

GW RESEARCH

An isometric illustration of a city. The left side of the image shows a clean, green area with a few small houses and a road with cars. The right side shows a dense, grey city with many buildings, smokestacks, and smoke rising from them. A road with cars runs through the middle. The overall style is a mix of bright green and dark grey.

THE GEORGE WASHINGTON UNIVERSITY 2022

LAND OF ICE AND FIRE

///
CLOSING AMERICA'S
HOMEOWNERSHIP GAP

///
IN AI WE TRUST

AIR EQUALITY

In the U.S., the most
disadvantaged neighborhoods
are also the most polluted. GW
researchers aim to change that.

FROM THE VICE PROVOST FOR RESEARCH

The George Washington University is a magnet for people who aspire to have a positive impact on the world. Not only are we a prestigious university whose “very high research activity” has earned it an R1 Carnegie Classification, we are also surrounded by some of the nation’s top institutes, agencies and advocacy organizations. As such, we’ve built a vibrant community of scholars in our nation’s capital.



Impact can be tough to quantify, but you know it when you see it. I encounter it every day when I talk with our faculty, students, postdocs and staff. You will encounter it in the pages of this magazine.

In our cover story, for example, GW researchers are using satellite data to measure and map air quality at the neighborhood level—showing stark inequalities in who has access to clean air (page 18). Their work is informing clean air initiatives close to home. They are also helping cities around the world integrate air pollution data into plans to cut emissions and curb climate change.

Of course, climate change is already rapidly transforming the Arctic, impacting a way of life for the 4 million people who live in this region. A large cohort of federally funded GW researchers with expertise in everything from engineering and education to international affairs are studying how a warming and irregular climate undermines infrastructure and culture in the “new Arctic” (page 28).

What’s not new and what hasn’t changed much over the decades is America’s homeownership gap, thanks to the cumulative effects of discrimination and racist policies. GW faculty with expertise in consumer behavior, economics, sociology and policy are collaborating with think tanks, municipalities and professional associations to identify possible interventions that address inequities in mortgage lending and home appraisals (page 38).

The nation’s capital is our classroom, and we are its research and development lab. From here we work with NASA scientists to build instruments for space exploration (page 2) and meet with industry experts to better design trustworthy AI (page 14). We administer the first mRNA HIV vaccines to human study participants (page 10) and boost regional innovation through a new \$15 million I-Corps Hub. (page 44) We share our research findings with lawmakers, hoping to inspire evidence-based policies and programs that improve life for all of us.

In short, our impact is big. At GW, the distance between the spark of an idea and the realization of its impact is truly as short as the span between campus and Capitol Hill.

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FEATURES

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GW researchers are using satellite data to measure communities' exposure to air pollution and associated health burdens. Their work is informing clean air initiatives and efforts by cities to go carbon neutral.

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More than 4 million people live in the Arctic, where climate change is progressing faster than on the rest of the planet. Researchers across GW are working to help sustain the region's cities, infrastructure and cultures.

38 /// Closing America's Homeownership Gap

Boosting homeownership among Black households in America begins with owning up to a history of racial discrimination in the real estate and mortgage industries, say GW researchers studying the homeownership gap.

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FRONT COVER:

Illustration by Raúl Arias

BACK COVER: **A 3D reconstruction by postdoc Hovhannes Arestakesyan traces the intricate structures of different cells in the brain. The image took top prize in the GW SMHS Art of Science competition.**





SPACE

GW-NASA PACT SKYROCKETS ASTROPHYSICS IMPACT

Agreement with NASA propels faculty and students to new heights in space exploration science.

By John DiConsiglio

In December 2021, the GW Astrophysics Group expanded its reach into space exploration through a new bilateral Space Act Agreement with the NASA Goddard Space Flight Center (GSFC). The agreement will promote faculty and student research at GSFC outside of Washington, D.C., and foster

new collaboration opportunities. GW researchers, many of whom are already leading projects at Goddard, will have enhanced access to lab facilities and equipment and will play a larger role in fields from data analysis to designing cutting-edge instrumentation.

At the same time, GW will support NASA missions by teaming

with Goddard scientists on new research projects, with an increased emphasis on headquartering them at GW facilities.

“The Space Act Agreement is a recognition by NASA that GW is a strong and reliable partner with which they wish to establish a long-term partnership for exploring the cosmos as well as fostering new

ideas,” said Assistant Professor of Physics Sylvain Guiriec, the principal investigator for the agreement.

The GW Astrophysics Group has enjoyed frequent collaborations with NASA in the past, particularly in the field of high-energy astrophysics. Faculty and student researchers have helped analyze and interpret data from cosmic explosions, gamma-ray bursts and more, playing a key role in “understanding the nature of the most energetic phenomena in the universe,” Guiriec noted.

“Goddard Space Flight Center is very happy to have a signed Space Act Agreement with the George Washington University,” said Anne Kinney, GSFC deputy center director. “We hope and expect that this agreement will lead to an exchange of expertise between GSFC and GW, which benefits both parties. Such agreements serve as a path between organizations, allowing talent and expertise to flow in both directions.”

Under the new agreement, Guiriec envisions GW leading the development of new astrophysics instrumentation, including the next generation of telescopes.

“Being highly involved in the development of future instruments is a strategic key for our students as well as for the long-term sustainability of the GW Astrophysics Group’s activities,” he said.

Several physics faculty members have long-standing ties with NASA, including Guiriec, who is a research scientist at GSFC, a member of multiple space missions and a 2017 recipient

of the NASA Exceptional Scientific Achievement medal for his work on modeling gamma-ray bursts and establishing them as cosmological “standard candles”—astronomical objects that have a known absolute magnitude.

Before coming to GW, Physics Department Chair Chryssa Kouveliotou was a high-energy astrophysicist at NASA’s Marshall Space Flight Center. A member of the National Academy of Sciences, Kouveliotou recently received the prestigious Shaw Prize in Astronomy for her contributions to advancing the understanding of magnetars, or neutron stars with the strongest known magnetic fields.

In 2021, Kouveliotou, Guiriec and Associate Professor of Astrophysics Alexander van der Horst joined a team of international researchers that helped NASA identify magnetar explosions in a neighboring galaxy. In recent years, GW astrophysicists have collaborated with NASA and scientists from around the globe on projects such as detecting the highest-energy light ever observed from a gamma-ray burst and studying the first confirmed observation of a kilonova, two merging neutron stars.

According to van der Horst, the new agreement will expand collaboration opportunities for both faculty and students.

“We can offer graduate students a broad range of high-quality Ph.D. research projects, which allows the physics department to attract more high-quality students, and the Astrophysics Group and others

at GW to broaden and deepen collaborations with NASA,” van der Horst said.

Currently, eight graduate students from the physics department are working at GSFC, with several leading important instrumentation projects.

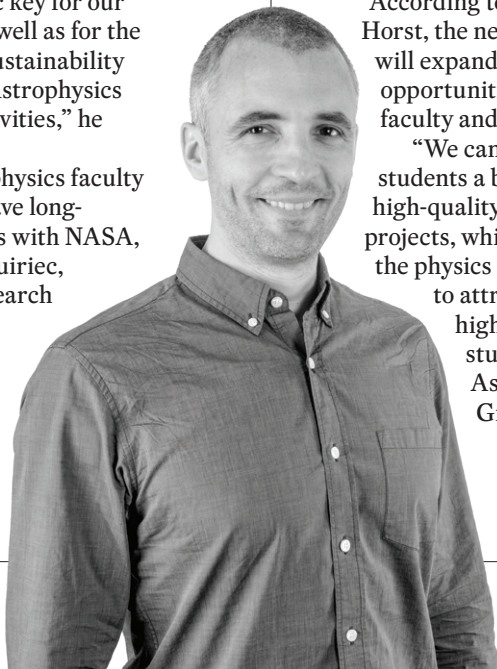
Fifth-year Ph.D. student Alyson Joens, recipient of the John Mather Nobel and NASA FINESST scholarships, is spearheading the calibration of the Burst Cube, a gamma-ray detection instrument that will be launched into space this year.

“Working at NASA Goddard as a graduate student has afforded me the unique opportunity of leading a critical component of a mission while also learning from the foremost experts in the field,” Joens said.

Grant Mitchell, a fifth-year Ph.D. student, is the leader of the sun electron events analysis for the international Parker Solar Probe collaboration. He is also developing cutting-edge space detectors for studying neutrons at the sun.

Third-year graduate student Nicholas Kirschner is a leader for the calibration of Goddard’s All-Sky Medium Gamma-ray Observatory mission, a project aimed at unveiling an unexplored regime of the gamma-ray electromagnetic spectrum. And Michael Moss, a fifth-year Ph.D. student, is currently working at the Institut d’Astrophysique de Paris, modeling gamma-ray bursts and developing an analysis pipeline for gamma-ray data across space missions.

“It’s not only about continuing our work on existing projects but also fostering new lines of research,” Guiriec said. “We will collaborate on even larger scales to take us beyond anything we have done before.” GWR



Sylvain Guiriec
Assistant Professor of Physics

EXTREMISM

TRACKING THE CAPITOL HILL SIEGE

Following the Jan. 6, 2021 attack on the U.S. Capitol, GW's Program on Extremism (POE) launched a central database to record arrests and prosecutions connected to the attack. The database is in keeping with POE's tradition of providing primary source documents to the research community and the public at large.

"We wanted to document history, and by any measure the Capitol Hill siege was a historic moment and a flashpoint of extremism in America, similar to what Waco and Ruby Ridge were," said Seamus Hughes, POE deputy director. In May, Hughes was part of a New York Times team of journalists that won the 2022 Pulitzer Prize

in National Reporting for their work on law enforcement in America.

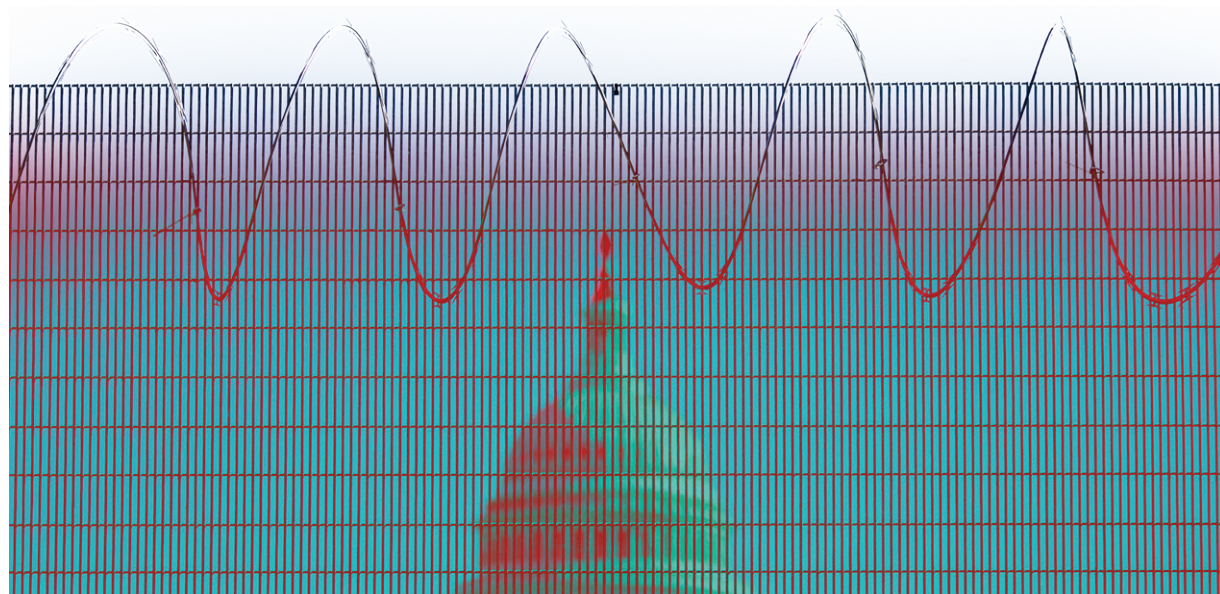
The POE Capitol Hill Siege tracker includes top-line statistics updated daily, a free-access archive of all related court documents, an interactive map that tracks state and county data, and a repository of analytical reports. Since its launch in January 2021, the tracker has been viewed over 500,000 times; featured in hundreds of national, international and local news stories; cited by multiple senators and congressional members during testimony; and selected by the Library of Congress for inclusion in the Jan. 6 Attack on the U.S. Capitol Web Archive.

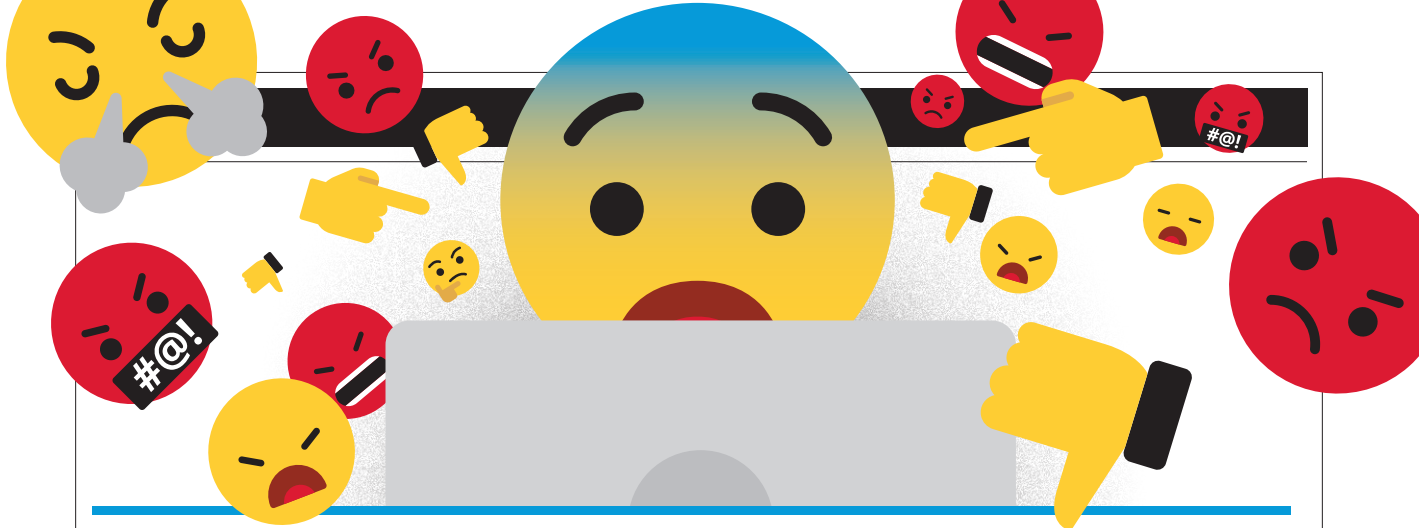
For over seven years now, POE has provided fact-based and nonpartisan analysis on the dynamics of extremism in the United States and abroad. In addition to the launch of the Capitol Hill Siege database, new POE research has tracked other aspects of the evolving domestic extremist

landscape, including racially and ethnically motivated attacks, neo-Nazi and neofascist groups, antisemitism, anarchist/left-wing violent extremism in America and more.

The POE also continues to track extremism abroad. In March, the program launched its new Nexus platform, which monitors Islamic State and al-Qaeda affiliates across the globe.

The program released the last episode of its limited podcast series, *Mosul and the Islamic State*, last fall. POE continues to support civil society efforts in Mosul to recover cultural heritage after ISIS's destruction and to build a greener, more resilient city for the future. The POE also uploaded the final tranche of documents in its ISIS Files project with *The New York Times*, a digital repository that provides public access to primary ISIS documents and accompanying analytical reports. GWR





SOCIAL MEDIA

PROTECTING VICTIMS OF ONLINE HARASSMENT

With a grant from the National Science Foundation's Convergence Accelerator program, a team of researchers, journalists, civil society representatives and technologists is developing a rapid response system to support public figures and experts facing coordinated campaigns of online harassment. Led by Rebekah Tromble, director of GW's Institute for Data, Democracy & Politics and an associate professor in the School of Media and Public Affairs, the multidisciplinary team is focusing on harassment of female journalists in the first phase of the project.

"Female journalists are often at the forefront of efforts to provide accurate information to the public, but their voices are too often being shut down and silenced by coordinated campaigns of harassment," Tromble said. "Our goal is to give journalists the tools and support they need to deal with these attacks, and ultimately to disincentivize online hate campaigns as a whole."

The team will build on the work of groundbreaking anti-harassment organizations like Hollaback! to create quickly accessible resources and support for victims.

Though initially focused on

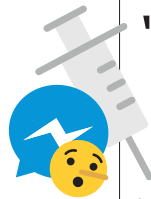
female journalists, the response system would be serviceable for scientists, public health officials and other experts targeted by coordinated harassment.

PARENTS PULLED TO EXTREME GROUPS ONLINE

Parenting communities on Facebook were subject to a powerful misinformation campaign early in the COVID-19 pandemic that pulled them closer to extreme groups and misinformation, according to a study conducted by GW researchers.

The study looked at Facebook communities totaling nearly 100 million users that became entangled in the online health debate through the end of 2020. The team found that mainstream parenting communities were exposed to misinformation from two different sources within Facebook.

First, alternative-health communities acted as a key conduit between mainstream parenting communities and pre-COVID conspiracy theory communities. Second, a core of largely under-the-radar anti-vaccination communities were able to continually supply COVID-19 and vaccine misinformation to parents.



"Our results call into question moderation approaches that focus on the largest and hence seemingly most visible communities, as opposed to the smaller ones that are better embedded," said Neil Johnson, a professor of physics and the study's lead.

VACCINE OPPOSITION UNITES AROUND 'FREEDOM OF CHOICE'

Vaccine opposition has historically taken many forms, from concerns about safety to conspiracy theories about government malfeasance.

A study published by GW researchers in the *American Journal of Public Health* reveals how, over the past decade, vaccine opponents online gravitated toward one position in particular: that refusal to vaccinate was a civil right.

"Framing vaccine refusal as a civil right allows vaccine opponents to sidestep the science and instead debate about values, especially the value of freedom of choice," said David Broniatowski, an engineering professor and associate director of the Institute for Data, Democracy & Politics, who led the study.

The team examined more than 250,000 posts on 204 Facebook pages expressing opposition to vaccines between 2009 and 2019. *GW*

EDUCATION

SCHOOL SUSPENSIONS AND STUDENT- TEACHER ETHNORACIAL MAKEUP

Black, Latino and Asian American students are less likely to be suspended from school when more of their teachers share their racial or ethnic background, according to a study led by Matthew Shirrell, an assistant professor of educational leadership and administration in GW's Graduate School of Education and Human Development.

Shirrell and his collaborators analyzed 10 years of data on suspensions for every student in fourth through eighth grades in New York City public schools. They followed individual students over time and examined whether the ethnoracial makeup of their teachers affected how likely they were to be suspended.



The team found the likelihood of suspension dropped about 3 percent for Asian, Black and Latino students when more teachers shared the same race or ethnicity as their students.

Latino students in grades four to eight are significantly less likely to be suspended in years they have greater proportions of Latino teachers, the study found. The effects are concentrated among boys and in elementary (K-5) schools.

"Our findings suggest that if we raised the proportion of Latino teachers for Latino students from 20 percent to 50 percent, the likelihood of suspension for Latino students would fall by 3 percent," Shirrell said. "In New York City, this would mean 1,500 fewer suspensions over 10 years, or roughly 7,800 more days in the classroom for Latino students in grades four to eight." GWR

IMPROVING EMPLOYMENT SERVICES FOR PEOPLE WITH DISABILITIES

Although the unemployment rate for Americans with disabilities has steadily decreased over the past three decades, in 2019, people with disabilities were still twice as likely to be unemployed compared with those without a disability. Moreover, during the pandemic, Americans with disabilities lost employment at a rate of one in five people,

2x

In 2019 people with disabilities were still twice as likely to be unemployed compared with those without a disability.

During the pandemic, Americans lost employment at a rate of...



compared to one in seven for those without disabilities, according to the U.S. Bureau of Labor Statistics.

"There are already so many challenges, and then you add COVID on top of it, and trying to figure out how to manage is very challenging," said Maureen McGuire-Kuletz, an associate professor of counseling at the GW Graduate School of Education and Human Development.

McGuire-Kuletz co-directs the GW Center for Rehabilitation Counseling Research and Education alongside Kenneth Hergenrather, who is also a professor of counseling.

The center has served as a national leader in rehabilitation counseling and research since 2014, and works to enhance research and provide opportunities for growth and development to a diverse population, including persons with disabilities.

In the last couple of years, the U.S. Department of Education has awarded nearly \$11.3 million in grants to the center to support research and the training of future rehabilitation counselors and administrators. GWR



LAW

ELECTRONIC PRISONS

New research spotlights excessive surveillance and risk of reincarceration.

The use of GPS-equipped ankle monitors is increasingly viewed as a more humane alternative to incarceration, yet a new report from GW Law finds they cause many of the same harms associated with traditional incarceration.

The report by Kate Weisburd, an associate professor of law, and a team of GW law students sheds light on how electronic monitoring, while not as restrictive as prison, deprives people of fundamental rights, violates basic privacy norms, extracts wealth, jeopardizes employment and undermines family and social relationships.

“Unlike traditional models of probation and parole, GPS ankle monitors are more intensive, restrictive and dependent on private

surveillance companies that are driven by profit,” Weisburd said. “Our report finds that electronic surveillance is not an alternative to incarceration; it is an alternative form of jail and prison.”

The research team collected and analyzed over 247 records from 101 agencies across 44 states and Washington, D.C. These records included policies, terms and contracts governing the use of electronic monitoring for people on pretrial release, probation and parole.

Among the findings:

- The nature and number of rules and restrictions imposed on people wearing monitors may lead

to reincarceration for technical and rule violations that often have nothing to do with public safety. For example, failure to keep the device charged or failure to charge it for a particular amount of time could land a person back in jail.

- Most jurisdictions require people on monitors to pay expensive user fees for the surveillance devices. The combination of monitoring fees, court costs and other expenses such as phone and internet service to maintain contact with supervising agents can run between \$2,800 and \$5,000 per year. Meanwhile, the four companies that dominate the electronic monitoring market are profiting from the use of the devices.

“Our report shows that the private prison industry’s hold on the criminal legal system is strong and rapidly growing through electronic monitoring,” Fatima Khan, a GW Law student who co-authored the report, said. “I hope this study will help inform criminal justice reform and policymakers who are considering putting an end to the use of electronic monitoring.”

In 2021, Weisburd was awarded the Reidenberg-Kerr Award for Outstanding Scholarship by a Junior Scholar at the Privacy Law Scholars Conference. The Virginia Law Review published the paper in 2022. GWR



“I hope this study will help inform criminal justice reform and policymakers who are considering putting an end to the use of electronic monitoring.”

BY THE NUMBERS



17

Number of years the Brood X cicadas were underground before emerging in May 2021.

A team of GW researchers used the once-in-a-generation ecological event to test some fundamental hypotheses about how trophic cascades—ecological phenomena triggered by the addition or removal of a species in an ecosystem—operate in Eastern forests. The team, whose data collection will continue for years, hopes the research will fill gaps in scientific understanding of how periodical cicadas impact local communities and ecosystems.



42%

Percentage of feed yards that had at least one of its "raised without antibiotics" cattle test positive for antibiotics.

Researchers from GW's Antibiotic Resistance Action Center and collaborators obtained urine samples and tested nearly 700 beef cattle from 312 lots and 33 "raised without antibiotics"-certified feed yards. Lots with at least one positive test represented approximately 15 percent of the "raised without antibiotics" cattle processed overall during the study period. The study was published in the journal Science.

10,000

Estimated number of elderly Washingtonians living with dementia.

A study conducted by the GW Institute for Brain Health and Dementia estimated that 10,000 Washington, D.C., residents age 65 and older are living with dementia, a general term for a range of memory loss disorders including Alzheimer's disease. The study, which was funded by D.C. Health, also found that the prevalence was higher for women, minorities and older D.C. residents.

The GW Institute for Brain Health and Dementia is an interdisciplinary research center that brings together faculty from across the university to promote and support research on cognitive health.

600,000

Number of flags installed on the National Mall as part of a COVID-19 memorial remembering those lost to the pandemic.

In September, a team of GW researchers, working with the memorial's creator, artist Suzanne Brennan Firstenberg, created a digital rendition of the memorial online. Led by Sarah Wagner, professor of anthropology, the GW team combed through the rows of flags daily, photographing and geolocating each personalized flag and adding it to the digital collection.

The collaboration between Firstenberg and Wagner grew from conversations around Wagner's research project, "Rituals in the Making," funded by a National Science Foundation RAPID award. The project looks at COVID's impact on funeral, burial and commemorative practices, and the research team largely focused on how mourning rituals move into digital spaces. According to Wagner, the National Mall installation and its field of flags offer insights into the improvised, creative forms used to remember lives lost to the pandemic.

To date, the number of reported COVID-19 deaths in the U.S. has surpassed one million.



Learn about the digital memorial.


\$3.6M

Amount awarded by the U.S. Department of Defense to GW researchers to develop a novel way to protect against biological or chemical threats.

Subcontracted through a \$16.4 million DoD-funded project, Dr. Paul Brindley in GW's School of Medicine and Health Sciences is using gene-editing technology to modify a microscopic organism that can serve as a platform to deliver neutralizing antibodies to frontline personnel such as soldiers and first responders. The team aims to create an anti-threat solution that can be activated in 10 minutes or less and quickly adapted for new threats.

800

Number of cities and counties in the U.S. with inclusionary zoning policies or programs.

Inclusionary zoning policies and programs give developers incentives (such as tax breaks, exemptions from regulations and other financial inducements) in return for setting aside a share of new housing units for low- to moderate-income families. A study conducted by Antwan Jones and Greg Squires from GW's Columbian College of Arts and Sciences found that jurisdictions with inclusionary zoning policies had fewer residents with high blood pressure and high cholesterol compared with communities without these programs. In addition, people living in cities with such policies were less likely to be taking medication to lower their blood pressure and less likely to have already developed coronary heart disease, they found. The study was published in the journal *Circulation*.

IN BRIEF

UNIVERSITY PROFESSOR APPOINTED TO NATIONAL COUNCIL ON THE HUMANITIES

Vanessa Northington Gamble was confirmed by the U.S. Senate as a member of the National Council on the Humanities. She was nominated to the council by President Joe Biden.



A physician, scholar and activist, Gamble has long worked to promote equity and justice in medicine and public health. She is an internationally recognized expert on the history of American medicine, racial and ethnic disparities in health and health care, public health ethics and bioethics.

In 1997, Gamble chaired the committee that led to a campaign to obtain a government apology for the United States Public Health Service Syphilis Study at Tuskegee. She is a member of the National Academy of Medicine and the National Academy of Sciences.

ANTHROPOLOGY PROFESSOR ELECTED TO NATIONAL ACADEMY OF SCIENCES

Chet Sherwood, professor of anthropology, was elected to the National Academy of Sciences.

Sherwood, a biological anthropologist, is an expert in evolutionary neuroscience. He is a part of GW's Center for the Advanced Study of Human Paleobiology and serves as director of the National Chimpanzee Brain Resource.



PHYSICS PROFESSOR AWARDED SHAW PRIZE IN ASTRONOMY

Chryssa Kouveliotou, professor and chair of the physics department, was awarded the international Shaw Prize in Astronomy for her contributions to our understanding of magnetars, a class of highly magnetized neutron stars linked to a wide range of astrophysical phenomena.

GFLEC CELEBRATES 10 YEARS

GW's Global Financial Literacy Excellence Center (GFLEC) commemorated its 10-year anniversary in October 2021. The center celebrated a decade of turning research into action by measuring and working to raise financial literacy across the globe and leveraging its location in Washington, D.C., to collaborate with policymakers and practitioners.

RESEARCH WORKFORCE DEVELOPMENT

GW has won a number of training grants that are supporting the next generation of scientists and scholars as they advance research in everything from HIV to trustworthy artificial intelligence. The National Institutes of Health awarded GW's School of Medicine and Health Sciences three T-32 grants between July 2020 and October 2021, totaling \$4 million, while GW's School of Engineering and Applied Science won a \$3 million award from the National Science Foundation's Research Traineeship Program.

HEALTH BRIEFS



HIV

GW PARTICIPATING IN THE FIRST HUMAN TRIAL OF MRNA-BASED VACCINE

In January 2022, GW became one of only four U.S. sites to administer the first mRNA HIV vaccines to human study participants, thanks in large part to the university's long-standing partnership with study sponsor IAVI.

The Phase I clinical trial, funded by the Bill & Melinda Gates Foundation and in collaboration with Moderna, will test the safety and immune responses of two mRNA vaccine antigens on 56 healthy adults.

Previous HIV clinical trials have focused on the efficacy of recombinant protein vaccines. These newer vaccines rely on the same mRNA technology that produced FDA-approved and

-authorized COVID-19 vaccines.

The mRNA HIV vaccines work by delivering instructions to the body's cells to produce versions of a protein found on the surface of HIV particles. The goal is to train the body's immune system to recognize the protein and then develop broadly neutralizing antibodies that protect against a wide range of different HIV strains. Although HIV can mutate quickly, the plug-and-play nature of the mRNA technology could make developing the vaccine more flexible and customizable.

"The COVID-19 pandemic really demonstrated the success of mRNA vaccines, and so the path from discussing its application for HIV to a Phase I clinical trial happened at an accelerated pace," said David Diemert, clinical director of the GW Vaccine Research Unit and professor of medicine at the School of Medicine and Health Sciences. "With these new mRNA vaccines, we're on the cutting edge of innovative vaccine strategies for HIV."

CERVICAL CANCER

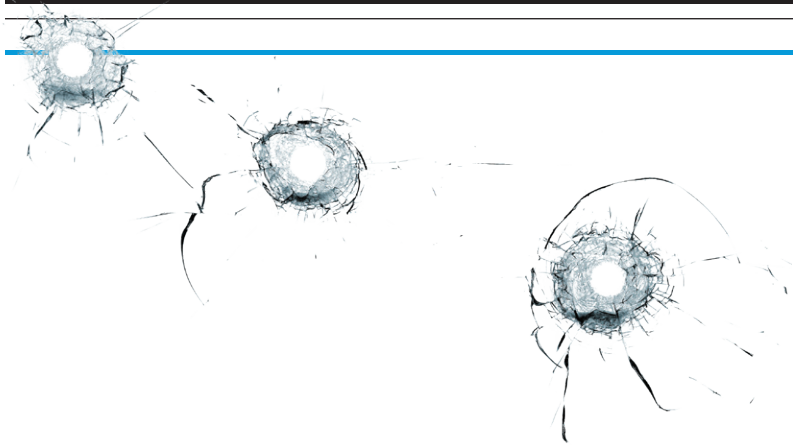
SELF-TESTING KIT FOR HPV SEEKS TO IMPROVE ACCESS TO CARE

Women over age 25 should be screened for cervical cancer every five years; however, immunocompromised individuals at high risk for cervical cancer—including those living with HIV—may need to be screened more frequently. Limited transportation, an inability to take time off work for appointments, a lack of childcare and more can all contribute to women not getting the screenings they need, says Daisy Le, an assistant professor in the School of Nursing.

Le, who specializes in community-engaged cancer prevention and health disparities research, is assessing whether HPV self-sampling kits could be an effective and feasible tool to improve screening for, and detection of, cervical cancer in women living with HIV in the Washington, D.C., and Baltimore metropolitan areas. HPV, or human papillomavirus, is a common sexually transmitted infection that can lead to cervical and other cancers.



Daisy Le



PUBLIC HEALTH

FIREARMS INDUSTRY FUELS GUN VIOLENCE EPIDEMIC

Just as the pandemic exposed how systemic racism, poverty and other social determinants impact the health outcomes of individuals and communities, it also exposed the role of the global firearms industry as a commercial determinant of health, according to a paper published in *Global Health: Science and Practice* by GW public health researchers.

In March 2020, 1.9 million guns were sold in the U.S.—the second largest month of sales in history—and nationwide background checks for individuals purchasing firearms were up by 41 percent. U.S. manufacturers also exported firearms worth more than \$90 million to low- and middle-income countries within the first five months of the pandemic—three times the number from March to July 2019.

As the authors argued in an op-ed published in *The Hill*: “We need to better understand the global gun industry’s motives, tactics and transnational practices, its associated markets, and the marketing and lobbying efforts utilized to increase the potency and availability of firearms.”

BREAST CANCER

HELPING IMMUNE CELLS INFILTRATE AND KILL TUMORS

In a paper published in the journal *Nature*, GW researchers identified a key molecule in certain kinds of breast cancers that prevents immune cells from entering tumors and killing the cancer cells inside—a finding that could pave the way toward new treatments for some aggressive forms of breast cancer.

“During cancer progression, this molecule, known as DDR1, organizes a high-order extracellular matrix that acts like barbed wire around the boundary of a tumor to prevent immune cells from entering the tumor,” said lead author Rong Li, the Ross Professor of Basic Science Research and chair of the GW School of Medicine and Health Sciences Department of Biochemistry and Molecular Medicine.

“Knowing that the DDR1 molecule creates a protective boundary around tumors, we were able to use preclinical models to show that the moment you deactivate DDR1, immune cells can infiltrate the tumor and kill the cells inside.”

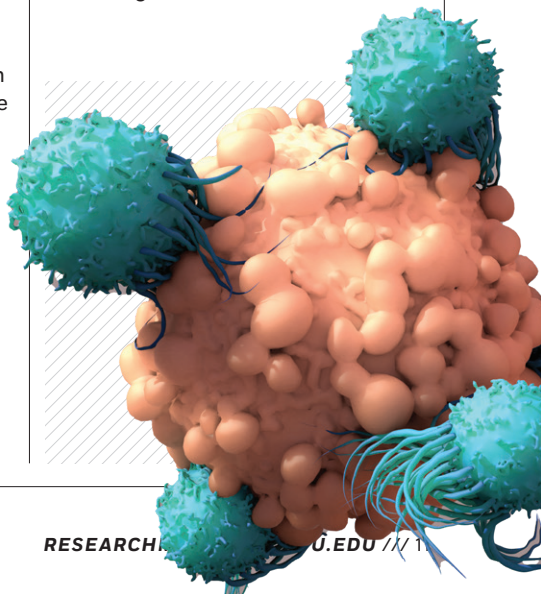
COVID-19

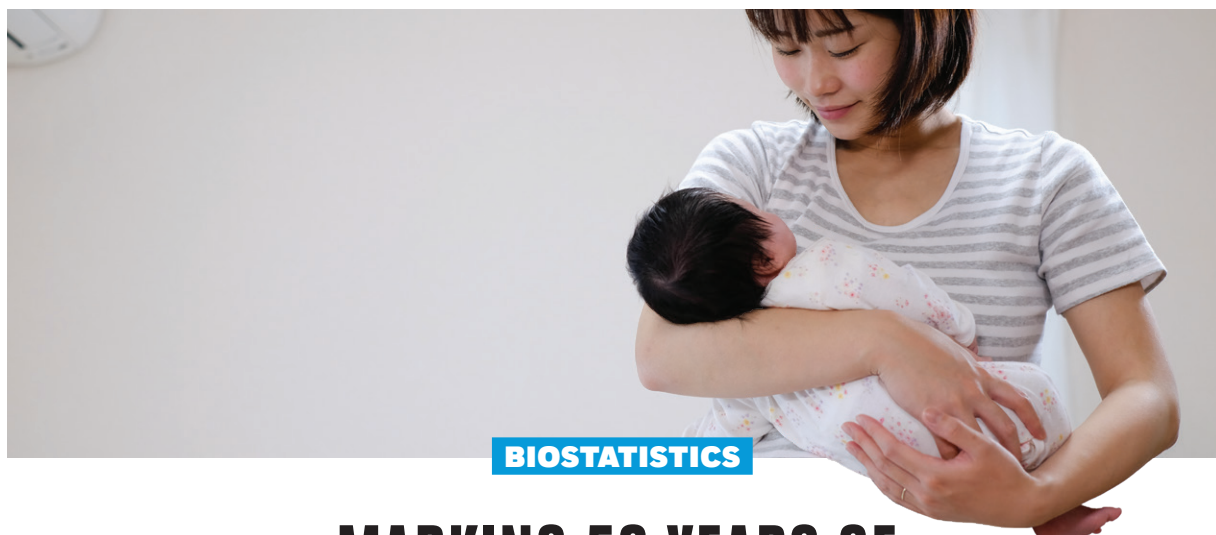
TESTING FOR INFECTION AND DISEASE SEVERITY

Currently, there isn't a good way to predict how the immune system will respond to the virus that causes COVID-19 or other disease-causing microbes. The immune response could range from mild symptoms all the way to critically severe symptoms, which can lead to the intensive care unit or even death.

A GW research team has developed a blood test that quickly detects if someone has COVID-19 and predicts how severely the immune system will react to the infection. The team sequenced whole blood RNA from COVID-19 patients whose symptoms ranged from asymptomatic to severe. They found visible changes in the cells of people with COVID-19. Their analysis also revealed that COVID-19 severity was associated with an increase in neutrophil activity and a decrease in T-cell activity. Neutrophils and T-cells, both types of white blood cell, are part of the body's immune system and help fight off infections.

The findings, which were published in the journal *PLOS ONE*, could someday lead to a powerful tool to help doctors determine the best treatment plan for people with COVID-19.





BIOSTATISTICS

MARKING 50 YEARS OF TRANSFORMATIONAL RESEARCH

GW Biostatistics Center's landmark studies have advanced diabetes care and treatment, maternal-fetal medicine and more.

By Kristen Mitchell

This spring, GW's Biostatistics Center celebrated 50 years of groundbreaking research that has improved the health outcomes and quality of life for millions of people worldwide. The center's large-scale public health and medical studies, conducted in close partnership with scientists and clinical sites across the United States and internationally, have transformed our understanding and treatment of everything from diabetes complications such as blindness and kidney failure to birth disorders like cerebral palsy.

Biostatistics applies statistical methods to the design, conduct, analyses, interpretation and reporting of research studies that address important research questions in public health and medicine. Such research results in evidence-based strategies to diagnose, prevent and treat

diseases. As a national leader in clinical trials and biostatistics methodology research, the center works to improve public health and clinical practice by conducting transformative scientific research, with a focus on providing leadership and expertise in the execution of clinical trials, observational studies and diagnostic studies.

Over the past five decades, the center has done just that, having published more than 1,700 papers, including 61 in the *New England Journal of Medicine*, and been cited numerous times in reports to the White House and U.S. Congress. In addition, the center has advanced biostatistical science by developing and implementing innovative approaches for the design, conduct, analysis and reporting of clinical research studies. It provides

training and education to GW students that is relevant to clinical trials and other clinical research. It currently employs 20 students.

Scott Evans, director of the Biostatistics Center, and professor and founding chair of the Milken Institute School of Public Health Department of Biostatistics and Bioinformatics, described the center's role as the nucleus of a much broader research endeavor.

"We hope to have a positive impact on public health and medicine through leading research projects that inform how you diagnose, treat or prevent diseases in patients," he said. "What is most

rewarding to see is the enormous magnitude of the impact that our studies have in the lives of patients, and the role that the center has had in the lives of the people that have worked there." GWR



Read the full story here.



ENERGY

FOGGY BOTTOM 'LIVING LAB' TO STUDY ENERGY SYSTEMS

Similar to many urban centers, GW's Foggy Bottom campus draws and creates energy from both traditional and renewable sources. The university employs its own combined heat and power plant located in Ross Hall, solar thermal heating, rooftop solar panels, battery and thermal storage, and draws energy from the grid.

Saniya LeBlanc, associate professor in the School of Engineering and Applied Science, is using the campus's energy management system as a "living laboratory" to build a framework that can determine how an urban energy system will hold up to challenges like a major heatwave or a storm that causes a grid outage. Her research team uses modeling to determine the system's reliability, resiliency and vulnerability.

"We have this really diverse energy system, and what we're doing is we're taking in all of that data and then saying, 'OK, how are we operating now as a campus, and what would happen if we changed the way we operated,'" LeBlanc said. "What would happen if we incorporated new technologies?"

The two-year project is funded by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. It builds on five years of previous work analyzing and modeling the Ross Hall power plant, which provides electricity,

heating and cooling for four campus buildings and building collaborations across GW and Washington, D.C. LeBlanc's team also works closely with the GW Division of Safety and Facilities and Sustainable GW.

The team has gathered data about water, natural gas and electricity being used by many buildings on campus, often manually checking meters and sifting through utility bills to collect the information it needs. As part of their research, the team has created a clickable map that shows key buildings on campus and the energy they use. That data is shared with the university to inform decisions about future sustainability initiatives and real-time decision-making about how to respond to weather events or power outages.

The campus energy system project fits into LeBlanc's larger

experiential framework to support hands-on learning for students interested in the energy sector. These combined opportunities give students the opportunity to learn how to navigate an industry where regulations often have not caught up to the latest technological developments.

"We've actually been able to see how valuable it is for their education, training and professional development, and how ready they are to take that step in their careers once they leave GW," LeBlanc said.

Ekundayo Shittu, associate professor in the Engineering Management and Systems Engineering Department, and Payman Dehghanian, assistant professor in the Electrical and Computer Engineering Department, are also part of the project. GWR





IN AI WE TRUST

Q&A WITH ZOE SZAJNFARBER



Few companies or industries today remain untouched by artificial intelligence (AI). Those that haven't adopted AI yet are wrestling with whether and how to integrate it into their systems and decision-making.

GW's School of Engineering and Applied Science was awarded \$3 million from the National Science Foundation Research Traineeship (NRT) program to help future designers navigate the opportunities and risks inherent in designing new AI algorithms and deploying them in real-world systems.

Zoe Szajnfarber, project co-lead and professor and chair of the Engineering Management and Systems Engineering Department, talks about what it means for AI to be trustworthy and how the program is training graduate students differently.

What do we mean by trustworthy AI?

Our operational definition of trust is the willingness of an organization or society to rely on AI systems to make decisions. In December 2020, the White House issued an executive order titled "Promoting the Use of Trustworthy Artificial Intelligence in the Federal Government," which defined 10 principles for designing, developing and acquiring AI for use in government. These include requirements that algorithms are accurate, reliable and effective; explainable to subject matter experts, users and those affected by the algorithm; and fair and consistent with the values of our nation. These broad definitions serve to frame our technical approaches to defining measures of accuracy, explainability, interpretability and fairness that are key foundations of trust.

For future designers and adopters of AI, what skills are critical?

Currently, algorithm innovators and decision-system designers are trained in separate silos. This is a recipe for both missed opportunities and the introduction of poorly understood risks. In terms of opportunity, an important potential of AI in work lies in rethinking the nature of a “task.” Systems designed to take advantage of the strengths of experts should look different from ones designed for gig workers or AI algorithms.

At the same time, while algorithms are capable of processing massive amounts of information, there is increasing recognition of the risks of delegating decisions completely (i.e., trusting the algorithm). Algorithms are known to exaggerate bias, sometimes fixating on the wrong salient features. Leveraging the opportunities for novel AI integration requires new strategies for trusting the corresponding tools. Unlocking these types of opportunities while mitigating the emergent risks requires researchers with depth and cross-training in AI algorithms and work system design, and a capacity to analyze the societal implications of emerging capabilities. Our program aims to provide that training and community.

What is the different approach you are taking to Ph.D. education?

Ph.D. programs often emphasize technical excellence and depth in a narrow focus area. While expert knowledge is the minimum bar for deploying AI, understanding the issues that might arise during

implementation or after an AI product has been deployed is also critical to the impact of new technology. For the most part, academia prioritizes “pure” research problems, but for students wishing to engage in our thematic area, many of the features that distinguish important topics from uninteresting or potentially dangerous ones rest on the interaction between theory and practice. Being able to make that judgment hinges on meaningful interaction with practitioners.

Our goal in designing the fellowship program was to balance disciplinary depth with interdisciplinary practice. We are implementing this in myriad ways, including seminars, cross-listing professionally oriented certificate classes with introductory Ph.D. classes and our flagship summer bootcamp. We’re particularly excited about the boot camp, which leverages principles from design thinking to rapidly explore and prototype convergent research ideas in context in a highly collaborative format. It’s taking all of us out of our comfort zone by challenging us to define core assumptions in our disciplines and learn new ways of thinking. I already find it changing how I think about research problems.

Tell us about the boot camp and the sites chosen.

The first two weeks of our boot camp are focused on exposing ourselves to the real-world messiness of implementing AI in operational systems.

We identified three sites that varied in their level of engagement with and adoption of AI tools as well as the safety criticalness of their application area.

We met with

Comcast’s AI research division to discuss the opportunities and risks of implementing AI across their technology platforms, for example, with voice-assisted search via TV remote controls and home security. We visited the MITRE Corporation, a federally funded research and development center and leader in air traffic safety and associated regulation. We toured several of their labs and talked with

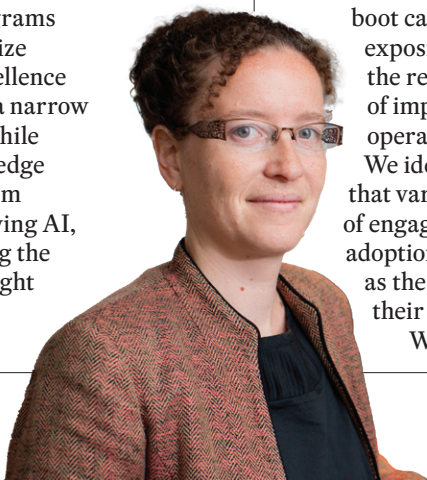
their technologists about evaluating the adoption of new AI and machine-learning tools in their systems.

Finally, we visited the Fairfax County Urban Search and Rescue training site, where the tools tend to be less technologically

advanced, but there’s an interest in exploring advanced decision-support systems that could improve their ability to rescue victims from collapsed structures. We focused on learning about their context and probing potential research opportunities.

What makes GW uniquely situated to do this kind of work and training?

Many of us came to GW for the opportunity to enjoy both rigor and relevance. It’s really rare to be able to do theoretical work and then walk down the street to your stakeholder (often NASA, for me) and share the importance of the research insight, which is something that I’ve enjoyed as a PI for years. With this program we’re trying to create these opportunities on a larger scale. The dean of our engineering school, John Lach, often refers to this as the school’s “engineering and...” approach. If we weren’t in D.C., engaging with stakeholders from day one, we would be solving different, likely less impactful problems, and our students would be having a very different Ph.D. experience. GWR





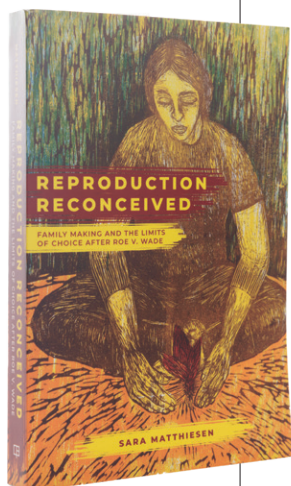
Sara Matthiesen

In 1973, the landmark *Roe v. Wade* decision redefined Americans' concept of choice. When the Supreme Court judgment legalized abortion, women won the right to control their reproductive freedom and choose not to have children. But as Sara Matthiesen, assistant professor of history and women's gender and sexuality studies, emphasizes in her book, *Roe* also transformed a second choice: having children.

In this new and timely history, Matthiesen shows how the effects of incarceration, for-profit health

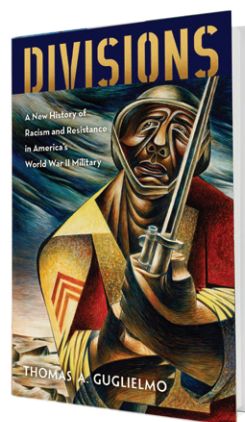
care, disease and poverty have been worsened by state neglect, forcing most to work harder to maintain a family.

"The reproductive rights battle doesn't start and end with abortion," Matthiesen said. "There is also a story to be told about how difficult we make it to have and raise children in this country."



***Reproduction Reconceived: Family Making and the Limits of Choice after Roe v. Wade* (University of California Press, 2021)**

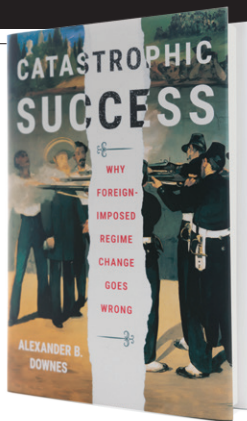
By Sara Matthiesen, assistant professor of history and women's gender and sexuality studies



***Divisions: A New History of Racism and Resistance in America's World War II Military* (Oxford University Press, 2021)**

By Thomas A. Guglielmo, associate professor of American studies

This first comprehensive look at racism within America's World War II military examines the complex division of African Americans, white Americans, Asian Americans, Latinos and Native Americans. In this book, Guglielmo looks at racism and resistance to racism in the military, from the enlisted personnel in the field to commanders in headquarters to civilian leaders in Washington.



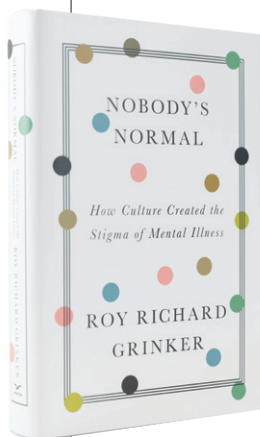
Catastrophic Success: Why Foreign-Imposed Regime Change Goes Wrong (Cornell University Press, 2021)

By Alexander B. Downes, associate professor of political science and international affairs
In "Catastrophic Success," Downes compiles all instances of regime change around the world over the past two centuries. Drawing on this impressive data set, he shows that regime change increases the likelihood of civil war and violent leader removal in target states and fails to reduce the probability of conflict between intervening states and their targets.

Nobody's Normal: How Culture Created the Stigma of Mental Illness (W. W. Norton & Company, 2021)

By Roy Richard Grinker, professor of anthropology, international affairs, and human sciences

More than 260 million people suffer from depression. Approximately one in 50 children in the United States is diagnosed with autism each year, and 25 percent of Americans meet the scientific criteria for a mental illness—not to mention the tens of millions



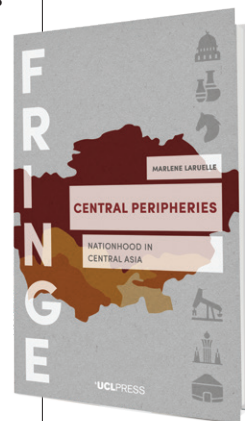
more who regularly suffer through waves of anxiety and sadness.

As Grinker checked off figure after figure in an undergraduate class, one student observed, "So, nobody's normal."

Not only had the student summarized the point of Grinker's lecture—in mental health, differences aren't always deficits—but she also gave him the title of his next book. In "Nobody's Normal: How Culture Created the Stigma of Mental Illness," Grinker reveals how centuries of moral judgments have fueled stigma against people with mental illnesses.

Few scholars are better qualified to cast a discerning eye on the history of mental illness than Grinker. He was raised among three generations of eminent psychiatrists. His grandfather was one of Sigmund Freud's last patients. And his books often draw on his personal history—from his daughter's autism diagnosis to his travels among hunter-gatherers in central Africa to conversations with his students—for illustrations of shifting cultural perceptions.

Grinker argues that we are at the cusp of a more accepting society, providing a hopeful outlook for people living with mental illness.



Central Peripheries: Nationhood in Central Asia (UCL Press, 2021)

By Marlene Laruelle, research professor of international affairs
"Central Peripheries" explores post-Soviet Central Asia through the prism of nation-building. It shows how states in the region have been navigating the construction of a nation in a post-imperial context, where Russia remains the dominant power and cultural reference.

Based on the principle that only multidisciplinary can help us to untangle the puzzle of nationhood, "Central Peripheries" uses mixed methods, combining political science, intellectual history, sociology and cultural anthropology. It is inspired by two decades of fieldwork in the region and a deep knowledge of the region's academic and political environment. GWR

An isometric illustration of a city scene. In the center, a large steam locomotive travels along a track, emitting thick black smoke that drifts across the sky. To the right, a large industrial building with a tall chimney also releases black smoke. The city is composed of various houses in different colors (red, green, orange, yellow) and styles, some with smoke coming from their chimneys. A large black circular structure, possibly a water tower or a large barrel, sits on a grassy area. The ground is a patchwork of green and yellow squares, representing grass and pavement. The overall atmosphere is one of environmental concern due to the visible air pollution.

AIR EQUALITY

An isometric illustration of a cityscape in shades of gray. In the center, a small red house with a chimney sits on a bright green rectangular patch of grass. The house's chimney emits a small plume of smoke. The surrounding city is composed of various buildings, some with smoke rising from them, and several large, dark, circular structures that resemble industrial tanks or silos. The overall style is geometric and modern.

FOR ALL

**THE MOST POLLUTED NEIGHBORHOODS
IN THE UNITED STATES ARE ALSO THE
MOST DISADVANTAGED. RESEARCH AT
GW AIMS TO SHINE A LIGHT ON THIS
INEQUITY—AND EFFECT POLICY CHANGE.**

**STORY // SARAH C.P. WILLIAMS
ILLUSTRATION // RAÚL ARIAS**





On a sweltering morning last July, the Metropolitan Washington Council of Governments issued a Code Orange alert for the D.C. metro area. The heat, topping 90 degrees most days that week,

was reacting with pollutants to make the air particularly smoggy. At the same time, wildfire smoke from thousands of miles west was blowing into the city. On the morning news, reporters cautioned people with asthma or heart disease to limit their time outside.

In five spots across the city, air quality monitoring stations took hourly measurements of man-made gases and particles circulating in the air. On that day—like many others—a sensor in the eastern corner of the city, along the busy Anacostia Freeway, registered the highest levels of fine particle pollution in D.C. Here, residents of Ward 7, more than 90 percent of whom are Black, are exposed to some of the worst quality air in the region, and July 21 was no exception.

In Ward 7 and other D.C. neighborhoods, poor air quality

is not just a nuisance—it has implications for the health of its residents. Susan Anenberg, an associate professor of environmental and occupational health and of global health at GW's Milken Institute School of Public Health, has been using data from NASA satellites to examine air pollution in cities. In D.C., she has found that the ZIP codes with the highest levels of fine particle pollution in the air are also the neighborhoods with the highest levels of asthma, lung disease and stroke.

Indeed, D.C.'s Ward 7, along with neighboring Ward 8, has 23 times the rate of emergency room visits for asthma than Ward 3, which stretches between the relatively affluent and white neighborhoods of Georgetown and Chevy Chase. Anenberg's data suggest that high levels of air pollution in the most disadvantaged urban neighborhoods across the country are intrinsically linked to poor health, even when sociodemographic variables such as education, employment and poverty rates are controlled for.

"Higher pollution-related health risks often line up with spatial patterns of racial segregation in D.C. and many other cities," says Anenberg.

Over the last 50 years, air quality across the United States as a whole

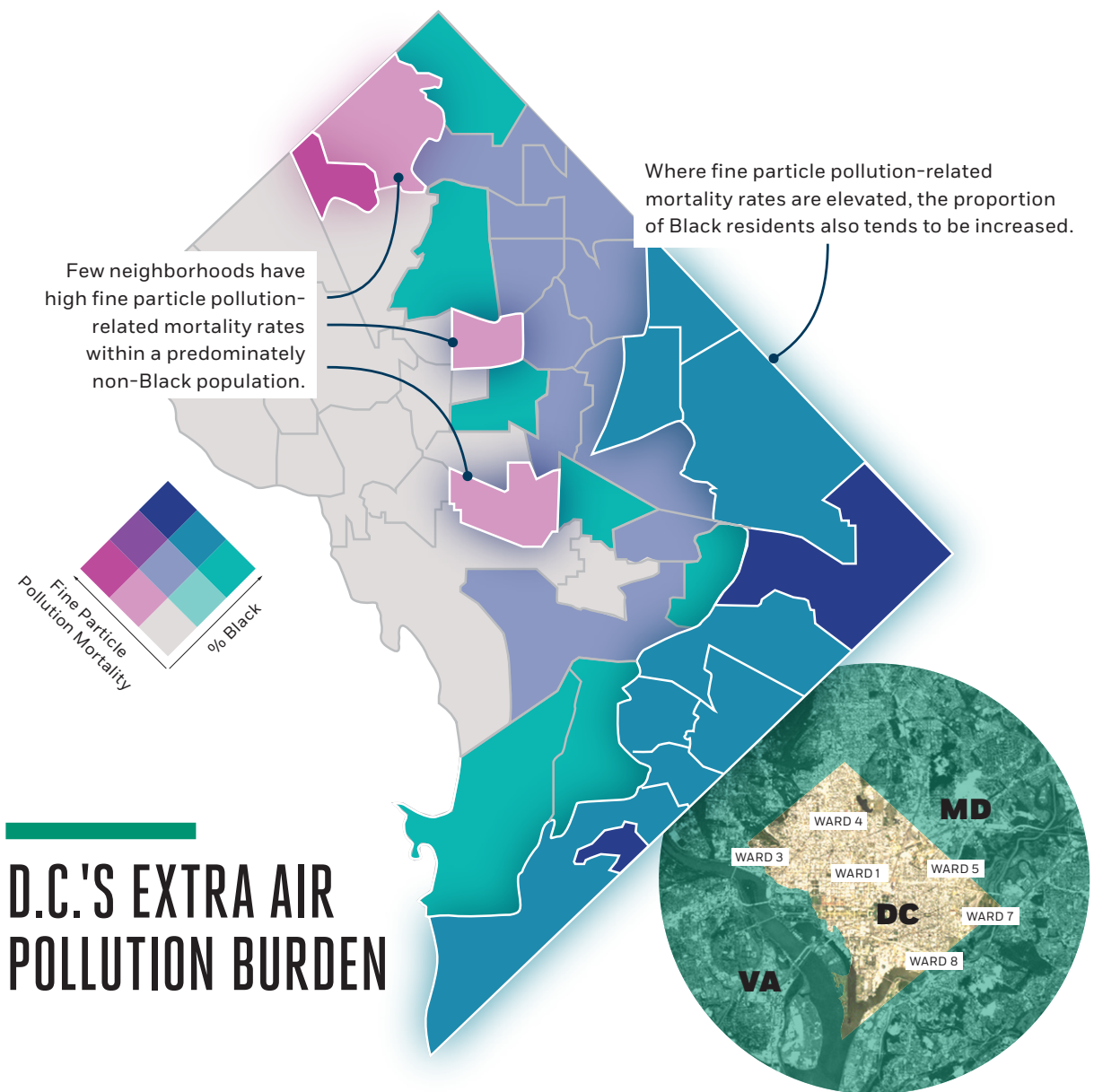


"HIGHER POLLUTION-RELATED HEALTH RISKS OFTEN LINE UP WITH SPATIAL PATTERNS OF RACIAL SEGREGATION IN D.C. AND MANY OTHER CITIES."

SUSAN ANENBERG

23x

THE RATE OF EMERGENCY ROOM VISITS FOR ASTHMA IN D.C. WARDS 7 AND 8 VERSUS THE MORE AFFLUENT WARD 3.



D.C.'S EXTRA AIR POLLUTION BURDEN

has improved, mostly thanks to the Clean Air Act and related legislation passed by Congress in the 1970s and 1990s, which empowered the U.S. Environmental Protection Agency to regulate the emissions of pollutants. But not everyone has had the same access to that cleaner air—air pollution is still worse for communities of color and those with lower income levels and educational attainment.

“The Clean Air Act and amendments that followed it have been very effective at bringing down air pollution in most places,” says Anenberg. “But it hasn’t brought

down air pollution equitably.”

Until recently, this inequity was mostly anecdotal, or measured only in health outcomes—researchers could cite the higher asthma rates in Black urban neighborhoods, for instance, but it was difficult to pin the degree to which pollution impacted that difference. Now, Anenberg and her colleagues are using spatially complete satellite data—rather than scattered ground monitors—to paint a neighborhood-by-neighborhood picture of air pollution, revealing the disparities in clean air. Their data can also, for the first time, offer policymakers

the quantitative evidence they need to start closing the clean air gap.

Anenberg has always wanted to make the world a healthier place. As a college student, she wanted to be a doctor. But when she started working in an emergency room, she saw the same patients show up with the same problems, again and again. She knew there must be a way to prevent their health problems outside of the hospital. She shifted focus from medicine to public health—and then discovered environmental health.

“It sounds cheesy, but I really wanted to know how I could have

the largest impact on the health of the most people possible,” says Anenberg. “I realized that environmental risk factors and climate-related risk factors have this huge effect on people’s health all around the world.”

Climate change impacts health in diverse ways, and air pollution, which is tightly coupled with climate change, compounds the health impact. The greenhouse gases in pollution trap heat in the Earth’s atmosphere, making temperatures rise. In turn, the warming climate causes shifts in both natural weather patterns and human behavior—from more forest fires and longer pollen seasons to increased use of air conditioners—that boost pollution.

As an air quality specialist at the Environmental Protection Agency during and after graduate school, Anenberg helped analyze the regulations set forth by the government to mitigate climate change and air pollution. But often, she says, there were holes in the data needed to back up policy change. Everyone knew that breathing air pollution was generally bad for health in all sorts of ways, for instance, but few studies had quantified the link between climate change and human health. That meant the cost-benefit analyses of new—often expensive—greenhouse gas-mitigation efforts overlooked a key variable in the equation: the health benefit.

“I began to recognize that there were major gaps in the evidence base, particularly when it came to the health outcomes of climate change, including its effects on air pollution, and these gaps were actually limiting our ability to implement policy change measures,” says Anenberg.

Those gaps led Anenberg to join the GW faculty in 2017. Rather than investigate air quality and climate change in an academic silo, her goal was—and still is—to involve stakeholders, such as local and national decision-makers and international think tanks, in every

“WE’RE REALLY TRYING HARD TO EXTEND OUR REACH BEYOND JUST RESEARCH AND MAKE SURE WHAT WE DO ACTUALLY INFORMS POLICY DECISIONS.”

SUSAN ANENBERG



THE GW CLIMATE & HEALTH INSTITUTE

36

FACULTY MEMBERS

10

GW SCHOOLS

**WITH EXPERTISE FROM
LAW, PUBLIC POLICY,
ENGINEERING, PUBLIC
HEALTH AND MEDICINE,
AMONG OTHER AREAS**

step of her research. Before she begins a new study, she wants to know that the results will be useful in effecting change.

At GW, Anenberg has not only launched numerous informal collaborations with researchers and clinicians across disciplines, but she has also spearheaded the formation of the GW Climate & Health Institute (CHI), which she now co-directs with other public health and medicine faculty members. Today, the chartered institute includes 36 faculty members from 10 GW schools. Their expertise ranges from law, public policy and engineering to public health and medicine. The institute’s mission echoes Anenberg’s own: to conduct policy-relevant and community-oriented research on climate change, human health and equity.

“We’re really trying hard to extend our reach beyond just research and make sure what we do actually informs policy decisions,” says Anenberg.



Every day, NASA satellites pointed at our own planet produce tens of terabytes of data on Earth’s conditions. The satellites not only see clouds, fires and changing land patterns but can also visualize pollution by measuring how much light is reflected from Earth. Since many cities only have a handful of on-the-ground pollution monitors, satellites help provide a more complete picture of how pollution varies across a region. Together, NASA’s satellites give snapshots of pollution levels within 1-kilometer-by-1-kilometer squares—a smaller area than the National Mall.

While NASA doesn’t use its data directly to inform policy, it does offer the data open access, and it works with policy-oriented researchers like Anenberg, who has received more than \$2 million from NASA since 2017.

“We actually require our grantees to be working with partners to assimilate their



observations into decision-making systems and policy,” says John Haynes, the program manager of air quality at NASA.

The NASA satellites, of course, can’t precisely measure every component of air pollution that’s hovering at the level people breathe. But they give accurate enough estimates of the major pollutants that come from vehicles, power plants and fires—the gases nitrogen dioxide, ozone, sulfur dioxide and carbon monoxide and the microscopic dust particles known as fine particle pollution.

Last summer, Dan Goldberg, an assistant research professor of environmental and occupational health, and Gaige Kerr, a research scientist in Anenberg’s group, led a study that used NASA satellite data to track how levels of nitrogen dioxide changed due to COVID-19 stay-at-home orders. Up to 80 percent of the nitrogen dioxide in urban air comes from vehicle traffic,

LEFT TO RIGHT Susan Anenberg, associate professor of environmental and occupational health and of global health; Kelly Crawford, associate director of air quality for D.C. Department of Energy & Environment; Catherine O'Donnell, M.P.H. candidate in global environmental health; and Anjeni Keswani, associate professor of medicine and director of the GW Allergy & Sinus Center.

and the researchers suspected that, with fewer cars on the road, levels of nitrogen dioxide would decrease. Indeed, in the 15 major cities studied, nitrogen dioxide plummeted in early 2020. But, as Anenberg has seen in other contexts, the improvements were uneven across neighborhoods.

During the pandemic shutdowns, the least white urban communities and those with lower income and education still had higher pollution levels than the average white communities had experienced pre-pandemic. The researchers’ explanation: Major roads are disproportionately located in marginalized neighborhoods, and although passenger traffic decreased with stay-at-home orders, heavy-duty trucking continued mostly unabated.

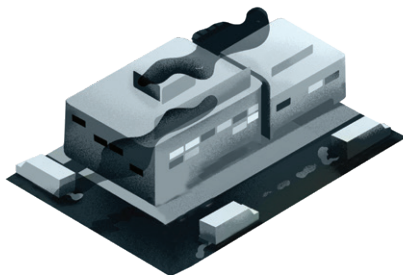
This inequity in air quality could even explain disparities in COVID-19 outcomes, says one of Anenberg’s CHI colleagues, Anjeni

Keswani, an associate professor of medicine at the GW School of Medicine and Health Sciences and director of the GW Allergy & Sinus Center. Keswani published a study last year that found one reason COVID-19 severity and death rates were higher in minority communities across the U.S. was that these communities are exposed to more air pollution. Breathing dirty air for many years, she says, can predispose people to lung inflammation. When these same people are then infected with COVID-19, their respiratory systems are more vulnerable. Just an increase of 1 microgram of fine particle pollution per cubic meter of air was correlated with an 11 percent increase in the COVID-19 death rate, Keswani found. (Last July 21, the difference in fine particle pollution between Ward 7 near the Anacostia Freeway and some other monitoring sites in the D.C. area was more than 5 micrograms per cubic meter of air.) The results held true in not just the United States but in Italy and China as well.

For individuals who live in polluted, disadvantaged neighborhoods, can anything—short of moving to a new house—be done to quell the risk of allergies, asthma and other respiratory illnesses? Keswani says people with allergies and asthma can keep closer tabs on pollution levels, even on days that aren't Code Orange.

"A lot of my patients are great at checking pollen counts and using that data to inform their activities for the day," she says. "But we still don't see a lot of people doing the same things for overall air quality measures."

To that end, Anenberg and Keswani are collaborating on a new air pollution guide for physicians. They present data linking air pollution to poor health; not just respiratory diseases but also cancer, cardiovascular disease, skin conditions and psychological disorders have been associated with pollutant levels. Additionally, they offer guidance on how primary care



11%

INCREASE IN THE
COVID-19 DEATH RATE
THAT CORRELATED
WITH A 1 MICROGRAM
(MCG) INCREASE IN FINE
PARTICULATE MATTER

5 MCG

THE DIFFERENCE IN FINE
PARTICULATE MATTER
PER CUBIC METER OF AIR
BETWEEN D.C.'S WARD 7
AND OTHER MONITORING
SITES LAST JULY

physicians can talk to their patients in routine clinic appointments about how air pollution might be affecting their health and what to do about it.

These kinds of efforts may seem small, but their effect shouldn't be understated, says Anenberg. Anything that helps decouple pollution rates from health effects can save lives. Closing the clean air gap, however, relies on larger collective action at the local, national and global levels. This January, Anenberg and her colleagues published new data that used satellite data to correlate nitrogen dioxide exposure with rates of childhood asthma. Worldwide, about 1.85 million new cases of childhood asthma could be attributed to nitrogen dioxide in 2019, her team calculated. The surprising part of the results: Pollution-associated asthma rates were estimated to be just as high in wealthy cities in North America and Europe as they were in more polluted cities in the developing world.

"We need both national-level policies and local action that result in less fossil-fuel combustion," says Anenberg. "The good news is that a lot of these interventions not only reduce greenhouse gas emissions and improve air quality but improve human health, save money and create jobs."



In D.C., the Department of Energy & Environment (DOEE) has welcomed Anenberg's collaboration to help guide its interventions against pollution. A November 2020 report by the U.S. Government Accountability Office found that, across the country, air monitoring agencies are currently underfunded, with budgets decreasing by 20 percent since 2004 despite increasing demands for air quality monitoring. DOEE is no exception in this belt tightening, with a 22 percent decrease in its overall budget just from 2020 to 2021. So academic research that

helps supplement its own research and policy is a big boon for the department.

“We’ve been very focused on supporting projects that are policy relevant,” says Kelly Crawford, associate director of air quality for DOEE. “It’s very intentional that we pull academic researchers in who can fill gaps in our own expertise and data.”

In one study, Anenberg and Maria Castillo, the study’s lead author and a former research associate of Anenberg’s, worked closely with Crawford’s team to carry out the analysis of how pollution varied across D.C. ZIP codes. Crawford says that before the collaboration with Anenberg and her team, she and her colleagues were familiar with which areas of D.C. were plagued with poor air quality—their on-the-ground monitors, health data and reports from community members gave them an idea of the disparities that existed. But the resolution from this information wasn’t good enough to pinpoint small sections of neighborhoods that were at most risk of health complications from pollution.

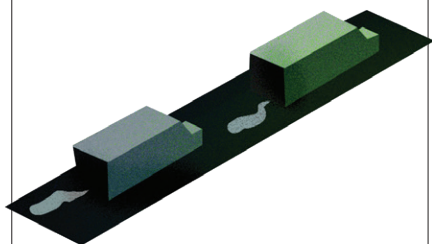
“If you think about the thermostat in your house, it gives you a general sense of how warm it is, but everyone knows that some rooms will be much warmer or colder than the thermostat says, and the thermostat doesn’t have the resolution to tell you, for example, whether one of your children has a fever,” Crawford says.

Teaming up with the GW research team to analyze NASA satellite data on D.C. pollution gave the DOEE a new higher-resolution picture of which D.C. neighborhoods had the highest levels of pollution.

“The results weren’t necessarily surprising for those of us who have lived in D.C. for decades, but they gave us a much better tool to communicate with stakeholders,” she says. “Until now, it was always anecdotal. Now, we can point to real numbers.”

**"WE'VE BEEN VERY FOCUSED
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IT'S VERY INTENTIONAL
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FILL GAPS IN OUR OWN
EXPERTISE AND DATA."**

KELLY CRAWFORD



For instance, in 2016, the U.S. Justice Department sued German automaker Volkswagen for using emissions-cheating software in its vehicles and withholding documents from investigators. Eventually, Volkswagen was ordered to pay billions of dollars in settlement money to car owners, environmental mitigation and clean-emissions infrastructure across the country. More than \$8 million of the settlement money was directed to D.C., with DOEE in charge of using the money to reduce nitrogen dioxide levels in the District.

“Even then, our plan for these funds prioritized equity and environmental justice by enhancing benefits for projects in historically overburdened communities,” Crawford says. She notes that the bulk of the settlement will be used to replace old diesel engines in Ward 5’s Ivy City, resulting in a 1 percent reduction in nitrogen oxide across the District.

“When developing the VW plan, we mostly used health data and demographic data to choose neighborhoods where we needed to reduce emissions the most. D.C. continues to be racially segregated, with communities of color concentrated in Wards 5, 7 and 8,” she says. “This is also where we see the highest instances of asthma and other health effects associated with poor air quality.”

Incorporating the satellite data helped them identify new neighborhoods (including those outside of Wards 5, 7 and 8) that wouldn’t have otherwise been included in the program. This allowed DOEE to tailor its work to a more granular level.

Other projects include funding electric street sweepers and buses; those vehicles will initially follow only routes in Wards 5, 7 and 8, where air quality disparities are greatest. They’re also working on a home asthma intervention that provides families of children with asthma with digital devices, educational materials, cleaning supplies and air filters to help

mitigate the effects of pollution.

“The data let us make our interventions much more focused,” says Crawford. “We know that we are targeting our efforts to the most vulnerable communities, which is something we couldn’t have said for sure even two years ago.”

The satellite data also underscored the need to continue tracking pollution at a higher resolution, to test whether disparities in clean air begin to close as interventions are rolled out. Crawford says her team is actively trying to increase the number of ground monitors across D.C., with the hope of eventually getting block-by-block information that beats even the satellite data. They started piloting this “hyper-local monitoring” project in three neighborhoods in spring.



Catherine O’Donnell, a Master of Public Health candidate in global environmental health at GW, was also inspired by Anenberg’s data on air quality disparities. She and two other graduate students, Perrin Krisko and Elizabeth Mason, wanted to help minority youth in D.C. collect and analyze their own air quality data—to not only pique their interest about how air quality might be impacting their own neighborhoods but also to empower them to lobby for change.

“We felt that involving young community members in monitoring air quality could help bring about locally relevant solutions,” says O’Donnell.

The trio won a Knapp Fellowship from GW’s Honey W. Nashman Center for Civic Engagement and Public Service to support this idea, and their project launched this spring as a partnership with the Latin American Youth Center River Corps Program, which aims to engage D.C. young adults in environmental stewardship.

While Anenberg’s studies have revealed just how unequal air pollution can be between

neighborhoods, O’Donnell says, scientists still don’t have good data on the public’s awareness of these disparities. That’s why her Knapp Fellowship project includes not only training for the River Corps youth but also interviews with the participants about their views on air pollution.

“There’s this gap in measuring people’s perception in this area,” says O’Donnell. “But if we can conceptualize how people are thinking about air quality and about their own exposure, I think we can spur education and action.”



For Anenberg and her colleagues at GW, their own stomping ground in D.C. is as good a place as any to test how their pollution research can help shape local regulations and initiatives, highlight disparities, change perceptions and help close the gaps in clean air. But their sights are set higher. Anenberg is working with the C40 network, a group of mayors in nearly 100 cities around the globe who share best practices when it comes to cutting emissions and curbing climate change. Based in part on her work in D.C., Anenberg and a large international team of researchers have developed models for the C40 cities to use to integrate air pollution data—from both satellites and ground sensors—into their planning.

The models and data help city leaders see that investing in carbon-neutral and energy-efficient technologies, in public transportation and bike paths, and in educational outreach not only reduces pollution but also has health and economic benefits. In the past year, several cities—including Accra, Addis Ababa, Buenos Aires, Guadalajara, Johannesburg and Lima—have used the team’s toolkit to incorporate air quality into their climate action plans.

In the end, Anenberg’s message for everyone—mayors and citizens alike—is that we need to burn less fuel. On the surface, that sounds

simple. But in practice, it’s more difficult. At least in the U.S., 50 years of air pollution policies have already curbed the biggest emissions sources. That means what is left will be harder, smaller cuts. It’s a challenge that Crawford and her colleagues in D.C. understand well.

“If you’re morbidly obese, it’s easy to get dramatic weight loss right off the bat by cutting the biggest culprits in your diet,” she says. “Maybe you replace soda with water; that’s simple, cheap and easy. But when you only have a few pounds left to lose, all of the choices tend to be much harder. You don’t have those big things left to cut.”

In Ward 7—and other similarly disadvantaged communities across the United States—changes to air pollution are bound to be slow; traffic along the Anacostia Freeway won’t suddenly disappear or stop emitting fumes. But electric buses and street sweepers and tougher standards for vehicles can, over time, help. And education and interventions that reduce the health risks of pollution can boost a community’s well-being even when air remains dirty.

For her part, Anenberg remains positive. She thinks her work, both analyzing pollution data and her efforts to communicate it, can make a difference.

“It can be frustrating to see a lack of action, but it really just doubles my motivation to improve the evidence base and ensure I’m communicating widely to people so that everyone understands the massive improvement in public health that could come from less fossil-fuel combustion.”

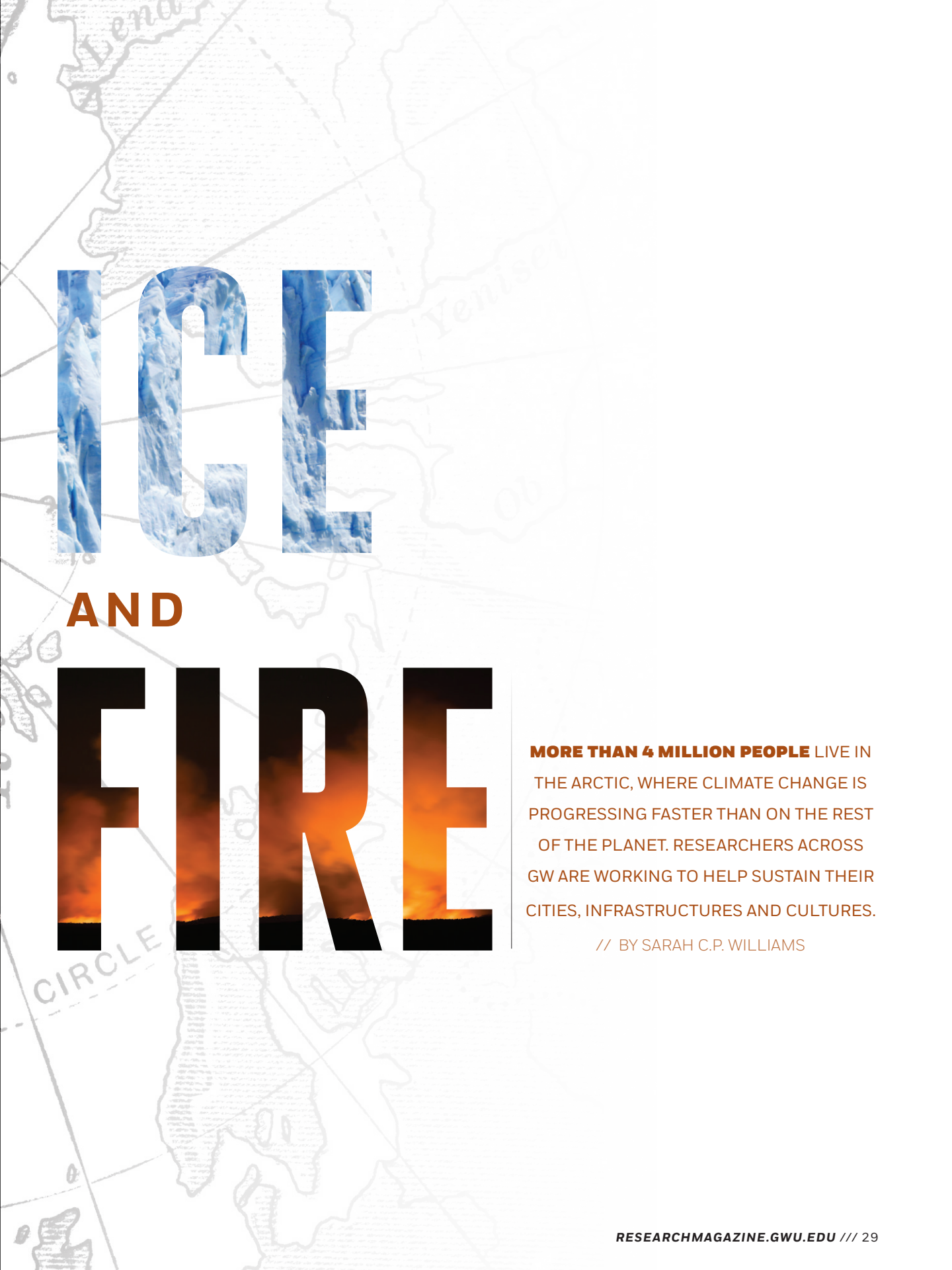


Scan to hear more from Susan Anenberg and Kelly Crawford about the importance of community collaboration in research.

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ICE

AND

FIRE

MORE THAN 4 MILLION PEOPLE LIVE IN THE ARCTIC, WHERE CLIMATE CHANGE IS PROGRESSING FASTER THAN ON THE REST OF THE PLANET. RESEARCHERS ACROSS GW ARE WORKING TO HELP SUSTAIN THEIR CITIES, INFRASTRUCTURES AND CULTURES.

// BY SARAH C.P. WILLIAMS

drivers away. (Counterintuitively, extra snow on top of an ice cellar can insulate and warm it.)

But the thawing *siguaq* are the almost literal tip of the iceberg when it comes to the challenges currently facing the people who call the Arctic home. With climate change, urbanization, political tensions, changing tourism and the boom-bust cycles driven by resource extraction, the Arctic is a place of upheaval. Unusual storms, increased wildfires, landslides, poor air quality and collapsing buildings are just some of what people there have faced in recent years.

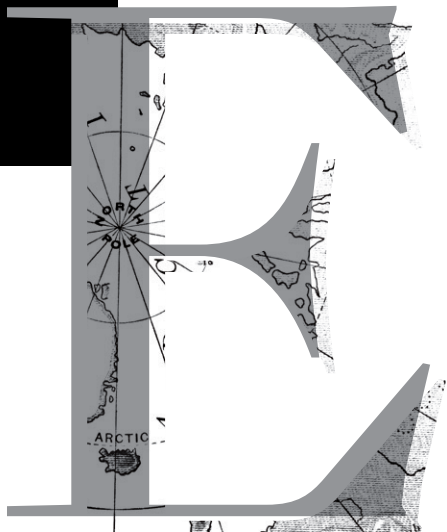
The Arctic is “the canary in the coal mine,” says Robert Ortung, research professor of international affairs at GW. “What happens up there in the north is what’s going to happen to the rest of the planet next.”

In 2016, Ortung spearheaded the Arctic Partnership for International Research and Education (PIRE) project, an international research network based out of GW that aims to promote greater urban sustainability in the Arctic.

The project was funded by the National Science Foundation (NSF), which, in 2016, unveiled “Navigating the New Arctic” as one of its “10 Big Ideas”—grand challenges that identified areas for investment at the frontiers of science and engineering. In the Arctic, the federal agency sought to spur multidisciplinary research that would advance understanding of the local and global effects of a rapidly changing region.

Since 2016, more than a dozen scientists across eight schools at GW have received approximately \$8 million in funding for Arctic research, much of it from NSF. They study areas ranging from geography, electrical engineering and transportation to politics and infectious disease.

GW Geography Research Scientist Vera Kuklina, for example, is leading a new NSF-funded project to study Arctic



EVERY YEAR, crews of Iñupiat men paddle from the northernmost reaches of Alaska into the Arctic Ocean in search of walrus, seals and bowhead whales. They float their catches back to land and—stocked with enough meat to last many months—lower it deep into the frozen ground.

In recent years, however, these ice cellars—or *siguaq* in Iñupiaq—have started to collapse, threatening the food security of entire communities. And it’s not just in Alaska. Ice cellars used by subsistence hunters in northern Siberia are also disappearing or decaying as the ground warms, says Dmitry Streletskiy, an associate professor of geography at GW.

“Imagine that you have a freezer—minus 18 degrees, and it becomes minus 15, minus 12, minus 10 and then minus 4. The meat is still frozen, but already some bacteria, mold starts to grow.”

To help intervene, GW researchers installed temperature monitors in traditional Iñupiat ice cellars in Utqiagvik, Alaska. They also mapped the cellars—71 in total—to help direct snowplow



“frozen commons”—ice, snow and permafrost landscapes collectively used and managed by Indigenous peoples, local communities and governments. Kuklina comes from a nomadic, Mongolian-speaking Indigenous group in Russia and is passionate about including local people in research and planning.

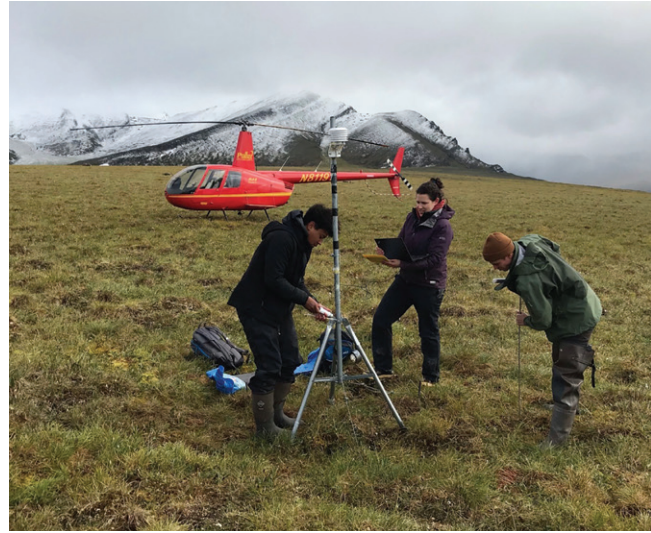
“There’s a lot of knowledge that isn’t written down anywhere but exists about how people in the Arctic have adapted and kept in balance relations with their environment,” she says.

The Arctic is a diverse place, of course—small towns in Alaska may, on the surface, have almost nothing other than their latitude in common with industrial cities of Siberia. But when you look deeper at the political fabric of Arctic locales, you find connections, Ortung says.

“Throughout the Arctic, the drivers of change right now are the climate and the demand for resources,” he says. “Those shape everything we do.”



LEFT Kelsey Nyland (second from right), a research scientist in the GW Department of Geography, led students in mapping Iñupiat ice cellars in Utqiagvik, Alaska. **BOTTOM RIGHT** Nyland (center) and students measuring permafrost thaw on Galbraith Ridge on the Alaskan North Slope.



The Arctic Circle wraps the globe at the 66th parallel, a line that cuts through Canada, Russia, Finland, Sweden, Norway and the top quarter of Alaska. Almost the entirety of Greenland falls inside the Arctic Circle, while only a handful of Iceland's most northern peninsulas stretch into it, like fingers grazing a bowl. Above this imaginary line is the Arctic—land of the midnight sun and polar night. Here, the summer solstice is marked by 24 hours of constant daylight. On the winter solstice, the sun never appears.

At times, scientists have used summer temperatures, the edges of forests or the presence of sea ice to define the boundaries of the Arctic. But as the climate changes, these boundaries shift far from the 66th parallel. Areas historically considered Arctic by these standards are now too warm, watery or green.

"No region of the world is

warming as fast as the Arctic," says GW Professor of Geography Nikolay Shiklomanov. "I've been going there for almost 30 years, and you can see the change every year. It's hard not to notice it."

Indeed, the Arctic Council, an intergovernmental forum that addresses issues faced by Arctic governments and Indigenous people, concluded that the Arctic is warming about three times as fast as the rest of the planet. As the air warms, so too do the ground and the sea. Glaciers and sea ice retreat, and the dark open ocean absorbs more heat from the sun than the reflective ice and snow once did, increasing the water temperature and melting ice further. Partially decomposed plants and animals begin to decay again as the soil around them thaws—they too hasten climate change by releasing methane into the air.

Most people know some of this science—they can tell you that somewhere in the north, glaciers are melting, releasing water that

laps hungrily at coastlines around the world. But, in the 2016 NSF-funded Polar, Environment, and Science survey, more than half of all Americans failed to recognize that the U.S. has any territory or people in the Arctic at all—let alone that an area of Alaska nearly the size of California lies inside the Arctic Circle.

"Alaska shouldn't be shrunk into a box on the side of U.S. maps," Streletskiy says. "It makes it so disconnected. This is part of our country."

Still, even if we are an Arctic country, why does this region matter so much? In other words, why should we care?

"There's this perception that the Arctic is this white, uninhabited place with polar bears. But there are cities there. There are industries and people and communities. The economy of the Arctic is the size of the economy of Malaysia," Streletskiy says.

Although that survey on Arctic perception didn't ask, most

Americans likely wouldn't correctly guess that, across eight countries, 4 million people live in the Arctic. The region includes 10 cities with populations of at least 30,000—the size of Alaska's capital city, Juneau (which itself lies about 600 miles south of the Arctic Circle).

Some of the reasons we should care about the Arctic are the same reasons we should care about anywhere—compassion for our fellow humans and a desire to preserve the diversity of spaces, flora and fauna on our planet, Streletskiy says. But others are more tangible and self-serving.

“Changes in the Arctic affect everything else globally,” he says. “It’s the kitchen of the climate.”

He means, of course, that the weather in the Arctic shapes weather patterns around the globe. Not only do melting glaciers feed rising sea levels, but warmer Arctic air and water affect trade winds and weather systems as far away as the equator. A warmer Arctic means more droughts and severe storms for all of us.

Moreover, Streletskiy adds, the lessons we learn in the Arctic can be applied elsewhere. Best practices to slow coastal erosion in Norway might also be useful in Florida. Lessons on sensing wildfires in Alaska surely have application in Los Angeles. And, ultimately, if researchers can make the Arctic—an isolated land of unpredictable fire and ice—a sustainable place to live, then maybe the rest of the world has a shot.

Shiklomanov has been visiting the same places in northern Alaska for so long that he talks about the journey to get to them in the same tone he might describe an outing to the grocery store. The trip, however, involves helicopters, hundreds of miles on dirt roads and backpacking—sometimes hiking 10 miles a day—to remote field sites. “We have to carry guns for protection against bears,” he says.

Shiklomanov, in collaboration

with Streletskiy, studies permafrost—soil or sediment that remains frozen year-round. Once, permafrost was considered permanent, hence its name. Now, however, much of it is thawing and the implications are far-reaching. Melting ice embedded in permafrost causes ground surface deformation and collapse, changes drainage patterns and triggers landslides.

“For decades, permafrost has been treated as relatively solid ground for pipelines, roads and buildings,” says Shiklomanov. “Now, when the permafrost thaws, that ground can collapse.”

A team of GW researchers led by Shiklomanov wants to better understand the process by which permafrost thaws, and how this weakening of the natural landscape affects the people and cities of the Arctic. Team members have been monitoring permafrost changes by measuring ground temperature and the depth of summer thaw at a large number of sites across the Arctic. Some sites that were established to represent grassy tundra a mere five or 10 years ago are now covered with knee-high shrubs. The change

in vegetation is another sign of the warming climate, with thicker shrubs making permafrost more resilient than once thought and insulating the ground from summer heat.

“In the 1990s, we had this assumption that as the climate warmed, the permafrost would thaw quite fast,” says Shiklomanov. “Now we’re finding that it’s surprisingly robust.”

But there’s a tipping point to permafrost robustness, Shiklomanov notes. The thawing of permafrost doesn’t happen at a reliably steady pace. Instead, it can warm slowly until it hits a threshold—and then it can thaw quickly and dramatically, affecting the stability of the landscapes and infrastructure built on them.

As part of another NSF-funded project, Shiklomanov and his colleagues will monitor the permafrost-affected landscapes in order to better understand the relations between climate and permafrost and to identify areas threatened by permafrost thaw.

For years, Streletskiy has been sounding the alarm about the



damage that warming permafrost can do to the Arctic's urban areas. In Igarka, a shrinking lumber town in northern Siberia, buildings constructed during the mid-20th century—the town's heyday—are now crumbling as their foundations sink into degrading permafrost.

In the early 2000s, the government resettled more than a thousand people whose homes in Igarka were collapsing. The same, Streletskiy says, will happen in dozens of other Siberian outposts, where—for many years—posts were pounded into permafrost as if it were concrete.

"We've been telling people to pay attention for two decades," he says. "But these local decision-makers have other things keeping them busy."

One of the reasons it's so easy to ignore, Streletskiy explains, is that thawing permafrost is like ice cream on a stick. For a while, it can warm up and keep its shape. You don't notice that it's losing stability. Then all of a sudden (and often too late to save infrastructure), it starts to slide. It's the same idea of a tipping point that Shiklomanov's data showed.

"You might not know that your house is on this unstable permafrost unless you measure it," Streletskiy says. "It

might look okay until it's not."

In 2019, using some of the data that he and Shiklomanov had collected from hundreds of boreholes drilled into the Arctic permafrost, Streletskiy worked with economists to model the future effect of thawing permafrost on the Russian economy.

By 2050, they concluded, the cost of replacing damaged buildings and infrastructure could add up to more than \$67 billion. Those dollar signs, he says, began to catch some policymakers' attention.

Then, in mid-2020, a diesel oil tank collapsed at a nickel mine in Norilsk, less than 150 miles north of Igarka, and 21,000 tons of oil leaked into the Ambarnaya River. The assumed cause of the collapse: The permafrost around the tank had thawed and given way.

A week after the spill, the Russian government announced that it would begin inspecting other potentially dangerous infrastructure at risk from permafrost changes.

"They didn't pay proper attention to the permafrost, and I hope this changes that," says Streletskiy.

In 2019, gusts of wind sent a tree careening onto power lines near

Anchorage, Alaska. The lines—pulsing with electricity—hit the dry undergrowth below and sparked an immediate fire. Within a day, 52 homes and three businesses had burned to the ground. As the fire spread over subsequent days—eventually burning more than 3,000 acres—additional trees collapsed on power lines and poles. It took weeks for power to be fully restored to the region.

Every summer, hundreds of wildfires burn millions of acres in and near the Arctic. They blanket the region in smoke, lower air quality and destroy forests and structures. They affect millions of people's lives. Orttung's group ran focus groups in 2020 and 2021 to better understand the impacts of wildfires on Arctic communities.

"You don't know that [the smoke] is affecting you until you wake up in the morning with a sore throat or scratchy throat," said one participant in Alaska.

"You can be cut off from family and friends and shops," said another from Sweden.

These fires have happened for decades—the Alaska Fire Control Service was established by Congress in 1933 in response to the number of fires in the state. But now, like fires in many places around the world, they're



getting worse.

“Record-breaking temperatures and the resulting dried-out vegetation in Alaska have fueled major fires in recent years,” says Payman Dehghanian, an assistant professor of electrical and computer engineering. “Such events are projected to increase in both frequency and magnitude.”

Dehghanian received an NSF grant in 2020 to study the interactions between wildfires in the Arctic and energy grids, including Alaska’s unique network.

In the mainland United States, Dehghanian explains, a power outage in one area can often be solved—even in advance of repaired power lines—by rerouting energy from another area. But in Alaska, there are more than 200 remotely powered, isolated villages; if a wildfire or ice damage breaks the single line connecting one of these villages to their power source, they often lose power for days until the failure is fixed.

Dehghanian, through conversations with engineers, social scientists, local utility companies, firefighters and policymakers, has been trying to wrap his head around how to break the cycle of electrical grid damage and wildfires in these remote places.

“On the one hand, the energy network can trigger wildfires when wires fall,” he says. “On the other hand, the fires can damage the energy network.”

The problems associated with numerous and lengthy power outages, Dehghanian says, can be solved in part with investment in mobile and renewable power sources—including backup generators, battery storage units and mobile wind turbines. (Solar energy can be difficult to obtain during the smoky conditions of a wildfire). But better sensing and monitoring—of both wildfires and the electric grid—would go further toward preventing outages and damage in the first place, he thinks.

Dehghanian is working on new technology that might be especially

useful in Alaska: an intelligent system that senses a broken power line and, in the split second before the live wire falls to the ground, isolates the section of wire and automatically cuts off the electricity flowing through it.

“By the time the wire hits the ground, there is no electricity, and there is no risk of sparking a fire,” Dehghanian says.

Learning about how this kind of innovative solution might be applied in Alaska can go far in not only helping lessen the effect of wildfires on Alaskans but also in deploying such technologies in other places—from California to Brazil and Australia.

“When we first started working on this project, our goal was to learn from other parts of the country and the world and apply that knowledge to Alaska,” says Dehghanian. “But we found there are also opportunities for others to learn from Alaska. These solutions that we will be trying on detection, prevention and mitigation can be applied elsewhere.”



Norilsk—the Russian city where an oil tank collapsed into thawing permafrost—is known for something else. Blanketed in black snow at times with air that tastes of rotten eggs, it’s been called the world’s most polluted city. And it’s not the only northern locale plagued with smog. In recent years, Fairbanks, Alaska (which lies outside the Arctic Circle but is often considered a gateway to the Arctic), has topped a list of most polluted cities in the United States published by the American Lung Association.

Like other problems exacerbated by the dual threat of climate change and urbanization, Arctic pollution is getting worse. Throughout the early 2000s, Fairbanks averaged between five and 10 days a year with unhealthy air; between 2017 and 2019, the average was 35 days.

“It’s counterintuitive because we think of the Arctic as this pristine place,” says Susan



Anenberg, associate professor of environmental and occupational health and of global health at the Milken Institute School of Public Health and director of GW’s new Climate & Health Institute.

Despite its vast wilderness, the Arctic has a confluence of stagnant air, wood smoke and pollution that drifts northward from the rest of the planet. In industrial cities of Siberia, like Norilsk, pollutants spew from mines and factories, puffing black smoke into the air. But even small Arctic towns in Alaska and Scandinavia struggle with air quality.

“Even though we’re generally talking about small towns and cities, wood combustion is pervasive in the Arctic,” says Anenberg. Some of that wood combustion comes from wildfires, but it also comes from the Arctic way of life. People heat their homes with wood, cook on wood and smoke fish on smoldering wood.

That’s not all. In most places around the world, the air is colder the higher you go. In some places in the Arctic, the air is frequently inverted, with a layer of warm air on top, trapping pollution in place. It’s one of the reasons that air quality models, designed to simulate how proposed policy changes might affect air quality, are hard to apply



to Alaska.

“A lot of our analytical tools don’t work in Alaska,” says Anenberg. Instead, she says, scientists like her must assemble new models from the ground up—a painstaking task that slows research.

With Orttung, Anenberg is carrying out studies on how forest fires and climate change affect air quality and, in turn, public health. Anenberg is analyzing recent wildfire episodes in conjunction with local medical records to see whether worsening air quality causes more people to die. This kind of analysis might help answer one of her lingering questions: Is burning wood more or less toxic than other kinds of pollution?

“Here in D.C., most of our pollution is from industry and vehicles. We’re burning a lot of natural gas, gasoline and diesel, but we’re not burning very much wood, so we just can’t study it,” says Anenberg. “In the Arctic, we have the ability to study pollution from wood combustion, and that can help us improve our models elsewhere.”

And it’s not just the air quality affecting health in the Arctic. The presence of infectious diseases and the changing burdens on the health system are shifting as well, says infectious disease physician Hana

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NIKOLAY SHIKLOMANOV

*PROFESSOR OF GEOGRAPHY,
COLUMBIAN COLLEGE OF ARTS
AND SCIENCES*

Akselrod.

An assistant professor of medicine at the School of Medicine and Health Sciences, Akselrod has introduced lectures on climate change and health into the medical school curriculum. Her interest in the topic began with curiosity about how climate change affects

infectious diseases—by changing the geographic range of disease-carrying insects, for example—but quickly grew broader.

Akselrod, who is collaborating with Dehghanian on a study to understand forest fire impacts (for example, fires connect climate change to asthma rates), shifted gears when COVID-19 began. Over the course of 2020, she has been collaborating on a study to look at Juneau’s response to the pandemic.

After her infectious disease residency in Maine, Akselrod thought she had some insight into what it’s like to live in a cold, coastal environment with isolated medical care and self-sufficient communities. “But whatever challenges we had in Maine, they’re amplified by several orders of magnitude in Alaska,” she says. “COVID was this opportunity to get some real insight into how an emerging infectious disease impacts a community like this.”

Community cohesion, strong communication as well as the Indigenous historical memories of the 1918 flu—which disproportionately affected Native Alaskans—helped Juneau respond relatively effectively to the pandemic, Akselrod says.

“Looking at a small, contained



community with a lot of resilience afforded us an opportunity to look at where things went right, and how the community adapted when things didn't go right," she says. "I think this is key to charting a course through not only COVID-19 or the next pandemic but also to the greater threats to health that are coming with a rapidly changing climate and destabilized natural environment."

She points to a recent mysterious anthrax outbreak in Siberia that was traced to thawing permafrost. Anthrax spores had hidden, frozen in the icy ground, for years—perhaps decades. When the permafrost began to warm, the spores came alive again, a kind of zombie bacteria. Grazing reindeer picked up anthrax on the tundra and spread it to dozens of people.

Ultimately, the changing pressures on the Arctic are changing what it means to live in the far north. Researchers like Orttung and Kuklina want to know how, in the face of these changes, Arctic cities—and entire cultures—can survive. Orttung, again and again, comes back to the idea

A sunken road in Siberia built on thawed permafrost. Wildfires ravaged the forest, and smoke obscures the sun and horizon.

of sustainability. He is trying to understand how to make Arctic cities more sustainable—and how to gauge their sustainability in the first place.

"In the Arctic, but also elsewhere, sustainability means making cities where people can live in a way that doesn't make it difficult for the next generation to live in the same way," Orttung says. "It means not using more resources than you consume."

Researchers around the world use urban sustainability indicators to help determine how sustainable local governments are. But in 2020, Orttung reported that one of the most commonly used of these indicators—an index known as ISO 37120 that measures city services and quality of life—is only useful as a starting point for Arctic cities.

"In a lot of ways, Arctic cities aren't that different," he says. "But these international standards don't take things like permafrost and extreme isolation into

consideration."

To help build new indicators that can be used to design more-sustainable communities in Alaska, Orttung is collaborating with Jim Powell, an assistant research professor at University of Alaska Southeast and former deputy mayor of Juneau. Powell has lived in Alaska for 45 years and seems to know just about everyone in the state doing anything related to sustainability.

"You can't manage something unless you can measure it," Powell says. "But if we want to get local decision-makers on board, we also need to keep it simple."

Frequently used indexes like ISO 37120 include more than 100 sustainability indicators. Powell points out that most local governments don't have the time or patience to track this many indicators. He and Orttung recently contributed to a sustainability plan for Fairbanks and homed in on just three indicators for city officials to follow: food, energy and waste.

Orttung has carried out research on, among many other topics, how to make Arctic recycling programs cost efficient, what factors affect the sustainability of solid waste management programs, how to boost food security in northern Alaska and how cruise ship tourism is affecting the economies of Arctic cities.

He's found that the more people in a city turn out to vote in elections, the better the city seems to rank in measures of sustainability. It's one of the reasons he and Powell strive to involve local stakeholders—from farmers and Indigenous groups to city council members—in their work.

Powell and Orttung push for what Powell calls "co-design." As he defines the term, "it means you involve locals from the beginning."

It's a sentiment that Kuklina, as she studies local knowledge in the Arctic, strongly agrees with. Kuklina says that much of her work couldn't be done at all without close-knit ties to Siberian locals. One of

her most recent projects involved mapping an entire network of informal roads that snake through Arctic forests in Russia.

"This project actually happened because I was up there doing something different, and people just kept talking about all these roads that didn't exist on maps and how important they were for locals," she says. "I realized that nobody usually took them into consideration for environmental planning."

To map the roads, Kuklina had to find them—that required tips from local hunters who regularly use the roads. Some, she found, were roads long ago established by oil and gas companies and believed to be abandoned. Others were widened from animal paths, and some had originated from long straight stretches of forest cleared for forestry or power lines.

"What I found was that these roads have a big impact on all sorts of things, from animal migrations to forest fires," says Kuklina. "And nobody other than the locals had paid attention to them before."

Her backcountry travels on these informal roads—which often involve broken-down off-road vehicles being tinkered with before the trips can progress—have also given her a glimpse at the effects of climate change. The roads and shoulders of the roads, most of which are built on permafrost, are cracking and drooping. Rivers, she says, are becoming shallower because of climate-related changes to water flow. The hunters who guide her in the forested taiga tell her that plummeting fish and animal populations are making them abandon traditional hunting and consider moving to larger cities.

Now, Kuklina has turned her attention to how local communities use and manage green and blue spaces and, when they are covered with snow and ice, "white space." Like Orttung and Powell, she thinks that studying the sustainability of Arctic towns and cities can help inform us about creating a more sustainable world.

Nearly all the researchers say they wish more people appreciated the Arctic's importance. Not just its natural beauty—icebergs on a nature documentary or glaciers viewed from a cruise ship window—but the diversity of people and cultures, its unique urban fabric and the outsized challenges the region faces.

That's one reason GW Associate Professor of International Education and International Affairs Laura Engel launched #60above60, a program that pairs students in Washington, D.C., with students living above the 60th parallel in Alaska, Norway, Canada, Finland and Russia.

"I think it's valuable for students who live at a great distance from the Arctic to see how their lives and their communities are intimately connected to what's happening in the Arctic," says Engel.

Through the program, students create and share 60-second digital stories that relate to the environments of their homes and

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ROBERT ORTTUNG

RESEARCH PROFESSOR OF
INTERNATIONAL AFFAIRS,
ELLIOTT SCHOOL OF
INTERNATIONAL AFFAIRS

communities. Engel and her GW graduate students are now studying whether the program informs students' pro-environmental behaviors and ability to connect what's happening around the globe with their own local community. The researchers are still analyzing data from student participants.

"What we hope," Engel says, "is that this kind of program leads to enhanced perspectives about how different communities live, how their communities thrive, and that it contributes to young people's deeper thinking about sustainability and conservation."

Engel would like to eventually expand #60above60 and involve college students in these kinds of global exchanges. Everyone, she says, could benefit from learning more about the ways their lives are connected to what is happening in other places.

Orttung agrees and cites signs of momentum. The Biden administration, for example, has signaled it wants to make science and the input of Indigenous people a higher priority in U.S. Arctic policy. The five new commissioners and one reappointed commissioner to the U.S. Arctic Research Commission (USARC) reflect a significant shift: One-third of the current commissioners are now Indigenous, half are women and two-thirds live in Alaska.

"The consequences of global Arctic [policy] ripple all over the world," said newly appointed USARC Chair Mike Sfraga in a statement. "It's very refreshing to see the United States leaning forward like this."

The new officials also said they plan to address issues around economic development, infrastructure, shipping, tourism, sustainability and food security in U.S. policy.

"You would hope people would think through the fact that our whole planet is interconnected," Orttung says. "Even though the Arctic is far away, it still has an impact on our daily lives." GWR

CLOSING AMERICA'S HOMEOWNERSHIP GAP





STORY // SARAH C.P. WILLIAMS

BOOSTING HOMEOWNERSHIP AMONG BLACK PEOPLE IN AMERICA BEGINS WITH OWNING UP TO A HISTORY OF RACIAL DISCRIMINATION IN THE REAL ESTATE AND MORTGAGE INDUSTRIES, SAY GW RESEARCHERS STUDYING THE HOMEOWNERSHIP GAP.

IT HAS FUELED THE AMERICAN DREAM,

inspired settlers to conquer new lands and motivated generations of young people to save a bit of each paycheck: the desire to own one's own home. In recent years, homeownership rates have increased by record amounts, even as home prices surge faster than inflation. But not everyone is riding this wave.

The latest data from the U.S. Census Bureau shows that for nearly three-quarters of non-Hispanic white households in this country, homeownership is a reality. For Black Americans, however, it remains a dream for the majority; only 43 percent of Black households live in a home they own. This homeownership gap—a 30 percentage point difference between non-Hispanic white and Black homeownership rates—is as large as it has been in 120 years. It is also intrinsically linked to the growing wealth gap between Black and white Americans, says Vanessa Perry, a professor at the GW School of Business. White households have a median net worth at least 10 times that of Black households, according to a report she co-authored in 2020 for the National Association

75%

of non-Hispanic white households that are homeowners

43%

of Black households that are homeowners

of Real Estate Brokers (NAREB).

“The wealth gap is really the homeownership gap,” she says. “We’re seeing young Black people who graduate from college and are able to get good jobs but are still falling behind their similarly situated white counterparts because their parents and grandparents weren’t homeowners and didn’t accumulate the same kind of wealth.”

It’s a Catch-22, of course. Those with the benefits of intergenerational wealth have the easiest path to becoming homeowners, which leads to more wealth. Perry wants to break that cycle—or at least give Black people a chance at joining it.

For decades, policymakers blamed the homeownership gap on other disparities—from education to employment. But improvements in these areas over the course of the 20th century barely moved the needle. Now, says Perry, it’s time for the country to face up to the much deeper roots of the gap: years of discrimination and exclusionary policies in the mortgage, housing finance, insurance and real estate industries that are still reverberating today.

“The solutions to the homeownership gap that have been tried so far haven’t worked because they haven’t addressed the underlying problems; they’ve skirted around them,” says Perry. “I hate to talk about reparations because people think it’s such a dirty word and shut down when they hear it, but at this point we need approaches that are directly enabling first-generation Black homeowners.”

Perry, who previously worked for the mortgage giant Freddie Mac, the U.S. Department of Housing and Urban Development (HUD) and the U.S. Consumer Financial Protection Bureau, now studies the homeownership gap. She and other researchers at GW use economic modeling, consumer research and public policy collaborations to probe the underlying causes of the gap, devise potential solutions to narrow it, and ask why—or whether—homeownership matters in the first place.

“I think academics have the freedom to ask bigger, bolder questions about the homeownership gap than a lot of economists working for agencies and banks,” says Janneke Ratcliffe, vice president of the Housing Finance Policy Center at the Urban Institute, where Perry is a visiting fellow. “Engaged scholars like [Perry] are in a position to really push the envelope for all of us on how we tackle these issues.”

CUMULATIVE DISADVANTAGE

President Franklin Roosevelt called real estate “about the safest investment in

the world” and, in the midst of the Great Depression, established the Federal Housing Administration to revive mortgage lending—at least for white Americans. Mortgages remained still largely unobtainable for Black Americans, in part due to how lenders and agencies interpreted a set of maps that

“redlined” Black neighborhoods across the country, categorizing them as risky investments.

Since then, numerous policies and initiatives have aimed to boost Black homeownership rates; most notably, the Fair Housing Act, signed into law in 1968, prohibited discrimination in the sale, rental and financing of housing.

Yet, in the NAREB-commissioned 2020 State of Housing in Black America report, Perry and her co-authors documented just how far the United States still is from meeting the goals of equity outlined in the Fair Housing Act. Black

homeowners pay higher interest rates and higher insurance rates than white homeowners; their houses have lower values and appreciate more slowly. In an Urban Institute article published earlier this year, Perry and her colleagues calculated that Black mortgage applicants are more likely to be denied than white applicants—even Black applicants with incomes more than 150 percent of the area median income (AMI) have a higher denial rate than white applicants with incomes less than 80 percent of the AMI.

The denials aren’t generally fueled by overt discrimination, but rather by engrained practices in the mortgage industry that make it hard for Black Americans—with less intergenerational wealth, poorer credit scores and a lower debt-to-income ratio—to qualify. While only 18 percent of non-Hispanic white households have more than \$40,000 in student loans, for instance, a third of Black households carry that much student loan debt.

“The way we measure risk does nothing but pass on historical discrimination and racism,” says Perry. “And so, to the extent we keep measuring risk in the same way, we’ll always be in a situation where Black and Hispanic home buyers have to pay more for mortgage loans.”

Even when humans are removed from the process—as mortgage companies increasingly turn to artificial intelligence-based tools to gauge credit risk—this kind of engrained historical discrimination cannot be easily removed from the equation, Perry says. New models of credit risk proposed by some researchers to take the weight off traditional measures of wealth have included a wide variety of data, from utility and rent payments to social media activity, GPS data, club membership and even school grades.

“But even these factors can be unknowingly correlated with race or with neighborhood,” says Perry. “So these new tools have to be really deeply looked at from a fairness perspective.”

A LARGER SET OF PROBLEMS

When Black Americans do buy a home, they still face other barriers that can prevent them from accumulating wealth over time. For one, homeowners’ insurance tends to be harder to obtain and more expensive. In a Journal of Urban Affairs article, Gregory Squires, a GW professor of sociology and public policy and public

“I HATE TO TALK ABOUT REPARATIONS BECAUSE PEOPLE THINK IT’S SUCH A DIRTY WORD AND SHUT DOWN WHEN THEY HEAR IT, BUT AT THIS POINT WE NEED APPROACHES THAT ARE DIRECTLY ENABLING FIRST-GENERATION BLACK HOMEOWNERS.”

VANESSA PERRY

administration who has long studied fair housing policies, concluded that racial profiling by the property insurance industry contributes to diminished opportunities for racial minorities. Even after controlling for other demographic factors, race is significantly associated with the availability and cost of insurance policies, he says.

Another problem revolves around appraisals. Home values in predominantly Black neighborhoods have historically been—and remain today—lower than those in predominantly white neighborhoods. It's a cycle that is hard to break out of, since home appraisers rely on "comps," or recently sold comparable properties, to set values. When one home receives a low appraisal, it then becomes a benchmark for the appraisal of nearby houses.

"When a property comes back with a very low appraisal, it suppresses the property value not just for the individual family but for the entire neighborhood," says Squires, who has worked with HUD's Office for Fair Housing and Equal Opportunity. "It means the effects of yesterday's and today's discrimination keep persisting into the future."

Appraisal bias—the undervaluation of homes owned by Black families or situated in predominantly Black neighborhoods—has received national attention in recent months. In March, the White House announced a plan to address home appraisal inequities. Squires is currently collaborating with the city of Philadelphia on a report about what local municipalities can do to solve appraisal bias.

Last year, the real estate brokerage Redfin crunched the numbers on 7.3 million home sales to conclude that homes in mostly Black areas are valued at about \$46,000 less than comparable homes in mostly white areas. In Philadelphia, there is a 27 percent undervaluation of homes in Black neighborhoods, according to

A WIDENING GULF BY THE NUMBERS

DEBT, DENIAL AND DISPARITY

HOUSEHOLDS WITH
MORE THAN \$40,000
IN STUDENT LOAN DEBT:

18% NON-HISPANIC
WHITE

33% BLACK

30% GAP BETWEEN
BLACK AND
NON-HISPANIC
WHITE HOME
OWNERSHIP RATES

2.9 MILLION

BLACK "MORTGAGE-READY"
HOUSEHOLDS

YET

BLACK MORTGAGE
APPLICANTS WITH INCOMES
>150% OF THE AREA MEDIAN
INCOME (AMI) HAVE A
HIGHER DENIAL RATE
THAN WHITE APPLICANTS WITH
INCOMES **<80%** OF THE AMI.

HOME VALUATION GAP

\$46,000

HOME VALUATION GAP
BETWEEN HOUSES IN MOSTLY
BLACK AREAS COMPARED
WITH MOSTLY WHITE AREAS

97%

PERCENTAGE OF HOME
APPRAISERS WHO ARE WHITE

COMPARED TO NON-HISPANIC
WHITE HOUSEHOLDS, BLACK
HOUSEHOLDS HAVE:

▲ **INTEREST RATES**

▲ **INSURANCE PREMIUMS**

▼ **HOME VALUATIONS**

27%

UNDervaluation OF HOMES
IN BLACK NEIGHBORHOODS

SOURCE: NAREB-COMMISSIONED 2020 STATE OF HOUSING



VANESSA PERRY
Professor of marketing, strategic
management and public policy

“Homeownership is connected to the ability for people to build equity, but there are also all these other benefits that can accrue almost immediately with increased homeownership rates. You see improved public education and other public services. There’s more political participation.”

“Our research would indicate that without a concerted effort, the homeownership gap is going to grow. If we want to turn things around, we really have to stay deeply engaged.”



JANNEKE RATCLIFFE
Vice President, Housing
Finance Policy Center at the
Urban Institute

“Stable, affordable housing in healthy communities can reduce stress and increase access to fresh produce, parks, jobs, safe streets and other amenities that help people stay healthy.”



GREGORY SQUIRES
Professor of sociology and public
policy and public administration

a paper Squires published last summer in the journal *Poverty & Race*. One driving factor? The vast majority of all home appraisers—97 percent, according to one White House report—are white. Increasing diversity in the appraisal, real estate and mortgage industries, Squires says, could help lessen appraisal bias.

NO SILVER BULLET

Diversity in the housing industry, though, is just a piece of the puzzle. “Wall Street investors, huge lending institutions, regulators, economists, public policy experts and countless housing advocacy groups have been working on this problem for many years,” says Perry. “No one has found a silver bullet.”

Researchers like Perry and Squires work collaboratively with all those other players to help come up with feasible solutions that might close the housing gap. Both local and federal programs and laws, they say, can make a difference. In 2015, the Supreme Court ruled on the legality of disparate impact claims under the Fair Housing Act, determining discrimination doesn’t have to be intentional to be illegal.

“Sometimes there can be violation of civil rights laws even when there’s not a proven intent to discriminate,” says Squires. “So if a housing provider, for example, refuses to make loans on homes that are valued below a certain amount, that might be a violation of the law because it disproportionately impacts people of color.”

In 2021, the White House issued a series of memorandums and executive orders around the concept of affirmatively furthering fair housing—underscoring the role of the Fair Housing Act in not only refraining from discrimination but also taking actions that “undo historic patterns of segregation and other types of discrimination and that afford access to long-denied opportunities.”

Those legal actions, Squires says, were a turning point for pushing

the housing industry to root out even unintentional discrimination. “It means it is a lot easier for lawyers and advocacy groups to file complaints against housing providers that are discriminating either in overt or very subtle ways,” he says.

And with those legal frameworks in place, Perry believes that now is the time to turn to special purpose credit programs, established under the Fair Housing Act, which aim to explicitly help groups of disadvantaged people obtain mortgages through financial assistance. Perry and her collaborators at the Urban Institute have argued that lenders can use these programs to help reduce the racial homeownership gap. They could, for instance, offer favorable mortgage terms, down payment assistance, streamlined refinances, flexible underwriting or income restriction exemptions to Black home loan applicants or applicants who want to buy in predominantly Black neighborhoods—two ways of defining the disadvantaged group.

In 2019, for instance, Vice President Kamala Harris—then a senator and presidential candidate—proposed a grant program, to be administered under HUD, which would provide money toward a down payment or closing costs for low-income homebuyers who live in historically redlined neighborhoods. More recently, Chase Bank announced \$5,000 loans for qualified homebuyers in Black neighborhoods.

Perry is also a fan of average-risk pricing instead of risk-based pricing—the idea that every person who qualifies for a mortgage

receives the same terms. This could help lower mortgage payments for Black families overburdened with student loans, for instance.

Critics of these kinds of approaches, Perry says, worry that easing the barriers to homeownership could lead to a dramatic rise in foreclosures and a housing crash. She argues, however, that there are millions of Black households that are low risk for defaulting on a mortgage yet don’t meet today’s standards. In the 2020 “State of Housing in Black America” report, she and her colleagues cited a Freddie Mac study that estimated there are currently 2.9 million Black “mortgage-ready” households in the country—with heads of household under 45 years of age who have the income and credit history to qualify for a mortgage.

“A lot of experts believe that the credit standards that have been in place have been far stricter than they need to be,” she says. “Nobody wants to recreate a subprime crisis, but the market has many more checks and balances now to keep that from happening.”

“NOBODY WANTS TO RECREATE A SUBPRIME CRISIS, BUT THE MARKET HAS MANY MORE CHECKS AND BALANCES NOW TO KEEP THAT FROM HAPPENING.”

VANESSA PERRY

BENEFITS FOR ALL

Other economists argue that boosting minority homeownership alone cannot close the wealth gap; there are too many other factors correlated with long-term savings. Perry, however, notes there are research-backed benefits to homeownership—even aside from its potential for financial gain.

Homeownership, she points out, affects the whole economy and benefits entire communities.

“Homeownership is connected

to the ability for people to build equity, but there are also all these other benefits that can accrue almost immediately with increased homeownership rates,” says Perry. “You see improved public education and other public services. There’s more political participation.”

Stable housing can also bring health benefits. In 2021, Squires and Antwan Jones, an associate professor of sociology at GW, reported in the medical journal *Circulation* that cities with inclusionary zoning policies—which incentivize developers to set aside a share of new housing units for low- to moderate-income families—have lower rates of heart disease and other cardiovascular illness. “Stable, affordable housing in healthy communities can reduce stress and increase access to fresh produce, parks, jobs, safe streets and other amenities that help people stay healthy,” said Squires when the paper was published.

Today, housing prices continue to boom, rising nearly 20 percent between February 2021 and February 2022. Those rising prices help line the pockets of homeowners with additional equity while pricing non-homeowners out of the home buying market—again, a phenomenon that only exacerbates the racial homeownership gap.

“Our research would indicate that without a concerted effort, the homeownership gap is going to grow,” says Ratcliffe, speaking about data analyzed by the Urban Institute. “If we want to turn things around, we really have to stay deeply engaged.”

Perry is as engaged as ever, advocating for the lending and real estate industries to address the issues head on. “For a long time, people would just not address that historical discrimination and redlining were still underlying causes of the homeownership gap,” she says. Now, Perry says, lenders and policymakers are more aware of the continued and compounded role of this history, and the time is ripe for solutions. **GWR**

LAUNCHPAD



GW BOOSTS REGIONAL INNOVATION AS PART OF \$15 MILLION MID-ATLANTIC HUB

University continues a tradition of helping researchers realize the commercial potential of their discoveries.

// By Nick Erickson

As a partner institution in a new \$15 million National Science Foundation (NSF) Innovation Corps (I-Corps) Hub, GW is advancing

innovation and entrepreneurship in the mid-Atlantic region and expanding the societal impact of fundamental research.

NSF I-Corps Hubs are the latest evolution in the federal agency's decade-old I-Corps program, which provides academic researchers with hands-on, immersive entrepreneurial training to help them transform their research into successful products and services.

In establishing five regional I-Corps Hubs—each funded at \$3 million a year for five years—the NSF aims to build and sustain a diverse and inclusive innovation ecosystem across the U.S. As one of 10 schools selected for the Mid-Atlantic Hub, GW is helping its researchers answer the call to serve key national needs. Those include increasing and improving translational research and technology commercialization, training students to become leaders for future deep technological research, and diversifying all levels of the national innovation network with the inclusion of women and

minorities, especially in leadership roles.

“This new hub’s partnership will provide resources to researchers at GW and other schools in the region,” said Bob Smith, GW’s I-Corps director. “I-Corps helps to shape new university research, and it helps researchers discover new commercial opportunities in the world outside the lab. We’re thrilled to be extending our long-standing relationship with the NSF and the I-Corps program.”

The University of Maryland will lead the I-Corps Hub Mid-Atlantic Region, with GW, Penn State and North Carolina State as partner institutions. Johns Hopkins University, Virginia Tech, Carnegie-Mellon University, the University of Pennsylvania, the University of North Carolina at Chapel Hill and Howard University are affiliates.

GW has long been a core university in the DC I-Corps Node, one of nine regional nodes across the country comprising NSF’s National Innovation Network, and has led many of the efforts to globalize I-Corps by bringing it and other related entrepreneurial training programs to countries around the world.

“Since I became involved as a mentor in the very first NSF I-Corps pilot in 2011, GW has been critical to the evolution of the I-Corps program as a leader in the DC I-Corps Node and GW I-Corps site,” said Jim Chung, director of GW’s Office of Innovation and Entrepreneurship. “I believe the new I-Corps Hub grant is just the first of many new developments that will benefit GW students and faculty interested in getting their inventions and research out of the classrooms and labs and into the real world.” BWR

TECHNOLOGY COMMERCIALIZATION AT GW

Every year, AUTM, the leading association in technology transfer, releases results from its Licensing Activity Survey, which “offers quantitative data and real-world examples about licensing activities at U.S. and Canadian universities, hospitals and research institutions.” The survey captures overall research expenditure growth across institutions as well as invention disclosures and the number of U.S. patents and startups formed. It also summarizes data from individual institutions and ranks them accordingly. According to the latest available data (FY20), GW’s Technology Commercialization Office is having a great run.

\$21M

Gross licensing income generated from GW inventions in FY20.



\$7.8M

Gross licensing income per research expenditures generated from GW inventions in FY20, ranking GW 10th among U.S. universities.



79

Number of GW inventions disclosed in FY20, a 25% increase over FY17.



25

Number of patents issued in FY20 to GW innovators, a 127% increase over FY17.



SHOP GW INVENTIONS AND TECHNOLOGIES

GW’s Technology Commercialization Office has launched a new site that will make it easier for companies to browse GW inventions and technologies ready for commercialization. As GW is a comprehensive research institution, faculty are advancing next-generation electronics, new materials, medical devices and more. Check out the site, search technologies by category and even subscribe to receive personalized technology updates.



GW President Mark Wrighton (LEFT) joined Jim Chung (RIGHT), director of GW’s Office of Innovation and Entrepreneurship, at the signing of a \$2 million grant from the D.C. Mayor’s Office to the Golden Triangle Business Innovation District (BID), where local startups, investors and real estate developers were also in attendance. GW is working with the Golden Triangle BID, the D.C. government, CONNECTpreneur and others to create a Penn West Equity and Innovation District in downtown D.C., helping to grow the district’s innovation ecosystem and transform D.C. into a thriving hub for startups.



STARTUPS

2022 NVC: FROM PROSTHETIC LEGS TO CANNABIS-INFUSED BAKING MIX

\$408,000 worth of prizes was awarded to student entrepreneurs at what is now the top student entrepreneurship competition in the U.S.

By Nick Erickson

Human legs have capabilities often taken for granted. They transition from walking to running on instinct. They accelerate vertically to a jump for something out of reach, and they squat to avoid a low overhang.

But one thing they don't have is a reset button, and those capabilities can be altered in the blink of an

eye—or blast of an improvised explosive device.

While working in a prosthetic clinic one day, GW biomedical engineering graduate student Sarah Malinowski met a U.S. military veteran who had lost his leg during active duty. Simple tasks such as getting up out of bed to go to the bathroom became excruciatingly

difficult for him.

His life, active by all accounts, was drastically changed, and that stuck with Malinowski. She noted there was no prosthetic knee on the market that allows a person to do things otherwise healthy legs can do.

“If you want to run away from a car that doesn't see you as you're crossing the street, you would have to go back to your own car, change your leg and then run,” she said. “It's not practical.”

She has proposed a prosthetic knee—called Rugged Redemption—that would empower amputees to maintain an active lifestyle. In April, she received a financial kick start after winning \$27,500 in prize money from the New Venture Competition (NVC), a nationally recognized pitch competition out of GW's Office of Innovation and Entrepreneurship.

Malinowski won one of three venture tracks—with each prize topping out at \$10,000—at the awards ceremony that wrapped



up the 13th NVC. Last year, the NVC earned the Times of Entrepreneurship's top ranking in university entrepreneurship competitions.

In total, 132 teams composed of 368 students participated in this year's four-round NVC. There were 104 qualifying teams in the second round, while 36 advanced to round three, and 12 teams made it to the final round. The finalists pitched their startup or idea to a panel of judges before winners were announced to a near capacity crowd at Jack Morton Auditorium.

Prizes worth \$408,000 were awarded during this year's competition, including \$128,000 in cash to the winners, and participants represented all 10 schools at the university.

"We are supported by all of the schools in the university, and I think that's one of the reasons why we have such a strong competition," said Jim Chung, director of GW's Office of Innovation and Entrepreneurship.

Chung noted that since the first NVC in 2009, there have been \$3 million in cash prizes, 350 new ventures launched, \$1 billion in follow-on funding and,

this past year alone, 800 Mentors-in-Residence appointments. It has also helped GW become a top-25 university worldwide for unicorn founders.

Director of Student Entrepreneurship Kate Heath, M.B.A. '10, applauded the 132 student teams for bringing their ideas to the table and encouraged all aspiring GW entrepreneurs to keep at it.

"Applying and trying takes great courage," Heath said. "Know that our office will always be here to support your ventures and ideas no matter what the NVC outcomes are."

GW fourth-year medical student Linda Mangera won the Social Track Venture award for a software startup called Paths that provides a more convenient way for housing-voucher recipients to search for nearby homes with welcoming landlords.

In addition to studying medicine, Mangera also has a rental business that has grossed more than

\$100,000 in gross revenue. What she has seen in the housing market is that people who qualify for housing vouchers often wait more than two years to see it through, and that many recipients' vouchers expire. Current online apartment and housing services do not cater to those with housing vouchers, and Paths is an application that tracks users' movements and searches local government databases for voucher-accepting landlords.

"We are saying this is a group of people who are very often neglected, and we had a solution to make sure that they can actually get their housing voucher obligated to be received," Mangera said. "We have a policy that's in place to provide rental assistance to a really large group of people."

GW School of Business senior Sabrina Clebnik won the New Venture Track award for her cannabis-infused baking mix brand called Clebby's. Her business was launched in spring 2021 after she conducted research for her father, who was helping facilitate the launch of Massachusetts' first social equity and vertically integrated licensed cannabis facility.

Clebnik was surprised that fresh-baked edibles weren't sold at any Massachusetts dispensaries, and she found that third-party testing time frames for THC dosage and strength made selling fresh-baked edibles in dispensaries nearly impossible. Her product eliminates testing latency by providing customers the ability to bake cannabis-infused products with dosage consistency at home.

"You can think of Clebby's as the Pillsbury baking mix of the cannabis market," Clebnik said. GWR





OTHER WINNERS

POP! (POWER OF THE PURSE)

is a pop-up thrift store that has generated \$12,000 in revenue by selling secondhand fashionable and affordable clothing to GW students. (\$25,000)

Anna Shah (GWSB '24), Maya Levine (CCAS '23), Stephanie Cheung (CCAS '22), Rachel Cohen (CCAS '23)

LÔPE TREE harnesses oil from the desert date tree in northern Uganda to meet the growing global demand for clean skincare while establishing a new model that shares high-end retail profits with people along the supply chain and with those who are protecting the forest. (\$11,000)
Lauren Servin (GWSB '24) Ruth Dwyer (GWSB '23)

PIR PREVENTION SYSTEMS

has designed a device that tracks patient movement using several cloth-attachable motion sensors that wirelessly transmit to a bedside monitor. (\$8,500)
Sam Smith (SMHS '25)

SURGCYCLE introduces surgical metal and biohazard waste recycling solutions, revolutionizing the field of medical waste disposal as we know it. (\$5,000)
Ameen Khalil (SMHS '24)

CURRANT is a platform that matches brands with influencers on TikTok to help them grow their revenue and awareness and scale their business. (\$5,000)
Ashwath Narayanan (CCAS '22), Ellie Artone (ESUA '23), Vidyut Ghuwalewala, Jasmine McCarton

BYLIL BIKINIS is redesigning the bikini world. By creating reversible and versatile pieces, ByLil offers bikini-wearers the chance to transform one bikini into several looks for the price of one—it's "just a lil' you." (\$3,500)
Lily Khosrowshahi (GWSB '22)

ASTHGUARD seeks to identify allergens shown to be involved in the development of childhood asthma in the homes of expectant parents in order to prevent its onset. (\$2,500)
Jordan Shock (SMHS '25), Jacob Diaz (SMHS '25), Johnny Davoodifard (SMHS '25), Grey Madison (SMHS '25), Arash Agharahmanian (SMHS '25).

NARRATIVE is a peer-to-peer story non-fungible token (NFT) marketplace that enables individuals and organizations to mint audible historical moments, events and ideas while monetizing them on the blockchain. (\$2,500)
Trevor Doucet (GWSB '22), Olivia Wilcox (GWSB '22), Chelsea Sutch (GWSB '22).

PICKMEUP is a mental health app for college campuses that aims to connect students with the mental health resources they need as they navigate their transition to college life. (\$2,500)
Katie Fernberg (CCAS '22), Krista Minas (CCAS '22), Hannah Froimson (SEAS '22)

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

OIE holds free monthly, virtual, one-hour workshops geared toward early-stage innovators and individuals, which provide an overview of the customer discovery process and the basics of 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

The NSF I-Corps program helps researchers commercialize their research and bring lab findings to market. Researchers learn how to test the viability of their idea, validate value propositions and build successful business models.

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



THE GEORGE
WASHINGTON
UNIVERSITY
WASHINGTON, DC



OPEN DOORS FOR FUTURE GROUNDBREAKERS

A global, preeminent research institution requires world-class faculty and students to transform discovery into meaningful change. You can open doors for GW students who are destined to drive innovation and shape a greater world.



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