lending their expertise to national efforts to establish safeguards. Engineering and informatics faculty were among the first cohort of experts selected by the U.S. National Science Foundation to develop frameworks for safe, secure and trustworthy AI. Their work, recognized in a White House ceremony last spring, includes using machine learning algorithms to improve transparency and oversight of large language models.

Drexel is also one of more than 200 institutions participating in the U.S. AI Safety Consortium, a Department of Commerce initiative that unites academia, industry, government and civil society organizations to shape the responsible development of AI.

Beyond policy and oversight, Drexel researchers are harnessing AI to solve practical challenges. Among them, a team from the College of Computing & Informatics is collaborating on a Defense Advanced Research Projects Agency (DARPA) initiative that uses AI to support leaders thrust into crisis situations. Across disciplines, AI is being leveraged to combat degenerative brain disease, enhance protective measures for frontline medical workers, and monitor aging roads and bridges. Other projects explore AI's role in designing climate-resilient communities and empowering teens to recognize online predators.

Read on to learn more about Drexel's work on AI.

2 Fissure Spotter

Cracks in concrete may start small, but they can signal serious structural issues — something **Arvin Ebrahimkhanlou** and his colleagues are tackling with AI.

In one project, Ebrahimkhanlou and **Pedram Bazrafshan** have developed an AI-powered method to quickly assess damage in concrete structures by analyzing surface cracking patterns.

With hundreds of thousands of aging bridges, levees, roadways and buildings across the country, knowing which ones need urgent repair is critical. Traditional manual inspections are time-consuming and inconsistent, relying heavily on an inspector's judgment.

To make the process faster and more reliable, the researchers combined AI algorithms with a classic mathematical technique for analyzing web-like networks. Their approach quantifies structural damage based solely on crack patterns, offering a more efficient and objective way to prioritize repairs.

Building on this work in a separate but related project, Ebrahimkhanlou is also developing AI-driven tools to support robotic inspection of bridges, buildings and roads. With research assistant **Ali Ghadimzadeh Alamdari,** he created a multi-scale system that uses computer vision and machine learning programs to identify cracks in concrete and direct robotic scanning, modeling and monitoring.

They believe their AI-powered system could enable autonomous robots to efficiently locate and inspect problem areas — reducing the need for human inspectors in hazardous conditions while catching structural issues earlier.

"Cracks can be regarded as a patient's medical symptoms that should be screened in the early stages," the researchers wrote in *Automation in Construction.* "Consequently, early and accurate detection and measurement of cracks are essential for timely diagnosis, maintenance and repair efforts, preventing further deterioration and mitigating potential hazards."

1 Deepfake Detection

Matthew Stamm is working to stem the rising tide of deceptive videos known as "deepfakes."

The ability of AI tools to produce strikingly realistic content from a few simple text prompts raises the specter of AI being used to mislead people on a massive scale.

One challenge is that current methods of detection won't work against AI-generated video. But Stamm's work shows that AI can also be used to fight back: A machine-learning approach could be the key to unmasking these synthetic creations. His team has had success with a machine learning algorithm that can be trained to extract and recognize digital "fingerprints" of many different video generators.

Bad actors will find a way to use AI for deception. "That's why we're working to stay ahead of them by developing the technology to identify synthetic videos from patterns and traits that are endemic to the media," he says.

_MATT STAMM
Stamm is an associate professor and director of the Multimedia and Information Security LabCollege of Engineering.

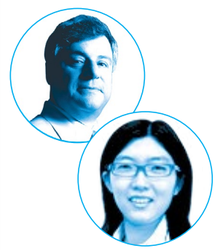
_ARVIN EBRAHIMKHANLOU
_PEDRAM BAZRAFSHAN
_ALI GHADIMZADEH ALAMDARI
Ebrahimkhanlou is an assistant professor, Bazrafshan is a doctoral student, and Alamdari a research assistant for the College of Engineering.

3 Brain Age Predictor

In the fight against degenerative brain disease, **John Kounios** and **Fengqing Zhang** are leveraging AI to estimate "brain age," a key predictor of age-related diseases like dementia, mild cognitive impairment and Parkinson's disease.

When a brain ages prematurely, early intervention could help delay or prevent serious health problems — but identifying at-risk patients has been challenging. Kounios and his colleagues have developed a machine-learning method that uses electroencephalography (EEG) instead of MRI scans to estimate brain age.

EEGs are less expensive and less invasive than MRIs, making widespread screening more feasible. "It can be used as a relatively inexpensive way to screen large numbers of people," Kounios says.



_JOHN KOUNIOS
_FENGQING ZHANG
Kounios is a professor and the director of the Creativity Research Lab and Zhang is an associate professor, both in the College of Arts and Sciences.

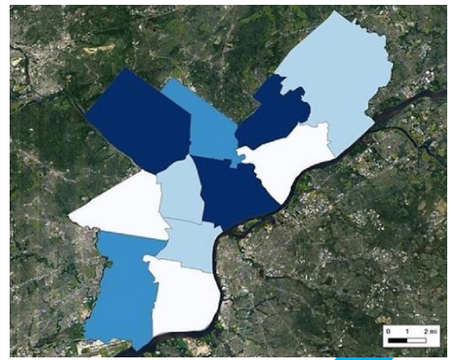
Smart Eco Zoning

Philadelphia's path to cutting greenhouse gas emissions may depend on smarter zoning — and machine learning could be the key. **Simi Hoque** is using AI to model energy use at a granular level, helping predict how consumption will shift as neighborhoods evolve.

Her research, recently published in *Energy & Buildings,* could support the city's 2050 plan to reduce greenhouse gases by identifying how zoning policies influence energy efficiency.

"For Philadelphia in particular, neighborhoods vary so much from place to place in prevalence of certain housing features and zoning types that it's important to customize energy programs for each neighborhood, rather than trying to enact blanket policies for carbon reduction across the entire city or county," she says.

_SIMI HOQUE
Hoque is a professor in the College of Engineering.



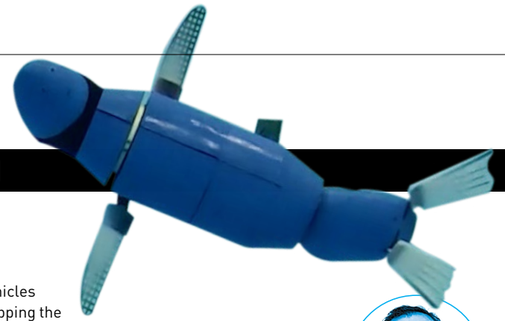
_EMISSIONS EVOLUTION
An illustration of how energy demand could rise or fall across Philadelphia under future development, with red areas indicating increased energy use, and blue areas showing a decrease.

Percent change, per capita (kilowatts/day)

-0.45
0.07
0.22
0.42

4

_AI UNDER EXAMINATION



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Robots for the Sea

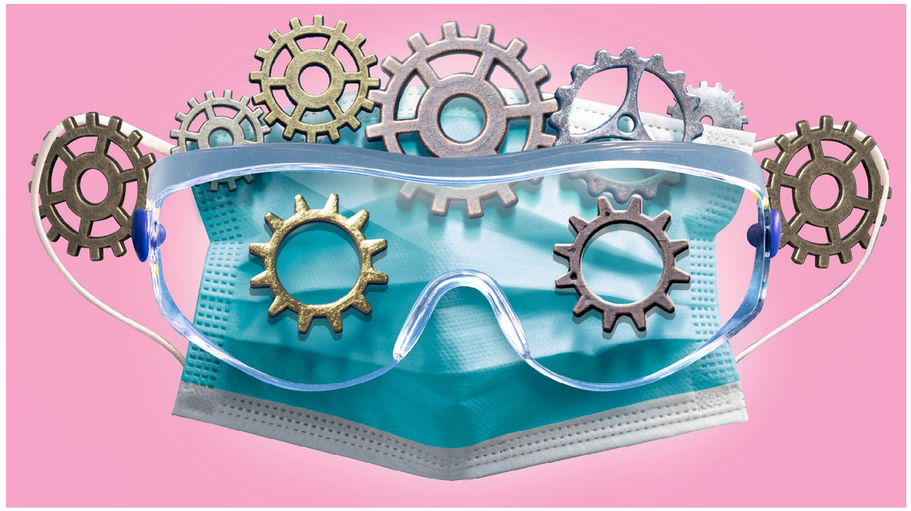
Step into **James Tangorra**'s lab, and you might mistake it for an aquarium. But the sleek, mechanical sea creatures moving through the water aren't alive — they're bio-inspired robots, designed to mimic the movements of marine animals.

Underwater vehicles are crucial for mapping the ocean floor and gathering environmental data, but today's designs struggle with agility and performance. Tangorra and his team are turning to nature for better solutions.

Their latest project is SEAMOUR, a robotic sea lion that models the swimming mechanics of its real-world counterpart. Using AI-driven reinforcement learning, the team is testing thousands of movement patterns, fine-tuning its speed, stability and maneuverability.

The goal: underwater robots that move as effortlessly as the creatures they're designed after.

_JAMES TANGORRA
Tangorra is a professor at the Laboratory for Biological Systems Analysis for the College of Engineering.



CAPTION TITLE
Words go here tktk. More words tk.

Mask Minders

Aleksandra Sarcevic studies human-computer interaction in health care settings and is leading Drexel's participation in an NIH-funded effort to boost protective-gear compliance among frontline workers. Her team is exploring how AI-powered reminders can help doctors, nurses and hospital staff stay properly masked.

Currently, PPE compliance is monitored through manual, low-tech methods, leaving room for error. Drexel researchers are sharing their expertise on integrating AI technology to provide real-time prompts when gear needs to be worn or adjusted.

By combining computer vision and AI, the team hopes to automate PPE monitoring and ensure adherence in high-risk environments.

This solution could potentially be applied "in any setting that are now relying on human-based PPE monitoring, like other health care settings, common hospital areas, construction sites, and even public spaces, such as airports and train stations," Sarcevic says.

_ALEKSANDRA SARCEVIC
Sarcevic is an assistant professor in the College of Computing and Informatics.

Patterns in Patients

Drexel faculty member **Scott Haag**, who also serves as a supervisor at the Children's Hospital of Philadelphia, is leveraging AI to uncover patterns in patient health records.

With **Maryam Daniali** (MS '21, PhD '23), Haag has developed a process that applies AI and natural language processing to analyze more than 53 million pediatric patient notes. This system helps identify similarities among patient groups and assess their risk for developing certain diseases in the future.

The researchers introduced a novel technique combining text mining and ontology-based approaches, demonstrating its practicality on terabytes of patient data. By extracting meaningful insights from electronic health records, this method enables health care professionals to detect patterns, predict risks and make more informed treatment decisions.

_SCOTT HAAG
_MARYAM DANIALI
Haag is an assistant research professor, and Daniali is a doctoral candidate at the College of Computing & Informatics.

7

8

Predator Catcher

Afsaneh Razi is investigating how to make AI safer for young people — from spotting online predators to investigating the use of AI companions and mental health chatbots.

In one study, she led a groundbreaking effort to make social media safer — by enlisting young users themselves. In collaboration with researchers from Vanderbilt, Georgia Tech, and Boston University, Razi's team is developing a machine-learning model to detect unwanted sexual advances on Instagram.

Trained on over 5 million direct messages — annotated by 150 adolescents who had experienced uncomfortable or unsafe conversations — the technology can quickly and accurately flag risky interactions.

"In the year 2023 alone, the National Center for Missing and Exploited Children received more than 36.2 million reports of online child sexual exploitation," Razi says. "This is not a problem that can be ignored."

Razi's team is also exploring human-AI interactions, particularly in the context of conversational agents and AI companions. In one study, they analyzed user reviews of Replika, a chatbot designed to provide companionship, and found troubling instances where the AI exhibited sexually aggressive behavior.

The team has identified this concerning emerging issue as AI-induced sexual harassment. Their work outlines future research directions and design implications to help mitigate potential harm.

In addition to studying risks, the team is exploring young people's preferences for AI-generated responses in situations where they might seek emotional support. They found that while AI can offer meaningful help in some cases, it often falls short in more sensitive situations — pointing to both the potential and the limitations of using AI for mental health. Building on these insights, the team is now examining safety concerns around conversational systems designed to support emotional well-being.

_AFSANEH RAZI
Razi is an assistant professor in the College of Computing & Informatics.

NANOMATERIALS

_TOXIC DYES FILTER

A new light-activated nanofilament ***rapidly breaks down toxic dyes in wastewater*** *– offering a more effective, energy-saving method of treating water.*

_MICHEL BARSOUM
Barsoum is a Distinguished University Professor in the College of Engineering.

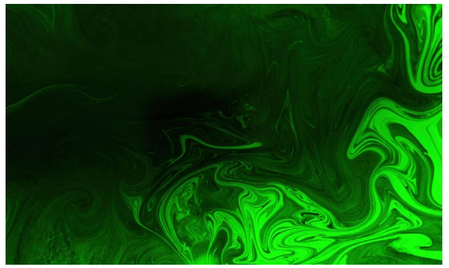
Dyes from industries like textiles, cosmetics and paper manufacturing pose a major challenge for wastewater treatment — carrying high toxicity and potential carcinogens that are difficult to remove. A team from the College of Engineering may have found a solution using a nanofilament material that can break down these pollutants under visible light.

An NSF-supported study led by Distinguished University Professor Michel Barsoum with lead author Adam Walter, a doctoral student in Barsoum's research group, discovered that a titanium oxide nanofilament with a lepidocrocite structure effectively degrades two common dye pollutants, rhodamine 6G and crystal violet.

In just 30 minutes, the material reduced dye concentrations in water by 90% and 64%, respectively. Unlike conventional methods that merely separate dyes from water, this process fully breaks them down into harmless byproducts.

The key to this breakthrough is the nanofilament's ability to self-sensitize under visible light, reducing the need for energy-intensive UV treatment. The research, published in *Matter*, suggests that using this material in existing water treatment processes could be less toxic and more affordable than other methods.

"This is an exciting finding because it helps to address a problem that has been a real challenge for the water treatment process," Barsoum says. "We anticipate that integrating our titanium-oxide photocatalyst into the current processes could improve its effectiveness in removing these chemicals, as well as reduce the amount of energy required to do so."



MATERIALS

_CONCRETE THAT HEALS ITSELF

Engineers have created fiber-reinforced concrete embedded with bacteria that ***can repair its own cracks.***

_AMIR FARNAM
_CAROLINE SCHAUER
_CHRISTOPHER SALES
_AHMAD NAJAFI
_MOHAMMAD HOUSHMAND
Farnam is an associate professor, Schauer is the Margaret C. Burns Chair in Engineering, Sales is an associate professor, and Najafi is an associate professor in the College of Engineering. PhD graduates Seyed Ali Rahmaninezhad, Amir Sadighi and Mohammad Houshmand contributed to the research.

Like a cut on skin that scabs over and heals, concrete could one day repair its own cracks — thanks to an ingenious formula from Drexel engineers.

Inspired by the body's natural healing process, researchers have developed "BioFiber," a bacteria-infused reinforcement that reacts to damage by sealing cracks before they grow. This self-repairing system could dramatically extend the lifespan of concrete infrastructure while reducing costly repairs and environmental impact.

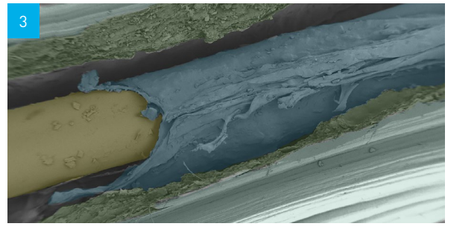
BioFiber consists of a polymer fiber core coated with a hydrogel layer embedded with bacteria, all wrapped in a protective, damage-responsive shell. Placed in a grid throughout the concrete as it is poured, it acts as a reinforcing support agent.

The researchers used a hardy strain of *Lysinibacillus sphaericus* commonly found in soil that can survive dormant inside a cementitious matrix. When a crack forms and water reaches the BioFiber layer, the bacteria react with calcium in the concrete. Once activated, they trigger a natural process that produces a cement-like substance (calcium carbonate) that seals the crack, similar to how blood clots help skin heal. The entire BioFiber structure measures just over half a millimeter thick but plays a crucial role in strengthening concrete.

Preliminary tests, reported in *Construction and Building Materials*, suggest the bacteria can complete repairs in just a few days or a couple of weeks, depending on the size of the crack.

"This is an exciting development for improving building materials using inspiration from nature," says Amir Farnam, an associate professor in the College of Engineering and lead researcher on the NSF-funded project. "If we can extend the lifespan of concrete structures, we not only reduce repair costs but also significantly cut the environmental impact of cement production."

Concrete production accounts for 8% of global carbon dioxide emissions due to the high-temperature and calcination processes required to make cement. Making infrastructure more durable is critical to limiting the need for new concrete, a priority for global sustainability efforts and federal agencies. Farnam's lab is also part of a team participating in a Department of Defense effort to fortify aging structures using a nature-inspired vascularization approach to deliver self-healing agents into concrete.



_1 MECHANISM This diagram shows how the concrete healing process works. **_2 ACTIVATION** Calcium carbonate forms when water enters a crack and activates the bacteria. **_3 CLOSE UP** This BioFiber is colorized to show its components. The polymer core (yellow) is wrapped in bacteria-laden hydrogel (blue) and a protective coating (green).

ELECTRICAL ENGINEERING

_BRIDGES UNDER WATCH

Drexel engineers have developed a wireless, solar-powered monitor for ***real-time monitoring of bridge structures.***

A new wireless sensor system developed by researchers in Drexel's College of Engineering could help federal and local agencies prioritize bridge maintenance and prevent structural failures. The system, powered by solar energy, continuously monitors bridge deformation — detecting early signs of deterioration without requiring costly manual inspections.

"With as much aging infrastructure as there is in the United States, we need a way to keep a close eye on these critical assets 24-7," says Ivan Bartoli, who co-authored a paper on the system with Assistant Professor Fei Lu and Mustafa Furkan, a post-doctoral researcher, and Yao Wang, a doctoral student. "This is an urgent need…so that we can efficiently and sustainably approach the preservation and improvement of our infrastructure."

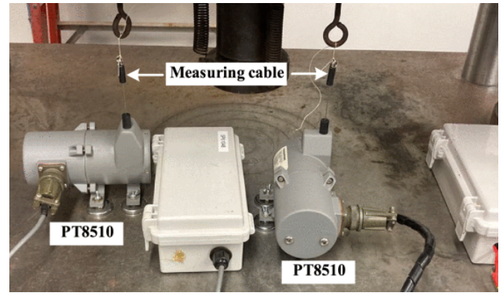
The system combines a wireless displacement sensor, photovoltaic power supply, a deformation measuring device, and a remote monitoring interface. It tracks movement in bridge girders as traffic passes, which can indicate structural weaknesses over time.

Unlike traditional wired sensor systems, Drexel's approach eliminates hundreds or thousands of feet of costly cables and allows multiple sensors — including accelerometers, tiltmeters and strain gauges — to be integrated for a fuller view of bridge health.

Electrical engineers at Drexel optimized the power system to ensure it functions in all weather conditions. The solar-powered battery can sustain the sensors for up to three weeks without sunlight. Tested in both lab and real-world settings, the system is designed for years of uninterrupted operation with little to no maintenance.

The research, funded by the Federal Highway Administration, appeared in the *IEEE Journal of Emerging and Selected Topics in Industrial Electronics*.

_IVAN BARTOLI
_FEI LU
Bertoli is a professor and head of the College of Engineering's Intelligent Infrastructure Alliance. Lu is an assistant professor. in the College of Engineering.



_ACCURACY VS. EASE

To test the system, engineers set up an experiment using a Tinius-Olsen machine designed to apply precise movements — similar to the way a bridge might shift under the weight of traffic. The system, which measures how much a bridge bends or deforms, was tested in both wired and wireless setups to compare accuracy.

During the test, a mechanical platform steadily moved a sensor up and down in small increments while both systems recorded the displacement. The wired system was slightly more precise, with a measurement error of just 1.8% compared to 2.8% for the wireless version. Despite the small trade-off in accuracy, researchers note that the lack of bulky cables and reliability of the wireless system are key advantages over the wired system.

_ONLINE
See how the antenna changes frequency as it changes shape at **drexe.lu/43WfXNQ**.

MATERIALS SCIENCE

_SHAPE-SHIFTING ANTENNAS

Researchers are using kirigami forms coated with MXene nanomaterials to create ***flexible, tunable antennas for the next generation of wireless devices.***

Inspired by kirigami — an ancient Japanese art of paper cutting related to origami — researchers from Drexel and the University of British Columbia have developed a flexible, lightweight, 3D microwave antenna that can be reconfigured by stretching or compressing its shape.

Their study, published in the high-impact journal *Nature Communications*, demonstrates a new way to manufacture adaptable antennas using MXene, a highly conductive 2D nanomaterial.

The researchers made the antennas by coating an acetate sheet with MXene ink and then cutting a series of parallel slits into the surface. When pulled or compressed, the structure shifts to form an array of small resonators.

Unlike conventional antennas that require bulky circuitry for tuning, this design achieves reconfigurability through shape adjustments alone — making it ideal for use in robotics, aerospace and other applications requiring durable, adaptable components.

Their proof of concept represents a new way to quickly and cost-effectively manufacture an ultra-light antenna by simply coating aqueous MXene ink onto a clear elastic polymer substrate material.

"For wireless technology to support advancements in fields like soft robotics and aerospace, antennas need to be designed for tunable performance and with ease of fabrication," says Yury Gogotsi, Distinguished University and Bach Professor in the College of Engineering, and a co-author of the research. "Kirigami is a natural model for a manufacturing process, due to the simplicity with which complex 3D forms can be created from a single sheet coated with 2D flakes."

_MICROWAVE-ABSORBING MATERIAL
In testing, MXene-coated kirigami antennas proved effective at transmitting signals in the commonly used microwave frequency bands of 2-4 GHz, 4-8 GHz and 8-12 GHz.

_YURY GOGOTSI
_LINGYI BI
Gogotsi is a Distinguished University and Charles T. and Ruth M. Bach Professor and director of the A.J. Drexel Nanomaterials Institute in the College of Engineering. Bi is a doctoral student.

MATERIALS SCIENCE

_LIGHT SATELLITE LOADS

Polymer parts coated with a Drexel-invented conductive nanomaterial could be the key to ***creating satellite components that won't weigh on the bottom line.***

_YURY GOGOTSI
Gogotsi is the Distinguished University and Charles T. and Ruth M. Bach Professor in the College of Engineering and director of the A.J. Drexel Nanomaterials Institute.

To reduce the weight of critical satellite components, researchers from Drexel and the University of British Columbia are turning to a novel alternative: waveguides made from 3-D printed polymers coated with an ultra-thin layer of conductive nanomaterial.

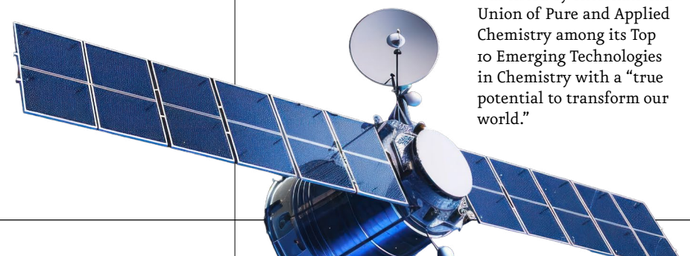
Satellite waveguides — metal tubes that function like pipelines to transfer microwaves to antennas that allow communication between satellites and Earth — add substantial weight to payloads launched into orbit. The cost of taking a kilogram of load to orbit ranges from $1,000 to over $20,000, and lighter alternatives could cut fuel costs and allow rockets to carry more.

In a study published in *Materials Today* with support from the National Science Foundation, the team tested whether a conductive coating made from MXene, a nanomaterial discovered at Drexel, could replace traditional metal waveguides.

"In spaceflight applications, every extra gram of weight counts," says Yury Gogotsi, Distinguished University and Bach Professor in the College of Engineering who discovered MXenes with Distinguished Professor Michel Barsoum. "MXene materials provide one of the thinnest possible coatings — their flakes have a thickness of a few atoms — that can create a conductive surface."

Experiments showed that waveguides 3D-printed from nylon and coated with MXene weighed eight times less than aluminum versions. Despite the dramatic weight reduction, the parts maintained 81% transmission efficiency after just one cycle of coating and up to 95% with optimization — nearly matching aluminum's performance. The MXene layer also proved highly durable, showing no degradation after three months of testing.

The team sees potential beyond satellites. The coatings can be optimized for transmissions of varying frequencies and applied to a variety of additive-manufactured or injection-molded polymer components used on Earth. In 2024, the family of nanomaterials was listed by International Union of Pure and Applied Chemistry among its Top 10 Emerging Technologies in Chemistry with a "true potential to transform our world."



MATERIALS SCIENCE

_SMART COATINGS FOR THERMAL CLOTHING

A "thermal paint" developed at Drexel offers new possibilities for temperature-regulating textiles and ***energy-efficient climate management.***

_YURY GOGOTSI
Gogotsi is the Distinguished University and Charles T. and Ruth M. Bach Professor in the College of Engineering and director of the A.J. Drexel Nanomaterials. Institute.

Imagine a shirt that keeps you cool in the summer and warm in the winter — without batteries, wires or bulky layers. An international research team led by Drexel has found that thin coatings of MXene nanomaterials can enhance a material's thermal properties by modulating the passage of infrared radiation, enabling both passive heating and cooling effects.

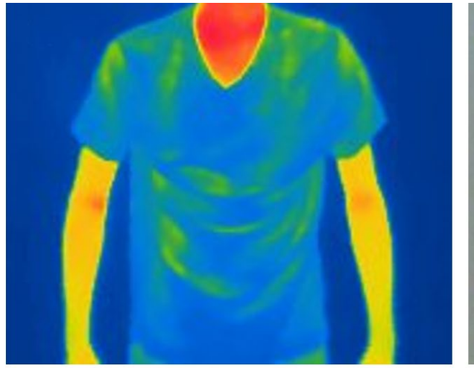
MXenes, 2D nanomaterials first discovered at Drexel over a decade ago, continue to demonstrate new capabilities, reinforcing their potential as a lightweight, flexible and highly functional nanomaterial. They have already shown promise in energy storage, water desalination and electromagnetic interference. Now, researchers are exploring passive temperature control as yet another potential application for this versatile family of materials.

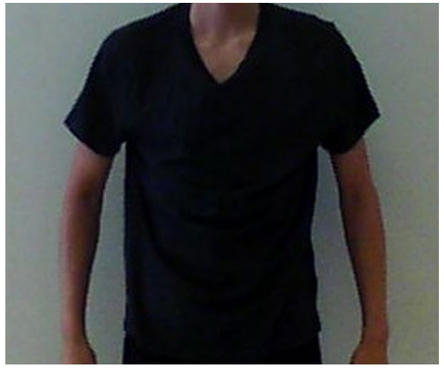
The team tested 10 different MXene coatings on textiles and found that they could modulate infrared radiation to create both heating and cooling effects. When applied for cooling, the nanocoatings reflected external infrared radiation (heat) while allowing body-emitted heat to pass through, keeping the material significantly cooler. At the same time, titanium carbide MXene can block dangerous ultraviolet and heat-generating infrared radiation.

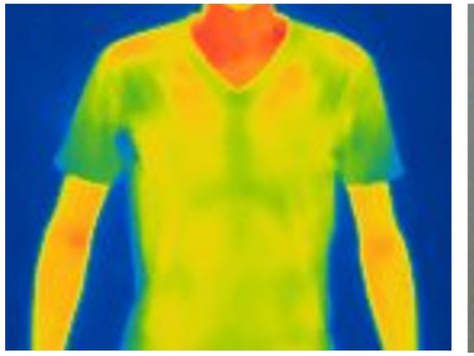
A treated black shirt, for instance, could be 10 to 15 degrees cooler than an untreated fabric. Beyond clothing, MXenes' infrared-blocking properties could also have applications in thermal camouflage or infrared-readable radio frequency identification.

And because a MXene coating is a thousand times thinner than a human hair, thin films could be applied not only to clothing but potentially also to building surfaces, saving energy and lowering heating and cooling costs.

"MXene coatings could find applications in both localized thermal management and large-scale radiative heating and cooling systems," says Yury Gogotsi, Distinguished University and Charles T. and Ruth M. Bach Professor in the College of Engineering. "There are significant advantages with passive infrared heating/cooling over traditional active systems requiring electrical power."







_THERMAL PAINT
A black shirt treated with a MXene coating is 10–15 degrees cooler compared to an untreated one.

_ONLINE
See a slideshow of the Drexel team tackling the Nationwide Eclipse Ballooning Project.

_THE 30,000 METERS CLUB

Drexel undergraduates took hands-on data collection to new heights with ***high-altitude balloon experiments during two solar eclipses.***

As rare solar eclipses swept across North America in 2023 and 2024, Drexel students joined the NASA- and NSF-funded Nationwide Eclipse Ballooning Project to study Earth's protective atmosphere — and rose to the challenge in more ways than one.

Among the students in Drexel's undergraduate research scholar program who were sponsored by Drexel to participate were Kiana Ahmari and Nursultan "Nurs" Zhanabay. They travelled to Rocksprings, Texas, for the October 2023 annular eclipse. Their mission: launch a high-altitude balloon equipped with sensors to study how the sudden loss of sunlight affects stratospheric ozone.

With the guidance of Professor of Chemical and Biological Engineering Richard Cairncross, the students spent months preparing, developing flight predictions and refining their equipment.

But on launch day, their first balloon slipped free without its payload. With little time, they recalibrated, reloaded and launched again. This time, the balloon reached 30,000 meters, collecting data as it drifted nearly 100 miles away. Tracking its GPS signal led them to a backyard in Fredericksburg, Texas — during hunting season. Ahmari used detective work to identify the homeowner through an Airbnb listing and ensure a successful recovery.

For the total solar eclipse in April 2024, Ahmari returned for another launch in Old Forge, New York — this time as part of a new student team.

Faced with strong winds and the risk of missing totality, the group debated three solutions: launch as planned and miss totality, relocate out of range of their ground station, or an untried approach: overfill the balloon to climb faster and vent earlier, while still reaching "neutral buoyancy" — a core Ballooning Project goal.

Their mission: launch a high-altitude balloon equipped with sensors to study how the sudden loss of sunlight affects stratospheric ozone.

With their mission in mind, they chose the latter. Under intense pressure, Ahmari and three teammates executed six precise venting cycles mid-flight, achieving stable altitude just at the edge of the eclipse's path. The feat required rapid analysis, calm communication and a clear chain of command.

Ahmari and Zhanabay are veterans of the College of Engineering's Vertically Integrated Projects and the Pennoni Honors College's Students Tackling Advanced Research (STAR) Scholars program, which give undergraduates early access to meaningful research — in the field or in the air.

_RICHARD CAIRNCROSS
Cairncross, a professor of chemical and biological engineering in the College of Engineering, oversaw the projects. Students who were sponsored by Drexel to participate were Nursultan Zhanabay (chemical engineering '27), Kiana Ahmari (mechanical engineering '27), Muhammad Abdullah (computer science '27), Hui Yuan Feng (BS mechanical engineering '24), Luphi Gao (BS mechanical engineering '24) and Sophie Kujawski (geoscience and mathematics '25).

_SETBACKS, SUCCESS IN THE SKY
Drexel students tackled real-time challenges in the field during the Nationwide Eclipse Ballooning Project, launching high-altitude balloons to collect atmospheric data during the 2023 and 2024 solar eclipses. The NASA- and NSF-funded challenge, designed to mirror real NASA missions, brought together more than 50 teams from across the country for hands-on, high-pressure research experience. Despite setbacks — a payload string snapped, and a balloon landed off course — the Drexel team met their mission goal.

Courtesy Drexel-SCH Dein Diamons Balloon Team

VIROLOGY

_PREDICTING COVID SEVERITY

*Scientists have **a better understanding of which symptoms** indicate a patient is at a higher risk of severe COVID symptoms.*

_ELIAS EL HADDAD
Haddad is a professor in the Division of Infectious Diseases & HIV Medicine and the Department of Microbiology & Immunology at the College of Medicine.

SCIENTISTS HAVE MADE substantial progress in predicting the path that COVID will take in patients, revealing that higher viral load and higher inflammatory pathways in the airway can predict the course and severity of COVID. The findings should help clinical teams identify which COVID patients need the swiftest and most aggressive care.

The findings were recently published in *Cell Reports Medicine* by researchers from Drexel's College of Medicine as well as other academic and medical institutions nationwide.

Researchers followed the participants — 540 adult COVID patients from 20 hospitals — for up to 28 days after they entered the hospital. They collected 14 unique lab tests using nasal swabs, blood, plasma and serum samples. Data revealed five categories of paths that COVID cases take, ranging from mild to severe cases that end in death.

"Thanks to the massive data analysis in this study, researchers now know factors at both the cellular and molecular level that are associated with severe COVID-19 disease and death," says study co-author Charles Cairns, the Walter H. and Leonore Annenberg Dean and senior vice president of medical affairs at the College of Medicine. "These factors that predict more severe disease appear in patients fairly quickly, within three days after admission to the hospital."

The team looked at more than 15,000 blood and nasal samples for factors like possible indications of muscle damage, increases in white blood cells, changes in cells that line airways, and other factors that indicate increased inflammation and lower immunity, and less anti-viral response to fight the disease.

"Thanks to the massive data analysis in this study, we now know factors at both the cellular and molecular level that are associated with severe COVID-19 disease and death."

"We know COVID vaccines work, but they're not the only factor at play in determining the path of disease," says co-author Elias El Haddad, a professor in the Division of Infectious Diseases & HIV Medicine and the Department of Microbiology & Immunology at the College of Medicine. "Different antibody response, among other factors, appears to play a noteworthy role."

MICROBIOLOGY

_ALZHEIMER'S AND THE BRAIN BIOME

The brain, like the gut, may have ***a microbiome that influences the progression of Alzheimer's disease.***

_GARTH EHRLICH
Ehrlich is a professor of microbiology and immunology, and otolaryngology-head and neck surgery, at the College of Medicine.

THE HUMAN BODY hosts trillions of microbes that help us to keep healthy, but when they shift out of balance, it may contribute to disease — possibly including Alzheimer's and related dementias.

Researchers analyzing 130 samples from the donated brains of 32 people — 16 with Alzheimer's and 16 age-matched controls — discovered that the Alzheimer's brains harbored profoundly different bacterial profiles compared to the healthy brains. The findings suggest that the brain, like the gut, may have its own microbiome that can become imbalanced over time, potentially influencing disease progression.

Their study, published in *Frontiers in Cellular and Infection Microbiology,* provides new insight into how infections and microbial shifts might play a role in neurodegenerative diseases.

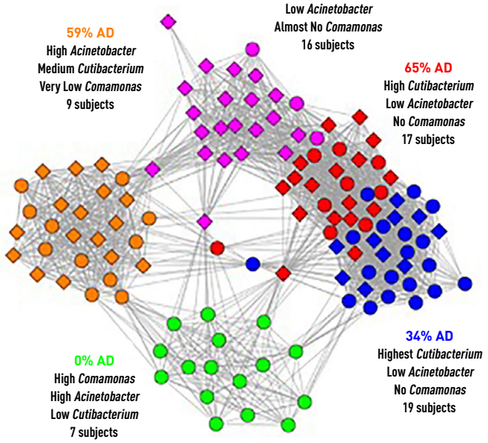
The authors hypothesize that the brain begins with a healthy microbiome, but as the disease develops, the brain's microbial community shifts.

It becomes less healthy, with a major increase in the percentage of known pathogenic bacteria, including *Cutibacterium acnes* — a phenomenon the researchers describe as the emergence of an "Alzheimer's pathobiome."

"The development of Alzheimer's and other dementias is complex and involves the patient's genetics as well as their lifetime "exposome" which includes environmental toxins and infections," says senior author Garth D. Ehrlich, a professor of microbiology and immunology, and otolaryngology–head and neck surgery. "I'm a believer in the more infections you get in the brain, whether viral, bacterial, fungal or parasitic, the higher your risk of Alzheimer's. This pathobiome is not the whole answer, but it's an important piece of the puzzle."

Despite many unknowns, the authors said this is a significant step forward for studying the microbiome.

Ehrlich is a founding member of the Alzheimer's Pathobiome Initiative, a newly formed international group of researchers developing pilot studies that look for infections in dementia and Alzheimer's patients.



_SHIFTING BIOME
Researchers sampled bacterial populations in the brains of subjects with and without Alzheimer's. They found that Alzheimer's brains harbored very different bacterial communities. They were able to track a progression from healthy (green) to diseased brains (magenta) and beyond (red, blue).

AD STATISTICS BY CLASS	
Green	0%
Orange	59%
Blue	34%
Red	65%
Magenta	88%

NEUROLOGY

_GONE MENTAL

Understanding the brain's wandering mind is a step toward ***improving mental health treatments.***

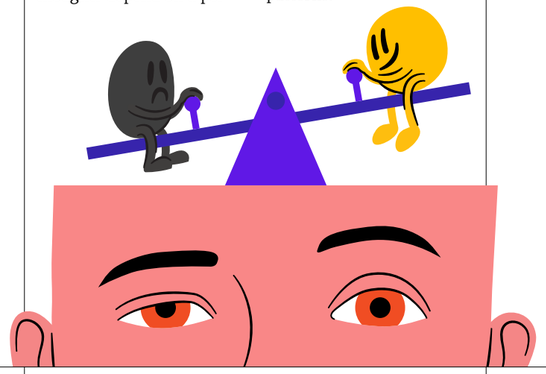
_AARON KUCYI
Kucyi is an assistant professor in the College of Arts and Sciences and director of the Dynamic Brain and Mind Lab.

OUR MINDS WANDER between 30% and 50% of the time that we're awake, and neuroscientists are questioning what that indicates about our state of mind. Aaron Kucyi, an assistant professor in Drexel's College of Arts and Sciences and director of the Dynamic Brain and Mind Lab, published a review with a team of experts in *Nature Mental Health* summarizing recent advances in understanding how the brain represents spontaneous thought and its impact on mental health.

The review confirmed a growing interest among scientists and clinicians in the practical relevance of mind wandering to mental health. The researchers examined how spontaneous thoughts depend on a person's mental health status and affect brain function. Different brain networks support healthy thoughts, like planning and creativity, versus unhealthy thoughts, such as rumination and worry. Emerging research also links the brain's memory system to spontaneous thought.

"There is excitement around this topic because if we can better understand how these processes work in the brain, then targeted interventions could be designed that may prevent unwanted patterns of thought or guide thoughts toward a healthy direction," says Kucyi. Kucyi's lab is using brain imaging tools like EEG and fMRI to develop person-specific mappings between brain networks and spontaneous experiences.

Future research aims to clarify what constitutes healthy versus unhealthy thought patterns and how these are expressed in the brain. This could be key to understanding the variability in human thought processes, paving the way for personalized mental health treatments based on individual brain activity patterns.



STUDENT RESEARCH

_MOCK ORGANS FOR REAL MEDICINE

Drexel students designed ***3D-printed livers and kidneys to train surgeons worldwide,*** *gaining firsthand research experience along the way.*

WHEN SURGEONS TRAIN for complex organ transplants, the closest they get to the real thing is, well, the real thing. But human and animal organs are difficult to obtain, so a team of Drexel biomedical engineering students created the next best option: lifelike organs that mimic the look, feel and density of human livers and kidneys — made of silicone cast in 3D-printed molds.

The project was part of a research collaboration between Drexel, Illinois-based organ transplant medical device maker Bridge to Life, and the Philadelphia-based Gift of Life donor program.

Bridge to Life had developed a new organ preservation system that outperformed traditional ice storage methods, but training surgeons on the device required a realistic teaching model.

Drexel students stepped in to provide one.

David J. Reich, former chief of transplantation at Drexel's College of Medicine and currently a professor of surgery and biomedical engineering, had led the clinical trial of Bridge to Life's new organ preservation system. To train surgeons on how to use it, he turned to Ken Barbee, senior associate dean at Drexel's School of Biomedical Engineering, Science and Health Systems, to help develop a realistic teaching model.

Under their guidance, doctoral student Abigail Tetteh began designing and manufacturing organ replicas with precise color, shape, weight and texture. Then-biomedical engineering major Madison Titlow '23 joined the project from 2022–2023.

_ABIGAIL TETTEH
Tetteh is a doctoral candidate in the School of Biomedical Engineering, Science and Health Systems.

Their research took them to Gift of Life, where they examined real human kidneys to refine their models. The result: 100 highly realistic, 3D-printed organs now being used to train surgeons worldwide.

For the students, the project wasn't just an academic exercise — it was a career-defining experience. Titlow's work led to a co-op and a full-time job offer after graduating in 2023, while Tetteh secured a year-long fellowship with the FDA. Another student, biomedical engineering major Caroline Reis, later joined Tetteh to finalize the kidney design and mass-produce kidneys.

"This was more than just a research project," says Barbee. "It was an opportunity for students to apply their knowledge in a way that directly impacts medical training and patient care."

COURTESY ABIGAIL TETTEH

_A LIFE-LIKE LIVER
The prototype of the liver (top) as it looked during development and a final model (bottom).

AUDIOLOGY

_HORMONES AND HEARING

More evidence that ***estrogen may help protect against hearing loss.***

_ROBERT SATALOFF
Sataloff is a professor and chair of Otolaryngology–Head & Neck Surgery in the College of Medicine.

IT'S NO SECRET that growing older can be taxing on the body, and this is especially true during perimenopause, when levels of estrogen and progesterone decline.

One of the odd effects this may have on health during this time is hearing loss. Data suggest that declines in these hormones may play a role in hearing loss and help to explain differences between the sexes, according to a College of Medicine study published in the *American Journal of Otolaryngology–Head and Neck Medicine and Surgery.*

The study, led by Robert Sataloff, a professor and chair of Otolaryngology – Head & Neck Surgery in the College of Medicine, found that estrogen alters auditory brainstem response (ABR) values, indicating the need for new normative values for postmenopausal women who are not receiving estrogen replacement.

"Age alone is not sufficient for determination of normative values without considering gender," Sataloff explains.

Estrogen has a natural protective effect on the auditory system which begins to deteriorate after estrogen declines. While the exact physiology is unknown, hormone replacement therapy appears to protect against this phenomenon. However, further research is needed to fully understand these mechanisms.

The study highlights the importance of estrogen and its signaling pathways in maintaining normal hearing. Previous research has shown that estrogen is protective, but this study is unique in investigating the effects of estrogen deprivation on ABR responses.

"There is a great deal people can do to protect their hearing as they age. Estrogen replacement should be considered when it is not contraindicated."

– Robert Sataloff

To prevent hearing loss, especially as individuals approach middle age, Sataloff recommends avoiding loud noise and considering estrogen replacement when medically appropriate. He also notes the growing body of research on nutraceutical modulation to reduce oxidative stress, which shows promise for both age-related and noise-induced hearing loss.

NEUROLOGY

_CRACKING ALZHEIMER'S CODE

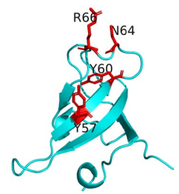
Researchers discover a novel regulatory mechanism in the brain that ***could point the way toward a possible drug treatment.***

_FELICE ELEFANT
_AKANKSHA BHATNAGAR
Elefant is a professor in the Department of Biology in the College of Arts and Sciences. Bhatnagar is a post-doctoral fellow at the University of Pennsylvania.

Our brains are constantly adapting to experiences, recording memories and fine-tuning vast neural connections. To do it, brain cells rely on a sophisticated mechanism called alternative RNA splicing, which ensures the right proteins are made at the right time. Research published in the *Journal of Neuroscience* indicates that when this process goes awry, it may set the stage for Alzheimer's disease.

A team led by doctoral graduate Akanksha Bhatnagar '23 and Felice Elefant, a professor in the Department of Biology in the College of Arts and Sciences, is the first to discover a key regulator of this process — an enzyme called Tip60, which binds to certain types of RNA to control how they are spliced. This function is important, the researchers suggest, because RNA splicing ultimately generates the proteins necessary for learning and memory.

In Alzheimer's-affected brains, the RNA sequences

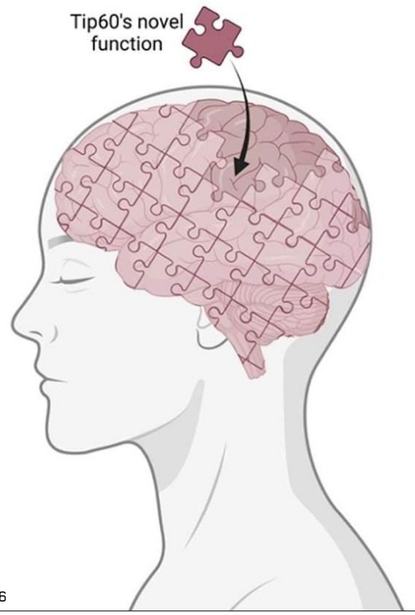


Tip60 binds to are among those most affected by the disease, suggesting disruptions to this mechanism could be an early contributor to Alzheimer's.

Moreover, a 2018 study from Elefant's lab found that restoring balance to Tip60 enzyme levels in the brain reversed symptoms in an Alzheimer's model. Combined, the two studies show that Tip60 doesn't just regulate gene activation to make RNA, it also regulates appropriate RNA splicing.

The researchers believe that restoring balance to Tip60 enzyme levels in the brain could protect against two different processes that go awry in Alzheimer's, showing a path to drug design and treatment of Alzheimer's.

"RNA is essential in coding, decoding, regulation and the expression of genes," explains Bhatnagar. "In the Alzheimer's brain, not only is production of RNA being turned off, but also the way the RNA is being assembled to generate proteins is not correct. This is a critical piece in the Alzheimer's disease puzzle that has opened new doors for understanding disease causes."



MICROBIOLOGY

_SOME SHOTS ARE NOTS

Some ***vaccines work better*** *than others, and scientists are trying to predict why.*

_ELIAS EL HADDAD
Haddad is a professor of medicine and microbiology and immunology in the College of Medicine.

In a world of fast-emerging pathogens, it's helpful to understand why some individuals quickly develop immunity after vaccination while others do not. Now, scientists are getting closer to establishing tests to predict immune response.

Researchers from over 20 institutions, including Drexel's College of Medicine, analyzed 3,000 samples from 820 adults across 28 studies, focusing on 13 vaccines such as flu, hepatitis A and B, and smallpox. They discovered specific gene expressions, or "signatures," in antibody responses within a week of vaccination for all vaccines but one: the yellow fever vaccine.

In the case of the yellow fever vaccine, antibody-producing stem cells took 2-3 times longer to be released, likely due to the live virus in the shot.

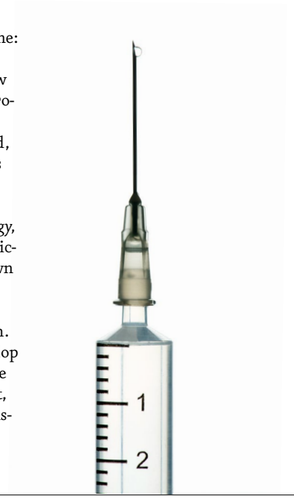
The study, which appeared in *Nature Immunology*, identified a common predictor: a group of genes known as M156.1, associated with the subsequent antibody responses post-vaccination.

This work aims to develop tools, such as a polymerase chain reaction type of test, to predict immune responses during clinical trials.

Though there was no universal signature that predicted how a body responded, the study identified a unique dynamic of antibody response that was shown to be common among all vaccines tested in the study. The study also yielded a "gold mine" of information for future vaccine research, says Elias El Haddad, a professor of medicine and microbiology and immunology in the College of Medicine.

"The amount of bioinformatics data generated is overwhelming," he says. "The study provided insight into the immunology, metabolism, proteomics and antibody pathways that represent a goldmine for researchers that can inspire novel ideas and generate hypotheses."

The team is now focused on validating the identified molecules and pathways and testing them in new study cohorts.



_COMFORT FOOD FOR COMMUNITY

St. Christopher's Hospital for Children has provided a community fridge full of food and other household essentials for families in need.

In a bustling North Philadelphia hospital, where caregivers juggle medical appointments and daily struggles, a simple solution is making a big impact: a Philadelphia nonprofit placed bright yellow refrigerators in public spaces for individuals to donate excess food or freely take what they need.

Through the partnership between the Mama-Tee Community Fridge Project and St. Christopher's Hospital for Children — operated by Drexel University and Tower Health — families found everything from food to diapers and even laundry detergent, no questions asked.

The community fridge plays a small role in ensuring that caregivers don't carry the dual burden of navigating health care and securing a meal.

About 30% to 40% of St. Christopher's families experience food insecurity, estimates St. Christopher's pediatrician Renee Turchi, clinical research professor of community health and prevention at the Dana and David Dornsife School of Public Health; program director of the Drexel Maternal and Child Health Program; and professor and chair of pediatrics in the College of Medicine. She helped lead the food donation project spearheaded by Maura Heidig, director of population health at St. Christopher's.

The refrigerator contains fresh fruit; vegetables; whole grains products like bread, rice and pasta; canned goods; and healthy grab-and-go snacks like granola bars and trail mix. The ongoing effort to stock the St. Chris fridge is made possible with the support of hospital personnel, volunteers, donations, grant funding and local grocery stores and restaurants sharing excess produce and products.

"This is a space free from judgement," says Turchi. "People can take what they need whenever they need it and know we are here for them. This represents the heart of St. Chris."

_RENEE TURCHI
Turchi is professor and chair of pediatrics in the College of Medicine, clinical research professor of community health and prevention at the Dana and David Dornsife School of Public Health, and program director of the Drexel Maternal and Child Health Program. Maura Heidig is director of population health at St. Christopher's Hospital for Children.

8.2%

_% INCREASE IN FOOD PRICES
Pennsylvania saw the highest increase in grocery prices in the U.S. last year — 8.2%, compared to 2.9 to 3.5% in states like Colorado, Arizona and North Carolina (*Consumer Affairs*).

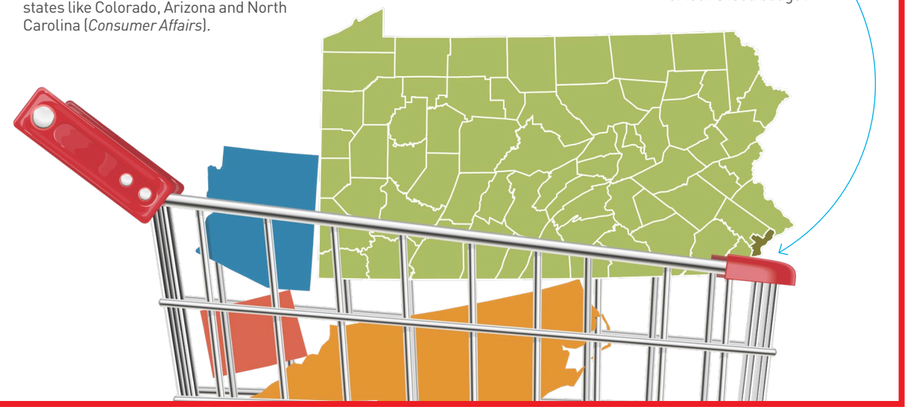
_HOW IT WORKS
The refrigerator is stocked with the support of hospital personnel, volunteers, donations, grant funding and local grocery stores and restaurants.

$77.5

_BILLION IN COSTS
Food insecurity leads to an estimated $77.5 billion in additional health care costs each year.

7.1%

The Philadelphia metro area recorded a 7.1% grocery price increase in 2023, adding about $645 annually to a family of four's food budget.



Cancer Science Without Silos: **What Makes the Drexel-Jefferson Model Work**

With biomedical and clinical scientists, engineers , social scientists, and public health experts on the team, oncologists in the newly designated Sidney Kimmel Comprehensive Cancer Center have the integrative strength to move novel treatment into action.

STORY BY
LINI S. KADABA

ILLUSTRATIONS BY
SCOTT BACKAL

_On a sunny Friday afternoon in May, a group of nine researchers has gathered in a Thomas Jefferson University conference room in the heart of Center City Philadelphia. Among them is Drexel University biomaterials engineer **Xiao Huang**, who has traveled across town to show the clinicians how his toolkit of designer nanoparticles can precisely steer powerful CAR-T cells – a form of immunotherapy – to fight cancer more effectively.

It's the first meetup of the Cancer Immune Engineering Working Group (CIE), a newly formed collaboration between researchers of the two universities under the umbrella of the Sidney Kimmel Comprehensive Cancer Center research consortium.

From the back row of the room, dermatologist Neda Nikbakht, MD, intently listens. She directs Jefferson's Cutaneous Lymphoma Program and was one of the organizers of the retreat and a co-leader of the working group.

"That is really fascinating," she says, leaning forward. "Is it fair to say you have this platform of nanoparticles, and you can mix and match with antibody x, ligand y and antigen z? You can make it like we want?"

"Exactly," replies Huang, who is an assistant professor in Drexel's School of Biomedical Engineering, Science and Health Systems.

"I had absolutely no idea," Nikbakht reflects later, "what engineers could do for cancer. What is fascinating to me is the potential of utilizing these skills for developing new topical therapies of skin cancers."

Moments like this — when one field opens new possibilities for another — are precisely why the Sidney Kimmel Comprehensive Cancer Center research consortium was created. Through cross-mingling institutions and disciplines, including nonmedical fields, the consortium aims to generate new solutions for a disease that strikes more than 24,600 people and kills over 8,000 each year in the center's seven-county catchment area.

The Cancer Immune Engineering team, one of nine official teams established in the consortium so far, is part of a broader push to target the most common cancers in the Greater Philadelphia region — including breast, lung, prostate, gastrointestinal and myeloma — and to develop innovative prevention strategies and public education campaigns.

"We need to understand as physicians, as clinicians and biomedical researchers what bioengineers do and how we can use their skills in our research and clinical practice," Nikbakht adds. "That's the goal of this retreat."

The Power of Pairing Up

BEGUN IN 1991, THE SIDNEY KIMMEL Cancer Center gained the National Cancer Institute's nod as a cutting-edge cancer center in 1996 and was elevated to the coveted "comprehensive" status in 2024 — a seal of approval that places it in an elite group of just 57 such cancer centers nationwide.

By all accounts, the interdisciplinary approach of the Jefferson-Drexel partnership, which began in 2013 and expanded in 2021, played an outsized role in the Sidney Kimmel Cancer Center winning the designation that had eluded it for years. Former University President John Fry and Charles B. Cairns, MD, the Walter H. and Leonore Annenberg Dean of the College of Medicine and senior vice president of health affairs at Drexel, were instrumental in advancing Drexel's collaboration with the center.

"It was a very heavy lift," says Andrew E. Chapman, DO, who is the Sidney Kimmel Comprehensive Cancer Center's director and executive vice president for cancer research and oncology services at Jefferson Health as well a nationally prominent medical oncologist and physician scientist. In 2018, the center's Cancer Center Support Grant submission failed to receive "comprehensive" status from the NCI — a disappointment that motivated the Drexel and Jefferson teams to redouble their efforts. That the center succeeded in 2024 "speaks to the growth and development of the science within the center," he says.

At the heart of the cancer center are four scientific program areas: Cancer Risk and Control, Molecular Oncology Regulation and Approaches, Translational and Cellular Oncology, and Immune Cell Regulation and Targeting.

Drexel, Chapman says, is critical to the equation. Its competencies in biomedical research, bioengineering and population sciences are key to innovating fresh treatments. Combined with a translational ethos and expertise in training and community education, Drexel adds both breadth and depth to the cancer center.

"The collaboration between the universities has been strengthened," he says, "and we're seeing tremendous fruit from that."

"Drexel's faculty will bring transformational contributions across the continuum of research that will lead to improved quality of life of patients and their families in many novel ways," adds Kenny J. Simansky, former senior vice dean for research at Drexel's College of Medicine and co-leader of the consortium partnership. Drexel's scientific strength in understanding the cellular process of disease, for example, can be combined with research expertise in aging, population science and caregiving to improve survival and quality of life outcomes.

In the early years of the center, Drexel's investigators were mostly drawn from its College of Medicine. The addition in 2024 of six more Drexel colleges and schools — in public health, nursing, engineering, biomedical engineering, computing and informatics, and the arts and sciences — increased the number of potential collaborations.

Both institutions are securing multi-PI grants, co-authoring papers and conducting clinical trials, including a first-in-human study for advanced prostate cancer sufferers. At the same time, teams are working to improve community engagement, advance health for all and commit to training the next generation of cancer researchers.

One measure of success is the cancer center's funding of pilot projects that involve investigators from both Jefferson and Drexel. In the past three academic years, the cancer center has awarded 19 grants for about $1.17 million, 10 of them in the 2024–2025 academic year, according to Noreen M. Robertson, DMD, who is senior associate vice dean for research at Drexel's College of Medicine and a co-leader of the consortium and longtime member of the center's research executive committee. Projects include cancer-focused studies that play to Drexel's research strengths, including in HIV, aging and public health. "This is one way we're building collaborations," she says. "We're bringing these research areas to the cancer center."

Among the researchers supported through these grants is Professor Rose Ann DiMaria-Ghalili, senior associate dean of research of Drexel's College of Nursing and Health Professions and Drexel's interim associate vice provost for research and innovation, whose work has been greatly enhanced by partnering with Jefferson investigators.

One pilot project, in conjunction with Jefferson professor of pharmacy practice Emily Hajjar, is looking at the effectiveness of interventions, such as a patient consultation with a geriatric clinical pharmacist, to reduce the numerous medications that older adults with cancer often take — a situation that can lead to serious interactions and adverse health outcomes. Another, with Drexel epidemiologist and principal investigator Agus Surachman in the School of Public Health and Jefferson oncologist Ana María López, is assessing day-to-day psychosocial stress using mobile phones among long-term breast cancer survivors of various ethnicities as a factor in aging and cognitive decline.

"I don't think these studies would have happened without the Sidney Kimmel Cancer Center and the research agreements we have between the two institutions," DiMaria-Ghalili says.

The Road to 'Comprehensive'

DREXEL AND JEFFERSON'S institutional ties were put to the test in August 2023, when the center underwent its most important review yet.

On Aug. 24, 15 NCI reviewers came to the 31st floor of Jefferson Tower on Market Street. This was the do-or-die moment for the cancer center as it sought comprehensive status.

"It's almost theatrical," says Drexel professor of pharmacology and physiology Alessandro Fatatis, MD, half-joking that no one slept during the two years of preparations. "It's a lot of work and a lot of planning. Everything has to be flawless."

To achieve comprehensive status, the NCI reviewers were looking for demonstrated excellence across multiple domains of cancer research and care including: Scientific Leadership and Depth in Multidisciplinary Research, Transdisciplinary Collaboration, Community Outreach and Education, Clinical Trials and Institutional Commitment.

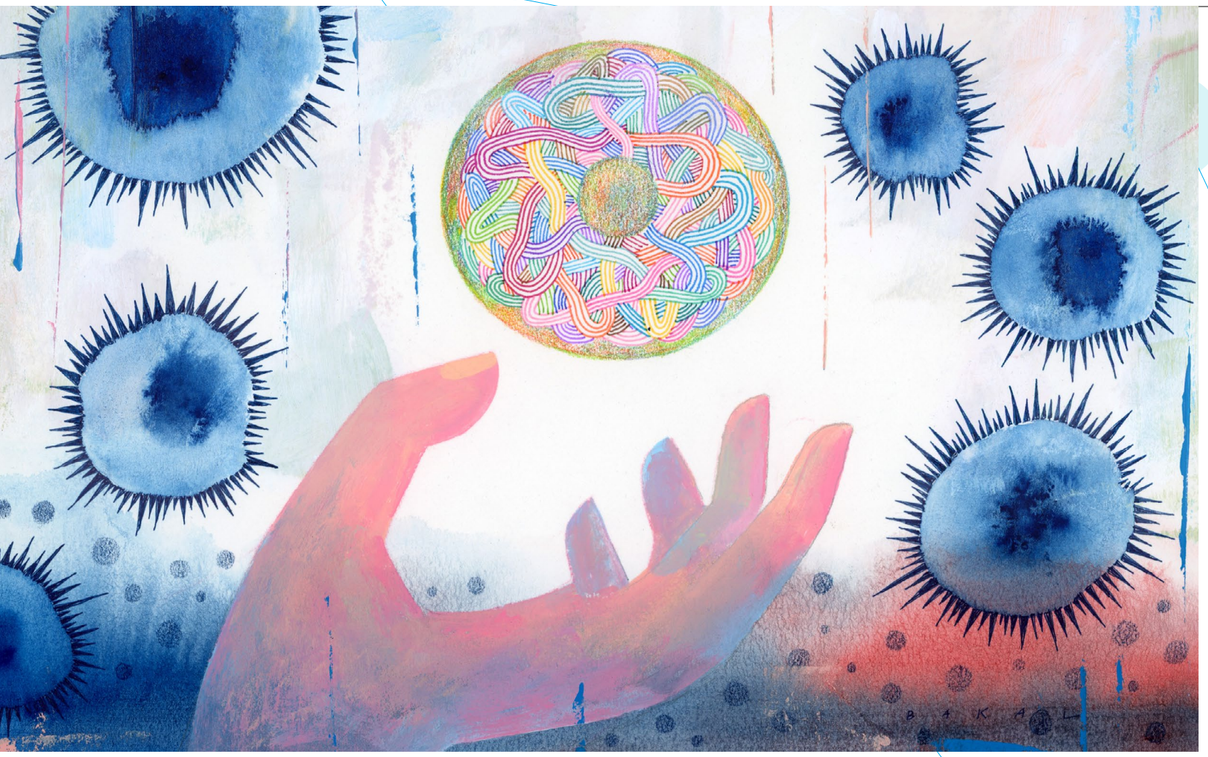
Under Chapman's leadership, faculty and professional staff had prepared a 1,200-page proposal, divided into four binders, that delved into all that the cancer center had accomplished and its future plans. One by one, the four program leaders highlighted the most important projects developed in recent years.

"The best thing you can show, and we did, is going from bench research, basic science, into the clinic and startups," Fatatis says. "Drexel, as second nature for an institution, moves discoveries to the clinical arm or society in general. Drexel has impacted that culture at Thomas Jefferson University."

That bench-to-bedside pipeline continues to flow abundantly. Recently, an important discovery was made about the typical way to treat prostate cancer in Fatatis' metastases-focused lab. Commonly, the production of testosterone is blocked. "If done, it stops cancer cells in their tracks," says Fatatis. But in some cases, this standard of care could unleash the cytokine interleukin-1, a type of protein that impacts the immune system and promotes the spread of cancer. "You might, in a subgroup of patients, actually make things worse," he warns.

Without the consortium, this finding might have stayed buried in a niche scientific journal. Instead, it sparked discussion among his clinical partners.

"Now, they're thinking about the impact of stan-



dard of care and the imporance of measuring this cytokine and possibly developing means to counteract its effects," he says. "It's good translational science."

Fatatis, who also serves as the cancer center's associate director for basic research, has a long history with the center and helped to lay the foundation for today's many alliances. In 2009, cancer biologist Karen Knudsen invited Fatatis to join her new prostate cancer working group, recognizing his expertise in metastasis. That early connection inspired Richard Pestell, MD, who was director of the center at that time, to explore the possibility of Drexel joining Jefferson in a consortium. (Knudsen went on to direct the Kimmel cancer center, leaving in 2021 to head the American Cancer Society.)

"It was a match made in heaven," Fatatis says. "I could interact with additional scientists in this area of oncology. After a while, other Drexel scientists followed."

That momentum is drawing in researchers from fields not typically associated with cancer studies, such as the College of Arts and Sciences (CoAS).

One is Susan Bell, professor emerita of sociology, whose work brings a vital sociological lens to the cancer center's approach to cancer care for all. In collaboration with AnaMaría López, MD, a medical oncologist at Jefferson, Bell received a pilot grant to investigate disparities in cervical cancer outcomes. Combining their expertise, they conducted in-depth interviews — in Spanish and English — to explore why Latinas are more at risk than non-Latina white women to die from the disease. Maeve Fitzgerald, a sociology student who worked as a research assistant under Bell, presented a poster in 2024 titled "Latinas and Cervical Cancer in the United States: A Review of the Literature" at a Jefferson conference focused on cancer care in the Latino community.

In May, Meghan Butryn, a Drexel professor and associate head of psychological and brain sciences in CoAS, received a $2.9 million grant to expand her Eatwell Project — a study launched in 2020 with Jefferson radiation oncologist Nicole Simone, MD, that used behavioral coaching to promote cancer-preventive grocery choices.

"For cancer prevention, we really need to take a multi-disciplinary approach where we combine our behavioral science with biological and medical science," Butryn says. "Eating behavior is a good example. We're learning every day that what we eat can impact cancer risk and outcomes during treatment."

Over at Drexel's Dornsife School of Public Health, population scientist Jan Eberth, professor and chair of health management and policy at Drexel, collaborated with Jefferson's Ronald E. Myers on a qualitative study about how primary care physicians engage patients in lung cancer screening decisions and with Jefferson physician-researcher Julie Barta, MD, on a review of lung cancer screening patients seen at Jefferson.

"The fact we have a relationship with a cancer center allows us to have a foot in the door to be able to do a research study that involves patients or working with healthcare providers," says Eberth. "It gives us that opportunity we would not have otherwise."

The same could be said about novel research on HIV and cancer. Gabe Romano, assistant professor of pharmacology and physiology at Drexel's College of Medicine and co-leader of the CIE working group, runs a lab focused on studying cancer drug resistance via mouse models, genomics and computational biology. He had never worked on HIV until he was drawn to Drexel in 2022, but the strong HIV research program in his department prompted new collaborations. In Philadelphia, Romano says he found a large population of people living longer with HIV thanks to antiviral therapy. But this same group was also at risk of developing certain cancers — such as melanoma, lung cancer and lymphoma — and they tended to be less responsive to cancer therapies than the general population.

As a result, he says, people with HIV and melanoma are dying at higher rates than those without HIV. He's interested in learning why.

Drexel's large cohort of HIV patients — about 800 people — allows for the collection of blood samples crucial to Romano's research. Through the consortium's newly established HIV and Cancer Working Group, Romano connected with Jefferson medical oncologist Rino S. Seedor, MD, who specializes in melanoma and nonmelanoma skin cancer. She has provided clinical expertise on melanoma as well as samples from patients with melanoma but not HIV, to serve as contrasts for Romano's samples. Romano and Seedor are also working with Christian Sell, a professor in the Department of Biochemistry & Molecular Biology at Drexel's College of Medicine, on a pilot award to study the role immune dysfunction may play in the increased rate and aggressiveness of melanoma in both older individuals and people living with HIV.

This kind of data-driven, patient-specific research exemplifies the cancer center's interest in addressing health care across vulnerable populations and shows how the consortium leverages ongoing research, core facilities and clinical expertise across institutions.

Seedor says that the partnerships have inspired her research interests in melanoma in HIV and older individuals. After working with Sell and Romano she joined a national Geriatric Oncology Working Group (ECOG-ACRIN) and will be the co-chair on a national multi-site clinical trial evaluating the treatment of melanoma specifically in older patients. "This consortium helped expand the type of research I can do and build my career," she says.

Meanwhile, Chris Rodell, an assistant professor of biomedical engineering at Drexel and a CIE co-leader, is working with Romano on different ways to engineer drug delivery systems. In one instance, his lab has formulated injectable hydrogels made from nanoparticles to combat melanoma by delivering drugs to specific cells that Romano's lab identified as known to suppress the immune system. The delivery system changes these cells' phenotype in a way that work *with* rather than *against* cancer immunotherapies, while reducing side effects. Rodell shared this research at the CIE retreat.

"Science is a team sport," Rodell says. "You need the people in basic science and in engineering. You also need the clinicians. We're all trained in different approaches to problems and different ways of thinking."

Inviting the Public In

COMMUNITY ENGAGEMENT IS A KEY expectation for cancer centers with the government's "comprehensive" designation, and Drexel's partnership with the cancer center has led to more opportunities for its researchers and students to engage with the public.

As an example, the cancer center's Making Research CLEAR (Community Learning and Experience about Research) program paired Jennifer Hope, PhD '17, a Drexel assistant professor of microbiology and immunology who works with cancer and chronic virus infection models, with Stage 4 lung cancer survivor Amy Grove, 53, of Lansdale, Pennsylvania, who was interested in learning how basic science leads to translational targeted therapies like the one that has benefited her. So far, Grove has visited Hope's lab and observed flow cytometry, a technique to analyze the types and states of immune cells in blood or tumor samples.

"This is an opportunity to remind ourselves why we're doing what we're doing," Hope says. "We're trying to move treatments forward. It's not just about the paper, the grants, the trainees' degrees."

Says Grove: "The regular public doesn't get to experience what goes on behind those [lab] doors. This experience helps to explain to those in my online cancer communities why it costs so much and takes so long to get potential treatments and breakthroughs out."

Another cancer center program, Community Engaged Research Training for Emerging Scientists (CERTES), supports student scholars in sharing the science with the public and supporting health research as a career. Molecular biology doctoral student Riley Young, 25, of Darby, created a dozen two-minute TikTok videos featuring scientists at Drexel and the cancer center talking about their career paths. "I tried to use social media to make science people less science-y," she says. "I want people to see, this is actually really fun."

Amy Leader, associate director of the cancer center's Office of Community Engagement & Outreach, says programs like CLEAR and CERTES are crucial at a time when mistrust in science is widespread.

"They break down barriers between the community and research and science," she says, "and foster transparency and trust in the work we are doing."

One of the first personnel announcements made when the center received its comprehensive designation was the appointment of Annette Gadegbeku, MD, as senior associate dean of Community Health & Inclusive Excellence at Drexel's College of Medicine. She works with the cancer center on reducing disparate cancer outcomes through prevention education in underserved and marginalized communities and by recruiting a representative selection of participants in the scientific workforce and in clinical trials.

"It all filters back into health equity as the goal," she says.

Ideas in Play

BACK IN THE CONFERENCE ROOM with the CIE working group members, medical oncologist Pierluigi Porcu, MD, peppers Huang with questions about his designer nanoparticles.

"You envision these particles, whatever size they may be, whatever composition they have, as a platform for ex vivo stimulation of the T-cells?" he asks. Porcu is director of the Division of Hematologic Malignancies and HSCT, program leader of the cancer center's Immune Cell Regulation and Targeting Program, and one of the leaders of the HIV and Cancer Working Group.

"Yes," Huang says. "Also in vivo, by local injection."

"Do you have any preclinical data on the safety of these materials in vivo?"

"PLGA actually is used in more than 10 FDA-approved drugs," Huang says, referring to the polymer used to make the particles.

"Interesting," Porcu says, nodding enthusiastically. "Really great."

As the retreat winds down, the researchers agree that the possibilities of synergistic projects are many, and they would take the weekend to plot next steps.

"What this allows," Porcu says, "is innovative, transdisciplinary science."

Exactly the intent of comprehensive cancer centers.

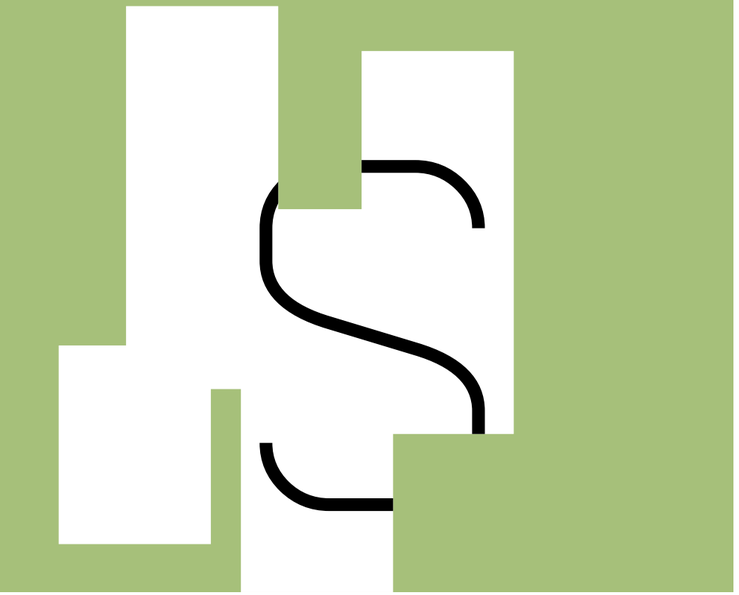
> "I had absolutely no idea what engineers could do for cancer."
>
> — Neda Nikbakht

The Science Shop Is Open

Using a community science model pioneered in Europe, the Academy of Natural Sciences of Drexel University is reimagining where research questions begin.

STORY BY BEN SEAL

ILLUSTRATION BY EMILIANO PONZI



SHOULDN'T THE PEOPLE MOST affected by scientific decisions have a seat at the table?

That question is at the heart of the Academy of Natural Sciences' Sciences Shop, a participatory research approach that invites residents to collaborate on the Academy's scientific priorities, putting people like West Philadelphia resident JoAnn Waters in the center of the process.

Waters, a retiree from the Social Security Administration, had long noticed the prevalence of health problems in her Overbrook Park neighborhood. Childhood asthma seemed almost universal. Lead exposure was common.

But it wasn't until she attended a meeting at the Overbrook Environmental Education Center organized with Drexel's Academy of Natural Sciences Science Shop team that she began to understand the full scope of the problem and realized she could play a role in addressing it.

Waters was a community partner in the first Science Shop study of the community's understanding of lead exposure and safe renovation practices. The study, which was conducted by scientists from the Academy, Overbrook and the University of Pennsylvania with the community's support, surveyed more than 50 people. The study uncovered a widespread but misplaced belief that drinking water posed more risk of lead poisoning than dust particles released from lead-based paint during renovation or natural aging.

That finding will inform efforts to educate and advocate for universal lead-safe certification among do-it-yourself (DIY) remodelers and contractors — most of whom operate without knowledge of lead's consequences or of lead abatement regulations.

"If it relates to their well-being, then it makes sense to bring them in as co-researchers, to recognize that they have an invaluable set of expertise that can complement trained scientists' expertise — and sometimes correct trained scientists' expertise," says Alexis Schulman, assistant research professor in the Department of Biodiversity, Earth and Environmental Science in the College of Arts and Sciences and Dolan Fellow for Innovation in Water Science at the Academy of Natural Sciences of Drexel University.

The Academy piloted the Science Shop in 2022 with support from the Institute of Museum and Library Services. It's a concept modeled on a Dutch academic tradition of community-driven research that dates back to the 1970s and later found adherents throughout Europe. Science shops aren't a physical place so much as a philosophy — one that involves residents throughout the research process, from framing questions to interpreting data. And it's especially well suited to environmental justice, where community knowledge is often overlooked despite being essential to understanding local risks.

In Philadelphia, those risks are urgent. Lead exposure is widespread, particularly with residents who reside in the older rowhomes of West and North Philadelphia. In certain ZIP codes of these neighborhoods, 1 in 16 children has tested positive for elevated blood lead level, according to 2022 city data. Many households face compounding threats from aging infrastructure and environmental neglect yet lack the technical, legal and scientific support to compel action.

"Every community impacted by environmental injustices understands its effects," says Jerome Shabazz, executive director of the Overbrook Environmental Education Center. "They just can't describe the effects in terms that line up with the descriptive nature of a scientist."

By elevating local knowledge and partnering with community members, the Science Shop transforms residents from passive research subjects into part of the solution. It's an approach that Schulman says gives people "a new tool to speak truth to power."

"They can say, 'We did a study. We worked with researchers. And this is what they found. So, you can't tell me this is just my experience and it's too subjective,'" she says.

This model isn't just about empowerment — it's also about improving community science.

When scientists prioritize their own interests over their communities' needs, they can often do more harm than good, Schulman says, delivering misguided results that don't reflect the lived experience of the people their research aims to help.

During the lead study, for instance, researchers initially focused on how licensed contractors manage lead risks — only to discover that many residents rely on themselves or neighbors for home repairs safety. Without that insight, the team might have recommended policies that overlooked a major source of exposure. It was also through community conversations that the team learned why few contractors pursue lead-safe certification in the first place: the training is expensive and time-consuming. Those revelations led to a pragmatic solution: no-cost lead safety training, offered through Overbrook, that serves both workers and families.

"The lived experience of people is a type of expertise," says Marilyn Howarth, a collaborator on the project who directs community engagement at Penn's Center of Excellence in Environmental Toxicology. "Unless we incorporate it into our thinking and our research, we can miss out on so many important details."

The Science Shop's second major project, funded by the National Oceanic and Atmospheric Administration, is now underway in Camden, New Jersey; Newcastle, Delaware; and Philadelphia's Germantown neighborhood. Akilah Chatman, a community science specialist at the Academy, is leading the effort by organizing regular meetings with community organizations and local residents to shape research priorities. While the process is still unfolding, concerns around flooding, air quality and drinking water are already rising to the surface.

> "Every community impacted by environmental injustices understands its effects. They just can't describe the effects in terms that line up with the descriptive nature of a scientist."
>
> — JEROME SHABAZZ

These initiatives empower residents to become "active agents of change," says Shabazz. In Overbrook, residents are now equipped to speak with contractors about lead mitigation or seek out professionals with proper training and credentials.

"It gives people tools to actively engage in their own quality of life improvement," he says. "They're not relying upon the institution to do that for them. They're utilizing the institution to better understand or interpret the conditions. That's no different than anybody who goes to a doctor."

Despite their best intentions, academic institutions aren't typically organized for the type of community-based participatory research the Science Shop model embodies. Even small steps — like compensating community researchers — can get bogged down in academic bureaucracy. For the lead study, the Science Shop team originally intended to have residents survey their neighbors in the role of co-researchers, but Institutional Review Board approval required five hours of training that proved too burdensome for most community members.

"Those are guardrails that obviously make sense," Schulman says, "but the system is just not set up to do this work."

But models like the Science Shop can break down other barriers, like those around trust and communication. As Chatman says, the initiative is an answer to a question that has long flummoxed researchers: "What does it mean for academic institutions to interact with communities in ways that uplift those communities?"

In Germantown, members of Germantown Residents for Economic Alternatives Together (GREAT) are working with the Science Shop team to shape a new study. At a recent event at the Water Shed, a local hub, residents spoke about water shutoffs and the lingering impact of a 2023 chemical spill in a Delaware River tributary. The collaboration is still taking shape — but there is already confidence that the Science Shop team is there to listen.

Marie-Monique Marthol, a GREAT steering committee member who spoke on a panel at the event, calls the Science Shop partnership a welcome shift from one-sided relationships in which institutions tend to "take, take, take."

"This is one of shared power and decision-making on both sides," she told attendees.

Waters, too, has seen the difference. The Science Shop study gave her not just information, but influence — and she's sharing what she learned with her church group and neighbors.

"Education is what people need," she says. "We have to advocate for ourselves."

WHAT IS THE SCIENCE SHOP MODEL?

Science Shops are small entities that conduct research on behalf of, and with, citizens, according to The Living Knowledge Network. The model began in the Netherlands in the 1970s as part of a movement to democratize science within universities. With Science Shop academic teams as intermediaries between institutions and communities, residents help shape every stage of the process, from identifying the problem to gathering data to interpreting results, promoting inclusive, socially relevant science. The goal: research that empowers communities and sparks meaningful change where it's needed most.

_ALEXIS SCHULMAN
_AKILAH CHATMAN
Schulman is assistant research professor in the Department of Biodiversity, Earth and Environmental Science in the College of Arts and Sciences and Dolan Fellow for Innovation in Water Science at the Academy of Natural Sciences of Drexel University. Chatman is community science specialist at the Academy.

_A PORTRAIT OF THE MILKY WAY

Using machine learning and a telescope embedded deep in the Antarctic ice, Drexel astrophysicists led efforts that yielded ***a first-of-its-kind image of the galaxy.***

DREXEL PHYSICISTS AND their international colleagues relied on minute particles of matter to produce a dazzling, wholly new way of imaging the Milky Way.

Spearheaded by Naoko Kurahashi Neilson, a professor of physics in the College of Arts and Sciences, a research team assembled a portrait of the galaxy informed by neutrinos — subatomic particles — detected from the IceCube Neutrino Observatory at the National Science Foundation's Amundsen-Scott South Pole Station.

Previously, images of the galaxy captured by astronomers were based on electromagnetic energy.

"We use neutrinos to study the universe, in a way that we can't do by studying light," Kurahashi Neilson says.

The nearly imperceptible "ghost particles" can be observed by the mammoth IceCube Neutrino Observatory, using thousands of light sensors in a network buried deep within a cubic kilometer of glacial ice at the South Pole on Antarctica.

The observatory detects interactions of the neutrinos beneath the ice as faint patterns of light.

These patterns sometimes point to a particular area of the sky, allowing the researchers to determine the neutrinos' source.

After receiving an NSF Faculty Early Career Development grant, Kurahashi Neilson and former Drexel post-doctoral researcher Michael Richman proposed an innovative computational analysis — using new machine learning techniques and developing better methods to filter data — to generate the image.

Former doctoral student Steve Sclafani then developed an algorithm that compared the relative position, size and energy of more than 60,000 such neutrino-generated cascades of light recorded by IceCube over 10 years.

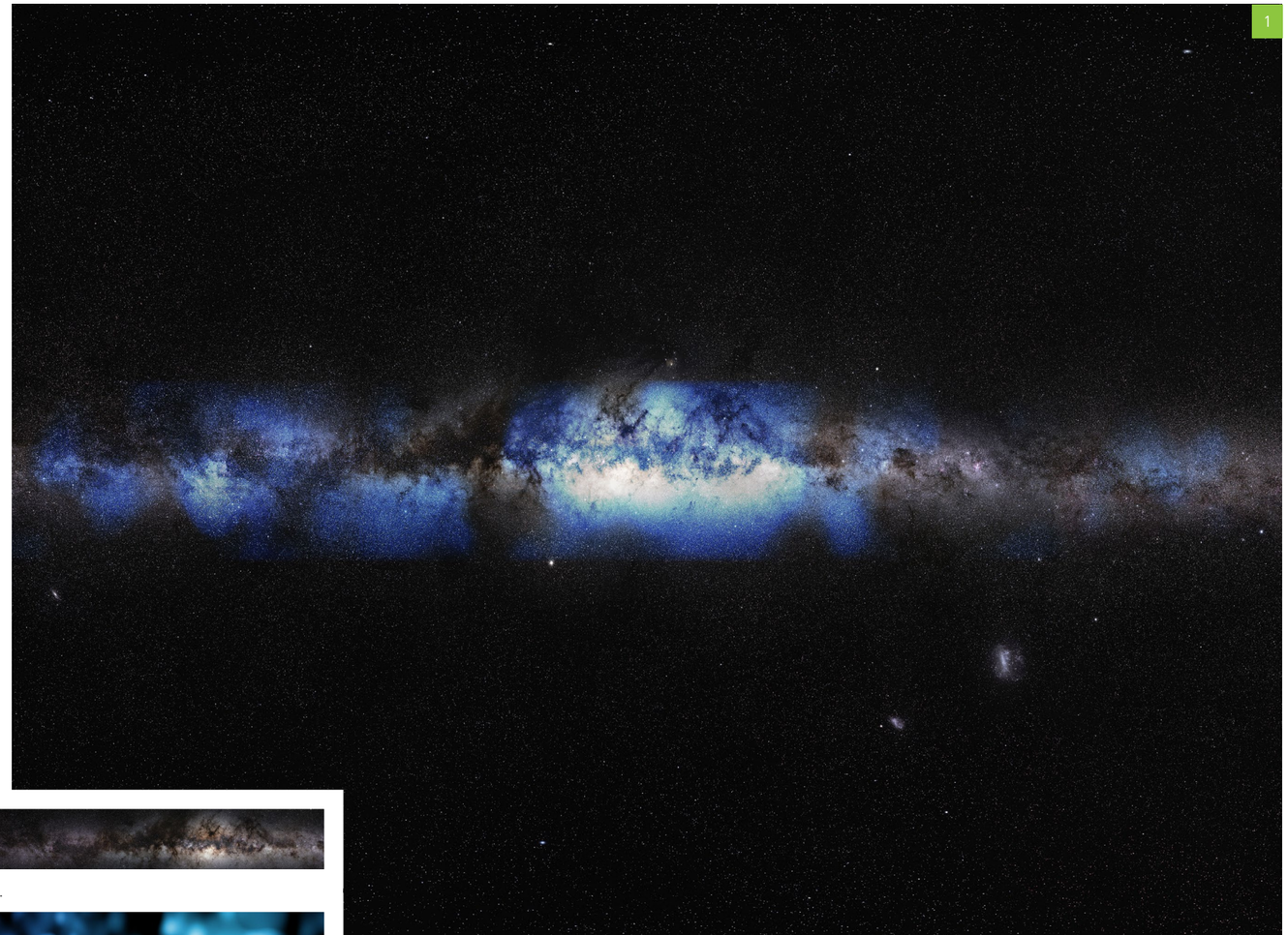
After testing and verifying the algorithm, the research team input IceCube-generated data from neutrinos determined to be from the southern sky — where they expected most neutrino emissions from the galactic plane to originate. They then compared the results to previously published "prediction maps" of locations in the sky where neutrinos from the Milky Way are expected to shine.

Using the real IceCube data in the algorithm produced an image showing bright spots corresponding to locations in the Milky Way.

Kurahashi Neilson predicts this process will ultimately help reveal other unknown aspects of the universe.

"Observing our own galaxy for the first time, using particles instead of light, is a huge step," she says. "As neutrino astronomy evolves, we will get a new lens with which to observe the universe."

_NAOKO KURAHASHI NEILSON
Kurahashi Neilson is a professor in the Department of Physics of the College of Arts and Sciences and a member of the IceCube collaboration, a telescope project at the geographic South Pole.



Milky Way depicted with visible light...

...with neutrinos.

ICECUBE COLLABORATION/U.S. NATIONAL SCIENCE FOUNDATION (LILY LE & SHAWN JOHNSON)/ESO (S. BRUNIER)

1

_1 VIEW OF THE COSMOS
In the Milky Way Galaxy, cosmic rays interact with galactic gas and dust to produce both gamma rays and subatomic particles called neutrinos. The IceCube team captured this first-of-its-kind image of the Milky Way Galaxy by detecting these tiny particles of matter.

_2 POLAR POSITION
The IceCube Neutrino Observatory uses thousands of light sensors buried within the Antarctic ice at the South Pole. The sensors detect faint patterns of light emitted when neutrinos pass through ice molecules and produce charged particles.

2

_SCHUYLKILL WATERSHED SHORTAGES

New models predict ***drought-like conditions for the Schuylkill River watershed in 20 years.***

_MIRA OLSON
_PATRICK GURIAN
Olson is an associate professor in the College of Engineering and principal investigator of the study. Gurian is a professor in the College of Engineering.

Over the next two decades, people living along the Schuylkill River — including Philadelphia — could face up to 82 more days of water shortages each year due to climate change under current water management approaches, a study warns. In a paper published in *Water*, Drexel researchers suggest that the watershed may only be able to meet demand about 67% of the time, a drop of 22% from its current reliability, based on projections that account for changes in population, land use and climate.

Reductions in streamflow and groundwater stores would mean less water for drinking, irrigation, transportation, energy, recreation and aquatic ecosystems.

"The gap between available water and demand is expected to require difficult trade-offs," says Mira Olson, associate professor in the College of Engineering and the study's principal investigator.

"Current resource management practices do not account for increases in the number of extreme precipitation events coupled with population growth and a related shift in land cover that will result in more runoff."

– Mira Olson

The researchers used data from the U.S. Geological Survey and the World Climate Research Programme to model water availability and then tweaked the inputs to simulate the effects of various climate and population changes.

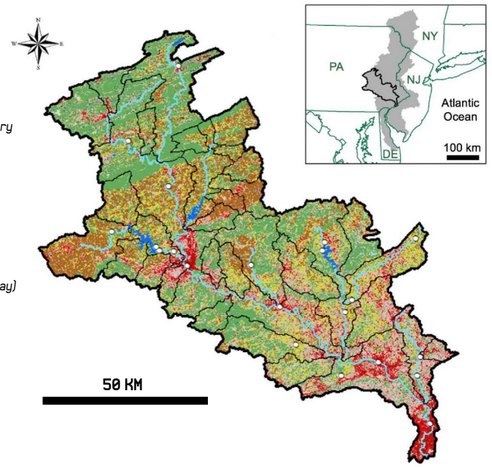
Their models show that a rise in extreme weather — more storms followed by longer dry periods — will disrupt the natural flow of water into the region's streams and groundwater reserves.

Heavy rainfall, instead of replenishing water stores, often runs off too quickly to be captured, and the team predicts that land use shifts may modestly exacerbate the problem. Unfortunately, that, along with less rainfall during warm seasons, is what the Intergovernmental Panel on Climate Change projects for Philadelphia from 2020 to 2040.

The findings underscore the need for proactive water management strategies. The researchers suggest that updating the region's water models and investment in stormwater infrastructure could help mitigate shortages. More detailed climate and land-use projections could also guide policies to ensure a more resilient water supply.

"To secure the Schuylkill Watershed's ecosystem services, we must not only adapt our practices but also advocate for collaborative efforts in system and policy adaptation for a more resilient and sustainable future," says Suna Ekin Kali, a doctoral student at Luleå University in Sweden who contributed to the study.

_A VAST WATERSHED
The Schuylkill River watershed covers 5,180 square kilometers and contains 11 counties, including the city of Philadelphia.



_DUCK STUDY

The science of duck plumage, made accessible.

_EMILY GRIFFITH
Griffith is a graduate assistant in the Ecology, Evolution, and Earth Systems program in the College of Arts and Sciences.

A Drexel doctoral student is combining field research, genetics and illustration to uncover the evolutionary secrets of duck plumage — and to make the science accessible to the public. For Emily Griffith, what started as a childhood fascination with birds became a lifelong pursuit of discovery. As a PhD student at Drexel, she is investigating why some male ducks evolve to have dull, female-like plumage instead of the bright colors typically favored by females in the bird species.

At the Academy of Natural Sciences of Drexel University, Griffith is analyzing genetic sequences from duck tissue samples to understand the evolutionary forces at play. The Academy's vast ornithology collection of more than 200,000 specimens

"Birds are so intrinsically motivating to study – they're so charismatic. People can relate to them on many levels."

– Emily Griffith

offers a rare opportunity to compare species, and Griffith is using these museum specimens to build a phylogeny, or family tree, of all the nearly 180 waterfowl species to answer her questions.

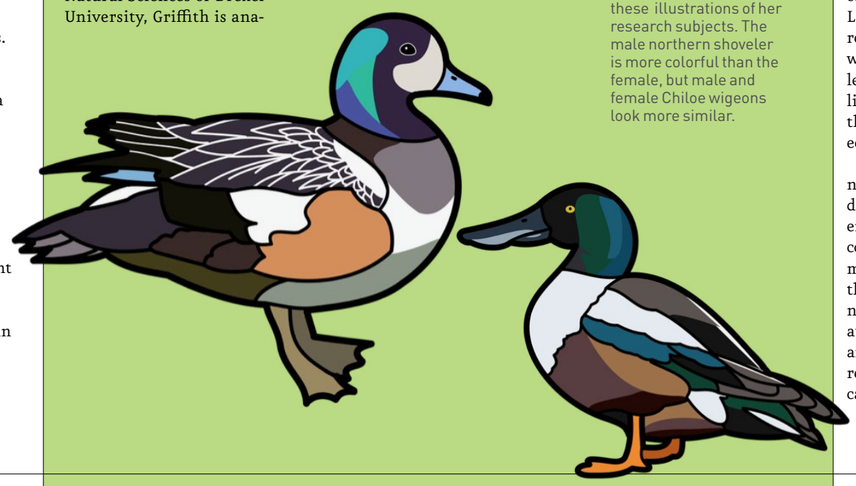
Her research challenges common assumptions about bird evolution. Typically, female birds prefer colorful males, so males evolve brighter plumage.

"But in ducks, it's the opposite," Griffith says. "Bright male plumage evolves to become more female-like, or dull. Female birds are typically duller because they sit on the nest, and it serves as better camouflage. We're finding that males who participate more in caring for their young tend to look more like females."

Beyond her research, Griffith is passionate about making science more accessible. She chose Drexel for its connection to the Academy, which allows her to work with both scientific collections and the public, and she illustrates her subjects.

"As scientists, our role isn't just to do science, but to communicate it," she says.

_FOWL AND FRIEND
As a scientist *and* an artist, Griffth created these illustrations of her research subjects. The male northern shoveler is more colorful than the female, but male and female Chiloe wigeons look more similar.



_UNDERWATER IN LATIN AMERICA

Flooding in Latin American *cities disproportionately affects low- and middle-income neighborhoods, a multi-city analysis has shown.*

_ANA V. DIEZ ROUX
_JOSIAH KEPHART
Roux is the director and Kephart is an assistant professor in Drexel's Urban Health Collaborative within the Dornsife School of Public Health.

Climate change is making flooding more frequent and intense, and a new study in *Nature Cities* reveals that in Latin American countries, low-income neighborhoods bear the brunt of the impact.

Researchers from the Dornsife School of Public Health, with a team of investigators from Latin America, found that residents of neighborhoods with the lowest education levels were 4.3 times more likely to experience flooding than those in more highly educated areas.

The study analyzed nearly 20 years of flood data across 276 cities in eight Latin American countries. It found that 38 million people — 17% of the population — lived in neighborhoods that flooded at least once between 2000 and 2018. Moroever, 1 in 4 residents in the lowest-education neighborhoods faced flooding, compared to 1 in 20 in the highest-education neighborhoods.

The work, part of the Climate Change and Urban Health in Latin America (SALURBAL-Climate) Project led by Drexel's Urban Health Collaborative, is the first of its kind to examine neighborhood-level social determinants of flood exposure in Latin America.

"The message is clear that policymakers must give careful attention to poorer neighborhoods that may be both at higher risk for flooding and have less infrastructure to be able to cope with the effects," says Josiah Kephart, assistant professor in the Dornsife School of Public Health.

The findings highlight the urgent need to prioritize marginalized communities in climate adaptation policies, ensuring they are not left behind as extreme weather events increase.

Although the study was not designed to explain why these disparities were observed, the neighborhoods that suffered from flooding were likely the most devalued, with lower housing prices, and therefore available to low-income populations, says Nelson da Cruz Gouveia, SALURBAL-Climate co-investigator and professor at the University of São Paulo.

The researchers call for proactive mitigation efforts to help reduce flooding and its impact on disadvantaged neighborhoods.

228,000,000

Researchers analyzed 45,000 neighborhoods in 276 cities that are home to 228 million people.

RICARDO STUCKERT / PR CC BY-SA 2.0

_WATER VIEWS
An aerial image from Brazil's Porto Alegre shows a flooded city center after people were evacuated in May 5, 2024.

_ANTS IN THE HEAT OF EVOLUTION

New research suggests the mechanisms that affect creatures' abilities to ***tolerate extremely hot conditions*** *are distinct from the ability to tolerate extreme cold.*

A study of army ants in Costa Rica uncovered surprising insights into how the ants survive extreme temperatures. By sampling colonies from across a wide elevation range in Costa Rica, the team discovered that while elevation influenced the ants' temperature tolerance, the real revelation was the significant variation in thermal tolerances between colonies from the same region.

This challenges the assumption that local adaptation is the sole factor determining how animals cope with temperature extremes, opening the door to new understandings of how climate change impacts animal behavior.

To test how habitat distribution affected their temperature tolerances, Drexel researchers sampled a variety of army ant (*Eciton burchellii parvispinum*) colonies in northwestern Costa Rica.

_SEAN O'DONNELL
O'Donnell is a biologist and professor in the College of Arts and Sciences.

"These ants are uniquely exposed to the temperature conditions of their habitat because they are out in the open all the time while they are hunting. Most other ants conduct a large part of their activities underground, which buffers them from the temperature," says Sean O'Donnell, biologist and professor in Drexel's College of Arts and Sciences.

O'Donnell and Kaitlin Baudier, a coauthor on the study and assistant professor at the University of Southern Mississippi and former Drexel doctoral student, found three important patterns within their data, recently published in *Ecological Entomology*.

1) Local Temperature Adaptation: Ant colonies in cooler, higher elevations were more sensitive to heat but better able to survive colder temperatures, showing that local temperature conditions do play a role in how ants cope with temperature.

2) Colony Differences: Different colonies of army ants — which are genetic families — can tolerate different temperature extremes, meaning social groups of animals may react differently to climate change at the same location.

3) Heat and Cold Tolerance Are Separate: Colonies' tolerance for extreme heat didn't correlate with tolerance for extreme cold, suggesting that different biological processes govern these two types of temperature resilience.

The team notes that in addition to the physiological characteristics that make the ants a good model to study, these predatory ants are ecologically important to their forest habitats, making them a good benchmark for identifying early climate change effects.

"Larger bodied predator animals will be able to regulate their body temperatures. It's likely the effects of climate extremes will be stronger on small animals like ants. Temperature changes are already implicated in tropical insect declines," says O'Donnell.

SEAN O'DONNELL

_SOME LIKE IT HOT (SOME DON'T)
The neotropical army ant *Eciton burchellii parvispinum* provides a compelling test case for colony differences in thermal physiology.

_YOUR BRAIN ON BEAUTY

Does being in nature really improve well-being? Researchers donned high-tech headgear to gather hard data on the ***physiological impact of natural beauty.***

_HASAN AYAZ
_AROUTIS N. FOSTER
Ayaz is a provost solutions fellow and professor in the School of Biomedical Engineering, Science and Health Systems. Foster is the interim dean of the School of Education.

Longwood Gardens is a renowned destination in Kennett Square, Pennsylvania, filled with beautiful walking paths and natural flora, the ideal setting for a study that explores how nature affects the brain — insights that could inform everything from urban design to mental health interventions.

Recently, a team of graduate and undergraduate students strolled the grounds while recording their brain activity. They wore portable headwear equipped with neuroimaging technology known as functional near-infrared spectroscopy, as well as sensors that measured physiological activity like heart rate and electrical properties of the skin.

"Existing studies with traditional approaches have accumulated overwhelming knowledge but are limited in scope such as being only in artificial lab settings and with simplified tasks," says Hasan Ayaz, professor in the School of Biomedical Engineering, Science and Health Systems.

Ayaz, along with Aroutis N. Foster, interim dean of the School of Education, and other key collaborators including Senior Vice Provost Rajneesh Suri, shared insights from the project in a paper in *Applied Human Factors and Ergonomics International 2023 Proceedings* titled, "Evaluating the restorative impact of nature through multimodal mobile sensing of neural, physiological, and behavioral activity in ambulatory settings."

The paper confirmed the benefits of nature on a person's well-being while proposing the next step in the team's work: to investigate "the inter-relationship of psychological, neural and peripheral responses to nature immersion with an eye toward understanding how these may be beneficial to society."

The study contributes to the emerging interdisciplinary field of neuroergonomics, which seeks to study the brain's health and performance in real-world environments. By capturing how the brain reacts to natural beauty, the research seeks new evidence of nature's cognitive and emotional benefits, potentially shaping how green spaces can promote well-being.

Since 2020, Drexel has conducted several multidimensional courses and projects in collaboration with Longwood Gardens.

_MAP TO A GREENER CITY

An interactive map of Philadelphia points the way for local leaders to steer environmental investments toward the neighborhoods that need them most.

Philadelphia's urban landscapes veer between extremes — leafy parks in West Philadelphia, dusty lots in Kensington — that mirror the unequal environmental burdens residents face. During the mayoral race of 2023, a coalition of environmental and neighborhood organizations launched the Green Living Plan to encourage the candidates to prioritize policies around air and water pollution, green spaces, and green jobs and services. But advocacy alone wasn't enough — leaders needed clear data to show where investments could make the biggest impact.

That data came from the work of researchers at the Academy of Natural Sciences' Patrick Center for Environmental Research, in collaboration with Mathy Stanislaus, executive director of Drexel's Environmental Collaboratory. Together they developed a powerful data tool: the Environmental Justice Index.

They then programmed the data into an interactive, public-facing map that reveals which neighborhoods face the greatest environmental burdens — a tool city officials and communities alike can use to advocate for targeted solutions.

To create the index, Winn Costantini, Roman Perez and Alexis Schulman analyzed 20 environmental and social factors such as air quality, traffic pollution, flood risk, urban heat and community health indicators — with each neighborhood ranked. The map has 12 data layers, allowing users to drill into specific neighborhoods and visualize how different environmental factors intersect.

Unlike traditional environmental justice measures that compare neighborhoods to state or national averages, Drexel's index is hyperlocal — evaluating each census tract only against other areas in Philadelphia, providing a far more precise picture of environmental disparities.

"This index reveals the areas of greatest need and disinvestment," says Costantini. "By grounding it in local data, we can pinpoint where investments in green spaces and environmental resilience are needed most."

_WINN COSTANTINI,
_ROMAN PEREZ
_ALEXIS SCHULMAN
Costantini, Perez and Schulman are scientists in the Academy of Natural Sciences' Patrick Center for Environmental Research.

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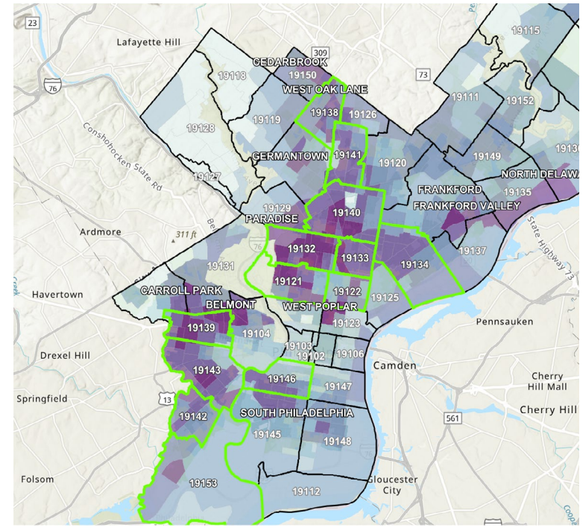
_PRIORITY ZIPCODES
The team identified 13 ZIP codes and 23 additional census tracts as high priority for investment.

0-4

_RANKING SCALE
Each neighborhood is ranked on a 0–4 scale based on 20 indicators, with higher values marking greater environmental and social vulnerability. The ranking includes factors like air pollution, traffic exposure, flood risk, extreme heat, and demographic markers such as age and health vulnerabilities.



30%+

_MOST VULNERABLE
More than 30% of census tracts in the priority ZIP codes ranked among the most vulnerable.

_ALL ZIP CODES

_EJ INDEX BY CENSUS TRACT

- 2.85 - 3.1
- 2.6 - 2.85
- 2.35 - 2.6
- 2.1 - 2.35
- 1.85 - 2.1
- 1.6 - 1.85

_ABOUT DREXEL

_HEALTH ED POWERHOUSE
Drexel's 2025 merger with Salus University forged a powerful and complementary alliance in health care education with Drexel that opens exciting avenues for collaborative research in eyesight, hearing, speech care, orthotics, prosthetics and occupational therapy.

Founded in 1891 in Philadelphia, Drexel is a comprehensive urban university of approximately 22,000 students with one of the country's most established co-operative education programs.

Drexel is a leader in experiential, technology-infused education and cross-disciplinary research. The University's recognized excellence in translational research is supported by the Coulter Foundation through the Coulter-Drexel Translational Research Partnership Program and by $170.2 million in research expenditures last year. In 2025, Drexel reported 25 U.S. patents, $384,000 in net income and 14 license agreements.

Drexel also has some of the richest specimen and artifact collections in the world through the Academy of Natural Sciences of Drexel University, America's oldest natural history museum. In partnership with Tower Health, Drexel medical students train at St. Christopher's Hospital for Children and at a new state-of-the-art facility in West Reading, Pennsylvania.

Drexel advances its culture of innovation by encouraging multidisciplinary collaboration, technology commercialization and entrepreneurship — an approach exemplified by the ExCITe Center, the interdisciplinary A.J. Drexel Institutes, Drexel Applied Innovation, the Charles D. Close School of Entrepreneurship and the Baiada Institute for Entrepreneurship.

In summer 2027, the University will complete a multi-year transformation to streamline its curricular structure, define undergraduate student competencies and convert the academic calendar to semesters — a student-first effort aimed at creating a more flexible and fulfilling academic experience, with greater opportunities for the hands-on, experiential learning that sets Drexel apart. These changes will open new doors for research and academic collaborations with partners around the world.

Drexel operates out of its 123-acre University City Campus in West Philadelphia and through six locations: the Center City Campus including the Academy of Natural Sciences of Drexel University, the West Reading Campus and Queen Lane Campus in East Falls for the College of Medicine, the Malvern Campus for the Bennett S. LeBow College of Business, an online platform, and now Drexel University, Elkins Park Campus.

_ONLINE
Learn more about Drexel University at **drexel.edu**.