GW RESEARCH

THE GEORGE WASHINGTON UNIVERSITY 2023

MRNA VACCINE MOONSHOT
///
AGENTS OF CHANGE
///
BUILDING BRIDGES WITH COMMUNITIES

FROM SYNAPSE TO SILICON

GW researchers are on the forefront of a revolution in computer hardware innovation—designing and fabricating computer chips that take inspiration from the human brain.

FROM THE VICE PROVOST FOR RESEARCH

At the George Washington University, we have a saying: Raise high. Year after year, our research enterprise rises to new heights. In June, the Association of American Universities (AAU) invited GW to join its coveted ranks, a significant milestone that is considered a mark of excellence within the academic and research community. AAU membership recognizes the talents of our scholarly community, the breadth and strength of our academic programs and the impact of GW-led discovery and innovation.

GW's invitation was well deserved. Our faculty are prolific authors of highly cited scholarship. Our students are diverse and broadly educated. We host a vibrant community of postdoctoral scholars. And GW continues to be the top recipient of federal research funding among academic institutions in the nation's capital.

And just like AAU's other members, GW is transforming lives and society. Our cover story about GW research advancing the next generation of computer hardware is just the latest example of our community rising to meet a moment—in this case, a national goal to boost American leadership and innovation in the semiconductor and nanotechnology industries **(page 18)**.

GW investigators are also developing and testing a new generation of mRNA-based vaccines that take aim at some of our most deadly diseases **(page 28)**. These vaccine candidates are designed to target everything from cancerous cells to malaria parasites. It's the type of research that continues to burnish GW's reputation as a hub for pioneering vaccine research and development.

On the international stage, the Global Women's Institute (GWI) is celebrating a decade of accomplishments and turning groundbreaking research into strategies that can prevent gender-based violence **(page 36)**. Now GWI is leading the world's largest global research consortium dedicated to preventing violence against women and girls.

Finally, with the launch of three new campus-wide initiatives, GW's research enterprise is poised to rise even higher. These include a National Science Foundation-sponsored institute on trustworthy artificial intelligence **(page 4)**, the GW Equity Institute dedicated to the eradication of racial, ethnic and economic inequality, and a Global Food Institute founded with chef and humanitarian José Andrés **(page 3)**.

If you are reading this magazine, your creativity, innovation, financial support or collaboration likely contributed to our invitation to join AAU. For that, I would like to offer my sincerest thanks. Together we will expand the boundaries of what's possible, advance our understanding of the world and continue to raise high.

Pamela M. Norris
Vice Provost for Research

P.S. For more regular updates about discoveries, innovations, and expertise at GW, sign up for our quarterly GW Research updates.

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The Global Women's Institute honors former political prisoners from Nicaragua with Champions for Justice awards at their 10-year anniversary celebration.

CREDIT: WILLIAM ATKINS

FEATURES

DEPARTMENTS

FRONT COVER:
Illustration by Sayo Studio

BACK COVER:
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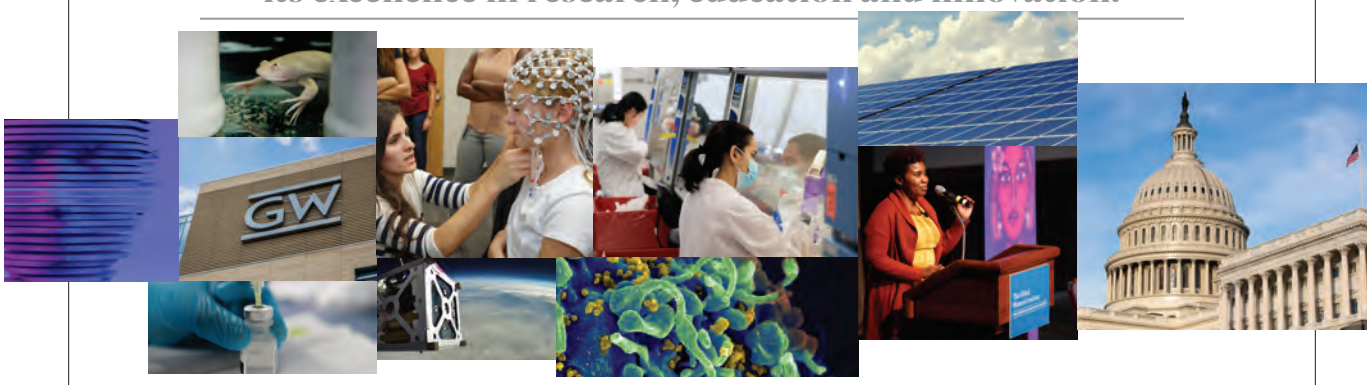
ACADEMIC RESEARCH

GW JOINS PRESTIGIOUS ASSOCIATION OF AMERICAN UNIVERSITIES

The university's membership in the AAU recognizes its excellence in research, education and innovation.



Joining the top tier of preeminent universities in North America, the George Washington University became one of just 71 institutions to receive membership in the Association of American Universities (AAU) in June.

Founded in 1900, the AAU comprises America's premier research universities working to address challenging problems through research while educating and training the next generation of leaders. Membership in the AAU is by invitation only.

AAU member universities are invited after a review of "quantitative indicators" assessing breadth and quality of research and education. The universities "earn the majority of competitively awarded federal funding for research that improves public health, seeks to address national challenges and contributes significantly to our economic strength, while educating and training tomorrow's visionary leaders and innovators," according to AAU.

AAU member institutions are also leading voices that shape policy in higher education, science and innovation; set the standard for excellence in undergraduate and graduate education; and have a positive impact on society.

"GW is a university on the rise, and the invitation to join AAU is a testament to the accomplishments of an ambitious community that strives for academic excellence and advances the university in its prominence and impact every day," said GW President Ellen Granberg, noting that she looks forward to the ways AAU membership will help the university elevate this impact in its third century.

AAU membership signals that GW has significant achievements in research. In addition, being invited to join the AAU recognizes GW's positive trajectory. Accelerating the progress of the research enterprise will be important in building the quality and impact of the university. Initiatives like the Global Food Institute, renewed efforts on sustainability and strengthening biomedical research will contribute to the advancement of GW. GWR

José Andrés

GW AND JOSÉ ANDRÉS LAUNCH GLOBAL FOOD INSTITUTE

GW and world-renowned chef, author and humanitarian José Andrés, HON '14, have launched the Global Food Institute, a transformative and unprecedented collaboration that will be the world leader in food system solution delivery.

Driven by Andrés' vision of changing the world through the power of food, the Global Food Institute at GW will work to transform people's lives and the health of the planet, taking an interdisciplinary systems approach across three main pillars: policy, innovation and humanity.

The institute will enable faculty and students from every school and college, industry leaders, policymakers and renowned experts to work and teach across these pillars, producing cutting-edge research to create and improve domestic and global food policies, incubate and engineer innovative technologies and entrepreneurial spirit and lead critical conversations about the impact of food on the human race.

"The Global Food Institute will reshape how we think about food, break down barriers across industries, politics and nations, and inspire and empower the next generation to develop systemic solutions that reshape the food system," Andrés said.

Made possible by a founding gift from Andrés, the institute is also supported by the Nelson A. and Michele M. Carbonell Family Foundation and the Rockefeller Foundation. GWR

EQUITY INSTITUTE CHARTERED AT GW

In February, GW chartered a new research institute, the Equity Institute, opening a new collaborative, interdisciplinary chapter for GW researchers addressing questions of racial and socioeconomic justice.

The formal establishment of the institute is a marker of GW's commitment to justice and also will cement GW's reputation as a resource to support scholars, governments and communities in meaningful, data-driven policymaking.

The institute, which provided seed funding to 10 research projects in 2022, will support the development of new research collaborations and provide support for faculty submitting equity-related grant proposals and scholarship. It will also expose students to the best practices of participatory based research and facilitate authentic community research partnerships.

"The university's decision to charter a new research institute dedicated to the principles of equality, fairness and freedom means everything."

DAYNA BOWEN MATTHEW
GW Law Dean and Harold H. Greene Professor of Law

"The university's decision to charter a new research institute dedicated to the principles of equality, fairness and freedom means everything," said GW Law Dean and Harold H. Greene Professor of Law Dayna Bowen Matthew, who launched the preliminary Equity Institute Initiative in 2021 and is serving as its inaugural faculty director. "It means that at the dawn of our third century, GW has dedicated its resources to support faculty and students who seek to improve societies near and far by contributing to the work of eradicating discrimination, bigotry, prejudice and inequality—to advancing the cause of justice, both here in the United States and around the world." GWR

CREDIT: ABBY GREENAWALT PHOTOGRAPHY

SPOTLIGHT ON **ARTIFICIAL INTELLIGENCE**

GW TO CO-LEAD $20M AI INSTITUTE

The institute will integrate broader participation in AI design, new technology and process development and more informed governance of AI-infused systems.

The George Washington University is co-leading a multi-institutional effort supported by the National Science Foundation (NSF) that will develop new artificial intelligence technologies designed to promote trust and mitigate risks while simultaneously empowering and educating the public.

The NSF Institute for Trustworthy AI in Law & Society (TRAILS) unites specialists in AI and machine learning with systems engineers, social scientists, legal scholars, educators and public policy experts. The multidisciplinary team will work with impacted communities, private industry and the federal government to determine how to evaluate trust in AI, how to develop technical solutions and processes for AI that can be trusted and which policy models best create and sustain trust.

Funded by a $20 million award from NSF, the new institute is expected to transform the practice of AI by encouraging innovations that foreground ethics, human rights and input and feedback from communities whose voices have previously been marginalized.

In addition to GW, TRAILS will include faculty members from the University of Maryland, Morgan State University and Cornell University, with more support coming from the National Institute of Standards and Technology (NIST) and private-sector organizations.

"AI can be the source of significant benefits and innovations to society but can also cause a lot of harm," said David Broniatowski, an associate professor of engineering management and systems engineering and the lead principal investigator (PI) of TRAILS at GW. "Many of those harms are felt by people who are historically underrepresented because their concerns are not reflected in the design process."

Faculty from across GW will contribute to TRAILS, including Susan Ariel Aaronson, a co-PI of the project and research professor of international affairs who will lead one of the institute's research thrusts on participatory governance and trust. GWR

CREDIT: ISTOCK/ KANAWATTH

IN INTERACTIONS WITH AI, DOES RACE MATTER?

Between human beings, racial prejudices shape all kinds of interactions. But as more interactions become partially or wholly digital, and as artificial intelligence becomes a more central part of those digital interactions, how might these prejudices and stereotypes translate into the digital environment?

An interdisciplinary team of researchers led by GW explored the question in a new study. They found that when consumers interacted with three identical chatbots with different racialized cartoon avatars—one white, one Asian and one Black—consumers rated the Black avatar highest on scales of competence, warmth and "humanness." Customers who interacted with the Black bot also reported higher satisfaction levels, the researchers found.

"Stereotypes cause us to form particular expectations, and when some cue or some signal is not consistent with those expectations, then it can cause a more extreme and opposing reaction to the expectation," said study co-author Vanessa Perry, professor of marketing at the GW School of Business. Perry and her co-authors, including Nils Olsen, assistant professor of organizational sciences in GW's Columbian College of Arts and Sciences, published their study in the Journal of the Association for Consumer Research. GWR

LARGE LANGUAGE MODELS IN SCIENCE

GW researchers from GW's Graduate School of Education and Human Development and School of Engineering and Applied Science have launched an online clearinghouse on the use of large language models (LLMs) in scientific research workflows. The site includes a searchable database of articles, documentation and case examples, as well as emerging guidance for peer reviewers who are presented with articles that use LLMs in their research methods.

"From creating synthetic data or joining datasets, to analyzing data or summarizing research, LLMs are becoming useful tools for researchers across STEM, social science, and humanities disciplines," Ryan Watkins, one of the site's co-developers, explains. "This site is really for anyone who wants to integrate LLMs into their research." GWR

go.gwu.edu/llmscience

Visit the site.

GLOBAL GOVERNANCE OF AI

As countries expand their use of AI, the Organization for Economic Co-operation and Development (OECD) has developed the most comprehensive website on AI policy, the OECD AI Policy Observatory. Yet, a new study by Susan Ariel Aaronson, research professor of international affairs and director of the Digital Trade and Data Governance Hub, finds that many governments failed to evaluate or report on their AI initiatives.

> **"Evaluations of AI policies are important because they help governments demonstrate how they are building trust in AI and AI governance."**
>
> **SUSAN ARIEL AARONSON**
> Research Professor, International Affairs

Aaronson examined 814 initiatives from 62 nations and found that less than 1% of the programs listed on the OECD.AI website had been evaluated.

"Evaluations of AI policies are important because they help governments demonstrate how they are building trust in both AI and AI governance and that policymakers are accountable to their fellow citizens," Aaronson said.

The paper, "Building Trust in AI: A Landscape Analysis of Government AI Programs," was published by the Centre for International Governance Innovation. GWR

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2

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PARTNERSHIPS

CELLPHONE CENTRAL

A new exhibit at the Smithsonian's National Museum of Natural History charts how cellphones have changed our lives and our planet. The exhibit, "Cellphone: Unseen Connections," traces the technological, environmental and cultural impacts of the cellphone and how it evolved from a bulky, brick-like eyesore to a sleek, razor-thin fashion statement.

The exhibit was curated by Joshua Bell, a professional lecturer in anthropology at GW and the museum's curator of globalization. For more than 10 years, Bell and GW's Joel Kuipers and Alexander Dent–both professors of anthropology and international affairs–collaborated on research that explored everything from cellphone repair to cellphone use in teens. As many as 100 students—GW undergraduate, graduate and Ph.D. students, as well as D.C.-area high school students—also contributed to the research.

"This has been a synergistic opportunity—in terms of our research partnerships and in terms of giving students a chance to really engage in natural history," Bell said. GWR

FROM LEFT TO RIGHT:
1) **The exhibit features interactive displays, including a cellphone repair game and hundreds of objects such as undersea cables and phone cases decorated with Indigenous art.** 2) **A centerpiece display focused on conflict-mineral mining showcases 65 elements that comprise standard cellphones.** 3) **Among the 750 objects on display is a 6-foot-tall fantasy coffin crafted by a Ghanian artist to resemble a cellphone.** 4) **A large-scale comic book-style mural examines the social effects of cellphones.**

go.gwu.edu/cellphone
Learn about the exhibit.

CREDIT: SMITHSONIAN INSTITUTION NATIONAL MUSEUM OF NATURAL HISTORY

EQUITY

LEADING FOR EQUITY IN THE CLASSROOM

Combating social inequality and injustice in society starts in the classroom. But it isn't just about creating more equitable policies in K-12 schools; it's about putting those ideas into practice, which often falls to school leaders. Yet, principals and other leaders don't always have the necessary training to address inequities in their schools.

GW researchers examined a professional development program designed to help K-12 principals become better equity leaders in five southeastern Virginia districts.

Their study found that school principals not only need to assess their own implicit biases and subjectivity, but they also need the sustained support of a peer network in order to find solutions for enacting equity in the classroom and school. School leaders cited isolation and a lack of collaboration as barriers to identifying and breaking down inequality structures in their schools. The study also highlighted the power of the personal journey, in which school leaders must reflect on their own stories and subjectivity to learn how they can lead their school communities.

"Every school has their own equity story and each of them will have a particular group that they may be serving better than others," Jennifer Clayton, an associate professor of educational leadership and administration in GW's Graduate School of Education and Human Development, said. "And that's how we frame the question: 'Who are you best serving right now?' When you ask the question in that way, you're able to potentially unearth groups of students that are not being served as well."

Clayton, who co-authored the study with GW's Christine Nganga, an associate professor of education administration, says that when a principal is able to identify their school's equity story, it allows them to take action on it in ways that help all students move forward.

The study, "Leading for Equity: How Principals Experience Professional Learning," was published in the Journal of Educational Administration. GWR

CREDIT: ISTOCK/ MONKEYBUSINESSIMAGES

FOOD SAFETY

MEAT BACTERIA CAUSES HALF A MILLION UTIS

A new study suggests that E. coli from meat products may be responsible for hundreds of thousands of urinary tract infections (UTIs) in the United States each year.

A team of scientists, led by GW's Lance B. Price and Cindy Liu from GW's Milken Institute School of Public Health, developed a new genomic approach for tracking the origins of E. coli infections.

The researchers collected raw chicken, turkey and pork purchased from major grocery store chains in Flagstaff, Arizona, and isolated E. coli from these meat samples. The researchers also collected urine and blood E. coli isolates from patients hospitalized at the Flagstaff Medical Center for urinary tract infections.

By analyzing the genomes of E. coli from meat and from people, the research team identified segments of E. coli DNA unique to strains that colonize food animals versus humans, then developed a new predictive model to differentiate E. coli from the two sources.

Using this method, the team estimated that between 480,000 and 640,000 urinary tract infections in the United States each year may be caused by foodborne E. coli strains. The study was published in the journal One Health. GWR

HIV

HIV INFECTION LEAVES A 'MEMORY' IN CELLS

Though anti-retroviral therapy has made HIV a manageable disease, people living with HIV often suffer from chronic inflammation. This can put them at an increased risk of developing comorbidities such as cardiovascular disease and neurocognitive dysfunction, impacting their longevity and the quality of their lives.

Now, a study by GW researchers helps explain why chronic inflammation may be happening and how suppression or even eradication of HIV in the body may not resolve it.

The study reveals how an HIV protein permanently alters immune cells in a way that causes them to overreact to other pathogens. When the protein is introduced to immune cells, genes in those cells associated with inflammation turn on, or become expressed, the study showed. These pro-inflammatory genes remain expressed even when the HIV protein is no longer in the cells. According to the researchers, this "immunologic memory" of the original HIV infection is why people living with HIV are susceptible to prolonged inflammation, putting them at greater risk for developing cardiovascular disease and other comorbidities.

"This research highlights the importance of physicians and patients recognizing that suppressing or even eliminating HIV does not eliminate the risk of these dangerous comorbidities," said Michael Bukrinsky, professor of microbiology, immunology and tropical medicine at GW's School of Medicine and Health Sciences and the study's lead author. The study was published in Cell Reports. GWR

CREDIT: ISTOCK/ TAVIPHOTO

COVID-19

INFECTION DURING PREGNANCY RAMPS UP SERIOUS HEALTH RISKS

Research led by GW found that pregnant women infected with the virus that causes COVID-19 face a sevenfold increase in risk of death, as well as a significantly elevated risk of pneumonia infection or admission to an intensive care unit.

The study also suggests that COVID-19 during pregnancy increases the risk that the baby will need to be admitted to intensive care.

"This study provides the most comprehensive evidence to date suggesting that COVID-19 is a threat during pregnancy," said the study's lead author, Emily R. Smith, an assistant professor of global health at GW's Milken Institute School of Public Health. "Our findings underscore the importance of COVID-19 vaccination for all women of childbearing age." The study was published in the journal BMJ Global Health. GWR

LGBTQ+ HEALTH

PARENTAL INTERVENTION TO REDUCE HIV RISK IN GAY/ BISEXUAL BOYS

Gay and bisexual youth make up nearly 80% of all HIV infections among teens, yet there are very few public-health interventions aimed at reducing the HIV risk among this group.

Now, a first-of-its-kind study by GW researchers suggests that parents can be taught to communicate with their gay or bisexual sons about safe sex. The study found that parents in the intervention group talked to their sons more about condoms and HIV and engaged in other parenting behaviors aimed at keeping their sons healthy.

According to David Huebner, professor of prevention and community health and study lead, this is the first study to focus on the parents of gay or bisexual sons and the first to show evidence of positive effects in a randomized controlled trial.

"Parents represent an untapped yet promising resource in preventing HIV infection and improving sexual health among this underserved population," he said. The study was published in the journal AIDS and Behavior. GWR

PALLIATIVE CARE

EXPANDING PATIENT CHOICE

The default treatment option for people with kidney failure is dialysis, which filters impurities from the blood when kidneys are no longer functioning properly. Some patients with kidney failure receive kidney transplants and are managed with dialysis while waiting for a donor organ. In the United States, a large number of patients are treated with dialysis, even at advanced ages.

Now, with a five-year, $12 million contract from the Patient-Centered Outcomes Research Institute, GW School of Nursing Research Professor Dale Lupu is leading a multidisciplinary, multi-institutional study designed to expand patient choice for people with kidney failure and improve shared decision-making.

The project will involve a randomized control trial to test two ways of expanding choice for people–one in which nephrology organizations are trained to provide patients with better information, and the second approach in which nephrology organizations provide an additional palliative care team to support patients.

"Many people regret going on dialysis and they don't realize that they actually had a choice," Lupu said. "The end of the story matters." GWR

CREDIT: ISTOCK/ SDI PRODUCTIONS

GLOBAL HEALTH

ROAD SAFETY INTERVENTIONS COULD SAVE 540,000 LIVES WORLDWIDE

A new series in The Lancet features strategies to save lives and prevent road traffic injuries. The series highlights research from the GW Milken Institute School of Public Health.

An estimated 1.35 million people lose their lives and more than 50 million are injured or disabled as a result of road traffic injuries every year.

As the United Nations General Assembly gathered for a high-level meeting on global road safety in June 2022, GW researchers published a series of papers in the The Lancet as part of the medical journal's The Lancet Road Safety 2022 series. The papers highlighted the growing problem of road traffic injuries and laid out some opportunities for preventing injuries and saving lives.

"The death toll from traffic injuries around the world is far too high," said Adnan Hyder, professor of global health and director of the Center on Commercial Determinants of Health. Hyder was the senior author on two of the papers and also the lead author of an analytic commentary published in the journal that describes where the opportunities are for making faster progress on road safety.

"Despite a United Nations goal to reduce this heavy burden, people everywhere continue to be at great risk of injury and death unless current road traffic strategies are changed to put protections in place," he said.

Two other papers in the series address the issue of road safety around the world. One looked at trauma care for road injuries and found that approximately 200,000 lives per year could be saved with improved trauma systems in low- and middle-income countries.

In the second paper, Hyder, GW Assistant Research Professor Nino Paichadze and collaborators from Johns Hopkins University studied four road safety risk factors—speeding, drunk driving, and use of helmets and seatbelts. They found that full implementation of already proven road safety interventions targeting those main areas could save up to 540,000 lives around the world.

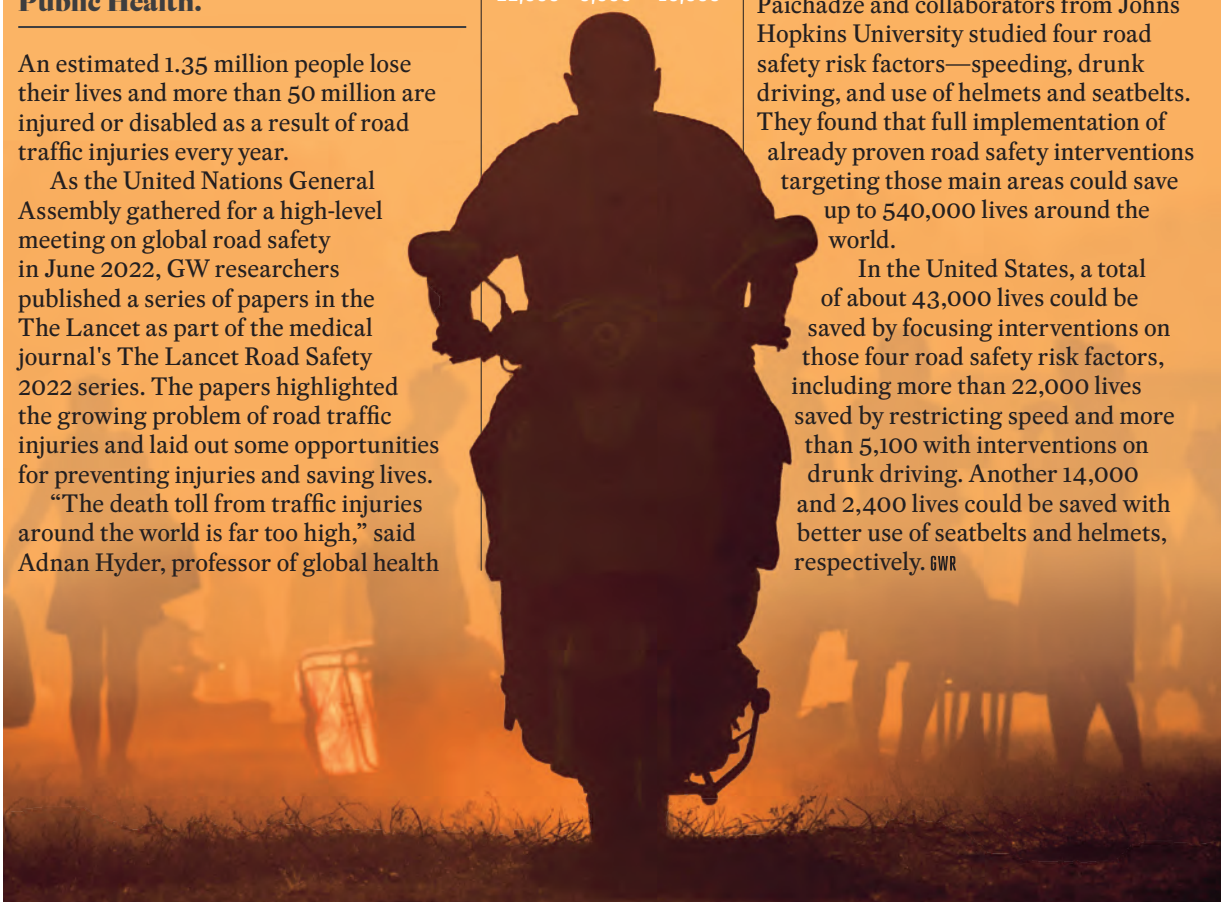
In the United States, a total of about 43,000 lives could be saved by focusing interventions on those four road safety risk factors, including more than 22,000 lives saved by restricting speed and more than 5,100 with interventions on drunk driving. Another 14,000 and 2,400 lives could be saved with better use of seatbelts and helmets, respectively. GWR

1 MILLION+
number of people who lose their lives from road traffic injuries every year

540,000
lives per year saved globally with implementation of proven road safety interventions

U.S. lives saved through interventions on speed, drunk driving, and seatbelt and helmet use:

55 22,000 | 5,000+ | 16,000+



CREDIT: ISTOCK/ANNAVACZI

BY THE NUMBERS

$67B

Amount countries saved in solar panel production costs thanks to a globalized supply chain, according to a GW study published in Nature.

The study–the first to quantify the historical and future cost savings to the solar industry from global supply chains–also found that if strong nationalistic policies that limit the free flow of goods, talent and capital are implemented going forward, solar panel costs will be much higher by 2023.

$276B

Estimated cost to fix roads, buildings, airports and railroads damaged by thawing permafrost across the Arctic by midcentury, according to a study published by GW researchers in Environmental Research Letters.

The findings follow on the heels of a 2022 study co-authored by a GW researcher and published in Nature Review Earth and Environment that found thawing permafrost could put as much as 50% of Arctic infrastructure at risk of damage by 2050.

77%

Percentage of pesticides from the EPA's pesticide registry that fulfilled the "safe chemical" criteria after being analyzed by a new computational model developed by GW researchers.

The team, which published their findings in Science, designed the new model to help rapidly screen pesticides for safety, performance and environmental endurance, and to aid in the design of next-generation molecules to develop safer pesticides.

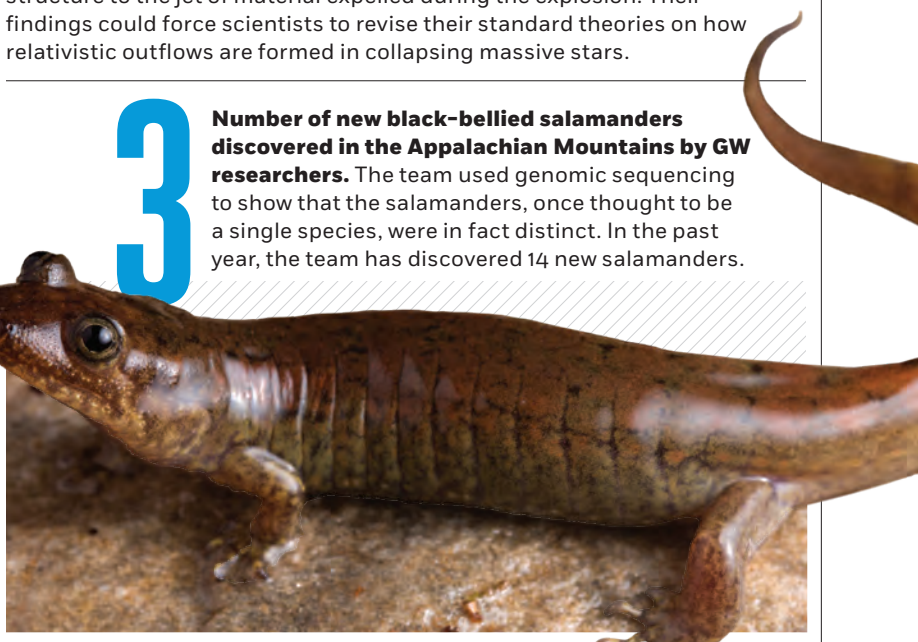
1-IN-10,000

The frequency–or rarity–with which scientists encounter events like the gamma-ray burst detected on Oct. 9, 2022, and dubbed the BOAT, or brightest of all time.

The Oct. 9 event likely signaled the death of a black hole two billion light years away. In a paper published in Science Advances, GW researchers and their collaborators examined troves of multi-wavelength data from the gamma-ray burst and described an unusual structure to the jet of material expelled during the explosion. Their findings could force scientists to revise their standard theories on how relativistic outflows are formed in collapsing massive stars.

3

Number of new black-bellied salamanders discovered in the Appalachian Mountains by GW researchers. The team used genomic sequencing to show that the salamanders, once thought to be a single species, were in fact distinct. In the past year, the team has discovered 14 new salamanders.



CREDIT (CLOCKWISE): ISTOCK/ HELIN LOIK-TOMSON, NASA, ESA, CSA, STSCI, A. LEVAN (RADBOUD UNIVERSITY); TODD PIERSON; ALEXANDER FYODOROV.

BUILDING BRIDGES WITH COMMUNITIES

Q&A WITH SHERRIE FLYNT WALLINGTON

By Nick Erickson

In December 2020, George Washington University School of Nursing Associate Professor **Sherrie Flynt Wallington** and colleagues launched a research project focused on the roles of fathers in addressing disparities in maternal mortality. Funded with a grant from the Robert Wood Johnson Foundation, Wallington and her collaborators—GW Nursing Professor Y. Tony Yang and D.C. Ward 8 Community Partner Terrance Staley with the local nonprofit Alliance of Concerned Men—worked closely with Black fathers from Washington, D.C., where the maternal mortality rate is twice the national average and especially high among Black mothers.

It's the kind of community-based research project that depends heavily on data gathered from the community through focus group discussions, interviews and surveys.

Here, Wallington talks about how she works with communities and why building relationships and trust rests with the researcher: "The onus should not be on them to trust us but on us becoming more trustworthy."

CREDIT: ISTOCK/ MELITAS

Why has there sometimes been a lack of trust between researchers and communities?

There's a concept called helicopter research, where researchers go into communities and collect all this data and then just leave the community without leaving anything for it. It's important to not just do the research in the community but to do it with the community. This is an important distinction. During COVID especially, I would hear a lot that the community doesn't trust us. But we haven't always given them a reason to trust us. The onus should not be on them to trust us but on us becoming more trustworthy. I think that starts by being honest, transparent and by communicating often. I also think, in times of crisis such as during the pandemic, we have to get these populations to the table at the beginning, not at the end. That's how you build sustained trust, and it takes time and patience.

"One of the good canons of research is you always leave the community better off than you found it."

How do you engage the communities you work with?

It's important to not go in and say, 'This is what we need.' To do this kind of community-engaged, participatory research, you have to be able to show the community you are interested in a sustainable relationship. You're in for the long haul and not just there to collect a letter of support or data, then you leave and they never hear from you again.

I also go to a lot of meetings in the community. Nothing can replace the value of face-to-face interactions. Here in D.C., one of the groups I work with is the Ward 8 Health Council. Many communities like Ward 8 have been taken advantage of by researchers, so they've started councils; researchers or individuals wanting to do work in the community must first be vetted by the council. I've also built great relationships with D.C. public housing, recreation centers, and other grassroots and advocacy groups, as well as the D.C. Department of Health; we have done community workshops together, and the knowledge I have gained from my community partners has been invaluable.

Sometimes we host town hall meetings where we aren't asking for anything other than building trust with the community by listening to their needs and understanding their priorities. It's about being there for them in their time of need, and in theory, when you need something, they will be there for you, too. One of the good canons of research is you always leave the community better off than you found it.

How do you end a project like your maternal mortality project with a community?

We hope once our data is analyzed to take the findings back to the community with infographics and have a town hall meeting. Of course, we'll do our peer-reviewed publications, but this is a community-engaged study focused on father involvement, so it's important to us to bring those results back to the community. We plan to do that by having our community partner lead the dissemination plan and conduct workshops, webinars and town hall meetings.

What advice do you have for researchers—especially young researchers—about how to do community-based research?

Don't go into a community with preconceived notions. Don't do all the talking. Let them talk to you first. That was such an important lesson to me. Also, I always make an effort to go to the community; I rarely have them come to me. Many of the community members say that they want to work with people who will help to develop programs in their community and that will come to them, so you will often find me on Alabama Avenue and Benning Road in Southeast D.C. That's how you really create trust and relationships to help build bridges and find solutions. I'm excited to see how our young people, especially many of our GW students, are really interested in working in communities. They have a passion for social justice and health equity.

How does a good relationship with a community also make for better research?

Much of my research funded by the National Institutes of Health and foundations was truly because of ideas that were first generated by engagement with the community. In addition, having a relationship with community members enables you to get to the right research questions and helps you know for sure you're asking the right questions for the best impact. I also know that because of my relationship with the community, my data collection tools and analyses are more rigorous and more robust because community members are subject-matter experts on issues that directly impact them.

GWR

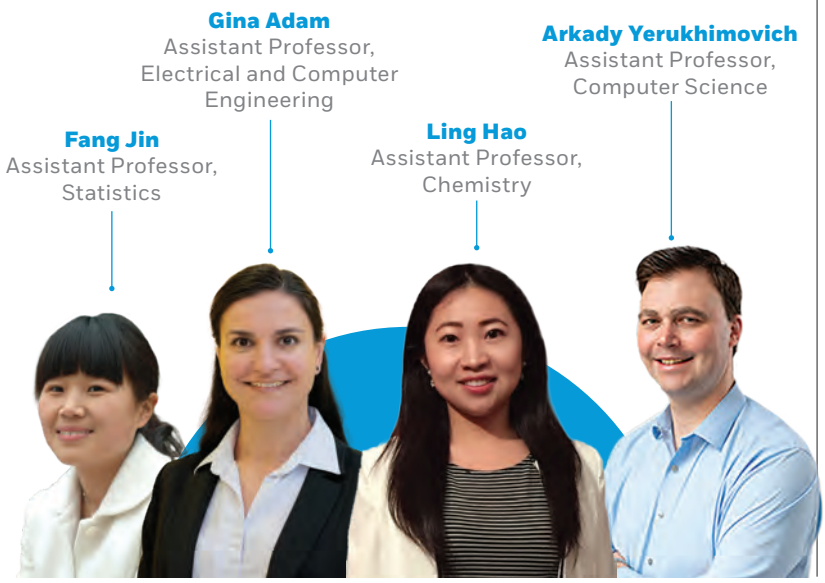
CREDIT: SHERRIE FLYNT WALLINGTON

DISTINCTIONS

GW faculty are recognized for their excellence through an array of honors and awards, including those highlighted here.

NSF CAREER AWARDS

In FY23, the National Science Foundation awarded four GW researchers its Faculty Early Career Development (CAREER) award, the federal agency's most prestigious honor supporting new work from junior faculty with the potential to serve as academic role models in research and education and to lead advances in their fields. Fifteen faculty researchers from GW currently have active NSF CAREER awards, which are supporting investigations into everything from the food-energy-water nexus to AI bias in medical imaging. "These faculty have already demonstrated early success in their careers and are well on their way to becoming among the most impactful scholars in their fields," Pamela M. Norris, vice provost for research at GW and a former CAREER awardee, said.



NEW AAAS FELLOWS

Chemistry's **Akos Vertes** (left) and Anthropology's **Chet Sherwood** (right) were elected to the 2022 class of American Association for the Advancement of Science Fellows, a distinguished group of scientists, engineers and innovators recognized for their extraordinary achievements across disciplines. Vertes, a co-inventor on 19 patents, is known for his work creating new analytical techniques for fields such as laser ionization and mass spectrometry. Sherwood, who conducts research into the brains of primates and other mammals, has shaped the field of evolutionary neuroscience.

FULBRIGHT AWARDS

18 **Number of undergraduate and graduate students who received Fulbright awards in the 2022-23 academic year. GW ranks among the top research institutions for the number of students granted Fulbright awards.** (Chronicle of Higher Education)

CREDIT: COURTESY OF JIN / COURTESY OF HAO / COURTESY OF YERUKHIMOVICH / ADAM, VERTES: WILLIAM ATKINS / SHERWOOD: LOGAN WERLINGER

NATIONAL INSTITUTE OF MENTAL HEALTH AWARD

The National Institute of Mental Health named **Lisa Bowleg** the 2023 James S. Jackson Memorial Award winner, which "honors outstanding researchers who have demonstrated exceptional achievement and leadership in mental health disparities research and excellence in mentorship, influence, and support of trainees." Bowleg, a professor of applied social psychology, co-directs the Social and Behavioral Core of the District of Columbia Center for AIDS Research and is the founder and president of the Intersectionality Training Institute at GW.

'NOBEL PRIZE' OF POLITICAL SCIENCE

Martha Finnemore, University Professor of Political Science and International Affairs, was awarded the Johan Skytte Prize in Political Science, widely regarded as the most esteemed honor in the field and often referred to as the "Nobel Prize of political science."

Finnemore is a world-renowned expert on global governance, international organizations, cybersecurity and constructivist social theory. Uppsala University in Sweden administers the award.

AMERICAN ACADEMY OF NURSING FELLOW

GW Nursing's **Christine Pintz** was inducted into the American Academy of Nursing. Pintz joins other distinguished nursing leaders in the 2022 Class of Fellows recognized for their leadership in education, management, practice and research.

BELL HOOKS LEGACY AWARD

Alexa Alice Joubin, professor of English, was named the inaugural recipient of the bell hooks Legacy Award. Established by the Popular Culture Association and American Culture Association to commemorate the late feminist writer and activist bell hooks, the award recognizes Joubin's achievements in research, teaching and service, particularly her efforts to "dismantle intersectional systems of oppression with the distinct goals of uplifting members of historically marginalized populations and striving for social justice, all while teaching compassion and love" through her public humanities work, open-access publications (such as her own Screening Shakespeare) and inclusive pedagogies.

HIGHLY CITED RESEARCHERS IN ECONOMICS AND BUSINESS

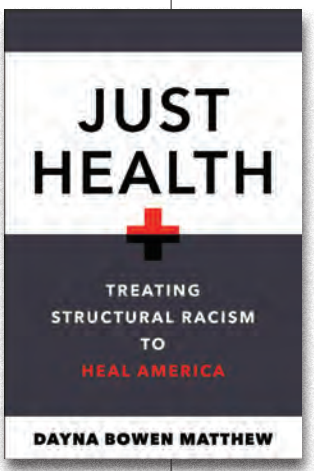
Herman Aguinis (left), the Avram Tucker Distinguished Scholar and Professor of Management, and **Annamaria Lusardi** (right), University Professor of Economics and Accountancy and director of the GW Global Financial Literacy Excellence Center, were included on Clarivate's Highly Cited Researchers list for 2022 in the category of economics and business. GWR

CREDIT: COURTESY OF BOWLEG / FINNEMORE; JOUBIN: WILLIAM ATKINS / COURTESY OF PINTZ / LUSARDI: JULIE ANN WOODFORD PHOTOGRAPHY / COURTESY OF AGUINIS

SHELF LIFE

This comprehensive look at systemic racism in America examines how discrimination in housing, education, employment and the criminal justice system leads to poor health outcomes for people of color.

Matthew, bestselling author of "Just Medicine" and GW Law dean, draws from the personal experience of her father's death as well as empirical data and research to demonstrate the far-reaching consequences of structural racism.



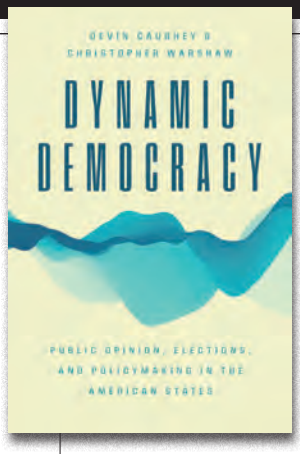
***Just Health: Treating Structural Racism to Heal America* (NYU Press, 2022)**
By Dayna Bowen Matthew, GW Law dean and Harold H. Greene professor

"As our neighborhood's community health outcomes got worse, so did my father's individual physical health," Matthew writes. "But it was the burden on my father's mental health, which structural inequality imposed, that was most crushing."

In "Just Health," Matthew addresses some of America's most deeply ingrained problems to ensure that everyone has an equal opportunity to be healthy regardless of the color of their skin.

Dayna Bowen Matthew

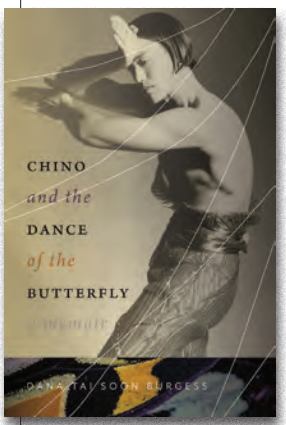
MATTHEW: COURTESY GW LAW / ILLUSTRATION: JOHN MCGLASSON



***Dynamic Democracy: Public Opinion, Elections, and Policymaking in the American States* (University of Chicago Press, 2022)**

By Christopher Warshaw, associate professor of political science

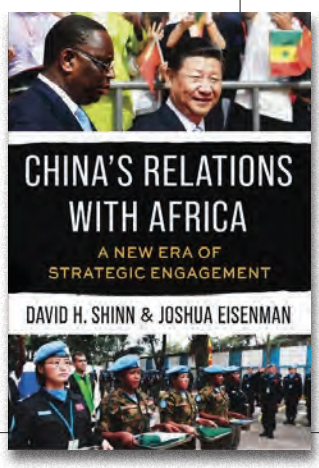
In "Dynamic Democracy," Warshaw and co-author Devin Caughey offer a thorough evaluation of democracy in the United States. Referencing more than eight decades of state-level evidence on public opinion, elections and policymaking, the duo demonstrates that—despite popular opinion to the contrary—voters have had a direct impact on the nature of state governments.



***Chino and the Dance of the Butterfly* (University of New Mexico Press, 2022)**

By Dana Tai Soon Burgess, professor emeritus of dance

Renowned dancer and choreographer Dana Tai Soon Burgess traces his artistic influences back to his early life in New Mexico and shows how his background and identity as a Korean American gay man shaped his creative vision. This deeply personal memoir is also a testament to the power of dance and art.



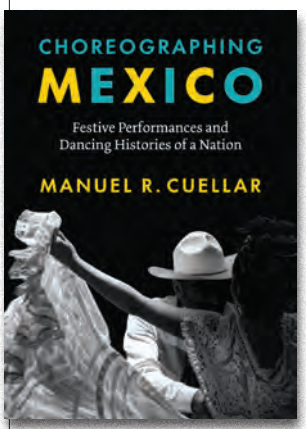
***China's Relations With Africa: A New Era of Strategic Engagement* (Columbia University Press, 2023)**

By David H. Shinn, adjunct professor of international affairs

In this book, Shinn and co-author Joshua Eisenman examine how the relationship between China and Africa has blossomed since Xi Jinping's accession to power. Pulling from two decades' worth of systematic data and hundreds of surveys and interviews, the pair explores the role the relationship plays in the current geopolitical environment and the impact it may have on the future.

"The main idea is that my research on the impact of Mexican dance in the configuration of a sense of identity and belonging in Mexico and across the Mexican diaspora draws directly from my experience as a dancer, instructor, and choreographer."

Manuel Cuellar



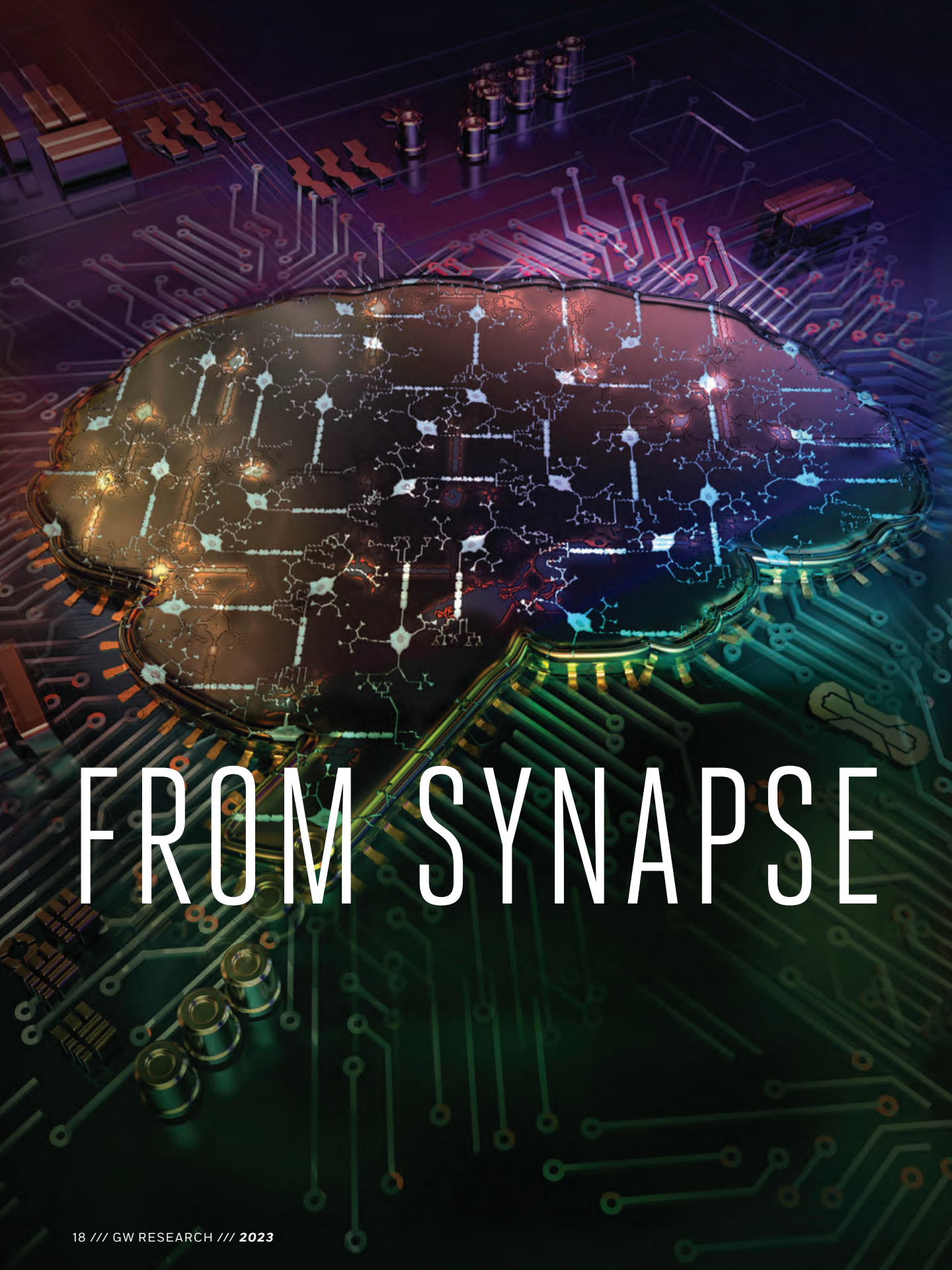
***Choreographing Mexico: Festive Performances and Dancing Histories of a Nation* (UT Press, 2022)**

By Manuel Cuellar, assistant professor of Spanish and Latin American literatures and cultures

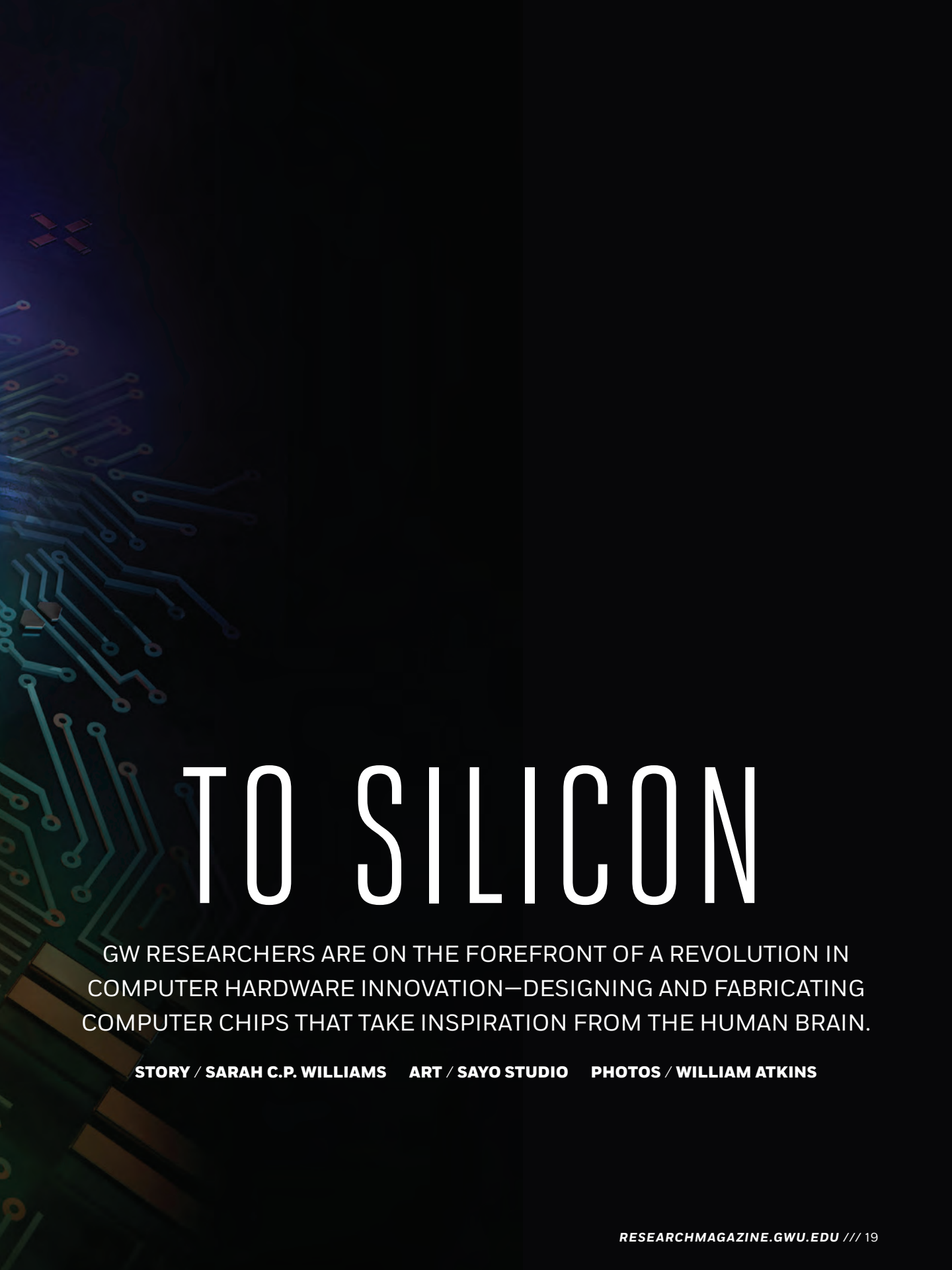
Building on nearly 30 years of Mexican folklórico dance experience, Cuellar explores how dance helped connect people from all backgrounds in post-revolutionary Mexico and across the Mexican diaspora in the United States. As Cuellar writes, when "brown bodies" have been feared, they have turned to dance to express themselves and create communities of their own.

– Lisa Conley-Kendzior

BOOK COVERS: WILLIAM ATKINS



FROM SYNAPSE



TO SILICON

GW RESEARCHERS ARE ON THE FOREFRONT OF A REVOLUTION IN COMPUTER HARDWARE INNOVATION—DESIGNING AND FABRICATING COMPUTER CHIPS THAT TAKE INSPIRATION FROM THE HUMAN BRAIN.

STORY / SARAH C.P. WILLIAMS **ART / SAYO STUDIO** **PHOTOS / WILLIAM ATKINS**

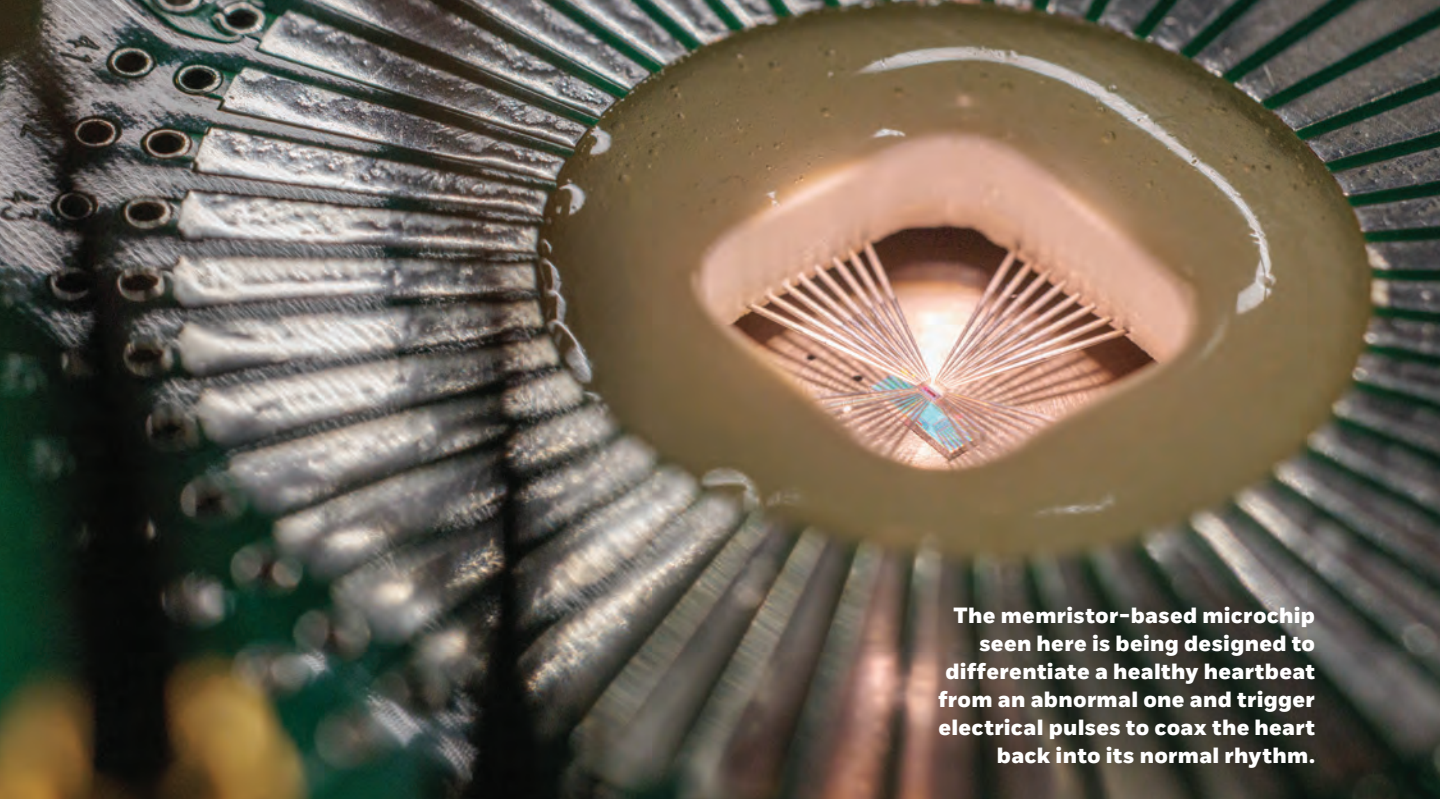
IN THE PALM OF HIS HAND, LEI ZHANG, A FOURTH-YEAR ELECTRICAL ENGINEERING DOCTORAL STUDENT, HOLDS A SQUARE COMPUTER CHIP. IT'S SMALL ENOUGH THAT WHEN HE COVERS IT WITH THE TIP OF A FINGER, IT DISAPPEARS.

To the naked eye, it looks like any other microchip—it began as a wafer of silicon, on which millions of microscopic wires and electrical components were created by successively depositing and carving away thin layers of material. But the chip designed by Zhang has a special use: to be part of an interconnected network of chips in a future implantable device that can detect the heart's electrical signals, differentiate a healthy heartbeat from an abnormal one, and trigger tiny electrical pulses to coax the heart's abnormal rhythm back into its usual lub-dub-lub-dub rhythm.

Most devices that can analyze a person's heart function and help maintain a normal heartbeat are larger—the size of at least a penny for simpler heartbeat analysis or much larger, such as a wearable vest, for more complex cardiac mapping. These devices also require multiple microchips to process and store data. Zhang's device, though, is so small that dozens of them could be implanted onto the surface of a human heart at once to deliver precisely coordinated shocks from all directions. That is in part because some of its underlying technology takes inspiration from one of the most energy-efficient and powerful computers known to mankind: the human brain.

"This is a completely new generation of technologies, and they're useful for all kinds of applications beyond just real-time sensing and therapy in the human body," says Zhang. "And GW is one of the best places to be working on this."

Computer chips are the basis for nearly every electronic device produced today. The tiny circuits that compose them can carry out computations, make decisions and store information. Simple chips power the repetitive reasoning of a calculator; more complex combinations of chips let massive computer systems learn how to predict the weather, the direction of tomorrow's stock market, how millions of human genes are



The memristor-based microchip seen here is being designed to differentiate a healthy heartbeat from an abnormal one and trigger electrical pulses to coax the heart back into its normal rhythm.

associated with a disease or the potential origins of a new virus, like COVID-19.

At GW's School of Engineering and Applied Science, researchers are trying to push the limits of how fast and efficiently computer chips can operate. One of their tactics is designing chips that function more like a living brain. Their work has implications in not only shrinking and speeding up consumer devices like cellphones and smart watches but also in allowing powerful artificial intelligence programs to run more quickly and smoothly—a major change that could revolutionize fields from economics to health care.

"Right now, there are tasks that humans are still much better than computers at," says Tarek El-Ghazawi, chair of electrical and computer engineering at GW. "The brain can analyze things brilliantly, weighing all kinds of information to make decisions while consuming almost no power. How can we mimic this in computer hardware?"

A standard computer chip has billions of transistors on its surface; these vast networks of on-off switches shuttle streams of electrons through large, complex circuits. Everything you see and hear on an electronic device is encoded in the on-off states of those transistors—represented as zeros and ones in computer language.

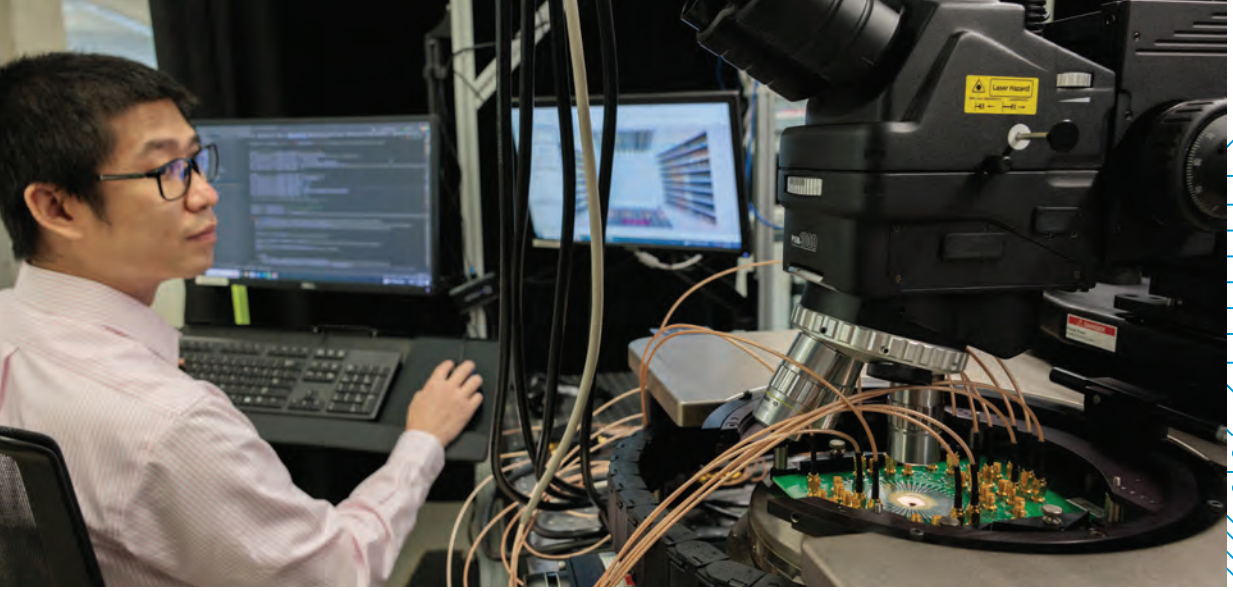
"The computer chip is one of the most advanced and astounding things that humankind has created," says Gina Adam, an assistant professor of electrical and computer engineering whose lab is developing next-generation computing hardware. "It amazes me that this feat of engineering is just everywhere in our lives today."

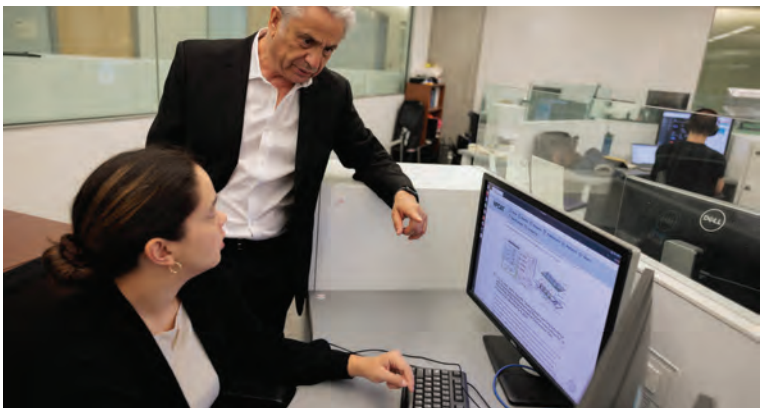
In recent decades, electrical engineers have shrunk, again and again, the size of transistors. In 1947, a single transistor measured a few millimeters across; by 1990, it was less than a micrometer (at least 10 times smaller than the width of a single human hair). Today, the transistor channel has shrunk down to a few nanometers—a nearly unfathomable size of just a few atoms. This downsizing has allowed chips and, in turn, computing systems to become smaller and more powerful.

Today's transistors, however, are nearly as small as they can possibly be—any smaller and they wouldn't be able to physically control the electrons that must pass through them. Researchers have also discovered that the tiniest transistors tend to have flaws; they fail more often and, packed together by the billions, can generate immense heat (this explains why your cellphone feels warm after a long call).

"We're approaching the physical limits of how small we can make transistors using current technologies," says El-Ghazawi. "But every time people think we have reached a limit, someone comes up with a new trick to extend the life of an existing technology or create a new enabling technology altogether."

Even if transistors can't be made smaller, he says, electronic circuits made out of transistors can still be organized in new architectures





TOP Electrical engineering doctoral student Lei Zhang designed the memristor-based microchip to be part of a network of chips that could be implanted on the heart. LEFT Doctoral student Juliana Curry with Ahmed Louri at the High Performance Computing Architectures and Technologies Lab.

to make chips more powerful. In addition, many researchers are creating new specialized devices as helpers to stack on top of computing chips—these so-called accelerators can use different innovative ways of processing and storing data to boost the power of existing chips.

The accelerators and chips that Adam designs move beyond the transistor technology of zeros and ones. Today, computing systems generally process information on one chip (a processor) and store large amounts of information on another chip (the memory). Moving data between these chips requires time and energy.

"It's been very challenging because as processors have become faster and memories have become bigger, there are a lot of mismatches; the processor needs to constantly wait to fetch data from the memory," explains Adam, a National Science Foundation CAREER awardee and recipient of the Young Investigator Program Award from the Air Force Office of Scientific Research. "But in the human brain, we don't separate memory into a different area. The same neuronal circuitry that processes information also stores it."

> "WE'RE APPROACHING THE PHYSICAL LIMITS OF HOW SMALL WE CAN MAKE TRANSISTORS USING CURRENT TECHNOLOGIES. BUT EVERY TIME PEOPLE THINK WE HAVE REACHED A LIMIT, SOMEONE COMES UP WITH A NEW TRICK TO EXTEND THE LIFE OF AN EXISTING TECHNOLOGY OR CREATE A NEW ENABLING TECHNOLOGY ALTOGETHER."
>
> **TAREK EL-GHAZAWI**
> Chair and Professor of the Electrical and Computer Engineering Department

Adam is collaborating with neuroscientists to better understand how the brain accomplishes this and how different neurons and supporting cells function and connect.

"We want to know why there is so much diversity of cell types in the brain, and how much of this diversity needs to be translated into our devices and neuro-inspired hardware systems," she says.

Now Adam is using her neuro know-how to build new types of devices that eliminate the

distance between the processor and memory. Among those devices are memristors, short for "memory resistors," which behave like artificial synapses by "remembering" the amount of electric charge that has passed through them.

Rather than moving electrons as transistors do, memristors involve the rearrangement of ions. Ions are charged atoms, much larger than electrons. When an electric current is applied to a memristor, heat is generated and those bulky ions start to move. As they move, the internal structure of the memristor changes, modifying its resistance value—how much the device resists the flow of electrical current. When the heat is removed, the ion motion halts, yet the new structure of the memristor freezes in place, giving the device a new resistance value. With each change in resistance, ions flow through the device differently when an electric current is applied again.

"What this means is that a memristor can actually learn. Like synapses in the brain, it changes gradually based on signals it has received," says Adam.

It also means that a memristor synapse can communicate in shades of gray, strengthening or weakening the connections between artificial neurons, rather than being limited to the black-and-white zeros and ones of transistors. A memristor has numerous states, each subtly different, depending on the arrangement of ions in its structure.

What does this look like at a practical level? Memristors could contribute to faster, more powerful data processing, computers that don't lose information when they shut down, and systems—like Zhang's implantable chip for the human heart—that can work for years, consuming little battery power. Their resemblance to a human brain, with shades of gray and memory integrated into processing, also means they are useful for the massive computing power needed in AI and machine learning platforms that aim to mimic human learning and reasoning.

Another member of Adam's lab—third-year doctoral student Imtiaz Hossen—designs and fabricates memristors in the GW Nanofabrication and Imaging Center's (GWNIC) clean room, a state-of-the-art facility that houses the equipment needed to produce novel devices and computer components. A small square chip he holds in his tweezers—nearly identical in appearance to Zhang's chip—has 20,000 tiny memristors on it.

"The way these 20,000 memristors behave gives us really important information," says Hossen. "But we'll actually want to scale the system up to the range of a million memristors on a chip or more for real-world applications. That translates to more storage and more data analysis capabilities."

Hossen has been fine-tuning the design and fabrication of these memristor devices so that they mesh perfectly with a chip underneath. Now he's begun handing off the chip with integrated memristors for testing by other lab members.

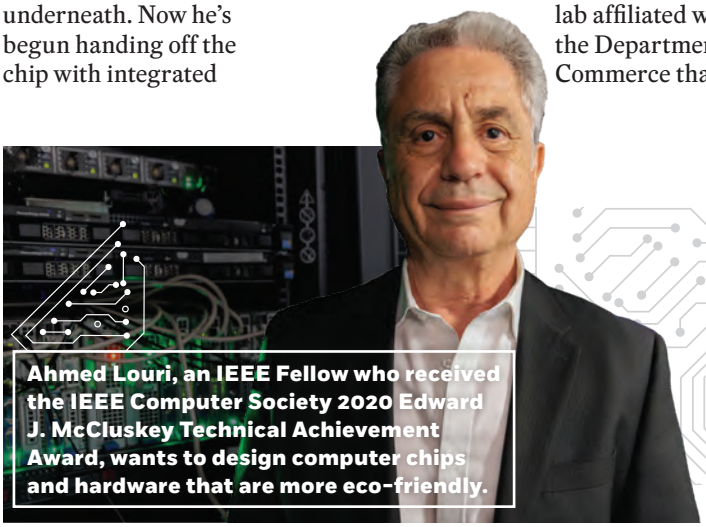
In 2022, GW became one of five academic research centers to partner with the National Institute of Standards and Technology (NIST), Google and chip manufacturer SkyWater Technologies to create a new supply of chips for research and development. As part of the agreement, SkyWater will fabricate test chips based on designs from Adam's team and the other academic partners and ship them to researchers in the broader community who will integrate their own memristor or other emerging device technologies. They can then use the chips to test how memristors or other accelerator devices work in conjunction with the standard transistor technology.

"This lets us benchmark technologies," says Adam. "We have the same underlying hardware, the same software, the same codes, and we can test how different devices stack up against each other."

NIST, the national lab affiliated with the Department of Commerce that's

"THERE ARE VAST OPPORTUNITIES TO IMPROVE CHIPS AND THEIR EFFICIENCY. THERE IS NO BETTER TIME THAN RIGHT NOW FOR THE FIELD OF COMPUTER ENGINEERING."

AHMED LOURI
David and Marilyn Karlgaard Endowed Chair Professor of Electrical and Computer Engineering

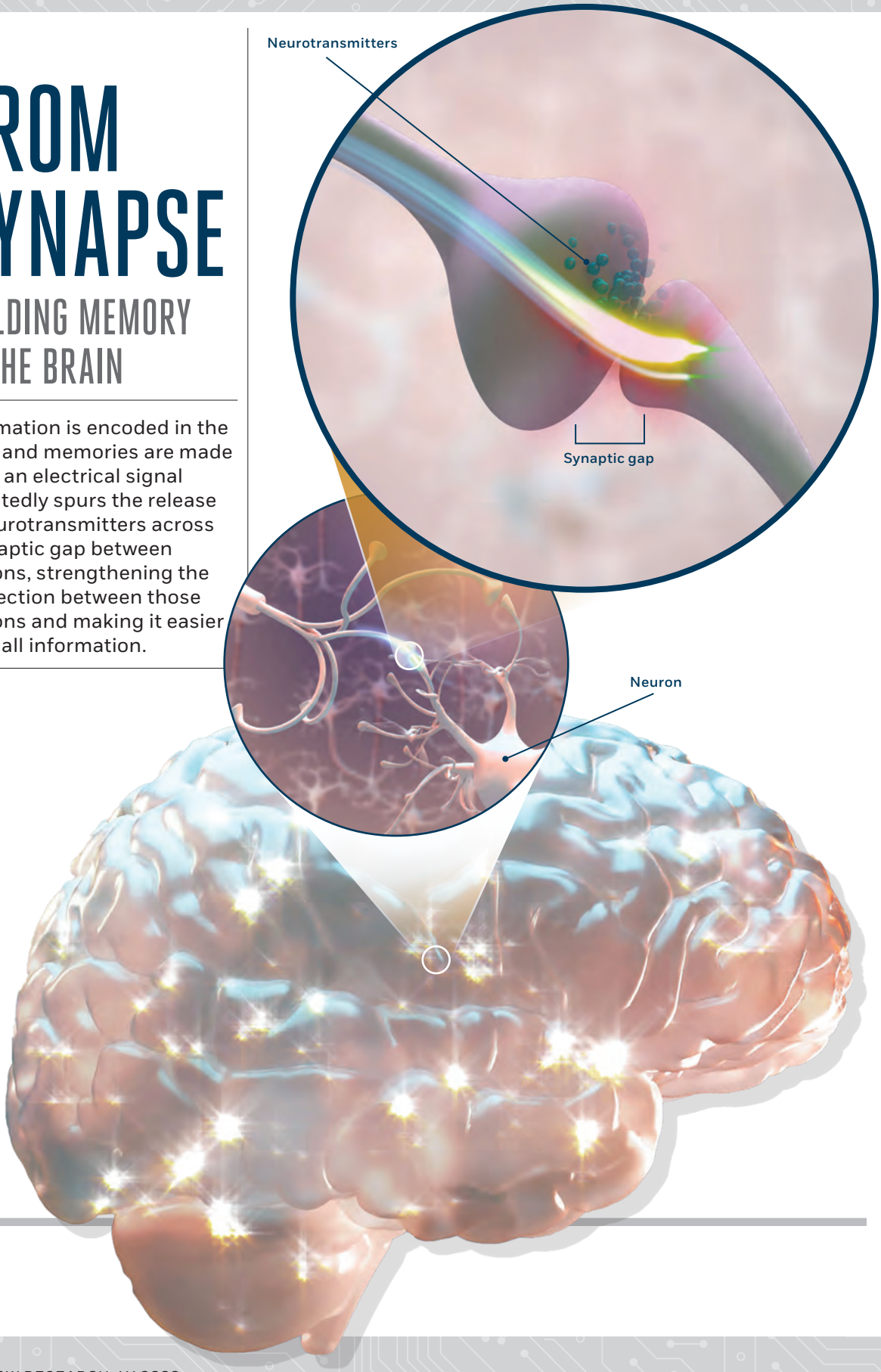


Ahmed Louri, an IEEE Fellow who received the IEEE Computer Society 2020 Edward J. McCluskey Technical Achievement Award, wants to design computer chips and hardware that are more eco-friendly.

FROM SYNAPSE

BUILDING MEMORY IN THE BRAIN

Information is encoded in the brain and memories are made when an electrical signal repeatedly spurs the release of neurotransmitters across a synaptic gap between neurons, strengthening the connection between those neurons and making it easier to recall information.

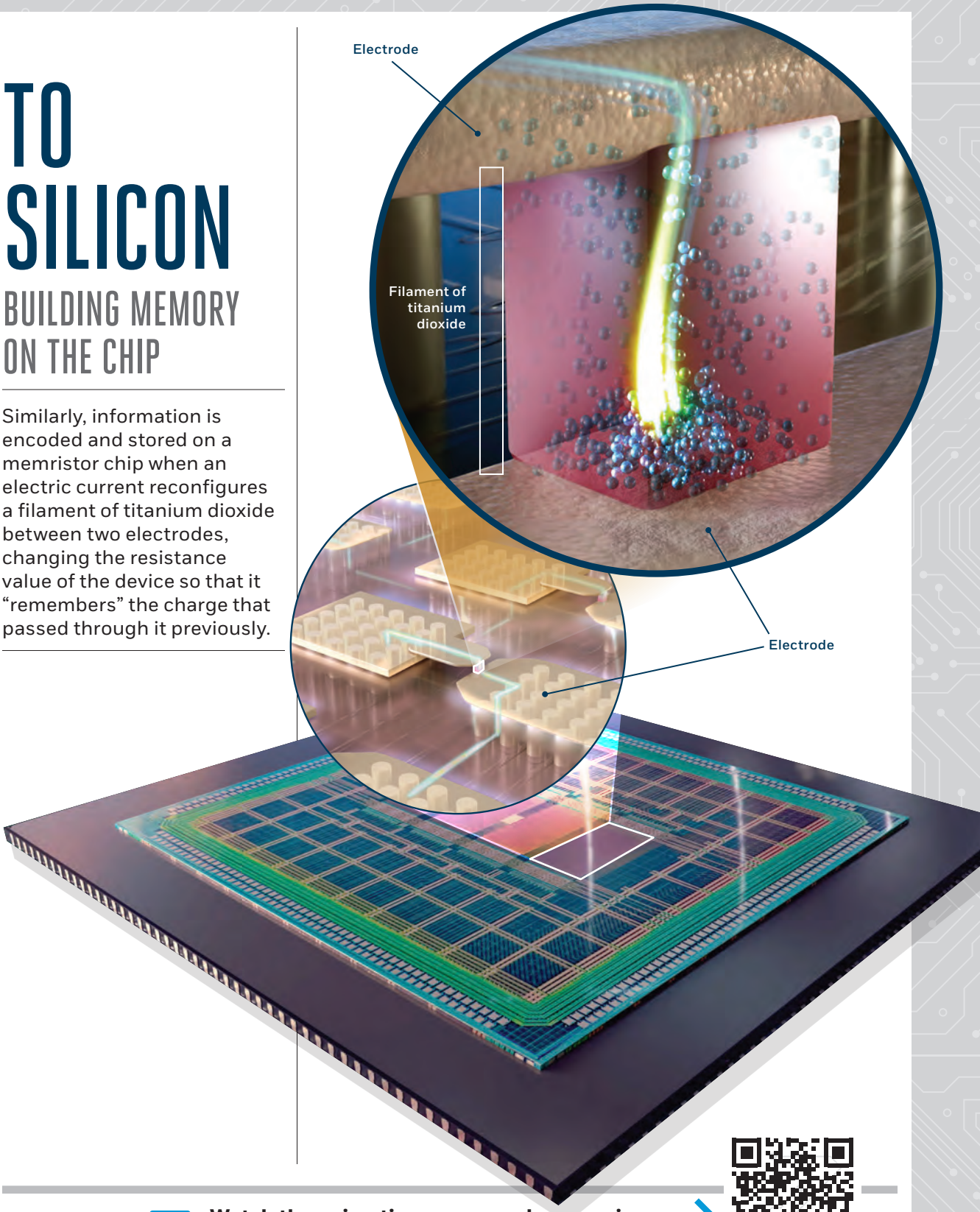


CREDIT: SAYOSTUDIO

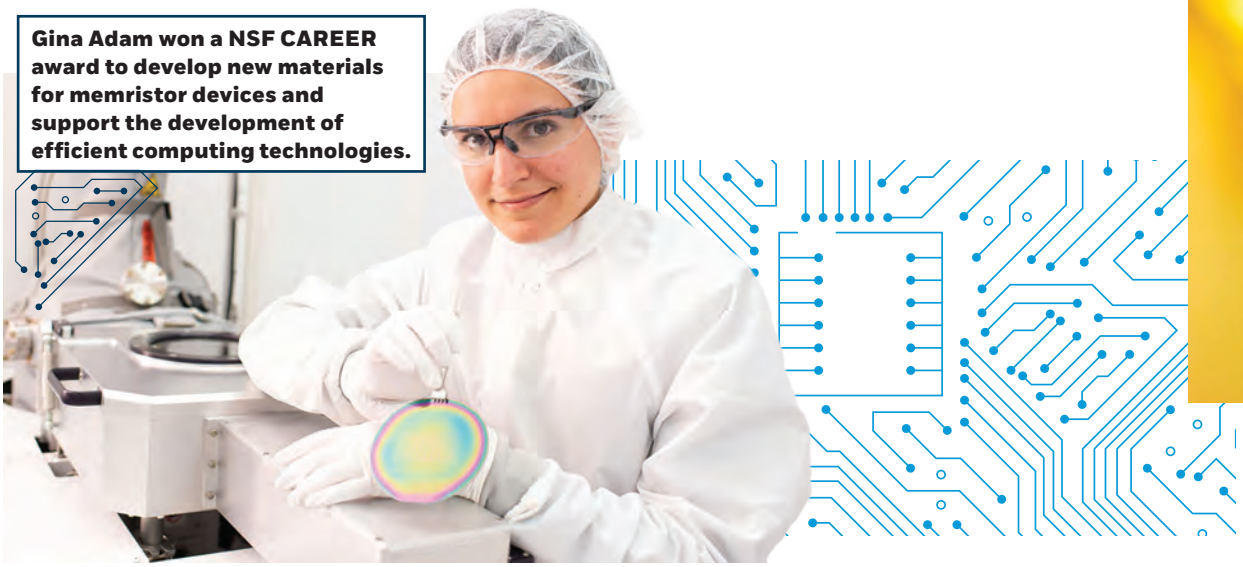
TO SILICON

BUILDING MEMORY ON THE CHIP

Similarly, information is encoded and stored on a memristor chip when an electric current reconfigures a filament of titanium dioxide between two electrodes, changing the resistance value of the device so that it "remembers" the charge that passed through it previously.



Watch the animation sequence by scanning the code or visiting go.gwu.edu/synapsesilicon.



Gina Adam won a NSF CAREER award to develop new materials for memristor devices and support the development of efficient computing technologies.

just a short drive from GW, helps lead and coordinate much of the new CHIPS and Science Act initiatives aimed at supporting computer chip innovation in the U.S. It's these types of university-industry-government collaborations that drew Adam to GW.

"Collaborations are very important in this field," says Adam. "We want to be able to quickly weed out materials and technologies that are not working and focus on those technologies most likely to perform the best and make it to market."

Ahmed Louri, the David and Marilyn Karlgaard Endowed Chair Professor of Electrical and Computer Engineering, also draws inspiration from the human brain in his research and collaborates with neuroscientists around the country who study the inner workings of the hippocampus—the brain's center of emotion and memory. Already, computer algorithms called neural networks try to mimic the structure and functioning of the hippocampus to make decisions and recognize patterns. But processing such algorithms requires a significant amount of processing power and consumes excessive energy.

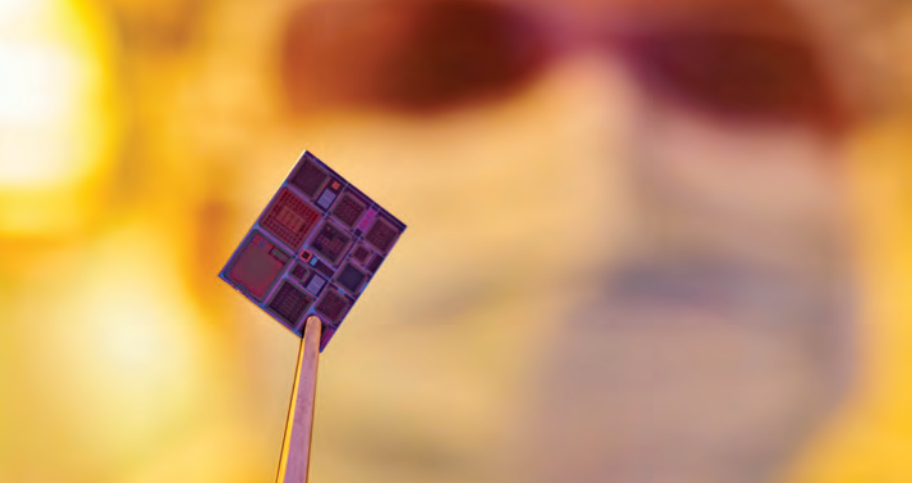
"What we want to do is design chips that optimize how neural networks can run efficiently," says Louri, who has dedicated his career to developing high-performance, energy-efficient and versatile AI chips. "That means emulating the brain in functionality with much higher speed and energy efficiency: Neurons become processing elements, synapses that connect the neurons become physical wires, and the way these processing elements are connected at the physical level is completely different from that in conventional chips."

Louri envisions an ideal AI chip, which he calls a versatile machine learning accelerator, that can execute a targeted class of AI applications much faster and with much less energy, similar to how a Swiss Army knife has many tools for specific tasks. However, unlike the Swiss Army knife, in which only one tool is used at a time, Louri's chip will be able to execute multiple applications simultaneously. He has developed novel chip interconnects to speed up data movement between processing elements and memory modules while minimizing energy consumption. Supported with several National Science Foundation awards, the chip interconnects have demonstrated exceptional adaptability for running diverse applications and, says Louri, are considered a promising solution for next-generation chips by an industry consortium led by major semiconductor companies.

Louri is also exploring incorporating other emerging technologies, such as silicon photonics, which use light instead of electrons to encode information, into AI chips. He's developed photonic architectures that seamlessly connect numerous processing elements, an approach that allows for scaling the processing power to be on par with the human brain while consuming orders of magnitude lower energy compared to existing electronic chips.

Some of Louri's motivation is driven by the need he sees for eco-friendly technology. Today, the energy consumption of computing devices and systems accounts for a significant percentage of global carbon emissions.

"Our world increasingly relies on digital systems and computer chips to record, support and shape most aspects of human activity, from commerce to transportation, from health to social networks, from experimental sciences to numerical engineering, and from manufacturing to knowledge production," he says. "This means there are vast opportunities to improve chips and their efficiency. There is no better time than right now for the field of computer engineering."



That excitement is echoed by El-Ghazawi, who says the growth and innovation around chip design and fabrication in his department are evidence of GW's growing strength in this field. In addition to his own research and that of Louri and Adam, he points to the pioneering work of other faculty such as Mona Zaghloul and Guru Venkataramani.

"Together faculty research in this area has been funded by millions of dollars and produced scores of patents and publications," El-Ghazawi says.

In the U.S., speeding up computer chips has become a national priority, as evidenced by the estimated $280 billion investment in the CHIPS Act passed by Congress and signed into law by President Biden in 2022.

TOP Third-year doctoral student Imtiaz Hossen shows off a microchip, on which 20,000 memristors have been integrated. ABOVE Hossen (left) and Gina Adam (right) have been fine-tuning the design and fabrication of memristor devices to be compatible with the chip underneath. Other lab members then test the chip with the integrated memristors.

"There's been a major drive right now to bring back chip manufacturing capabilities to the U.S. rather than contract them out to other countries," says El-Ghazawi. "Scientists believe that advances in these kinds of technologies will actually determine the next global superpower."

The CHIPS Act was inspired by the fact that only about 14% of all semiconductors—the fundamental materials of chips—are currently manufactured in the U.S., a drastic drop from the 37% of semiconductors made here in 1990. The act includes direct funding for research like that carried out at GW but also money to support new chip manufacturing facilities and to invest in education related to semiconductor research, development and manufacturing.

"This is going to create tremendous opportunities for our electrical and computer engineering students," says El-Ghazawi, referring to the push for new jobs in the semiconductor industry.

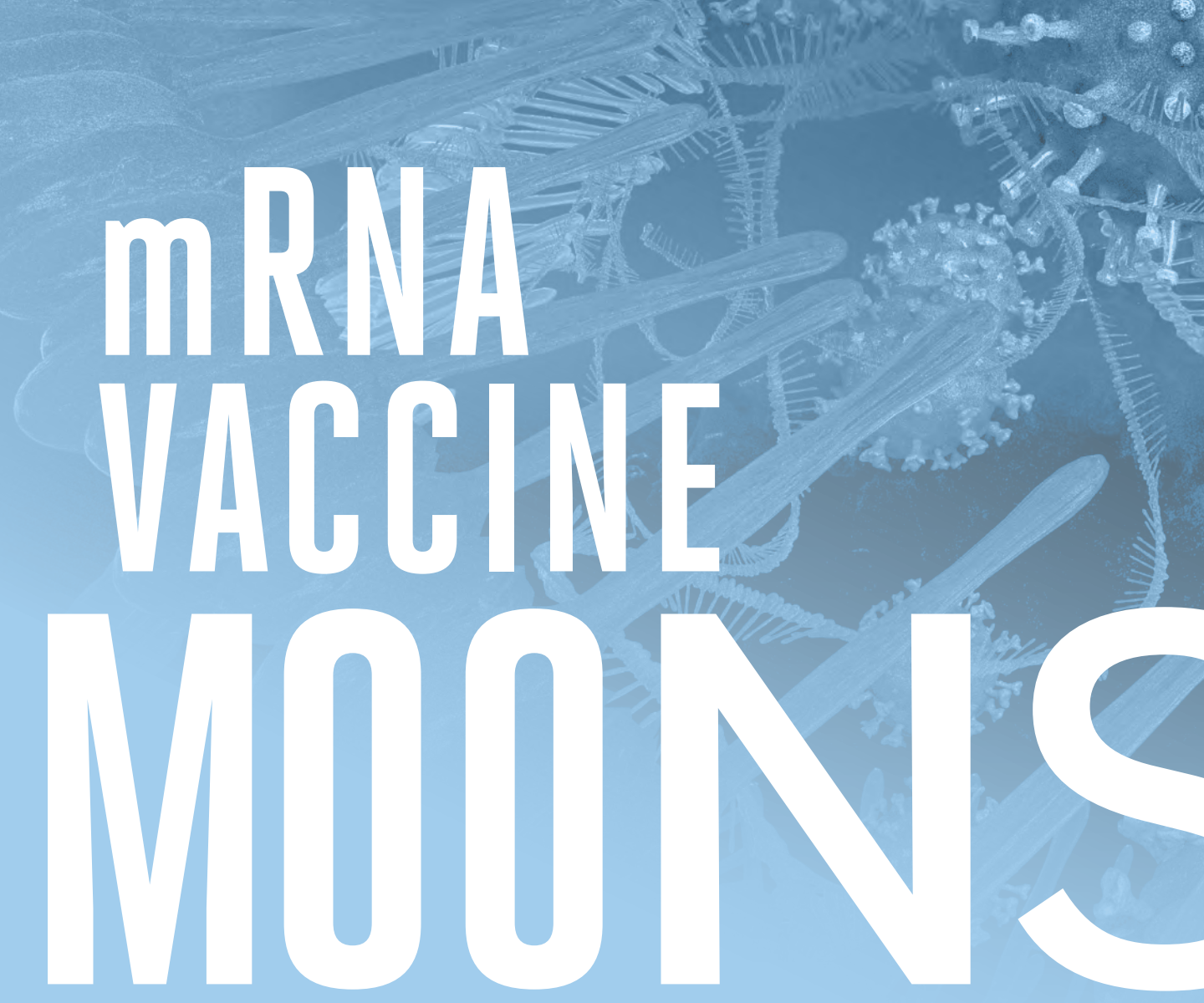
GW's Nanofabrication Center is helping students—from interested high schoolers to students at GW—learn the nuts and bolts of this industry, including how to collaborate with researchers in other fields.

It's what allowed Zhang—under Adam's mentorship—to design his chips for future cardiac implants.

He and Adam are collaborating with Igor Efimov, a professor who specializes in cardiovascular engineering and who recently moved from GW's biomedical engineering department to Northwestern University. Together they are working to design the appropriate algorithms and memristor chips for future testing on heart tissue. While still experimental, their proposed system has already shown 96% accuracy at detecting abnormal heart rhythms.

For Adam, who credits her early teachers in Romania with inspiring her to pursue science, the work with Zhang and Efimov demonstrates how critical both mentorship and partnership are to science.

"I was fortunate to have amazing mentors throughout my education, and my goal is to pay that forward," she says. "I want students to not only be able to learn the science and engineering concepts but also how to get along with and collaborate with people in diverse fields and from diverse backgrounds." GWR



mRNA VACCINE MOONS

MRNA VACCINES CHANGED THE COURSE OF THE COVID-19 PANDEMIC. NOW GW RESEARCHERS ARE DEVELOPING THESE VACCINES TO TREAT AND PREVENT DISEASES FROM CANCER AND HIV TO MALARIA AND SHINGLES.

Story by Sarah C.P. Williams

Long before a mysterious, pneumonia-like illness grew into a global pandemic—and long before an array of vaccines emerged to halt COVID-19 in its tracks—scientists were experimenting with messenger RNA (mRNA) vaccines.

Unlike some classical vaccines that introduce a dead or weakened part of a pathogen into the body to generate a protective immune response, mRNA vaccines instruct the body's own cells to make a protein that the body recognizes as unfamiliar, and the immune system goes into action. With classical vaccines and mRNA vaccines, the end goal is the same—to train the body's immune system to detect and dispense with a pathogen—but many scientists working on mRNA vaccines believe they might be easier and less expensive to manufacture as well as more effective.

The first mRNA vaccines against influenza were tested in mice in the 1990s, and by the early 2000s, cancer researchers were developing mRNA vaccines

SHOT

to target tumors. Once scientists figured out how to enclose the fragile mRNA molecule inside a lipid nanoparticle—a fatty sphere that acts as a tiny delivery vehicle—to keep it from degrading in the body before delivering its instructions to cells, research began to pick up even more. Still, for decades, vaccine research and development remained slow and expensive.

Then the COVID-19 pandemic hit. Scientists and pharmaceutical companies that had been working on mRNA vaccines for years saw how their technology's speed and versatility could help fight the new coronavirus. Just 42 days after the publication of the genetic sequence of the SARS-CoV-2 virus, the pharmaceutical company Moderna Therapeutics shipped its first mRNA vaccine against COVID-19 to the National Institutes of Health to administer to volunteers. Later in 2020, GW was selected as one of the clinical vaccine sites to test that same vaccine in a Phase 3 trial, the final step before a vaccine can be submitted to a regulatory body for approval.

"As soon as I saw how quickly we were able to develop and study the COVID-19 vaccines, I knew this technology was absolutely going to be a boon for the broader field of vaccine development," says David Diemert, professor of medicine at the GW School of Medicine and Health Sciences and clinical director of the GW Vaccine Research Unit.

That prediction was right. The efficacy of mRNA vaccines against COVID-19 on a global level has ushered in a new era of innovation. Researchers can design and test vaccines against nearly any pathogen in a matter of weeks, using a versatile mRNA platform that is considered incredibly safe.

At GW, the mRNA vaccines being developed and tested in clinical trials have lofty goals—eradicating malaria, treating aggressive cancer and preventing HIV, among them. ›

BATTLING MALARIA

A New Way to Deliver a "Trojan Horse"

In Nirbhay Kumar's native India, the monsoons come every summer. And with the monsoons—mosquitoes and malaria. As they suck blood, infected female mosquitoes inject the malaria parasite into humans. Hundreds of millions of people around the world are infected with malaria each year, and more than half a million people die of the disease, mostly in sub-Saharan Africa but also dozens of other countries.

Kumar, a professor of global health at the GW Milken Institute School of Public Health, was drawn to studying malaria because of its public health impact in India. Now he's spent 40 years working to fight the parasite.

"During that time, there has been a lot of progress, and we have seen dozens of countries eliminate malaria," he says. "But we also see the malaria parasites continuously evolving to become drug resistant. Sooner or later, we once again may not have any effective drugs to treat malaria."

"Even today, I'm astonished at how effective these vaccines are. They're at least 10 times more effective than the DNA vaccines I was working on."

In 2021, the World Health Organization endorsed the first malaria vaccine. According to Kumar, however, the vaccine is not as effective as most would like—it prevents disease in about a third of the people who receive it and wears off in a matter of months. "We definitely don't have an ideal vaccine yet," he says.

The vaccines Kumar has developed over the years take multiple approaches to blocking malaria. Some trigger antibodies that stop malaria from reproducing in a person's liver and causing infection. But others lead to antibodies that block the malaria parasite from maturing in mosquito guts. Alone, this kind of vaccine isn't designed to prevent disease in a person who receives it but instead works to stop malaria at a broader scale. When a mosquito bites a vaccinated person, they receive something akin to a Trojan horse: blood containing not only malaria parasites but also antibodies that stop the parasite from getting any further in its life cycle.

CREDIT: NIRBHAY KUMAR

"The idea is to basically stop the malaria transmission cycle so that we can reduce the number of infected mosquitoes," says Kumar. "Fewer infected mosquitoes, over time, means fewer infected people."

In the 1980s and 1990s, however, Kumar struggled to make these vaccines a reality because of the challenges of producing protein-based vaccines—the same struggle that others in the vaccine development space were also facing. "Some of these malaria proteins are incredibly difficult to manufacture," he says.

Over the following years, researchers, including Kumar, began to experiment with DNA-based vaccines that delivered genetic material, rather than proteins, to human cells. The cells themselves could produce the corresponding protein to trigger an immune response. But to work, DNA vaccines must sneak into the tightly guarded central nuclei of cells where DNA is stored—a difficult task requiring small pulses of electricity to be administered with the strands of DNA. Kumar wasn't sure patients would ever agree to this kind of shot.

Nirbhay Kumar, professor of global health, has spent four decades working to combat malaria, a public health menace in his native India.

Then, at a vaccine conference in 2019, Kumar saw a presentation by Drew Weissman of the University of Pennsylvania on mRNA-based vaccines for influenza. He was immediately intrigued.

Information in cells flows from DNA to mRNA to protein. mRNA is copied from a cell's master DNA and then leaves the nuclei of cells to be translated into proteins. That means an mRNA vaccine has the same information as DNA but, to yield proteins, needs only get into cells, not their difficult-to-access cell nuclei.

"If you use mRNA, you completely bypass this delivery process we'd been struggling with," Kumar says. "I sought out Drew after his talk, and the first thing I asked him was whether we could do this for malaria."

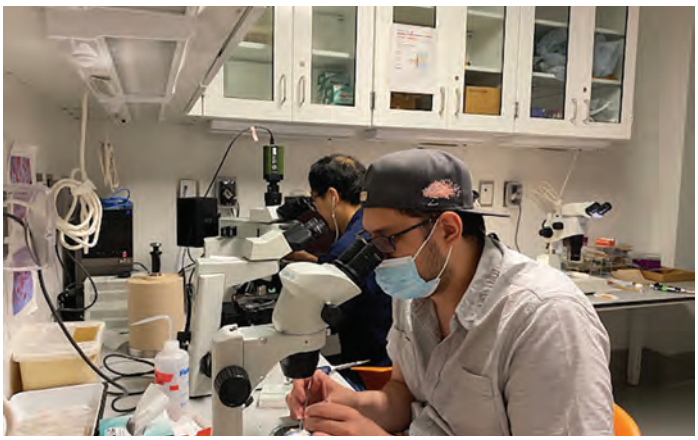
Kumar and Weissman began collaborating and, after a break for COVID-19, produced experimental mRNA vaccines against two malaria proteins that Kumar had long studied—one that blocks human infection and a second that blocks the malaria parasite's development in mosquitoes. Both proteins are from *Plasmodium falciparum*, one of the four parasite species that cause malaria.

Last year, the researchers reported in the journal npj Vaccines that their combination mRNA vaccine was incredibly effective at preventing *P. falciparum* infections in animals and nearly 100% effective in blocking mosquito-to-mosquito transmission.

"Even today, I'm astonished at how effective these vaccines are," says Kumar. "They're at least 10 times more effective than the DNA vaccines I was working on, and they take a fraction of the time to manufacture compared to classic protein-based vaccines."

Weissman, who also works on vaccine development for many other health conditions, says that the malaria vaccine is a perfect example of the promise of mRNA vaccines.

"Malaria is a major concern that previous vaccines have poorly addressed. The ease of producing this vaccine and its effectiveness were both very exciting," he says. "The mRNA platform has enormous potential to treat many diseases, including vaccines for infectious diseases, autoimmunity, allergies and cancer." ❯



CREDIT: NIRBHAY KUMAR

COMBATTING CANCER

A Personal, Precise Approach

In 2019, Julie Bauman, professor of medicine at the GW School of Medicine and Health Sciences and director of the GW Cancer Center, enrolled a new patient in a clinical trial to test a personalized cancer vaccine made by pharmaceutical company Moderna, in combination with an FDA-approved immunotherapy called pembrolizumab. The patient, a 35-year-old mother in Arizona with an aggressive form of head and neck cancer, was planning her own funeral. Standard chemotherapy and surgery had failed to contain the cancer, which had now spread to her lungs. As a last resort, she signed up for the trial.

While many vaccines are designed to prevent disease—you receive shots so that you never get sick with measles or tetanus, for instance—cancer vaccines instead aim to treat existing disease by teaching the immune system to recognize cancer-related proteins as foreign invaders.

"I think the idea of harnessing our own natural immunity appeals to everyone because cancer feels like such a betrayal," says Bauman, who came to GW in 2022 from the University of Arizona. "One of our own cells has betrayed us and threatened our very existence, but let's waken our own immune system to eradicate it."

"We're at the beginning of a trajectory where we can target cancer in a much more precise and effective way."

CREDIT: RICH RIGGINS

For the young mother enrolled in the clinical trial, the team compared a sample of her tumor with her healthy cells, pinpointing genes that had mutated and were different in the cancer. These mutations can act like flags to the immune system, signaling which cells are affected by cancer. In just a few weeks, a vaccine was designed to deliver these genes, in the form of mRNA, to the patient by an injection in the muscle. Because they don't integrate into the genomes of human cells, the mRNA molecules themselves can't cause cancer. Instead, immune cells take up the mRNA molecules, translate them into protein fragments, and educate the immune system that these protein "flags" should be destroyed. This spurs the immune system throughout the body to begin attacking the cancer cells containing the mutated proteins.

Twenty-seven weeks after she began receiving the mRNA vaccine, the patient's cancer was gone. She was in complete remission.

Unlike the flurry of mRNA vaccines under development in the wake of COVID-19, these personalized cancer vaccines aren't new—mRNA has been a mainstay in cancer vaccine research for nearly two decades.

"One of the reasons we were able to develop a COVID vaccine so quickly was actually because of the decades of research in cancer vaccination that preceded it," says Bauman.

Bauman specializes in head and neck cancer, which has a high mortality rate when not diagnosed early. Ten of her patients, including the young mother from Arizona, were part of a Phase 1 trial run by the pharmaceutical company Moderna to test mRNA vaccines in combination with pembrolizumab. Five of the 10 patients saw their tumors shrink or disappear.

At GW, Bauman will be opening the next phase of the clinical trial, evaluating the same personalized mRNA vaccine together with pembrolizumab in patients with advanced cases of several cancers, including pancreatic and head and neck cancer. The fact that each vaccine is individually matched to a patient's own tumors makes it a novel and promising approach to fighting cancer, she says.

This summer, she and her colleagues at the GW Cancer Center also treated their first patient with a different kind of mRNA vaccine—one that encodes two immune proteins called IDO and PD-L1, which are often found at high levels in cancer cells and act like brakes on the immune system. The vaccine spurs the immune system to target IDO and PD-L1, enabling both direct immune killing of the cancer as well as wiping out the T cell brakes to increase other immune activity.

"I think in 20 years, we'll look back and think that most of our cancer treatments before now were incredibly barbaric," says Bauman. "But now, in part due to mRNA vaccines, we're at the beginning of a trajectory where we can target cancer in a much more precise and effective way." ›

Julie Bauman aims to build better patient outcomes by bridging innovative, multidisciplinary research and clinical care. In 2022, Bauman was installed as the Dr. Cyrus Katzen Family Director of the GW Cancer Center (pictured bottom, with Jay Katzen).

CREDIT: WILLIAM ATKINS

PURSUING IMMUNITY

From HIV to Neglected Diseases

Infectious disease doctor David Diemert, professor of medicine at the GW School of Medicine and Health Sciences and clinical director of the GW Vaccine Research Unit (VRU), began his career studying malaria in West Africa and hookworm in rural Brazil. At the time, developing a vaccine mere months after the start of a pandemic or rapidly developing vaccines against neglected tropical diseases seemed almost impossible. mRNA vaccines are changing that.

Over the course of the last 20 years, Diemert and his colleagues at the GW VRU have built, from the ground up, the facilities and infrastructure to test the safety and efficacy of vaccines through clinical trials conducted at GW. In 2020, the VRU worked with the pharmaceutical companies Moderna and Sanofi to run Phase 2 and 3 trials of vaccines against the SARS-CoV-2 virus. It was the first time Diemert had worked with an mRNA vaccine, and he was astounded by how quickly the vaccine could be produced and how effective it ended up being.

"COVID 19 acted as proof of concept for mRNA vaccines in terms of both safety and how well they can elicit immune responses."

"COVID-19 acted as proof of concept for mRNA vaccines in terms of both safety and how well they can elicit immune responses," he says. "With mRNA vaccines,

CREDIT: HARRISON JONES

there's absolutely no messing with someone's DNA. The mRNA goes into cells, gets translated into protein and very quickly gets degraded."

Before COVID-19, GW had been one of the first sites in the world to test a new generation of protein-based HIV vaccines, which coaxed people's bodies into producing broadly neutralizing antibodies against part of HIV. (Broadly neutralizing means the antibodies recognize many strains of the virus, even as it quickly evolves.)

The Phase 1 trial was successful, showing that the vaccine was safe and triggered the production of a critical immune cell. But by the time the results of that study were published in 2022, Diemert and his colleagues at GW were already recruiting dozens of patients for the next version of the vaccine: an mRNA vaccine that is designed to make the body produce the same broadly neutralizing antibodies. Using an mRNA vaccine instead of a protein vaccine means the vaccine can be mass produced more easily and cheaply and—if it ever becomes ineffective against a strain of HIV—easily altered.

David Diemert and other colleagues at GW led one of the clinical trials sites that played an essential role in developing a COVID-19 vaccine approved for emergency use during the pandemic.

At the same time, Diemert is ramping up enrollment of patients in a Phase 1 trial of an mRNA-based shingles vaccine produced by Pfizer. The only shingles vaccine on the market today—a protein-based vaccine—has significant side effects for many recipients, and scientists think the mRNA version might lead to fewer side effects and be equally effective.

The quick pivots by pharmaceutical companies to develop these new mRNA vaccines in just a few years illustrate the speed and versatility of the technology, Diemert says. But it remains to be seen whether mRNA becomes the standard platform for all future vaccines or just one option in the menu of vaccine design components.

"There are still some open questions about the long-term effectiveness of mRNA vaccines and whether that's any different than with protein-based vaccines," he says. "As we move through all these other trials, I think those questions will get answered."

Despite those questions, the promise of mRNA vaccines to halt the next pandemic, treat emerging pathogens and address epidemics around the world is real. Work on developing a new generation of experimental hookworm vaccines, for instance, is already underway at the VRU. The low cost and ease of production of the vaccines mean that they could be made on site in resource-limited countries.

"The World Health Organization and other international groups are laying the foundations for establishing mRNA vaccine research and manufacturing facilities in places like sub-Saharan Africa to nimbly respond to future emerging infections such as the Marburg and Ebola hemorrhagic fever viruses," says Diemert.

For researchers such as Diemert, Bauman and Kumar, mRNA vaccines represent a highly promising and potent new defense against some of the world's most enduring and lethal diseases.

Curing cancer and HIV or eradicating malaria may have once seemed like moonshot-level aspirations, but they could be on the verge of becoming achievable realities with an assist from mRNA vaccines. GWR

CREDIT: WILLIAM ATKINS

AGENTS OF

COURTESY OF GWI

CHANGE

FOR THE PAST DECADE, THE GLOBAL WOMEN'S INSTITUTE HAS HELPED BUILD THE EVIDENCE BASE ON VIOLENCE AGAINST WOMEN AND GIRLS AND WHAT WORKS TO PREVENT GENDER-BASED VIOLENCE.

WHERE DOES IT GO FROM HERE?

STORY // KATHLEEN GARRIGAN

When fighting broke out in Juba, South Sudan, in July 2016, a research team trained by GW's Global Women's Institute was in the middle of collecting data on violence against women and girls (VAWG).

The work, led by the institute and its humanitarian partners, was part of the first large-scale, population-based study on VAWG in a conflict setting.

"We had pretty good methods for doing this kind of research in non-conflict circumstances, and we'd done some research in post-conflict settings," says Mary Ellsberg, founding director of the Global Women's Institute (GWI). "But we needed to figure out how to adapt and apply that rigorous scientific method to an area that was in complete upheaval. There was some skepticism about whether it could even be done."

As violence erupted, GWI and its partners were forced to pause the study. After six months, the study resumed but with some modifications: Previously, the team had conducted door-to-door interviews at three sites, but one of those sites was deemed too challenging to proceed.

"The team felt it would threaten the data collectors' security going door-to-door in Juba," says Maureen Murphy, a research scientist with GWI who helped lead the South Sudan study alongside Ellsberg. "By pausing the study during the worst of the crisis, we were able to collect rigorous data without endangering the team on the ground."

A key element in the study was its scope: Rather than focusing on rape and sexual violence perpetrated by soldiers, the team would be examining all forms of gender-based violence.

"We've known for a long time that rape is sometimes used by armed actors as a tactic of war," Ellsberg says. "But there are other forms of violence—for example, intimate partner violence and forced marriages—that also occur or increase during war. Part of what we were trying to break down is this paradigm that conflict-related sexual violence is something that the U.N. should be doing something about, yet nobody's paying any attention to what's happening to women in their homes. Who are we to say which of those is worse?"

The findings from the team's groundbreaking study—that as many as 73% of women had been physically or sexually assaulted by a partner, and one in three women had been sexually abused by a non-partner—completely upended the understanding about VAWG in conflict zones.

Not only were the findings revolutionary, but the methods and tools the team developed and adapted along the way created a global standard for the ethical and rigorous collection of VAWG data against a backdrop of volatility and uncertainty.

Today, the South Sudan study is representative of the pioneering work GWI has undertaken in 10 short years to fulfill its mission of advancing gender equality through research, education and action.

A DECADE OF IMPACT

2012

THE GLOBAL WOMEN'S INSTITUTE LAUNCHES

The George Washington University establishes GWI, a pan-university initiative, with Mary Ellsberg as founding director.

2013

PARTNERING WITH THE MALALA FUND

GWI works with the Malala Fund to create a resource guide for universities and secondary schools based on the inspiring memoir by Nobel Prize winner Malala Yousafzai.

COURTESY OF GWI

Further evidence: GWI earlier this year was tapped to co-lead a new £65.7 million ($82 million) initiative to identify, evaluate and scale interventions that prevent VAWG around the world.

Thirty years ago, there was scant evidence on VAWG's prevalence and no standard practice for collecting data on it.

"There was almost no research on violence against women, particularly epidemiological research, until the 1990s, when a few groups of feminist researchers around the world started trying to break that open," Ellsberg says. She was one of those researchers.

During the 1980s and 1990s, Ellsberg was living and working in Nicaragua, where she was also a part of the country's burgeoning women's movement. In the early 1990s, members of the movement proposed a law criminalizing domestic violence. When government officials refused to vote on the law on the grounds that there was no evidence domestic violence was a problem, Ellsberg decided to get the numbers.

While pursuing a doctoral degree in epidemiology at Umeå University in Sweden, Ellsberg carried out the first population-based survey on domestic violence in Nicaragua in 1995.

"We had to make the case that violence was actually a public health issue, and that meant prevalence studies," she says. "But that also meant developing methods for collecting data that were ethical and kept women safe."

Over six months, Ellsberg and a research team that included members of the Nicaraguan women's movement interviewed 488 women in León, Nicaragua's second largest city, about their experiences with domestic abuse. When the team published its study, the findings caused an uproar.

One out of every two women had experienced physical or sexual abuse by an intimate partner, and, of those, one in four women had experienced violence within the past year.

Feminist activists immediately launched a campaign to publicize the results of the study across radio, television and newspapers. Within

"There was almost no research on violence against women, particularly epidemiological research, until the 1990s, when a few groups of feminist researchers around the world started trying to break that open."

MARY ELLSBERG
GWI FOUNDING DIRECTOR

2014

SPOTLIGHTING VAWG IN THE LANCET

GWI publishes a groundbreaking, comprehensive review of evidence-based interventions to prevent violence against women and girls in The Lancet in a first-ever issue focused on VAWG.

2015

PIONEERING RESEARCH IN SOUTH SUDAN

GWI launches the first population-based study on VAWG in conflict-affected areas of South Sudan, which subsequently influences peace negotiations.

2016

DOCUMENTING SUCCESS IN NICARAGUA

GWI conducts a 20-year follow-up study to previous research in Nicaragua and finds a 70% reduction in intimate partner violence, demonstrating VAWG can be prevented through a multisector approach and feminist organizing.

six months, Nicaragua's National Assembly unanimously passed the country's first domestic violence law. Other legislative reforms and improvements in social and law enforcement services followed over the next couple of decades.

"Through this research, we were able to uncover a devastating problem affecting Nicaraguan women that had been hidden for so long," Ellsberg says. "At the same time, by partnering with the feminist movement throughout the research process, we were able to use our results to contribute to real social change."

By this point, researchers around the world had been conducting similar studies. And in 2000, a landmark, multicountry World Health Organization study, to which Ellsberg contributed, revealed the enormity of the issue: Globally, one in three women would experience physical or sexual abuse in her lifetime. Ellsberg and other researchers also began collecting prevalence data that linked domestic violence to a range of medical conditions, including preeclampsia, depression, chronic pain, fibromyalgia, irritable bowel syndrome and heart disease.

"As the evidence accumulates, nobody can say, 'This is not a human rights issue,'" Ellsberg says. "We have shown that violence against women and girls is both a violation of human rights as well as a health emergency."

Twelve years later, Ellsberg came to The George Washington University. As the founding director of GWI, Ellsberg was able to draw on the work she did in Nicaragua and with the WHO to advance research on VAWG and its prevention around the world.

Early on, Ellsberg and her fledgling team were clear that their goal was to utilize their research to develop practical interventions that would improve the lives of women and girls.

"How can we be a partner who doesn't just care about doing academic research that ends up in peer-reviewed journals?" Ellsberg recalls the team discussing. "How do we become a center that is known for practical, policy-based solutions that can contribute to international dialogue at the [United Nations'] Commission on the Status of Women?"

Over the next 10 years, GWI would answer those questions.

Among the many revelations of the South Sudan study was that VAWG takes many forms and its perpetrators wear many faces. While one in three women in conflict settings reported sexual violence by a non-partner (a high rate when compared to non-conflict settings), the rate of intimate partner violence was even higher. Between 54% and 73% of women experienced sexual or physical violence by a partner.

2017

IMPROVING FOREIGN ASSISTANCE

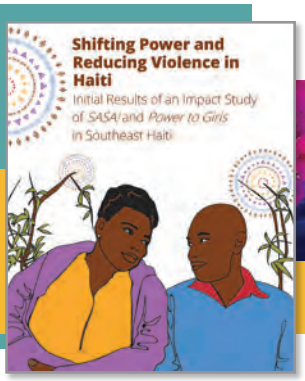
GWI assesses the Australian government's international program to end VAWG, evaluating the impact of investments to improve women's access to justice, services and prevention.

2018

TRAINING DEVELOPMENT PROFESSIONALS

GWI launches GenderPro, a first-of-its-kind program—delivered virtually and available globally—to professionalize, standardize and strengthen the field of gender within international development.

2019



EVALUATING PROGRAMS TO PREVENT VAWG

Between 2019 and 2022, GWI evaluates the Rethinking Power Program, developed by Beyond Borders and Raising Voices, in southeast Haiti. The program is now a proven solution that has reduced intimate partner violence by nearly 45%.

In addition, the study revealed that humanitarian actors were sometimes reported as perpetrators of sexual abuse, and approximately 20% of women and girls reported being sexually exploited when they tried to access goods and services.

"It's about power imbalances," says Murphy, who now leads GWI's Building Gender-Based Violence (GBV) Evidence in Conflict and Refugee Settings program, among other projects funded by the U.S. State Department. "In a humanitarian emergency, some of those power dynamics become more acute, and people become even more vulnerable because of that."

For Amal Hassan, the fact that humanitarian actors were exploiting women and girls was shocking.

Hassan, a graduate research assistant with GWI who earned a bachelor's degree from GW's Milken Institute School of Public Health in 2022, joined the institute in 2019. As an undergraduate research intern, she began working with GWI's Empowered Aid program, a participatory action research project studying sexual exploitation and abuse of women and girls in refugee settings in Lebanon and Uganda.

"I think one of the main things that surprised me was that most of the perpetrators of violence against women and girls in humanitarian settings were actually trusted people such as humanitarian aid workers," she says. "They were workers who were supposed to be helping and distributing aid in a very diligent and honest way. There were also male community leaders and community activists and even relatives who were exploiting women and girls."

Working alongside refugee co-researchers in Uganda and Lebanon, Empowered Aid helped uncover a number of risks women and girls faced through aid distribution processes.

"I think we assumed that entrenched social norms that promote violence and gender inequality would take generations to change, that there's no way you could meaningfully impact the rate of violence within a two-to-five-year program. But you can."

CHELSEA ULLMAN
GWI RESEARCH SCIENTIST

2021

STOPPING EXPLOITATION IN REFUGEE SETTINGS

GWI develops and leads Empowered Aid, a multiyear, multicountry project that explores sexual exploitation and abuse of women and girls in refugee settings, including Lebanon and Uganda.

COURTESY OF GWI

2022

WhatWorks
TO PREVENT VIOLENCE AGAINST WOMEN AND GIRLS

LEADING A GLOBAL RESEARCH CONSORTIUM INTO THE NEXT DECADE

GWI is selected to lead the world's largest ever, multiyear, global research consortium to study and scale effective measures to prevent gender-based violence through "What Works to Prevent Violence Against Women and Girls: Impact at Scale," a program funded by the U.K. government.

2023

GWI CELEBRATES 10 YEARS

GWI celebrates the institute's first decade in action at GW and honors U.S. Rep. Pramila Jayapal, 33 ex-political prisoners from Nicaragua, and a sexual violence survivor and activist from Bolivia with Champions for Justice awards.

"That the recommendations we came up with directly impacted women and girls in those contexts and allowed them to get humanitarian aid in a much safer way was extremely touching and empowering. It helped show that the work I was doing as an undergraduate research intern was really helping make a difference for this global public health crisis."

AMAL HASSAN

GWI RESEARCH ASSISTANT

In Lebanon, for example, where the majority of the country's 870,000 refugees come from Syria, the Empowered Aid team found that women and girls were at an increased risk of sexual exploitation and abuse by sanitation and hygiene humanitarian workers who visited homes to make repairs. In Uganda, where people fleeing the conflict in South Sudan make up a large percentage of the country's refugees, the team found that food distribution posed one of the greatest risks.

The team developed a series of recommendations, tool kits and even a free online course to help the humanitarian sector better mitigate sexual exploitation and abuse through aid distribution, monitoring and evaluation.

"That experience really changed my outlook," says Hassan. "That the recommendations we came up with directly impacted women and girls in those contexts and allowed them to get humanitarian aid in a much safer way was extremely touching and empowering. It helped show that the work I was doing as an undergraduate research intern was really helping make a difference for this global public health crisis."

The opportunities that GW students like Hassan have working at an institute like GWI are critical for the future of the field, says Murphy.

"We have a really strong commitment to students," she says. "We've brought on a bunch of students over the years to work on research projects, which is exciting. That opportunity of working with researchers and the communities is important in building up the next generation of researchers and practitioners in the nongovernmental organization space."

Not long after GWI opened its doors, the institute published a review paper in a special issue of The Lancet medical journal focused on VAWG. They looked at all the rigorous studies aimed at reducing violence against women and girls and found that almost all of them focused on responses to violence. There was virtually no evidence as to whether the programs actually worked to prevent violence, and there were very few studies carried out in low- and middle-income countries.

Yet, violence could be prevented. Ellsberg showed that when she returned to Nicaragua in 2015 to carry out a follow-up study to her 1995 prevalence study. The study, published in BMJ Global Health, showed a 70% decline in physical intimate partner violence over a 20-year period. It attributed the decline to the success of the women's movement and its ability to not only change laws and offer services for survivors but also to transform gender norms and educate women about their human rights.

According to Chelsea Ullman, a research scientist who's been with GWI since its inception, the fact that violence is preventable has been one of the breakthroughs over the last 10 to 15 years.

"Not only is it preventable, but we can see reductions in violence within relatively short programmatic time frames," Ullman says. "I think we assumed that entrenched social norms that promote violence and gender inequality would take generations to change, that there's no way you could meaningfully impact the rate of violence within a two-to-five-year program. But you can."

We're learning more every day about what works to prevent violence, Ullman says. She points to programs like Uganda's SASA! Initiative, which engages all members of a community, including religious leaders, parents and children, as examples of effective prevention programming.

Created by the nonprofit organization Raising Voices, SASA!—meaning "Now!" in Kiswahili—focuses on the power imbalances between men and women.

"They don't start by talking about violence," Ullman says. "Some people are immediately turned off when you start talking about violence. But if you start by talking about how we all have power, and we all understand what it feels like to be without power, then we all have a choice about how we use our power."

An evaluation of SASA! showed that the program reduces intimate partner violence by over 50%. Now the model has been adapted to other countries, including Haiti, where a GWI evaluation of a program in the southeast of the country found similar success in a different context.

"SASA! looks at violence prevention in a brand-new way, which is really about changing social norms and changing power imbalances," Ellsberg says.

Called "Seven Sisters," this painting by Shirleen Nampaynpa Campbell, an Indigenous women's rights activist and artist from Australia, was commissioned by GWI.

Claudia García-Moreno, who leads the WHO's unit on vulnerable populations in the Department of Sexual and Reproductive Health and Research and is a member of GWI's Leadership Council, has been witness to the institute's meteoric rise and impact over the last decade.

"GWI has made invaluable contributions to the field of violence against women, from research on the prevalence of violence against women in humanitarian settings to advocacy for prevention and services, including for migrant women, Indigenous women, political prisoners and other disadvantaged groups of women," she says.

Earlier this year, GWI was selected to lead the Research and Evaluation Consortium of the "What Works to Prevent Violence Against Women and Girls: Impact at Scale." Funded by the U.K. government, the seven-year, £65.7 million ($82 million) initiative is the world's largest ever, multiyear global program to identify, scale up and evaluate measures to prevent gender-based violence.

When GWI conducted the South Sudan study in 2016, it was part of the first iteration of the "What Works" initiative. Now it leads one of the program's two consortia.

"This is one tangible metric of our growth," says Ullman, who is the deputy director of the "What Works" program. "The South Sudan study was innovative and new, and we were able to learn a lot in the field from it. That put us in a position where now, instead of taking one piece of the project, we're able to help lead it."

In partnership with research colleagues in Kenya, South Africa, Pakistan, Australia and the U.S., GWI will lead and support over 50 studies in dozens of countries over the next seven years. First, it will assess where information gaps still exist and where more research is needed, particularly in low- and middle-income countries and among populations with diverse identities.

"Many people have overlapping identities, and some of those confer privilege and some of them don't," Ellsberg says. "We can't just talk about 'all women.' We have to understand class, ethnicity, gender identity and sexual orientation. The dialogue and our understanding of gender has become so much richer with an intersectional lens."

Beyond "What Works," GWI continues to build capacity among humanitarian actors through its Building GBV Evidence and Empowered Aid programs. It is also preparing a new generation of global leaders through GenderPro, a credentialing program that trains mid- and senior-level development professionals to integrate gender into their work. And the institute is applying the lessons it has learned overseas to its own backyard.

"In the U.S., people are much less focused on prevention, and we think the work of groups like SASA! in Uganda and the work around changing social norms has a lot to teach people in the U.S.," Ellsberg says.

As the U.S. Justice and State Departments develop gender-based violence action plans, for example, the institute has organized listening sessions between U.S. officials and global gender-based violence experts to share lessons learned from other countries.

For Ullman, the issue of VAWG in the U.S. is not so different from VAWG elsewhere. Different variables may exacerbate or change the way violence looks, she notes, but the intimate partner violence we see in South Sudan is the same type of violence we have here in the U.S.

"Violence happens everywhere," Ullman says. "It varies by region, but there is no region in the world where it's zero. However, this is an exciting moment, because we're not only furthering our global knowledge but also building momentum to take action on VAWG."

That momentum was on full display March 9 at an event to celebrate GWI's 10-year anniversary, where U.S. Rep. Pramila Jayapal (D-Wash.) delivered the keynote address, calling GWI "an important catalytic force."

"You showed the world what it looks like to stop gender-based violence and, crucially, how to achieve that change," she said. "And research that's generated here actually does play a direct role in crafting stronger evidence-based policies and preparing the next generation of leaders to create an even stronger movement." GWR

COURTESY OF GWI

INNOVATION

GW LAUNCHES NATIONAL ACADEMY OF INVENTORS CHAPTER

The organization is dedicated to recognizing and promoting academic innovation.

For many cancer patients, the treatment can be nearly as excruciating as the illness. Chemo rash, a painful and common side effect of certain chemotherapy medications, can become so debilitating that treatment has to be discontinued. But a promising potential solution is now in clinical trials: HT-001, a new drug for alleviating skin disorders caused by epidermal growth factor receptor inhibitor therapy. Co-developed by George Washington University Professor of Biochemistry and Molecular Medicine William Weglicki and licensed to Hoth Therapeutics, Inc., HT-001 is an exemplar of the possibilities for human progress that arise when corporate resources meet academic vision and ingenuity.

Accordingly, Weglicki was one of 38 GW faculty members inducted into the university's newly launched chapter of the National Academy of Inventors (NAI) in April. Founded in 2010, NAI is dedicated to fostering cultures of innovation, collaboration and entrepreneurship within and between academic institutions.

In collaboration with GW's Technology Commercialization Office (TCO), the NAI chapter will provide resources and networking opportunities to established inventors as well as a mentorship platform for the next generation of innovators.

"This chapter will be a great tool to help increase collaboration and boost the impact of our collective work," Vice Provost for Research Pamela M. Norris said at the launch. "We have a strong culture of GW innovation and entrepreneurship [which] is possible thanks to our

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visionary faculty, staff, postdocs, students—individuals that can think beyond their labs and imagine their discoveries making the world a better place."

"The GW NAI chapter launch is a testament to the university's commitment to fostering a culture of discovery, creativity and entrepreneurship," TCO Executive Director Brian Coblitz said. "By celebrating the accomplishments of its members and providing a forum for idea exchange, this event plays a pivotal role in shaping the future of innovation at GW and beyond."

The 38 inventor members of the GW NAI chapter have either more than one GW-owned issued U.S. patent or a patent licensed by GW. Some have both. Besides HT-001, GW licensed technologies include a treatment for septic shock, diagnostic systems for infection and appendicitis, thrusters for microsatellites and many more. (Twenty honorary members also were inducted into the chapter, including student inventors and community entrepreneurs.)

Eight NAI Fellows have been inducted while at GW, including current faculty members Robert H. Miller, Akos Vertes, Mona Zaghloul and Michael Keider. (Keider also received GW's inaugural Inventor of the Year award at this year's Faculty Honors Ceremony.)

Hoth Industries CEO Rob Knie, who worked with Coblitz and Weglicki to license HT-001, lauded the GW TCO for its "unheard-of" efficiency in facilitating the licensing process.

TECHNOLOGY COMMERCIALIZATION BY THE NUMBERS

$1M

Gross licensing income generated from GW inventions in FY23

58

Number of GW inventions disclosed in FY23

25

Number of patents issued in FY23 to GW innovators

Tim Warden, president of West Virginia-based air handling business Englo, Inc., shared the possibilities of a hybrid solar kiln, developed by GW faculty members and licensed to his company last summer, which can drastically lower the energy costs of drying lumber. "From the beginning, the inventors combined some good engineering skills with industry knowledge, and that's what creates something valuable," Warden said.

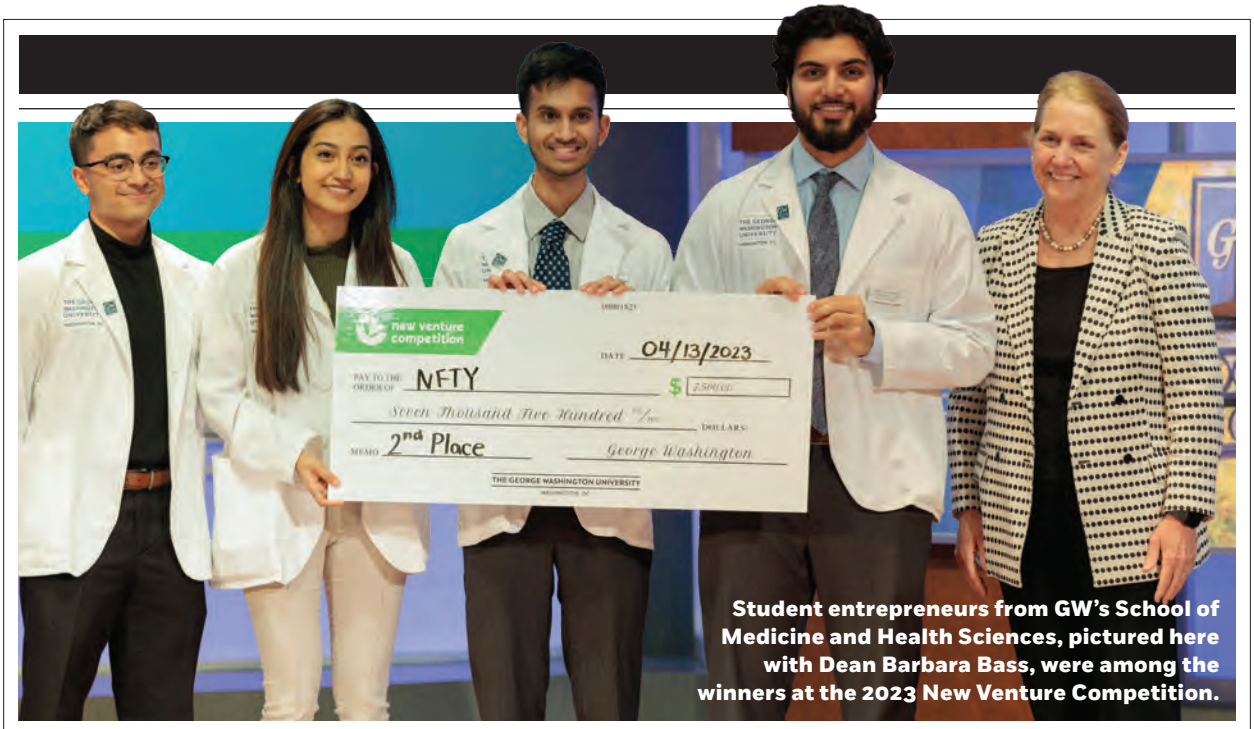
"In order to maintain our competitive edge in an ever increasingly competitive global environment, we must harness the intellect and energy of as many diverse and creative inventors as possible," said Elizabeth Dougherty, an NAI board member and eastern regional outreach director for the U.S. Patent and Trademark Office. "America's inventors, including and especially those who celebrate here this evening, will continue to be at the heart of it, making it all possible. We celebrate you and the entirety of your work in the GW inventor community."

GW School of Engineering and Applied Science Dean John Lach echoed Norris on the importance of honoring innovators and moving promising research beyond the laboratory.

"When I think about why we're all here, what are we doing—especially with our research mission—the word that always comes to mind for me is impact," Lach said. "We are creating knowledge to have an impact and make the world a better place." GWR

SHOP GW INVENTIONS AND TECHNOLOGIES

GW faculty are advancing next-generation electronics, new materials, medical devices and more. Browse the GW Technology Commercialization Office's site for a large array of inventions and technologies that are ready for licensing and subscribe to receive personalized technology updates.



Student entrepreneurs from GW's School of Medicine and Health Sciences, pictured here with Dean Barbara Bass, were among the winners at the 2023 New Venture Competition.

ENTREPRENEURSHIP

STUDENTS WIN FUNDING AND CASH PRIZES AT 2023 NEW VENTURE COMPETITION

NVC awards $357,200 worth of prizes, including $163,000 in cash to winners, for the nationally recognized annual competition.

By Nick Erickson

As demand rapidly increases for electric vehicles and devices, so too does demand for rechargeable batteries, which often come from lithium-ion sources. Yet, lithium-ion batteries contain toxic metals that can contaminate water supplies and ecosystems.

GW Engineering's Lingchen Kong, a Ph.D. student, and Professor Xitong Liu have unearthed an environmentally conscious solution.

Their company, Ellexco, offers a way to convert geothermal brine to lithium hydroxide, which would lower the carbon footprint.

"We are confident that we can promote this technology and explore more lithium sources, and our goal is to make lithium extraction much more cost effective and much more environmentally friendly," Kong said.

They received a big boost in that mission. The pair took home two top honors totaling $20,000 at the 2023 New Venture Competition awards ceremony at Jack Morton Auditorium. Kong and Liu won the Business Goods and Services Track and the CirrusLabs Prize for Best Tech Venture, each $10,000 awards.

Four other startup groups won $17,500 for their ventures pitched at the GW Office of Innovation and Entrepreneurship annual flagship event, which has turned into one of the nation's top student entrepreneurship competitions.

In the 2023 competition, there were 417 participants across 161 teams, and judges awarded $357,200 in prizes, including $163,000 in cash to winners. Twelve finalists, who all received a minimum of $5,000, across four tracks gave an elevator pitch after advancing past the first two rounds of competition. Participants represented nine of the 10 GW schools, making for a diverse range of innovative startup solutions.

"If this is an indication of the next generation of problem solvers, then we are all in good hands," then-GW President Mark S. Wrighton said. "It is extraordinarily impressive to hear about the diverse set of new businesses."

This year's competition included several major changes reflecting OIE's efforts to make entrepreneurship more accessible and relevant to students. In addition to the four tracks that had presentations—the Business Goods and Services, Social Innovation,

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Consumer Goods and Services, and Healthcare and Life Sciences Tracks—a new track made its debut at the competition this year for students who had yet to gain experience with innovation and entrepreneurship but were curious to learn. The Explorer Track, sponsored by GW alumnus Shaya Reiter, B.S. '93, and his wife, Mandy Reiter, offered smaller cash prizes and an automatic bye to round 2 of next year's NVC to finalists. Eleven groups advanced to the final round.

There were also three rounds instead of four to simplify the application process and allow for more programming between rounds. All moves were made to appeal to a wider range of participants, some of whom may have been intimidated in the past. The inclusiveness factor was a big undertaking for Director of Student Entrepreneurship Kate Heath and her team.

"It's our mission to make innovation and entrepreneurship accessible and relevant to all students, regardless of which school they're in or how mature their concepts are," Heath said. "We've been very thoughtful in our approach to programming, ensuring a range of opportunities that serve the would-be innovator, the committed founder and everyone in between. The changes we made to NVC were part of that approach, and so far the response has been extremely positive."

Winners of the Business Goods and Services, Social Innovation, Consumer Goods and Services and Healthcare and Life Sciences Tracks all received $10,000 prizes. Second-place winners received $7,500, while third place earned $5,000.

GW Law student Rafael Caballero, along with teammate Santiago Perez, won the Social Innovation Track venture, as well as the Quinn Prize for Social Impact for $7,500. Their product, MiCorte, is a text messaging service that automatically checks immigration court hearing information from the Executive Office of Immigration to notify immigrants in real time about changes to hearing, date, time location or presiding judge. This is a response to millions of backlogged cases, leading to hundreds of thousands of immigrants missing their court hearings.

> **"It's our mission to make innovation and entrepreneurship accessible and relevant to all students."**
>
> **Kate Heath**
> Director of Student Entrepreneurship

Caballero, an immigrant from Venezuela, explained that the current system usually notifies immigrants by mail but noted that some immigrants change addresses often. His service would give immigrants up-to-the-minute information on court cases and a history of previous records and changes.

"It is going to completely revolutionize the way immigration court cases work," Caballero said.

GW medical student Iris Brammer pitched a reusable dough that delivers consistent cooling without restricting movement and can be sculpted for any area of the body. She said her product, called CryoDough, could be a household essential for first aid to rapidly ice burns.

Her idea won her top prize in the Healthcare and Life Sciences Track and a $7,500 award for best prototype.

"I'm very passionate about medical care and innovation, and my priority was always taking care of patients and making sure that these types of common inconveniences are actually addressed," Brammer said.

GW Law student Sonia Schmidt, as well as business partner Devan Geib, won the Consumer Goods and Services Track and received an additional $7,500 prize for Best Storytelling. Immorta is a social media platform where users can upload, store and share multiple types of media that serve as a collective memory book so legacies can be celebrated during life and preserved beyond death.

Schmidt said Immorta would be more than a scrapbook or photo album, as it would be an easy way to preserve memories such as a cake recipe, and each family member could have their own page.

"We believe every story is worth telling, and every person is worth remembering," Schmidt said. "We wanted to make sure that every single person's story could be told."

GW Business senior Yijia Gu won the coveted Viewer's Choice Award, a $10,000 prize voted on by the public. She also won second place in the Social Innovation Track. Her venture, called YIMU, is a nonprofit supporting Chinese and Asian sexual-minority women through producing documentary series, broadcasts and films to raise public awareness of the Chinese and Asian LGBTQ communities, improve mental health and trigger social change.

Olivia Ouimet and Nitya Bonda, both Milken Institute School of Public Health students, won the $1,500 prize for top Explorer Track. Their company, GlobeER, is a technology to mitigate the concern of finding health care services in a foreign country for travelers who experience a health crisis.

OTHER NVC WINNERS

AMPLIFIED is a comprehensive DEI-solution platform that offers data analytics to drive progress, measures success towards an inclusive workplace and offers access to advisory services. ($15,000)
Kimberly de la Pena (GWSB '23), Gaby DeAndrade (GWSB '23), Lana Synder (GWSB '23), Lauren Loadvine (GWSB '23)

NFBUS is an online marketplace through which bus companies offer their tickets as digital tokens, allowing them to retain more control, save costs and introduce ticket reselling. ($5,000)
Edoardo Brunello (GW Exchange Student '23), Enrico Sgarbossa

SEEKER provides guarantor services to international students renting apartments in the U.S., enabling them to secure housing without a U.S.-based guarantor. ($15,000)
Sebastian Ewel (GWSB '23), Aditya Jaju (GWSB '23)

J STREET is a coffeehouse serving locally sourced specialty drinks where J Street customers can rent coloring or other art supplies at their leisure. ($5,000)
Millicent Li (GWSB '23), Kennedy Generalli (GWSB '23), Camila Zamalloa (GWSB '23), Gerel Enkhbol (GWSB '22)

NFTY utilizes blockchain to streamline the sharing of medical images in a way that is secure, private and HIPAA-compliant for private-practice imaging centers and patients who require frequent imaging.($15,000)
Abhisri Ramesh (SMHS '26), Abdulla Ahmed (SMHS '26), Rithvik Chekuri (SMHS '26), Phillip Parel (SMHS '26), Avanthika Ramesh

KORNERSTONE HEALTH SOLUTIONS, LLC, proposes to develop a nano-tech wearable mouthguard device designed as a concussion tracking device in real time. ($5,000)
Louis Eke, Ph.D. (SMHS '24)

ADF (AGDEV FUND) is a global private equity fund that provides a global investment platform in the agri-food sector, focusing on food-value chain investments in East Africa. ($5,000)
Brent Miller (GW Law '25)

LIQUID HANDLING ROBOT aims to revolutionize the handling of small, live biological samples with its computer-controlled robot that can delicately extract and dispense soft-cell spheroids while preserving their integrity. ($1,000)
Daniel Liu Schmid (SEAS '23), Ruby Limanowski (SEAS '23), Orooluwa Emmanuel (SEAS '23), Helen Knight (SEAS '23), Joshua Welch (SEAS '23)

CIRCINUS revolutionizes vacations and travel planning by leveraging AI and machine learning to automatically generate a dream itinerary based on your travel destination, budget and interests. ($5,500)
Sarah Ahmad (GWSB '26), Jiajie (Steven) Qi (GWSB '24)

GWR

Get Involved in Entrepreneurship at GW
GW's Office of Innovation and Entrepreneurship (OIE) prepares early-stage innovators for their next step. OIE's lean startup instruction and holistic mentorship programs help entrepreneurs identify their first customers and develop successful go-to-market strategies. OIE is in its 13th year, and its efforts have resulted in 1,500+ teams trained, 350+ ventures started and $1.04 billion in follow-on funding raised.

Introduction to Lean Innovation
Each month, OIE hosts virtual one-hour info sessions for early-stage innovators which provide an overview of the customer discovery process and the basics of research commercialization

Mentors-in-Residence
Meet with one of OIE's many experts who've undergone the entrepreneurial journey and can provide coaching, feedback and long-term support.

Lean Startup Training
NSF I-Corps is an immersive training program that facilitates the transformation of research into societal impact. Researchers learn how to test the viability of their ideas, validate value propositions, build successful business models and ultimately bring lab findings to market.

For more information, contact Kerry Slattery at *kerryslattery@gwu.edu*

GW RESEARCH

IMPACT THROUGH COLLABORATION

GW is tackling local, national, and global challenges from the heart of the nation's capital. Partner with our vibrant research community to advance shared goals and build a greater world.

» **Accelerate research and development** by collaborating with pioneering investigators or utilizing state-of-the-art research facilities.

» **Recruit top talent** by accessing GW's diverse community of students and trainees.

» **Engage influential audiences** by convening events on GW's Foggy Bottom campus.

» **License cutting-edge technologies** by working with GW's commercialization team.

» **Tap into GW's entrepreneurial community** through our top-ranked new venture pitch competition or the Penn West Equity and Innovation District.

Explore a collaboration with GW by emailing ***oicr@gwu.edu***

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RAISE HIGH

University mascot George shows off a computer chip at GW's Nanofabrication and Imaging Center during an event celebrating women and girls in science.