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# Enterprise

2024 THE UNIVERSITY OF MARYLAND RESEARCH MAGAZINE



## Charging Up That Hill

NINETY-SECOND BATTERY FILL-UPS. ALL-DAY RANGE. UNPARALLELED SAFETY.  
UMD RESEARCHERS ARE WORKING TO POWER UP EVS AND SAVE THE PLANET 20



From the  
**Vice President  
for Research**



**SPRING IS A PERIOD** of renewal and rebirth, but it is also a great time for reflection, particularly on the campus of a leading public research university. The University of Maryland's research enterprise had a banner year: We celebrated a record \$834 million in funding for research and related activities, were named a top five school for entrepreneurship by The Princeton Review and *Enterprise* magazine, and with the University of Maryland, Baltimore, again earned a top 20 spot among U.S. research institutions in the National Science Foundation's Higher Education Research and Development survey. Rankings and recognition are nice, but ultimately are not what drive us fearlessly forward. UMD researchers are committed to transforming new knowledge into creative solutions that serve our fellow citizens in Maryland and around the world. After reading through the stories in this magazine, you'll understand why we refer to ourselves as the nation's first Do Good campus.

For instance, geographical sciences Assistant Professor Catherine Nakalembe has dedicated her life to fighting a food crisis in Africa using her expertise in satellite remote

sensing. Read about her journey to UMD and eventually back to her home country of Uganda and beyond, where she continues to alter the agricultural landscape.

You'll also learn about how UMD researchers are leading the effort to bolster one of our best weapons against climate change—electric vehicles—by developing safer and more stable batteries that charge faster and last longer.

Roughly a year after we launched the \$30 million Grand Challenges Grants program, awardees are delivering impact and accelerating solutions across the state, nation and world, from boosting safety and emergency preparedness through a network of weather monitoring and data collection sites to transforming artificial intelligence to include ethics, human rights and marginalized voices, and much more.

This third annual issue of *Enterprise* contains some of our most exciting, impactful research and funding news from the past year, as well as faculty honors and awards. I hope you are as amazed as I was to look back at all that we were able to accomplish in our shared mission to Do Good.

Go Terps!

**Gregory F. Ball**

*Vice President for Research*

“After reading through the stories in this magazine, you'll understand why we refer to ourselves as the nation's first Do Good campus.”

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Illustration by Denis Frieras

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Learn more about the University of Maryland's diverse, dynamic research enterprise at [research.umd.edu](https://research.umd.edu).



# New Institute to Focus on Ethical AI Development

UMD to Lead Interdisciplinary Research and Education, Prepare Future Workforce

The University of Maryland this spring announced the launch of a new institute dedicated to developing the next generation of artificial intelligence education, technology and leaders.

Its new AI Interdisciplinary Institute at Maryland will be a hub for AI, supporting faculty research, offering hands-on learning experiences and focusing on responsible, ethical development and use of a technology expected to be revolutionary—all to advance the public good across industry, government and society.

“Artificial intelligence continues to grow exponentially, creating opportunities to solve the grand challenges of our time. With this institute, our experts will work together to globally lead responsible AI development that spurs economic growth and promotes human well-being,” says UMD President Darryll J. Pines. “We’re not just adapting to the AI age but shaping its future.”

The new institute will be funded by the university, research grants and industry gifts. It builds on existing research and centers, including the Center for Machine Learning, the National Science Foundation-funded Institute for Trustworthy AI in Law & Society (TRAILS), the Value-Centered AI Initiative and the Social Data Science Center. These centers will be an integral part of the institute, as will faculty members across campus who teach and study AI.

“From the start, collaboration across disciplines will drive our AI institute’s success,” says UMD Senior Vice President and Provost Jennifer King Rice. “We’re fortunate to have AI experts in fields ranging from computer science and engineering, to journalism, education and the arts—a unique breadth of expertise that Maryland brings to the table. By uniting our efforts under one institute, we will not only become a magnet for AI development and research but a global leader in preparing students and the



workforce for an AI-infused world.”

Through the institute, UMD students across all majors will learn the principles of AI and how they apply to their fields of study, preparing them for an AI-infused workforce. The institute will also coordinate the development of new degrees and expanded courses in the subject, a professional certificate and other workforce development programs, and AI partnerships and community events.

In addition to the current 100-plus faculty members who conduct a broad range of AI research, the university expects to hire additional faculty and staff to work within the institute. Hal Daumé III, a Volpi-Cupal Family Endowed Professor in the Department of Computer Science, will serve as the inaugural institute director.

AI-infused systems have the potential to enhance human capacity and creativity, mitigate complex societal challenges, and foster innovation, Daumé says.

“Achieving this requires a joint effort between those pushing the boundaries of new AI technologies, those who innovate AI applications, and those who study human values and how people and society interact with AI,” he says. “The University of Maryland is drawing together faculty experts, researchers and students from across campus to lead the responsible development and implementation of this world-changing technology.”

PHOTO VIA ISTOCK



## With AI, Geographers Map Unexploded Ordnance on Ukraine’s Front Lines

**INDISCRIMINATE SHELLING** during Russia’s ongoing invasion of Ukraine seeded farm fields and towns with untold numbers of unexploded munitions. University of Maryland geographical sciences researchers have combined satellite imagery with deep learning artificial intelligence (AI) to find them and prevent a deadly harvest.

Their system has mapped about 2.5 million artillery strike craters in a 500-mile arc to prioritize areas for cleanup when the tides of battle allow.

Up to an estimated 30% of the Soviet-era artillery shells land without exploding, says Associate Professor Sergii Skakun, co-author of a paper on the

system published in June 2023 in *Science of Remote Sensing*. Farmers face a choice between bankruptcy and the risk of hitting one with their tractors, says the Ukrainian scientist who studies agricultural and environmental conditions.

He and co-author Erik Duncan, a Department of Geographical Sciences faculty specialist, trained a deep learning AI system to pinpoint artillery impacts visible in high-resolution satellite imagery. Then, using commercial data from Planet Labs’ SkySat and Maxar’s WorldView satellites—which resolve details as small as 30 centimeters—it quickly identifies areas likely bristling with unexploded ordnance.

“We can provide this valuable information to the (demining) operators and the government they couldn’t get by themselves, and help save lives,” Skakun says.—**cc**

## Math Class Gets a Machine Learning Boost

**ALONG WITH** the traditional ingredients of a good lesson plan—teacher preparation and an effective curriculum—support from artificial intelligence (AI) is part of the mix in a new project funded by a \$1.5 million grant from the National Science Foundation that includes UMD researchers.

The multi-institutional team is using machine learning AI to assess the quality of mathematics lesson plans in the middle grades, freeing up teachers to do what they do best.

“A big promise of AI is that it will help relieve

teachers from many routine tasks, including lesson planning, so they can spend more time working with students,” says Jing Liu, UMD assistant professor of education policy. Other collaborators include College of Information Studies Assistant Professor Wei Ai and faculty from the University of Washington, the University of Nebraska-Lincoln and Duquesne University.—**cc**







# Up in the Air—Without Leaving the Ground

Lab’s New Immersive Flight Simulator Will Test the Rigors of Flight for Safer Skies

ON A RECENT DAY in College Park, a Sikorsky S-76 sheared the golden arches clean off a McDonald’s. But no harm was done—to Big Macs, bystanders or the \$20 million helicopter.

This crash-and-burn scenario took place only in virtual reality (VR), enabled by the Extended Reality Flight Simulation and Control Lab launched at UMD in Spring 2023. It’s the first U.S. university-based facility to reproduce flight in various aircraft through motion-based VR simulation and haptics, which provide tactile feedback like rumbling and vibrations.

“Our objective is to increase immersion and recreate scenarios that are difficult

to simulate otherwise,” says aerospace engineering Assistant Professor Umberto Saetti, who founded and directs the lab, “and ultimately, increase flight safety.”

Unlike conventional flight simulators, which train users for a single type or class of aircraft, the sky’s the limit here, from Black Hawk helicopters to an F-18 fighter jet. Sights and sounds of flight are fed through VR goggles and headphones; the team is also testing a full-body haptic feedback suit to explore new methods for providing sensory cues to help navigate low-visibility situations, hostile flight scenarios, or to assist visually impaired pilots.

Saetti’s team is conducting research for the U.S. Defense Department, NASA and Lockheed Martin, which together provided the lab with \$2.19 million in funding in 2023. In the future, the researchers plan to monitor brain activity and track stress and other human responses to flight.

Someday, the lab’s innovations could enable more difficult missions without compromising safety. “Our job is to come up with and demonstrate new ideas, then the companies can do the rest,” says Saetti.—MH

## Major Federal Research Partnerships

Two large cooperative agreements created or renewed U.S. government collaborations with UMD in science and technology:

**DRIVEN BY DATA** The Army Research Lab (ARL) has tapped the University of Maryland for an ambitious effort to integrate data science and engineering on a sweeping array of projects, ranging from a “smart nose” to sniff out hazardous materials to lightning-quick “fingerprinting” of cell phones and other radio-emitting devices. ARL awarded the A. James Clark School of Engineering a five-year, \$78.2 million cooperative agreement to spearhead the Data Driven Engineering Research program.—CB

**REGULATORY MUSCLE** The U.S. Food and Drug Administration (FDA) has renewed its funding for the University of Maryland Center of Excellence in Regulatory Science and Innovation (M-CERSI) under a new five-year, \$50 million cooperative agreement. M-CERSI, a partnership between the University of Maryland, College Park and the University of Maryland, Baltimore, focuses on improving the evaluation of medical devices. The center collaborates with the FDA on approximately 30 research projects, including those for drugs, biologics, devices and tobacco.



## Philanthropy’s Role Grows in Journalism

Study Suggests More Funding Heightens Ethical Considerations

**PHILANTHROPIC FUNDING** of American journalism has grown substantially in the past five years, particularly for outlets serving communities of color, according to an August 2023 study co-authored by a University of Maryland professor.

At the same time, the survey of grantmaking institutions and newsrooms found the need for more newsrooms to disclose donors and adopt clear policies to protect

editorial independence and public confidence.

“To earn and keep the public’s trust, funders and news organizations should agree on clear and universal guidelines to protect against conflicts of interest,” says Tom Rosenstiel, the Eleanor Merrill Professor on the Future of Journalism at UMD’s Philip Merrill College of Journalism and a senior fellow at NORC at the University of Chicago.

The NORC survey, conducted in partnership with Media Impact Funders and the Lenfest Institute for Journalism, found about 70% of nonprofit newsrooms have policies to disclose funders, up from 40% in 2015. On the funder side, 74% focus on specific topics, and 65% said they prefer to support nonprofit journalism over for-profit news.

## Cold Facts About Warm Fuzzies

Researchers Examine Power of Responses to Social Media “Cuteness”

**COULD A KITTEN** in your Instagram feed sway your cereal choice? If the cat has saucer-sized eyes and teeters on a wobbling box of frosted carbs, you might just add it to your shopping list, say UMD researchers aiming to understand why a social media post makes us go “awwww,” and how that influences actions and beliefs.

It’s part of UMD’s Applied Research Laboratory for Intelligence and Security’s (ARLIS) Emotions in Social Media Project, a multidisciplinary effort examining how emotions influence the spread of information campaigns. The project received funding from the U.S. Department of Defense Minerva Research Initiative and the Office of Naval Research.

“As enjoyable as it is to discover in your Twitter feed, we know cuteness is also used to deliberately manipulate your feelings—and it works,” says Susannah Paletz, associate professor in the College of Information Studies and principal investigator.

The study, published in March 2023 in *Frontiers in Psychology*, offers 15 quantifiable attributes, including visual characteristics, behavior and

linguistic cues, to create what researchers call a Cuteness Attributes Taxonomy (CAT). Annotators used it to code over 1,800 social posts, and their emotional responses were also measured.

The team, including lead author Associate Research Scientist Ewa Golonka, is digging deeper into the implications of CAT-related findings, as well as those resulting from newly developed measures of emotional reactions to media. The questions have potentially far larger implications than cereal choice: Can an online cuteness onslaught get you to click “like” or “share” even if the underlying message isn’t cute at all?—MH







# In the Shadow of History

At Robert E. Lee’s Former Residence, Researcher Opens the Door to Overlooked Legacies

**T**HE VIEW FROM Arlington House, Robert E. Lee’s former home perched atop Arlington National Cemetery, is both majestic and mournful: D.C.’s monumental skyline stands in the distance, while a sea of Union and Confederate Army gravestones just steps from the Southern general’s front door serves as a reckoning and reminder of the Civil War’s human cost. But it’s what’s hidden from view that occupies Associate Research Professor Cheryl LaRoche Ph.D. ’04. The archaeologist and historic preservationist is piecing together the stories of Arlington House’s enslaved workers, whose contri-

butions to the wealth of a nation are often overlooked. “You can’t talk about this house without talking about enslavement,” she says. “There is not a space among this mansion that an enslaved person did not touch.” Arlington House was built on Virginia’s side of the Potomac River in 1802 to memorialize George Washington and house a collection of his artifacts. The first example of Greek Revival architecture in America, it was passed down to Lee’s wife, Mary, four years before Virginia seceded from the United States. After the war, the U.S. government took ownership of Arlington House; the National Park Service (NPS) received jurisdiction in 1933. NPS and Arlington House descendants hired LaRoche and her team in 2022 to lead an ethnographic history of the mansion. Uncovering the lives of the enslaved is a fraught process, says LaRoche, who has consulted on dozens of projects around the 19th-century Black experience. In the chaos of the Civil War, records were often destroyed or scattered, if they ever existed. Some enslaved bore no last names, and

families were frequently broken up as owners died, acquired more land or sold the individuals as chattel. “It’s the perfect crime scene because they’ve wiped the murder weapon clean,” she says. “There’s no pathway for what we’re doing here.” LaRoche and her team are tenacious, though, using oral histories, tombstones, photographs, written documentation and landscape mapping—a protocol for ethnography she developed for her dissertation at UMD—to tell a broader, more inclusive story. That story might help spur major changes at the house. In recent years, descendants of Robert E. Lee, as well as the Parks, Grays and Syphaxes—enslaved people who worked there—have come together to petition a name change from Arlington House, The Robert E. Lee Memorial to simply Arlington House. “I think when you call it the Arlington House, you’re just opening it up to more of the families who lived there,” Rob Lee, Robert E. Lee’s great-great-grandson, told NPR last April. —MH

# Researchers Help Minor Leaguers Swing for the Fences

New AI-Powered Analytical Model Tracks Baseball Players’ Path to the Big Show

**MAJOR LEAGUE BASEBALL** teams draft roughly 1,500 prospects annually, but less than 20% eventually make the jump to the majors. Building on statistical ideas and methods popularized in the 2003 book “Moneyball,” University of Maryland researchers may help more of them get there. Their study in the 2023 edition of *Analytics Enabled Decision Making* provides a tool for minor leaguers to identify aspects of their



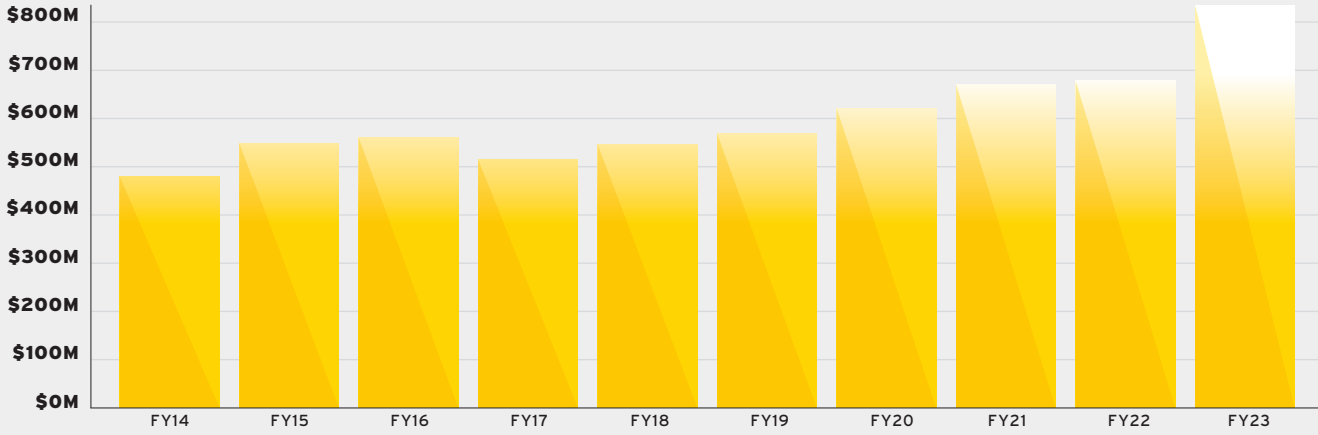
game they must improve to boost their shot at the big leagues. Sharing a passion for baseball, Chung-Hao Lee M.S. ’22, MBA ’22 and Adam Lee, associate clinical professor of information systems in the Robert H. Smith School of Business, used machine learning artificial intelligence to analyze performance stats and other data of

players drafted from 2001-10 and test models predicting their likelihood of reaching the majors. The researchers determined four significant factors contributing to players’ development: batting average, slugging percentage, draft position and overall time spent in the minors. “‘Moneyball’ taught us that the important factor in deciding whether a player can be called up to the major leagues is their on-base percentage,” says Chung-Hao Lee, now an artificial intelligence and machine learning project manager at Winstron in Taiwan. “But based on our model, we found that the batting average is way more important to decide whether the player can be called up.” —PS

# UMD Research Enterprise Smashes Funding Record in FY23

**MAJOR AWARDS** from NASA and the Department of Defense headlined a 23% surge in funding to \$834 million for research and related activities last year, but no single factor fueled the record growth, says Gregory F. Ball, vice president for research at UMD.

The topline number, he suggests, reflects the energy and innovation of UMD’s faculty and staff researchers in their drive to solve major societal issues and uncover new knowledge, along with continued work to strengthen ties with major sponsors.





# Growing the Future of Fertilizer

Scientists Explore Transforming Poultry Waste to Prevent Aquatic “Dead Zones”

**BACKED BY A** \$4.8 million grant from the U.S. Department of Agriculture (USDA), University of Maryland agriculture researchers are working with partners to develop a more sustainable fertilizer—one that’s safer for aquatic ecosystems than traditional alternatives and could even help fight climate change.

Standard fertilizers like poultry litter, a nutrient-rich mixture of chicken waste, feathers and bedding, boost crop growth but cause excess phosphorus and nitrogen runoff into streams. That leads to algal blooms and oxygen-poor “dead zones” in the Chesapeake Bay and other water bodies worldwide.

The new research focuses on converting the poultry litter into a material

known as “biochar” through a process called pyrolysis: a slow, controlled burn at extremely high temperatures in the absence of any oxygen, resulting in a powdery end product high in carbon and other nutrients essential to crop growth while cutting excess nutrient runoff.

The four-year project, which includes scientists from Florida A&M University, the University of Florida and the University of California, Davis, will focus on optimizing the process and determining how to best apply it to soils.

“The technology is there, and companies are already commercially producing biochar, so we want to improve the science, make definitive recommendations for farmers, and make its use more prevalent than it is now,” says Rohan Tikekar, an associate professor and extension specialist in the Department of Nutrition and Food Science who is leading UMD’s team.—**LW**



# UMD Leads New Transportation-Focused Research Centers

**EXPERTS IN THE** Maryland Transportation Institute and the Department of Civil and Environmental Engineering and their partners at UMD and worldwide are working to address some of the greatest transportation-related challenges of our time:

■ The U.S. Department of Transportation chose the University of Maryland to lead a multi-institutional center aimed at improving the mobility of people and goods across the country as part of a growing federal focus on transportation safety and equity. UMD and partner institutions will receive \$10 million over five years for the Center for Multi-Modal Mobility in Urban, Rural, and Tribal Areas through the U.S. Department of Transportation’s SDOT University Transportation Centers (UTCs) Program.

■ The university and its partners at Japan’s University of Tsukuba and Delft University, Netherlands launched the new Digital and Cyber Railway Engineering and Operations Center based at UMD to help the rail industry bring high-tech tools, including quantum technology, to bear to secure this crucial part of the nation’s transportation system. The center aims to fight ransomware and other cyberattacks aimed at rail infrastructure of the type that have snarled operations in recent years—and prevent even more serious catastrophic ones.



# Neurotoxins’ Unequal Toll

Sweeping UMD-Led Review Finds Greater Disparities in Environmental Harm Across Racial, Class Lines

**C** HILDREN OF COLOR and those from low-income families are disproportionately exposed to neurotoxic chemicals, resulting in greater harm to brain development and more developmental delays, according to a review of five decades of studies co-led by a University of Maryland researcher.

The expansive review, covering more than 200 studies of children up to age 18 in the United States, showed how discriminatory practices and policies have exposed families to chemical hazards “where they live, work, play, pray and learn,” says environmental health Associate Professor Devon Payne-Sturges, one of the lead authors of the September 2023 publication in *Environmental Health Perspectives*. “Their neighborhoods are more likely to be located near factories, chemical plants, Superfund sites, highways and more vehicle traffic or by agricultural fields where pesticides are applied.”

The review also found that when these exposures are reduced, health disparities fall. Among key findings from the environmental health studies spanning 1974 to 2022:

- Low-income and Black children had higher exposures to lead than children from higher-income families and white children.
- Children in communities of color and low-income communities were disproportionately exposed to air pollution.
- Black and Hispanic children were exposed to higher levels of organophosphate pesticides widely used in agriculture.
- Black and Hispanic mothers had higher levels of phthalates, chemicals used in food packaging, personal care products and elsewhere that suffuse our environment.
- Babies living in economically disinvested neighborhoods and exposed to air pollution in their first year of life were more likely to be diagnosed with autism than those in higher-income neighborhoods.

The review co-authors are all affiliates of Project TENDR (Targeting Environmental Neuro-Development Risks), an alliance of more than 50 scientists, health professionals and advocates working to protect children from toxic chemicals and pollutants that harm brain development.—**AE**

# Grant Launches Multistate Environmental Justice Initiative

**A \$2.2 MILLION GRANT** is supporting a University of Maryland-led effort to address the effects of environmental racism and climate change.

The Mid-Atlantic Climate Action Hub (MATCH) builds connections across Washington, D.C., Maryland, Virginia, Delaware and Pennsylvania, targeting communities disproportionately experiencing the negative effects of climate change because of historic disenfranchisement, coupled with proximity to environmental hazards.

Funded by the Robert Wood Johnson Foundation, MATCH is led by the Center for Community Engagement, Environmental Justice and Health, directed by Professor Sacoby Wilson in the School of Public Health. Organizing partners include the University of Maryland Environmental Finance Center; Namati, an environmental organization “dedicated to putting the power of law in the hands of people;” and the Mid-Atlantic Justice Coalition.—**KB**





# QLab Opens as Quantum Research Hub

Partnership With IonQ Offers Researchers, Students, Professionals Access to Cutting-Edge Hardware

THE UNIVERSITY OF MARYLAND in September announced the grand opening of the National Quantum Laboratory (QLab), a groundbreaking research center developed in partnership with College Park-based IonQ, a leader in the quantum computing industry.

The QLab enables people from across the nation and around the globe to work with one of the world’s most powerful quantum computers alongside leading experts in efforts to address some of the most complex challenges of our time.

Located at the company’s headquarters in UMD’s Discovery District, this workspace aims to build the next generation of

quantum talent and innovations and further establish the region as the Capital of Quantum.

U.S. Sen. Ben Cardin of Maryland told attendees that the university-company partnership is a step toward building quantum computing as a necessary societal tool.

“This is important for Maryland and the University of Maryland, but what you’re doing here today is critically important to America’s future and quite frankly, the global future,” Cardin says.

Thanks to a nearly \$20 million UMD investment that fueled the facility’s opening, the QLab collaboration enables exploration of quantum computing’s role in improving AI, materials discovery, supply chain logistics, climate modeling, cybersecurity and more.

“We cannot fully imagine where quantum computing will take us in the future, but we do know the collaborations made possible through the QLab will be essential to moving the field forward and reaching the life-altering discoveries we seek,” says UMD President Darryll J. Pines (below, center).



# Letting the Hot Air Out of Climate Change Misinformation

UMD Researchers Partner With Teachers to Develop Kids’ Critical and Scientific Thinking Skills

**DEMONSTRABLY FALSE** online claims about climate change are as common as melting glaciers, starting with, “Climate change can’t be real—it’s cold out today!”

How can young people in particular learn to separate credible, evidence-based information from claims that are biased, intentionally misleading or just plain wrong?

Funded by the National Science Foundation, University of Maryland researchers are partnering with teachers in three states to answer that question. They’re developing classroom materials that help students cultivate skills—including the ability to evaluate evidence and sources, make reasoned claims and collaborate respect-

fully—that are key to finding solutions to issues like the climate crisis. The work represents a third phase in the \$5.7 million project, which launched 11 years ago.

“We hope to help students become better informed citizens and give them tools they can use to engage in critical and scientific thinking,” says Doug Lombardi, associate professor in the College of Education and project leader.

Lombardi and Sarah McGrew, an assistant professor in the College of Education, are leading a national team of five master teachers to create materials for middle and high schools, and began testing the materials during the 2023-24 school year.—**ES**

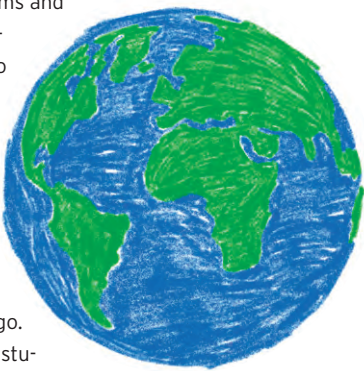


PHOTO BY STEPHANIE S. CORDLE; ILLUSTRATION BY VALERIE MORGAN

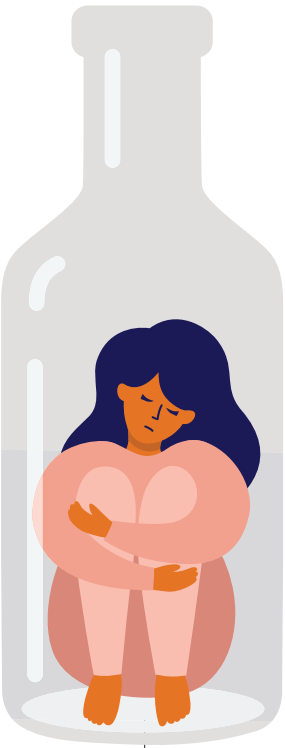
# Unpacking Anxiety-Fueled Alcohol Misuse

\$3.1M NIH Award Focuses Neuroimaging, Computational Tools on Daily Lives of Heavy Drinkers

**W**ITH ABOUT HALF of middle-aged adults reporting they sometimes drink for stress relief, a UMD psychology researcher is delving into the factors governing anxiety-fueled drinking with support from a five-year, \$3.1 million award from the National Institute on Alcohol Abuse and Alcoholism (NIAAA).

Led by Alexander Shackman, an associate professor of psychology, the study uses a combination of brain imaging tools and data gathered via smartphone surveys to clarify the neurobiological mechanisms of the phenomenon in a racially diverse sample of participants.

Social anxiety is a strong predictor of alcohol use disorder, but how this relates to drinking in daily life is not fully understood, says Shackman.



“The new grant from NIAAA will allow us to study the neural circuits that orchestrate states of fear and anxiety in the lab and the everyday experiences of heavy drinkers as they navigate their daily lives,” he says. “Fusing the brain imaging and smartphone data streams will enable us to test the relevance of the brain circuits we identify in the scanner to stress- and relief-motivated drinking in the real world.”

Alcohol misuse is a leading cause of human misery, morbidity and mortality. Approximately 14% of deaths worldwide among 20- to 39-year-olds are attributable to alcohol, according to the World Health Organization.

Past work by the Shackman lab has assessed what takes place in the brain given the danger or risk posed by a threat. Now, the team will render a fuller picture of anxiety by isolating the neural circuits activated by ambiguous threats.

Shackman’s co-investigators include Senior Faculty Specialist Kathryn DeYoung and Research Associate Jason Smith, along with collaborators from the University of California, Davis, University of Wisconsin-Madison and the California National Primate Center.—**NU**

# Apples, Adapted

New Fruit From UMD Could Weather Changing Climate, Labor Shortages to Boost Grower Profits

**HERE’S A CRISP** rejoinder to climate change: Through careful crossbreeding and selection, University of Maryland researchers have developed what might be the perfect apples for American growers.

The two new apples, a yellow and a red one, are heat-tolerant, blight-tolerant, low-maintenance, easy to harvest and not least, delicious-tasting. Both received final patent grants from the U.S. Patent Office in late 2023.

They address a growing suite of problems for the apple industry. While the fruit has always been labor-intensive, apple farming has been among the hardest-hit parts of

the agriculture sector, with severe labor shortages and unusual weather conditions increasing as climate change progresses.

The UMD team’s new apple trees could help farmers sidestep these obstacles, with hardier apples that grow on shorter trees to facilitate harvest.

“These trees require a lot less hand labor compared to apples that are available to growers now,” says Chris Walsh, professor emeritus in the Department of Plant Science and Landscape Architecture who developed the new apples with colleagues Julia Harshman and Kathleen Hunt.—**KC**





# Research in Action Builds Climate Shield for State Residents

New Mesonet System Funded by State, UMD Grand Challenges Grant

UNIVERSITY OF MARYLAND researchers and state and federal government officials gathered in late October to hoist a 30-foot tower into place in a central Maryland farm field, activating the first piece of a statewide system to speed early warnings of dangerous weather.

The Maryland Mesonet, a partnership between UMD and the state Department

of Emergency Management (MDEM), will feature more than 70 towers at approximately 10-mile intervals. The system is scheduled for completion in fiscal 2025, with approximately two towers per week being installed as of spring 2024. Every minute, they send data on temperature, wind, precipitation, soil moisture and more, augmenting National Weather Service data collection and allowing state emergency personnel to stay abreast of rapidly developing storms.

The project was funded with a \$4 million state investment announced in 2022 at UMD. The inaugural tower was erected at UMD’s Central Maryland Research and Education Center, located a few miles west of Ellicott City’s historic downtown. Heavy rains twice in recent years caused violent flash floods that took lives and destroyed buildings in the city.

“The Mesonet will protect Marylanders

from extreme wind and water harm by advancing emergency preparedness and the accuracy of regional weather forecasts,” says Sumant Nigam, the project’s leader and atmospheric and oceanic science chair. “The University of Maryland will provide Marylanders insightful information on severe weather and climate variability and change that will benefit the state’s agriculture, tourism and transportation sectors, among others.”

Beyond allowing communities to respond more quickly to impending wind and water dangers, the system enables farmers to make better decisions on planting and other activities, providing increased information about metrics like soil moisture to State Climatologist Alfredo Ruiz-Barradas, an associate research professor in atmospheric and oceanic science at UMD who provides regular agriculture reports.

The Mesonet is part of a project supported by a \$3 million Grand Challenges Institutional Grant from UMD. The overall initiative works to leverage the latest scientific tools and discoveries in various fields to meet the existential threats of climate change in Maryland.

Like the \$30 million Grand Challenges Grants program, the Maryland Mesonet is taking proactive steps to solving difficult societal problems—and doing it in the interdisciplinary way demanded by the complexity of those problems.

“As Earth’s climate undergoes accelerating changes, weather forecasting only gets tougher. Getting it right quickly is crucial to the safety of people in this region as well as farmers’ ability to feed the world,” says UMD President Darryll J. Pines. “This state-of-the-art system, coupled with our work with local, state and federal officials, makes our state a better place to live for all Marylanders.”—cc



# \$1.4M Mellon Foundation Grant Expands Black Digital Humanities

New Round of Funding Supports Scholarship, Training and Community Building

A THREE-YEAR, \$1.4 million grant from The Andrew W. Mellon Foundation is sparking an expansion of research at the intersection of digital studies, digital humanities and Black studies—all part of the next phase of the African American Digital and Experimental Humanities Initiative (AADHum) at the University of Maryland.

The grant allows the College of Arts and Humanities (ARHU) and UMD’s Maryland Institute for Technology in the Humanities to offer a range of programs for scholars and artists studying Black life and digital and experimental storytelling and design. Mellon previously



awarded \$1.25 million in 2015 and \$2 million in 2019 for the initiative.

“Given that Black studies is so interdisciplinary, AADHum has become a space where many different kinds of energy can converge to produce truly exciting new work,” says Marisa Parham, a professor of English and the initiative’s principal investigator.

With a focus on hands-on practice as a path to humanities inquiry, AADHum affiliates and grantees have produced websites, podcasts, social media storytelling, digital essays,

games, digital publications and more since its 2017 launch. The initiative’s offerings include microgrants for students, workshops and humanities/design programs.

“This work really is in the service of a larger vision for more dynamic, inclusive and just approaches to knowledge production, which is more important than ever,” says ARHU Dean Stephanie Shonekan.—JW

# UMD Analysis: Cut Methane Emissions Now to Slow Climate Change

30% Reduction Would Limit Global Temperature Rise in Coming Decades

REDUCING METHANE EMISSIONS over the next 12 years—particularly from oil and gas—is the most quickly deployable mitigation strategy available to reduce climate risk, a analysis from the Center for Global Sustainability (CGS) at the University of Maryland reveals.

Released near the start of the United Nations Climate Change Conference in

November 2023, the analysis supported by Bloomberg Philanthropies demonstrates that methane can make up nearly half of the needed emissions progress until 2030. However, if governments fail to slash methane emissions by 30% by 2030, then the world will reach a 1.5°C increase sooner than it would otherwise, experience a more prolonged period above that threshold, and increase the risk of tipping-point disruptions of sea level rise or oceanic temperatures.

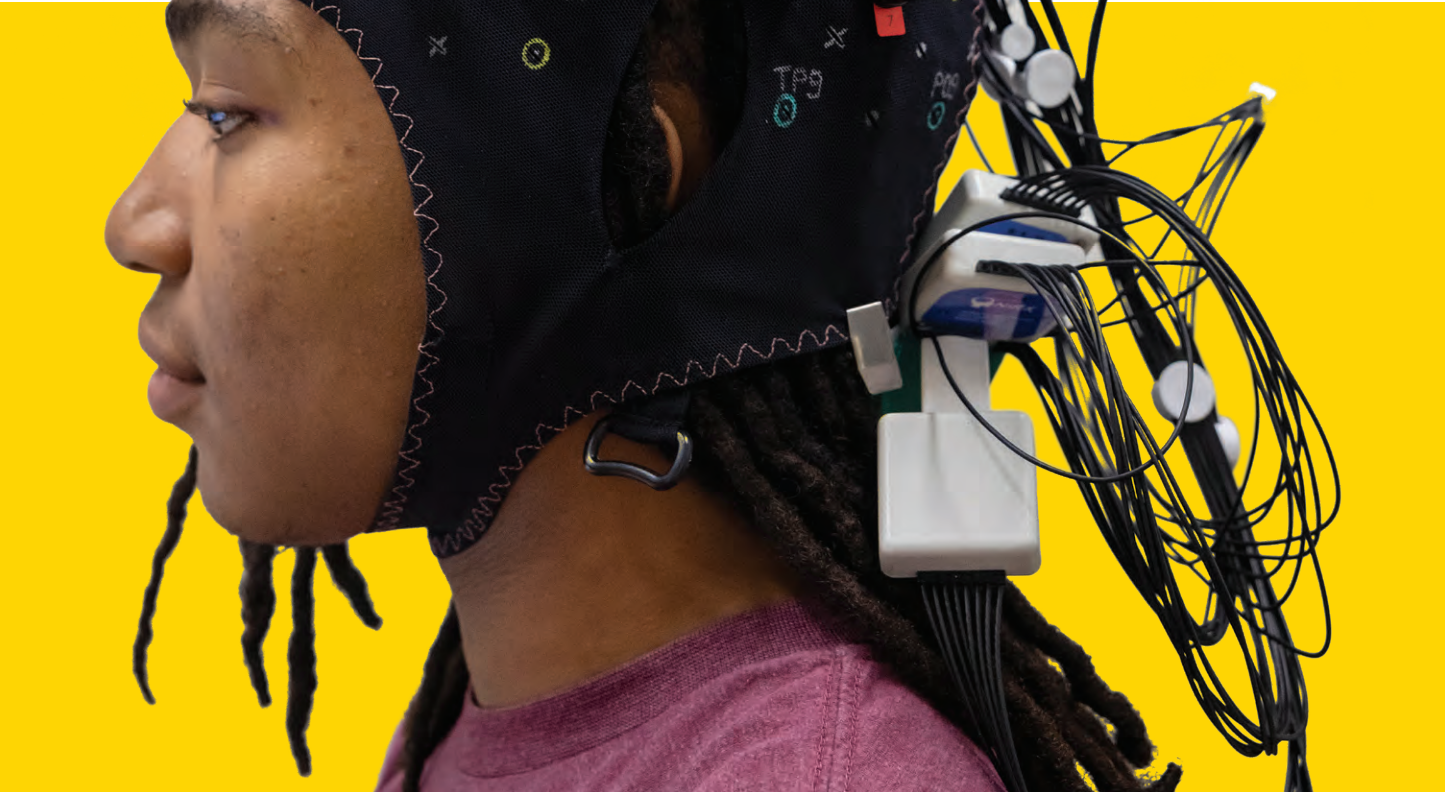
Unlike CO<sub>2</sub> emissions that linger for centuries, methane’s 10-year lifespan means

reducing it can rapidly curb the short-term rate of global temperature warming, which is a crucial factor.

“Our research shows that the maximum and immediate methane abatement is crucial to limiting global temperature increases and achieving global climate goals over the next 15 years,” says Nathan Hultman, CGS director and co-author of the report.—SK







# Hair, Hair for Equity in Neuroscience Research

Lab Expands African Americans’ Participation in Studies With a Scientific Approach to Styling

**R**ACHEL ROMEO, a UMD assistant professor of education, shines a light on kids’ early development—literally. Using a technique called Functional Near-Infrared Spectroscopy (fNIRS), she beams light into the brain from sensors on a stretchy black cap, pinpointing blood flow to measure brain activity.

That light, she knows, can’t easily penetrate Afro-textured hair, which is dark and densely curled. Yet her focus is on socioeconomic disparities in learning and development, so she had to find a way to work with kids from all backgrounds to conduct her study.

“Most of the time in neuroscience research, if you can’t get a good signal from

a participant, you just exclude them or you throw that data away,” says Romeo, who directs the Language, Experience, and Development (LEAD) Lab. “This contributes to underrepresentation.”

More than 70% of research participants in the U.S. are white, and as a white woman, Romeo didn’t know where to turn to learn how to change that dynamic. So she put out an ad for a lab assistant to braid Black hair—and serendipitously, Abria Simmons ’25 had just declared a human development minor and enrolled in one of Romeo’s classes. She wasn’t a professional, but had learned from generations of women in her family and was eager to help increase Black representation in neuroscience.

“There’s a lot of distrust in African American communities of medical research because of the neglect of African American bodies in earlier research studies, so it’s really important that they feel comfortable enough to be included today,” says Simmons (below, left), an aspiring counseling psychologist for kids and teens.

Now, she’s heading the effort to develop best practices for braiding and styling Afro-textured hair for fNIRS neuroimaging. She initially conducted a literature review but only found a few recommendations for EEG caps, which work differently than fNIRS. So she turned to Black barbers and hairstylists for tips, then started recruiting volunteers so she could experiment on their hair before the start of Romeo’s trials with 3- and 4-year-olds.

“This has been a real friends-and-family project for me,” Simmons says. Throughout the summer of 2023, she brought five participants, including her brother and best friend. She first tried cornrows, which she’s most familiar with, braiding them in different patterns to avoid the optodes (sensors) on the cap.

She soon determined that the most successful braiding style involves creating a middle part, then braiding from the center of the scalp down toward the ears. With different curl and hair-growth patterns, however, it’s not a one-size-fits-all solution.

“There’s not many Black women in our research field, so I really want to represent my community.”

—Abria Simmons ’25

That’s why Romeo (below, right) gave the go-ahead for Simmons to purchase a cart full of barbershop products, including clips and combs, tubs of edge control and gel, and a hair dryer and diffuser, so that people with dreadlocks or shorter hair also have options.



It’s already proven useful: Romeo brought in her first 4-year-old Black participant, and since his hair wasn’t long enough to be braided, his mom used the gel to slick his hair up and out of the way.

Simmons knows how much effort it takes to care for and style Afro-textured hair, so she schedules times in the lab based on participants’ wash days and prioritizes the health of the hair as she works. Some of her earliest memories involve three- to four-hour braiding sessions with her mom as she fell asleep in her lap as a toddler, with Disney princess movies playing in the background.

“It was definitely a bonding experience,” says Simmons, who took what she learned and combined it with YouTube tutorials to develop her own style as a teenager.

In September, she traveled to the Flux Society conference for developmental cognitive neuroscience with Romeo and other LEAD Lab members, where Simmons won best poster out of more than 130 presentations. Having tenured professors and longtime researchers seek her advice on data collection challenges was surprising but validating.

“There’s not many Black women in our research field, so I really want to represent my community,” Simmons says. She’s planning to expand on her poster presentation and write a paper this summer, and hopes her findings can give scientists the tools to conduct more equitable studies.

Romeo says, “I needed someone who was creative and willing to take the plunge with us. I’m just really grateful to have a partner who is willing to flip institutions on their head and figure out how to make neuroscience more inclusive.”—KS





# Deep in a South Dakota Gold Mine, UMD Physicists Prospect for Dark Matter

A “Eureka” Moment Could Revise Basic Understanding of Forces in Universe

**N**ESTLED IN THE MOUNTAINS of western South Dakota is the little town of Lead, which bills itself as “quaint” and “rough around the edges.” Visitors driving past the hair salon or dog park may never guess that an unusual—even otherworldly—experiment is happening a mile below the surface.

A research team that includes University of Maryland physics faculty members and graduate students hopes to lure a hypothesized particle from outer space to the town’s Sanford Underground Research Facility, housed in a former gold mine that operated at the height of the 1870s gold rush.

They’re prospecting for WIMPs—not 98-pound weaklings, but “weakly interacting massive particles,” which are thought to have formed when the universe was just a microsecond old and which may exist unseen all around us. The research facility suits this type of search because the depth prevents the intrusion of cosmic rays, which would otherwise interfere with experiments.

If WIMPs are observed, they could hold clues to some of the most perplexing problems in physics: the nature of the mysterious, hypothetical substance called “dark matter” and the very structure of the universe itself.

The UMD team is led by physics Professor Carter Hall, who has been looking for

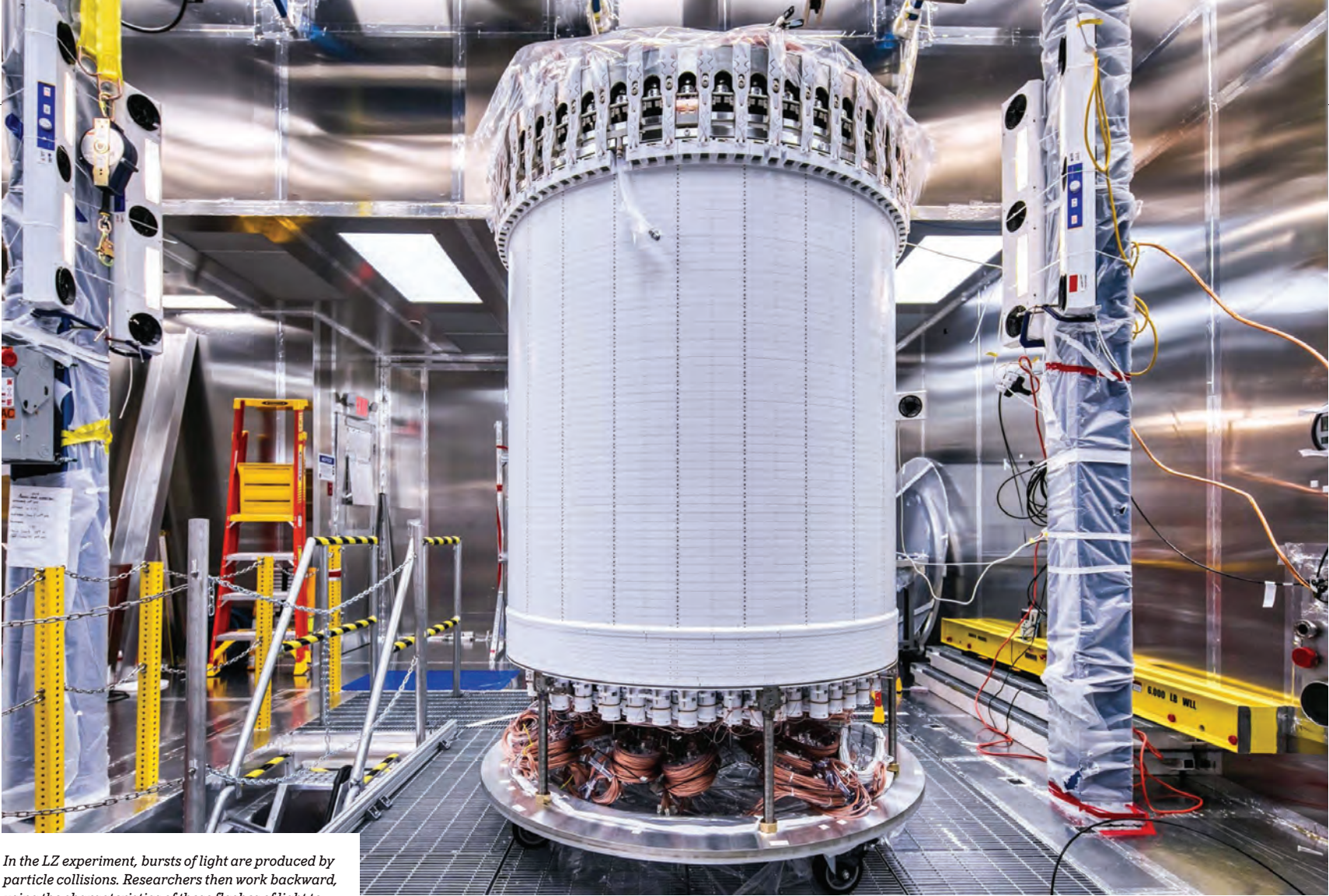
dark matter for 15 years. Excited by the possibility of observing unexplained physical phenomena, Hall had previously joined the Large Underground Xenon (LUX) experiment at the Sanford Lab. LUX was the most sensitive WIMP dark matter detector in the world until 2018; the current LUX-ZEPLIN (LZ) experiment launched in 2022.

LZ, which was specifically designed to search for WIMPs and has a significantly larger target, has even better odds of detecting or ruling them out as a dark matter candidate. The discovery of WIMPs could help account for the missing 85% of the universe’s mass—which calculations predict must exist, but can’t be seen.

Unlike experiments conducted at particle smashers like the Large Hadron Collider (LHC) in Switzerland, the LZ attempts to directly observe—rather than manufacture—dark matter. Anwar Bhatti, a research professor in UMD’s Department of Physics, says both approaches have pros and cons. He worked at the LHC from 2005 to 2013 and is now part of the LZ team at UMD.

“There’s a chance we will see hints of dark matter, but whether it’s conclusive remains to be seen,” Bhatti says.

UMD physics graduate students John Silk, Eli Mizrachi and John Armstrong are also part of this experiment, and the team published its first set of results in July 2022 following a few months of data collection.



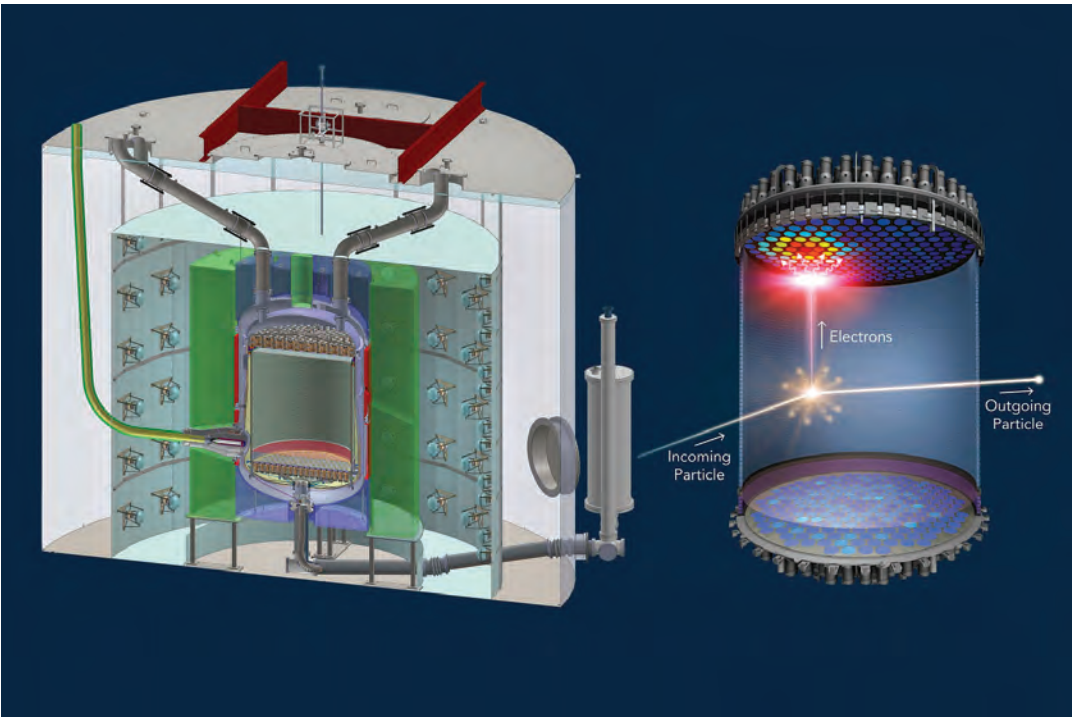
*In the LZ experiment, bursts of light are produced by particle collisions. Researchers then work backward, using the characteristics of these flashes of light to determine the type of particle as they search for a type known as a WIMP (weakly interacting massive particle), a candidate for dark matter.*

No dark matter was detected, but the results show that the experiment is running smoothly. Researchers expect to continue collecting data for up to five years.

“That was just a little taste of the data,” Hall says. “It convinced us that the experiment is working well, and we were able to rule out certain types of WIMPs that had not been explored before.”

Direct searches for dark matter can only be conducted underground because surface-level cosmic radiation can muddle dark matter signals and make them easier to miss.

“Here, on the surface of the Earth, we’re constantly being bathed in cosmic particles that are raining down upon us. Some of them have come from across the galaxy



and some of them have come across the universe,” Hall says. “Our experiment is about a mile underground, and that mile of rock absorbs almost all of those conventional cosmic rays. That means that we can look for some exotic component which doesn’t interact very much and would not be absorbed by the rock.”

In the LZ experiment, bursts of light are produced by particle collisions. Researchers then work backward, using the characteristics of these flashes of light to determine the type of particle.

The UMD research group calibrates the instrument that powers the LZ experiment, which involves preparing and injecting tritium—a radioactive form of hydrogen—into a liquefied form of xenon, an extremely dense gas. Once mixed, the radioactive mixture is pumped throughout the instrument, which is where the particle collisions can be observed.

The researchers then analyze the mixture’s decay to determine how the instrument responds to background events that are not dark matter. By process of elimination, the researchers learn the types of interactions that are—and aren’t—important.

Learning whether they found dark matter could take at least a year, because they want the sensitivity of the second data set to significantly exceed that of the first, which requires a larger amount of data overall.

If detected, these WIMP particles would prompt a massive overhaul of the Standard Model of particle physics, which explains the fundamental forces of the universe. While this experiment could answer pressing questions about the universe, there is a good chance it will also spark new ones.

“It would mean that a lot of our basic ideas about the fundamental constituents of nature would need to be revised in one way or another,” Hall says. “Understanding how that would fit into particle physics as we know it would immediately become the big challenge for the next generation of particle physicists.” —EN





# Roads to Recovery

In Rural Maryland, a New “Been-There-Done-That” Approach to the Opioid Crisis Offers Hope on Four Wheels

**I**N THE PARKING LOT outside the First Church of God in Federalsburg, Md., a 38-foot van carries what many people in rural parts of Maryland desperately need but often can’t get: treatment—and genuine understanding—for opioid use disorder.

The Mobile Treatment Unit (MTU) operated by the Caroline County Health Department is part doctor’s office, part counseling center and part support group meeting. Clients board, meet with a registered nurse in the back, enter a booth to virtually visit a doctor from the University of Maryland School of Medicine (UMSOM) in Baltimore, stop by a restroom for a urine sample, and wrap up by chatting with a substance use counselor in her office in the RV.

A patient’s guide through the process, though, is a peer—someone who’s experienced the ravages of addiction and can listen without judgment to the stories

people may be too ashamed to tell a doctor or nurse.

On this afternoon, Jessica Anthony is observing how the MTU’s staff handles patient visits, but it wasn’t long ago that she was on the other side, climbing the van’s steps for help with an addiction to methamphetamine and prescription opiates. She’s part of a University of Maryland, College Park study examining how peer treatment can be a bulwark for recovery—a project with sweeping possibilities that stretch from this rural hamlet to struggling neighborhoods in Baltimore to impoverished shantytowns on the other side of the world.

The study is led by the director of UMD’s Center for Substance Use, Addiction and Health Research (CESAR), Jessica Magidson Ph.D. ‘13 (right), with UMSOM Associate Professor of Medicine Dr. Sarah Kattakuzhy as part of the

Jessica Anthony, below, is a peer recovery specialist with a UMD project offering help for people with opioid use disorder in Caroline County, Md.



MPowering the State initiative, a strategic partnership between the two campuses, and funded by a nearly \$4 million grant from the National Institutes of Health.

“It’s essential to get community buy-in,” says Magidson, an associate professor of psychology. “The peer model of having someone who’s from your community, who’s been a patient of the service—it’s so important to establish that trust and lived expertise.”

As the opioid epidemic sank its claws into Maryland and the nation over the last several years, there was no physician trained in addiction who served Caroline County, and the closest rehab



centers could be an hour away in Cambridge or Chestertown.

Dr. Eric Weintraub ’80, an UMSOM professor of psychiatry, proposed to the local government in 2018 that they work together to pursue a federal grant for a telemedicine vehicle to reach people in their neighborhoods. Now operating out of two RVs with a team of five doctors, a registered nurse, a social worker, two coordinators and two peer recovery specialists, the MTU provides an opportunity for Magidson to examine the impact of peer counseling in hard-to-reach areas—a methodology she’s been focused on since seeing it in action in South Africa as a graduate student.

I can use my personal experience to help others create a path to recovery and build a more hopeful future.

— Jessica Anthony  
Peer Recovery Coach

Magidson, who has been awarded \$14 million in combined NIH funding since joining UMD’s faculty in 2018, leads seven clinical trials across South Africa, Detroit, Baltimore and Maryland’s Eastern Shore. In each location, she and her team train peers in evidence-based techniques to support recovery, including behavioral activation—a treatment originally developed for depression that emphasizes engaging in fulfilling substance-free activities. Peers also learn problem-solving strategies to address barriers to taking medication and staying in care, and how to share their own stories in a way that will resonate with patients.

“It fits me perfect,” says Anthony. “I can use my personal experience to help others create a path to recovery and build a more hopeful future. It’s almost too good to be true.”—**SL**

## UMD’s SAFE Center Expands Training Program for Human Trafficking Survivors

**THE UNIVERSITY OF MARYLAND** Support, Advocacy, Freedom, and Empowerment (SAFE) Center for Human Trafficking Survivors and Marriott International will expand a program to prepare survivors for hospitality careers.

Trafficking survivors face many barriers in their search for education and employment, prompting Marriott to develop the FiT Curriculum in collaboration with the Global Fund to End Modern Slavery in 2018. Designed with input from survivor consultants and field experts, the FiT Curriculum provides trauma-informed job readiness training.

The FiT Curriculum was piloted by the SAFE Center—a signature initiative of the University of Maryland Strategic Partnership: MPowering the State—in 2022, with more than 60 survivors trained.



## Seed Grant Sparks Project on Domestic Terrorism Policies

**DOMESTIC TERRORISM IS** on the rise, as is the call for ways to combat it. Are new laws or stiffer penalties the answer? A \$64,133 seed grant in 2022 from the MPowering the State Initiative to a UMCP-UMB team led to 2023 funding of \$762,533 from the National Institute of Justice for a study to answer that question.

Michael Jensen, a senior researcher at the National Consortium for the Study of Terrorism and Responses to Terrorism (START) at UMCP, and Michael Vesely, academic program director and senior law and policy analyst at UMB’s Center for Health and Homeland Security, will expand their work reviewing hundreds of terrorism prosecutions to determine if

current legislation is sufficient to reduce the threat.





# Charging Up That Hill

BY CHRIS CARROLL

ILLUSTRATIONS BY DENIS FRIETAS

Ninety-second battery fill-ups. All-day range. Unparalleled safety. UMD researchers are powering up EVs to save the planet.

**WESTWARD-BOUND PIONEERS** of an earlier era packed their wagons, hitched up the oxen and set out. Before his own trailblazing cross-country journey, Mark Eakin first tested his wheels at a D.C.-area drag strip.

There, his Ford F-150 Lightning—a battery-powered version of America’s most popular vehicle—posted acceleration times that would rival a Ferrari’s, while emitting no greenhouse gases. The “frunk,” however, is Conestoga-esque in the storage gained from ditching the traditional internal combustion engine.

His new truck seemed the perfect vehicle to help Eakin, a retired coral reef scientist for the federal government and occasional University of Maryland research collaborator, forge a new Oregon Trail of climate-friendly travel. In early 2023, he and his wife, June, became the first people—as far as anyone in the electric vehicle enthusiast community can tell, anyway—to pull a travel trailer coast to coast and back with an EV.

Make that the almost-perfect vehicle. The trailer’s weight and wind drag shrank the truck’s range, requiring half-hour stops at fast-charging stations about every 110 miles. Those breaks became all-day

affairs in remote areas like rural Idaho and the Texas plains with scarce charging infrastructure, where the truck had to sip electrons from regular outlets.

None of this surprised the couple, who planned on short hops between friends, family and sightseeing. “It was a bit of an experiment,” Eakin says. “The idea wasn’t to get anywhere as fast as possible.”

Beyond committed environmentalists and hardy early adopters, the rest of the nation may be less tolerant of battery-related EV inconveniences. At least that’s the fear of government agencies and nonprofits behind a sweeping plan to “decarbonize” the U.S. economy to save the planet from global warming—and it’s why UMD researchers are at the forefront of developing EVs that can charge faster than you can fill a gas tank, have the range to cruise to the horizon and beyond without a stop, and boast unprecedented safety and performance in even the most extreme conditions.

The clock is ticking. Limiting U.S. greenhouse gas emissions to head off the worst effects of climate change means getting as many

An estimated  
**200M**  
EVs will be on the roads  
globally by 2030.

—INTERNATIONAL ENERGY AGENCY

butts in electric vehicle seats as possible and moving to a power grid based on renewable energy sources, including wind, solar and hydrogen fuel.

“We have to accelerate the societal shift to electric vehicles,” says Distinguished University Professor Eric Wachsman, a globally recognized expert in next-gen battery technologies and director of the

Maryland Energy Innovation Institute. “And that means you have to overcome the resistance some people have to these kinds of vehicles.”

## Maintaining Momentum?

EVs in 2023 accounted for 7.6% of the U.S. new vehicle market, up from 5.9% in 2022,

but beyond the coasts and big cities, the lure of swoopy Teslas, burly Rivian trucks and an increasing selection of cars from traditional manufacturers is in question.

For instance, a January 2024 Deloitte survey of 27,000 global consumers showed concerns about charging speeds and vehicle range were causing people to avoid EV purchases. At almost the same time,





In early 2024, new EVs cost  
**17% more**  
than the average car.

—KELLEY BLUE BOOK

Ford slashed F-150 Lightning production by two-thirds, citing weak demand, while other manufacturers also retrenched with plans to sell fewer EVs and more traditional vehicles.

What’s needed, say UMD researchers, is a self-perpetuating virtuous circle where every advance expands the user base, leading to greater support and infrastructure, and making EVs appealing to ever-broader swaths of society. That will include marginalized and low-income groups who bear much of the brunt of pollutants from conventional vehicles, and who are most vulnerable to climate-related harm as fossil fuel use continues to heat up the earth.

Beyond the upper-income groups that make up most of the EV market today, switching to an EV in 2024 is a tall, if not impossible, order, contributing to growing tech disparities and hampering society’s ability to head off environmental catastrophe.

“We shouldn’t be naïve about how hard it is for people from disadvantaged groups to enter these kinds of markets,” says Deb Niemeier, Clark Distinguished Chair in the Department of Civil and Environmental Engineering (who is not part of the A. James Clark School of Engineering’s battery design efforts). “First and foremost, you have to have affordability and there has to be a viable used car market, and public charging must be available in places where it barely exists now.”

To address such challenges, UMD battery researchers are among the most active in the nation working to meet the performance requirements of the EVs4ALL program overseen by the Advanced Research Projects Agency-Energy (ARPA-E), a federal agency that deals

in cutting-edge energy projects. To those ends, Wachsman and others plan to bring batteries to market in coming years that last through many thousands of charge cycles, enabling used car markets; batteries that use cheaper, more readily available components than traditional ones like lithium; batteries that charge up in minutes rather than hours, even in low temperatures that stymie current technology.

“At UMD we have a large number of faculty and students on these projects compared with other academic institutions,” says Paul Albertus, an assistant professor of chemical and biomolecular engineering who in his previous job was the program manager for over \$60 million of mostly battery projects for ARPA-E. “What really sets us apart is that we have research groups working on so many of these different aspects—solid electrolytes, liquid electrolytes, people doing basic science and people doing technological innovation—and that portfolio of work is complementary.”

**Replacing the Batteries**

Current lithium rechargeables have fueled technological leaps in mobile computing, medical devices and e-bikes and -scooters; they’re tucked into an ever-increasing number of our cars and light trucks—from an International Energy Agency figure of around 26 million EVs globally in 2022 to recent Bloomberg forecasts of 77 million next year. More than 200 million electric vehicles are expected to be on the road worldwide by the end of the decade—but powered by what?



“We have to  
accelerate the  
societal shift  
to electric  
vehicles.”

—Eric Wachsman  
Director, Maryland Energy Innovation  
Institute; Distinguished University  
Professor, Departments of Chemical  
and Biomolecular Engineering  
and Materials Science and  
Engineering



As anyone knows who’s seen surveillance videos of exploding scooters and terrorized vape pen users dropping and fleeing their devices, or discovered their phone bulging and nonfunctional with a swollen battery, lithium-ion cells have a dark side that stems from their chemistry. They use a flammable liquid electrolyte, the part of the battery that carries electric current between the positively and negatively charged internal components of cells, made of lithium salts dissolved in an organic solvent.

“Liquid lithium electrolytes are very volatile. If you have a short or damage to the battery, you can have what’s called a thermal runaway reaction where the battery’s energy heats up the battery uncontrollably and can start a fire,” says Professor Chunsheng Wang, director of UMD’s Center for Research in Extreme Batteries—a collaboration with the U.S. Army Research Lab—and like Wachsman (left), a faculty member in chemical and biomolecular engineering as well as in materials science and engineering.

(For perspective, EVs don’t burn often, although they get a lot of press when they do. “They’re very safe, safer than a typical car, in fact,” says Ron Kaltenbaugh, president of the Electric Vehicle Association of Greater Washington. His claim echoes recent data from both Tesla and an Australian government study showing that EV batteries, frequently bundles of hundreds of smaller battery cells, are an order of magnitude less likely to ignite than petroleum-powered engines. “But they can be pretty hard to put out” once fully engulfed, Kaltenbaugh says.)

Managing conventional lithium-ion batteries’ safety issues comes at a heavy cost—literally. Their various added layers and separators, along with extra circuitry and other protection measures on the outside, make current EV battery systems far bulkier and less “energy-dense” than they would be with inherently safer chemistry.

“Every layer of material you add to the battery is that much less energy the battery can hold,” Wachsman says.

According to ARPA-E, the current generation of lithium-ion batteries suffer from “performance limitations that incremental progress cannot address,” hampering a full transition away from the 1.7 billion conventional light vehicles on the road globally, along with a similar number of heavy trucks, buses and the like.

A new path lies in solid-state battery technology. It replaces lithium-ion batteries’ problematic liquid electrolytes with safer, nonflammable alternatives. This is at the heart of research in the Maryland Energy Innovation Institute, which in recent years has helped launch dozens of companies, filed for well over 100 patents and secured around \$150 million in funding for the startups, several of which focus on technology directly applicable to vehicles.

Wachsman’s solid-state design replaces the liquid electrolyte with a rigid ceramic known as garnet that conducts ions about as well as a conventional lithium-ion electrolyte, while being nonflammable and tough enough to endure thousands of charges. The technology is being developed in Wachsman’s spinoff company, Ion Storage Systems, with the help of recent \$40 million investment rounds.

**Access Issues**

As the Eakins wended their way across the country, the frequent stops for fast charging along major interstates weren’t what bothered them. “People talk about the 400-mile battery—who’s got a 400-mile bladder?” Mark Eakin says.

The lack of charging spots in the nation’s interior was what made it impractical to visit the house in the Texas Panhandle where Mark’s grandparents had lived; the Eakins also had to carefully manage their approach to Big Bend National Park in the western end of the state to avail themselves of the few available charging opportunities and driving slower than normal to extend their range along certain stretches of interstate.





Issues of vehicle range, charging rates and infrastructure are interrelated; one way to incentivize building more charging infrastructure is to make more people want—and buy—electric cars by addressing the issues in a holistic manner rather than individually. UMD’s battery experts plan to do that in part by rendering obsolete one of the loudest complaints against EVs: They take too long to charge.

While “slow” is relative, so-called Level 1 charging with regular outlets is painfully poky, adding less than five miles of driving range for every hour plugged in. Level 2, available at around 54,000 public charging stations in the U.S. and at many EV drivers’ homes, uses 240-volt power to add 20 or more miles of range an hour. Level 3, known as DC fast charging, or Supercharging in the Tesla universe, can boost a car’s battery to 80% in 20 minutes to an hour. The catch? Only about 9,400 such charging stations exist in the United States, according to research by UMD’s Center for Global Sustainability (CGS), and per mile they rival gasoline in cost, negating one of the draws of EVs.

That scarcity leaves vast swaths of the population without a practical way to drive an EV, contributing to sluggish sales even as average prices have been plummeting. CGS’s work found that access to charging is far from equal in U.S. society, with members of racial and ethnic minority groups and low-income people on average traveling farther to find an EV charger, says Jiehong Lou, a CGS assistant research

professor who studies equitable access to EV technology. Likewise, African Americans have less potential to reap the cost savings of home charging because of significantly lower homeownership rates than white people, she says.

To be broadly popular, EVs can’t require a hobbyist level of commitment and a spacious suburban home, Wachsman says.

“Someone like me can drive home at night, close the garage door when it’s cold outside (because EVs don’t charge well in the cold), plug into a Level 2 charger, and you’re ready to drive the next day,” says Wachsman, who’s driven a Tesla since 2013. “But there are a lot of people who live in apartments, live in a city environment, who just don’t have home charging. Then it gets a lot harder to drive an EV.”

### In a Flash

Today’s half-hour fast charging sessions offer drivers a chance to play a few rounds of Candy Crush and read emails, welcome or not. In the future, they’ll race to wash their windshield before the charge is finished.

In recent work, Wachsman showed that by modifying the composition of his patented ceramic architecture, he could charge or discharge lithium metal batteries at rates up to 100 milliamperes per cubic centimeter, enabling EV battery charging in about 90 seconds and exceeding the

“It’s a matter of whether the price-to-performance ratio works for you. If it does, you get an EV.”

—Ron Kaltenburgh  
President, Electric Vehicle  
Association of Greater  
Washington D.C.

Public charging  
stations around  
the U.S.:

62,000

—UMD CENTER FOR GLOBAL  
SUSTAINABILITY

U.S. Department of Energy’s fast-charging goal for EVs by a factor of 10. The new approach would also result in batteries with a lifespan far longer than typical cars need.

Meanwhile, Wang and colleagues showed a way to stop “dendrites,” tiny branch-like structures that grow in the microscopic confines of an advanced solid-state cell during fast charging and other intense usage, causing short circuits.

A new interlayer in the battery can stop lithium dendrites that develop in the battery’s negative electrode, piercing the solid electrolyte and destroying the battery.

Wang also presented battery technology recently that overcomes another major hurdle for lithium-ion batteries: rapidly declining efficiency and chargeability as the temperature gets closer to the freezing point. In 2023, he demonstrated a battery that operates down to minus 60 degrees Celsius. He’s commercializing the technology through his battery spinoff company, Wh-Power.

In research not directly related to EVs, Wang has produced batteries that use saltwater as an electrolyte and with previously unheard-of voltage levels; he’s working to boost the energy a bit higher to create batteries that are intrinsically safe and cheap—“just go get some water from the ocean,” he jokes—that can be used to store excess wind or solar energy generated on a renewable power grid. Such batteries could provide carbon-free vehicle charging in the most remote locations.

UMD engineers and chemists are working on a wide range of other battery technology as well that could one day power electric vehicles and other technology of the future. Some focus on finding “earth-abundant” replacements for lithium, which is toxic, relatively rare and vulnerable to supply line delays caused by geopolitical disruptions. Another line of research, led by Distinguished University Professor Gary Rubloff in materials science and engineering, uses nanotechnology to precisely design microbatteries with huge power output for their size; they could be constructed

much like microprocessors on outdated assembly lines for silicon chips.

“The more of these problems we solve, the more electric vehicles people will be driving, and the better for the environment,” Wang (right) says.



### Accelerating Acceptance

On a back road near Frederick, Md., Kaltenbaugh, head of the D.C. EV owners’ network, presses the accelerator on his Tesla Model 3; the dual motors kick in almost silently, squishing a passenger back into his seat as barns and a farm animal or two fly by.

“We’re still in ‘Chill’ mode,” he points out, indicating the possibility of several higher levels of squish. Although Kaltenbaugh says he rarely tests the car’s performance potential, the acceleration has at least once helped him avoid a potential collision with an erratic driver while he was merging onto a highway.

A massive dashboard screen displays miles remaining on his battery—about 170—and when Kaltenbaugh pulls over, he activates a map showing every available charger in the region. It looks like a cornucopia, but the density of options thins toward the edges.

“Electric vehicle technology is never going to ‘get there’ if that means a stage where it’s fully developed,” says Kaltenbaugh, whose family has transitioned entirely to battery-powered cars. An avid skier, he’s seen the impact of climate change in mountain environments around the country, where subtle temperature changes can have outsized impacts on snowpacks.

“It’s going to keep developing. It’s a matter of whether the price-to-performance ratio works for you. If it does, you get an EV.”

For those who can afford a new car now and have a place to charge it, EVs’ efficiency and performance advantages combined with lower regular maintenance requirements already make them a logical choice over fossil fuel-powered vehicles, says Wachsman. With their revolutionary battery advances, Maryland researchers plan to soon push it over the hump for everyone else. ■

“The more of these problems we solve, the more electric vehicles people will be driving, and the better for the environment.”

—Chunsheng Wang  
Director, Center for Research  
in Extreme Batteries; Professor,  
Departments of Chemical and  
Biomolecular Engineering  
and Materials Science and  
Engineering



Ugandan-born geographer Catherine Nakalembe links satellites and on-the-ground monitoring to help African farmers weather extreme events.

BY MAGGIE HASLAM  
PORTRAIT BY JOHN T. CONSOLI

# Growing Resilience From the Ground, Up

“A lot of the things that have happened in my life are by chance. But maybe the chances just add up.”

CATHERINE NAKALEMBE STOOD shin-deep in the middle of an Eastern Ugandan river on a sweltering, blue-sky day in 2014, peering out from beneath her wide-brimmed hat as she surveyed the farmland before her. A geographical sciences assistant professor and expert in satellite remote sensing, she’d seen this field before—from space. Approximately 350 miles up, satellites could capture the patchwork tapestry of browns and greens that make up Africa’s agricultural landscape. But the images they beamed back couldn’t tell Nakalembe if the crop in front of her was maize or wheat.

As the Africa program lead for NASA Harvest, an international consortium commissioned by the space agency and led by the University of Maryland, those details were critical to her work. Without knowing the crop type, computer models couldn’t monitor how it will fare against a spike in temperature or a projected wet season, or inventory what’s growing in the region. So Nakalembe tromped across Eastern Africa’s small farms—often no more than three acres each—every July and August from 2010 to 2016 to document its fields.

“I walked so many miles, I was in such great shape,” she says. “It was time-consuming and so hard, but it’s what was needed.”

Much of Nakalembe’s own orbit, she says, has been shaped by fateful encounters, people and timing: from her journey to UMD to her path home to fight Africa’s food crisis. And as earth-circling satellites piled up growing mountains of data, she knew she couldn’t singlehandedly teach them to “see” African agriculture with

her cross-country treks. It would take another chance event—and on a truly global scale—to literally drive her team to a solution.

“A lot of the things that have happened in my life are by chance,” she said. “But maybe the chances just add up.”

**TWO YEARS BEFORE THAT WOULD HAPPEN**, in 2018, two cyclones drenched the desert sands of the “Empty Quarter,” a barren expanse straddling Saudi Arabia, Yemen and Oman, awakening generations of locusts to breed and wage a ravenous campaign. Deafening swarms stretching to the horizon laid waste to crops and pastureland over six countries in East Africa, plunging the already food-insecure region into crisis.

Locust plagues and other extreme events, from floods to drought, have battered Africa’s agriculture industry for centuries, exacerbated its high rate of hunger and fueled economic and political instability. But this crop of airborne pestilence, which lasted until 2022, stemmed from irregular circulation and temperature patterns in the Indian Ocean likely caused by climate change.

Extreme events, which are expected to increase as global warming continues, deliver profound socioeconomic blows. According to the consulting group McKinsey and Co., agriculture is Africa’s largest economic sector, accounting for more than \$100 billion annually and employing over half the continent’s workers. Meanwhile, nearly 800 million Africans—roughly 60% of the population—are food-insecure. In 2022, a person died every 36 seconds in drought-stricken East Africa.





Nakalembe's work is central to UMD's effort to advance the use of remote sensing and artificial intelligence (AI) to monitor and protect global food security. In Africa, she has established herself as a trailblazer: Over the past 14 years she has combined her geographical expertise with the demanding, often improvisational nature of field work to provide governments with the tools to know what's growing where, and the ability to respond to and head off crises on a continent where deadly food shortages occur with numbing regularity.

"This research is about getting out in front of some of the worst events," says geographical sciences Professor Emeritus Christopher Justice, who has worked with Nakalembe since 2010. "And it's about getting quick, actionable information to those who need it to minimize the impacts on the population. In this respect, Catherine's grabbing the bull by the horns."

**TWO DECADES BEFORE** Nakalembe was pointing satellites toward Africa, she was taking an interest in its diverse ecology

while walking each day between school and her family's tidy, plastered mud house outside Kampala, Uganda's capital. A chance conversation with a family friend who worked at Makerere University in Kampala—and her knack for geography and math—helped her win a fully funded spot in its new environmental science program. After her undergraduate degree, her sister encouraged her to apply to graduate school in the U.S. Each week, she made the four-mile trek from her home to the local U.S. Embassy's library to research schools and take practice tests.

With help from family, friends, acquaintances and university administrators, she pursued a master's at Johns Hopkins University, then went on to get her Ph.D. at Maryland. At a faculty event in her first semester she met Justice; he had just launched UMD's Group on Earth Observations Global Agricultural Monitoring Initiative (GEOGLAM) in Africa, which preceded NASA Harvest in applying remote sensing to develop policy around agriculture and global food security. At the time, Nakalem-

It's about getting quick, actionable information to those who need it to minimize the impacts on the population.

In this respect, Catherine's grabbing the bull by the horns."

—Christopher Justice  
Professor Emeritus,  
Geographical Sciences

be's knowledge of agriculture was limited to growing maize outside her parents' house, but her geographical expertise, coupled with knowledge of her home country, was the missing piece the initiative needed.

Three sentences into their first conversation, Justice, who would become her doctoral adviser, asked her, "How would you like to go back to Uganda?"

Nakalembe began work on her dissertation in Uganda and projects for GEOGLAM in countries including Mali, Ethiopia and Kenya in 2010. With funding from organizations including the Gates Family Foundation, she collaborated with government ministries to develop agricultural risk analyses and a framework for crop monitoring systems. She quickly learned, however, that what worked in Kenya might not in Tanzania; beyond what was growing in the fields, government structures varied wildly.

But it was less about reinventing the wheel and more about rearranging the spokes. With the launch of NASA Harvest in 2018, Nakalembe synthesized all the work and lessons learned during her years in the field to begin developing a catalog of tools, computer models and data already available through public and private organizations that, in different combinations, could meet each country's specific needs.

Nakalembe worked with ministries across Eastern Africa to give them critical information, from land use to rainfall amounts. For the first time, they had unprecedented views of the health of Africa's agricultural industry—but not a complete picture.

**WHAT GAVE NAKALEMBE** the visibility she needed was the event that shuttered the world: COVID-19. Unable to travel or conduct in-person research, the extensive, on-the-ground network of people she developed through her years in the field—including farmers, field agents, humanitarian groups and ministry stakeholders—proved to be the linchpin to secure a grant to purchase and distribute GoPro cameras, free to any African farmer or field agent willing to send back the pictures they capture.

Canvassing the landscape at around 40 mph, the cameras, which are affixed to cars and motorbikes, can rapidly generate pictures of crops and record each location. The images are fed to machine learning systems to turn the data from "street to sat," creating satellite-ready labels that can allow artificial intelligence to eventually recognize crops from space.

When her team ran the first trial in December 2020, it was able to cover 30-40% of Western Kenya in two weeks. Across the continent, it has so far generated over 5 million images—data integral to tracking crop types and growing conditions, while warning of potential droughts,



flooding and diseases. The team is now working to perfect yield predictions.

"This real-time information enables ministries to prioritize response efforts early enough before it becomes a crisis," says Kenneth Mwangi, an agriculture monitoring and early-warning expert with the Intergovernmental Authority on Development in Eastern Africa, who has worked with Nakalembe for six years. "And that's how we really benefit from some of the work being done by UMD, Catherine and NASA Harvest."

**ASK NAKALEMBE** what success looks like, and she eschews the recognition she's earned on the international stage, including the \$1 million Al-Sumait Prize for African Development in 2022 that she split with a co-awardee and the Africa Food Prize in 2020. Instead, she'll point to a recent conversation she read on WhatsApp among a crop monitoring team in Kenya. A news article had announced that the ministry was going to dispatch fertilizer to an area that had a measured reduction in production.

"This is to let you know that all the work you're doing is leading to

these types of decisions," read a comment from a ministry official.

Having countries in charge of their own destiny, says Nakalembe, is the key to reversing the food crisis. She sees Harvest's role as setting up and supporting the systems, but it is up to the governments to provide the human capacity to run them, generate the communications that lead to policy and collaborate across their borders.

"This is more powerful than any remote sensing," she says. "It's a seed that then yields this connectivity, and having a place where they can show, 'This is what's happening.'"

Grants helped Nakalembe and her team collect the initial data; but collecting it over multiple years will help them build better models, which will lead to better outcomes for Africa. That will require more money. In the meantime, she will cart another box of GoPros home from her office—where boxes of them cover every surface—for her twin sons to assemble. She will keep delivering what's needed.

"The fact that she's utilizing her skills to impact her home country is particularly meaningful, but for her I think it brings some responsibility," says Justice. "You have to find good people who want to make a difference, and Catherine's one of them." ■



# Accolades

Awards and Honors Earned by Faculty and Staff  
Researchers in 2023



## Gun Violence Expert Elected to National Academy of Medicine

**A PROFESSOR BEST** known for his work studying the effect of urban gun violence on Black youths and young men was elected to the National Academy of Medicine.

**Joseph Richardson Jr.**, the MPower Professor of African American Studies, Medical Anthropology and Epidemiology, was cited by the academy for his pioneering work “translating science into the development of innovative interventions to reduce gun violence and firearm-related morbidity and mortality.”

Richardson, who holds a secondary appointment in the Department of Epidemiology and Public Health at the University of Maryland School of Medicine, was one of 90 new members and 10 international members to receive the honor.

Though UMD does not have a medical school, he is its second faculty member elected in the past two years, joining Ruth Enid Zambrana, a Distinguished University Professor in the Harriet Tubman Department of Women, Gender, and Sexuality Studies.

Richardson has interviewed dozens of victims of gun violence and connected them to the hospital-based programs he's led in an effort to reduce trauma, criminal recidivism and the likelihood of victims becoming offenders. He also founded and directs the Transformative Research and Applied Violence Intervention Lab (TRAVAIL).

## Quantum Physicist Joins American Academy of Arts and Sciences

A University of Maryland quantum scientist was among the 269 artists, scholars, business leaders and others elected in 2023 to the American Academy of Arts and Sciences, one of the nation's oldest and most prestigious honorary societies.

**Wendell T. Hill III**, a professor in the Institute for Physical Science and Technology and a fellow of the Joint Quantum Institute, was recognized for his groundbreaking research focused on laser-matter interaction under extreme conditions—ultra-fast, ultra-intense and ultra-cold.

He is a fellow of the American Physical Society and a member of the National Academies' Board on Physics and Astronomy and the Scientific Advisory Committee for the Centro de Lasers Pulsados in Spain. He also served as director of the NSF's Atomic, Molecular and Optical Program from 2010 to 2012.



## Criminologist Awarded Discipline's Top Prize

Distinguished University Professor **Gary LaFree**, an expert on terrorism and the causes and consequences of crime, was selected to receive the Stockholm Prize in Criminology from the Swedish Ministry of Justice.

It is the third time a UMD researcher has received the field's highest honor since its inception in 2006.

LaFree will be recognized in June with the award, based on his research on procedural justice and legitimacy, including the 1998 book “Losing Legitimacy: Street Crime and the Decline of Social Institutions in America.”



## 3 Faculty Members Welcomed to National Academy of Engineering

**THREE UMD PROFESSORS** were among the 124 engineers elected to the 2023 Class of the National Academy of Engineering (NAE), one of the highest professional distinctions accorded to an engineer. All were peer-selected for pioneering new technologies, advancing engineering education, outstanding business and government leadership, and contributions to engineering research and practice.

The academy hailed **Inderjit Chopra**, Distinguished University Professor and director of the Alfred Gessow Rotorcraft Center, “for advancing rotorcraft aeromechanics/aeroelastic analysis, enhancing bearingless rotors, active control, and human-powered helicopters.”

Chopra is a fellow of the American Institute of Aeronautics and Astronautics, VFS (the Vertical Flight Society, formerly the AHS/American Helicopter Society) and American Society of Mechanical Engineers, and an honorary fellow of AHS. Among other honors, he was awarded AIAA's 2023 Walter J. and Angeline H. Crichlow Trust Prize, which includes a \$100,000 prize.

**Ji-Cheng “JC” Zhao**, chair of the Department of Materials Science and Engineering and

Minta Martin Professor, is a pioneer in the development of accelerated methodologies for discovery and rapid screening for metals as well as a renowned expert on computational design of materials.

He is a fellow of ASM International, the Materials Research Society, the National Academy of Inventors, the American Association for the Advancement of Science and the Minerals, Metals and Materials Society.

**Rama Chellappa**, College Park Professor and professor emeritus at UMD and Bloomberg Distinguished Professor at Johns Hopkins University, is a groundbreaker in the area of artificial intelligence. His work in computer vision, pattern recognition, and machine learning has had profound impact on areas including biometrics, smart cars, forensics, and 2D and 3D modeling of faces, objects and terrain.

He is the 2020 recipient of the Jack S. Kilby Signal Processing Medal—a top honor from the Institute of Electrical and Electronics Engineers (IEEE), where Chellappa is a life fellow. He has also been honored by the IEEE Computer Society and IEEE Signal Processing Society.

## 7 Researchers Named AAAS Fellows

**SEVEN UMD FACULTY** members were named fellows of the American Association for the Advancement of Science, the world's largest general scientific society. The honor brings the university's total to 102 fellows, and recognizes the outstanding contributions of:

■ **SONALDE DESAI**, Distinguished University Professor in the Department of Sociology;

■ **SAMUEL GRAHAM, JR.**, dean of the A. James Clark School of Engineering and Nariman Farvardin Professor;

■ **ABBA GUMEL**, the Michael and Eugenia Brin Endowed Chair in Mathematics;

■ **MOHAMMAD HAJIAGHAYI**, the Jack and Rita G. Minker Professor of Computer Science;

■ **WOLFGANG LOSERT**, physics professor;

■ **DANA NAU**, computer science professor; and

■ **JI-CHENG “JC” ZHAO**, chair of the Department of Materials Science and Engineering and Minta Martin Professor.





## Moving Beyond “Getting Tough”

**Amid Spiraling Violence, Criminologist Studies New Approaches to Gun Crime**

**WHILE STUDYING STREET GANGS** as part of his Ph.D. in Chicago in the late '90s, an interview with a non-gang teen helped change **Rod Brunson's** thinking about what his research could accomplish.

“She'd figured out how to navigate going to school or the corner store without being victimized,” says Brunson, a professor of criminology and criminal justice. “But then

this young person said very somberly, ‘Can you do something about the police?’”

In his research today, which broadly tackles gun violence, Brunson focuses on answering questions—like how police officers' enforcement decisions can be affected by their racialized perceptions of places—that interest not just criminologists, but people in the often-underserved communities he studies.—**CC**

**What's the common thread between mass shootings we see on the news and the daily killings we usually don't?**

They're different issues in many ways, but tied together by the attraction guns have for young males. We have many more guns per citizen than any country you'd normally compare us to.

**Will simply reducing the number of guns help solve the violence problems?**

Discussions of laws keeping guns out of the hands of people who should not have them are well-intended, but the sheer number of guns means people are going to obtain guns for the foreseeable future. And just telling

people who are high-risk or prohibited from carrying guns to stop doing so is ineffective.

**In areas plagued by violence, what prevents people from just walking away from guns?**

Not all, but many people feel, whether it's reasonable or exaggerated, everyone around them is carrying—including people out to do them harm. When my collaborator, (UMD Assistant Professor) Brooklynn Hitchens, and I analyzed data from people in New York, where there are high penalties for illegally carrying a gun, we were struck by the quip, “I'd rather be judged by 12 than carried by six.”

**So we're awash in guns, and laws are hard to pass or maybe won't work. Do we throw up our hands?**

No, we need to hold people accountable, but maybe we also should pivot and learn from the failures of the past. I think one thing most people can agree on is that “get tough on (insert whatever issue here)” has not worked

out well, whether it's drugs or other criminal activity. It doesn't solve problems, but it does have unintended consequences like mass incarceration or further disenfranchisement. Instead of coming at it simply from the standpoint of law enforcement, we examined a public health approach in this new study and found it could help.

**What would that entail?**

A surprisingly high number of people we surveyed in at-risk neighborhoods got instruction in handling guns from movies or video games. Many people do not store guns safely—unlocked under the bed where children can find it, for instance, or outdoors.

What we're suggesting is that grounding people in gun safety could solve some of these issues. It is a little bit similar to immunization: Immunize everyone you know with safety practices, so it will hopefully protect those people who are most in need, or at highest risk.

### Researchers Seek PROGRESS on Gun Violence

A new UMD research initiative is taking on rising violence against a grim backdrop of Washington, D.C., homicide totals that jumped by more than one-third in 2023 and more than 650 mass shootings nationwide the same year.

PROGRESS (Prevent Gun Violence: Research, Empowerment, Strategies and Solutions) launched in November to study gun violence, offer educational programs on gun safety and issue policy recommendations. It is led by **Joseph Richardson Jr.**, the MPower Professor of African American Studies, Medical Anthropology and Epidemiology, and **Woodie Kessel**, a pediatrician and professor of the practice of family science. Partners across campus and at the University of Maryland, Baltimore will contribute.

It's part of the 120 Initiative co-created in 2022 by UMD President Darryll J. Pines to take on gun violence, and will address a range of issues including suicide, domestic violence, safe gun storage and gun trafficking. The team will collect and analyze data, offer a speaker series and engage community members to create solutions.—**SL**

### Groundbreakers



## Quantum Physicist Elected to National Academy of Sciences

**A GROUNDBREAKING QUANTUM**

physics researcher who has long been affiliated with the Joint Quantum Institute (JQI) at the University of Maryland was elected a member of the National Academy of Sciences.

**Paul Julienne**, an emeritus fellow at JQI and an adjunct professor of physics at UMD, joined 142 other U.S. and international members recognized in 2023 for their exceptional, ongoing achievements in original research.

Julienne helped establish the research field of ultracold matter, which investigates atoms and molecules near absolute zero. He joined JQI in 2007, soon after its founding as a joint research institute combining the scientific strengths of the University of Maryland with the National Institute of Standards and Technology.

He received the 2015 William F. Meggers Award of the Optical Society of America and the 2004 Davisson-Germer Prize of the American Physical Society and is a fellow of the division of Atomic, Molecular, and Optical Physics of the American Physical Society.





Engineer Receives Franklin Institute’s 2023 Bower Award

Deb Niemeier, Clark Distinguished Chair of Energy and Sustainability in the A. James Clark School of Engineering, received the Franklin Institute’s 2023 Bower Award and Prize for Achievement in Science, which came with a \$250,000 prize.

Niemeier has helped spur policy and regulatory changes through groundbreaking research in the areas of vehicle emissions, air quality, affordable housing, and infrastructure funding both nationally and internationally. More recently, she has focused on aspects of the built environment that give rise to structural inequality, particularly relating to climate change.

She is a Guggenheim and AAAS fellow, and a member of the National Academy of Engineering and American Philosophical Society.



Sociologist Receives \$1M Berggruen Philosophy Prize

Patricia Hill Collins, a Distinguished University Professor emerita of sociology known for her pioneering research on the intersections of race, gender, social class and sexuality, received the Berggruen Prize for Philosophy, a \$1 million award for advancing powerful ideas that help shape our world.

The winner of the prize, established in

Communications Pioneer Receives National Medal of Technology and Innovation

Alum, Faculty Member Lauded for Boosting National Security, Creating Successful Tech Firms

President Joe Biden in October awarded Jeong H. Kim Ph.D. '91, namesake of an A. James Clark School of Engineering building and a professor of the practice in mechanical engineering, the nation's highest honor for technological achievement.

A longtime UMD benefactor, Kim received the National Medal of Technology and Innovation for his advances in broadband optical systems, data communications and wireless technologies that have made communication faster and clearer, including improvements in battlefield communications that strengthen national security.

Kim, who immigrated to the U.S. at 14 speaking little English, today is chairman and co-founder of Kiswe Mobile, an interactive mobile video company; he previously founded Yurie Systems, eventually selling it for \$1.1 billion to Lucent Technologies. He is a member of the National Academy of Engineering and was recognized by the U.S. Pan-Asian American Chamber as one of the Top 10 Most Influential Asian Americans in Business.

“Jeong Kim’s contributions in the field of communications, national security and wide area networks have made an incredible technological impact on a global scale,” says UMD President Darryll J. Pines. “He exemplifies the power of American spirit, entrepreneurship and innovation.”



2016 by philanthropist Nicolas Berggruen, is selected from a list of nominees by a jury of internationally recognized authors, philosophers, economists and Nobel Prize laureates.

Collins, best known for her groundbreaking book, “Black Feminist Thought,” has focused on how intersectionality creates unique experiences and perspectives for individuals—especially Black women—as well as shared experiences and perspectives on the human condition.



Bookshelf

Books Written by UMD Faculty in 2023



FUNDAMENTALS OF AERODYNAMICS, 7TH EDITION

MCGRAW HILL

John Anderson, Professor Emeritus of Aerospace Engineering, and Christopher Cadou, Professor of Aerospace Engineering

WAVE HOUSE

SMALL PRESS DISTRIBUTION/ FLOOD EDITIONS

Elizabeth Arnold, Professor of English



SHAKESPEARE ON CONSENT

ROUTLEDGE

Amanda Bailey, Professor and Chair, Department of English

SMALL PARTICLE RING ACCELERATORS AND PAUL TRAPS: CASE STUDIES AND PROSPECTS

INSTITUTE OF PHYSICS PUBLISHING

Santiago Bernal, Associate Research Scientist, Institute for Research in Electronics and Applied Physics

NEGATIVE MONEY

SOFT SKULL PRESS

Lillian-Yvonne Bertram, Associate Professor of English

THE AVENGERS ASSEMBLED: THE ORIGIN STORY OF EARTH'S MIGHTIEST HEROES

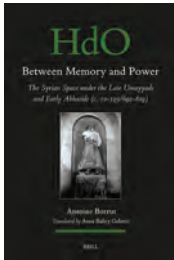
PENGUIN RANDOM HOUSE

David Betancourt, Lecturer of Journalism

BETWEEN MEMORY AND POWER: THE SYRIAN SPACE UNDER THE LATE Umayyads AND EARLY Abbasids (C. 72-193/692-809)

BRILL

Antoine Borrut, Associate Professor of History



MANAGEMENT: AN INTERACTIVE APPROACH

PEARSON HIGHER EDUCATION

Kelly Mollica and Nicole Coomber, Clinical Professor of Management and Organization

IN THIS PLACE CALLED PRISON: WOMEN'S RELIGIOUS LIFE IN THE SHADOW OF PUNISHMENT

UNIVERSITY OF CALIFORNIA PRESS

Rachel Ellis, Assistant Professor of Criminology and Criminal Justice

TEACHING BEYOND THE MUSIC: TOOLS FOR ADDRESSING SOCIETAL CHANGES THROUGH THE ARTS

GIA PUBLISHING

Jason Max Ferdinand D.M.A. '15, Director of Choral Activities, School of Music

MALLPARKS: BASEBALL STADIUMS AND THE CULTURE OF CONSUMPTION

CORNELL UNIVERSITY PRESS

Michael T. Friedman, Assistant Research Professor of Kinesiology

MURDER AT AMAPAS BEACH

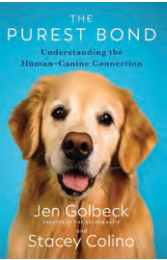
ATMOSPHERE PRESS

James Gilbert, Distinguished University Professor of American History Emeritus

THE PUREST BOND: UNDERSTANDING THE HUMAN-CANINE CONNECTION

ATRIA BOOKS

Jen Golbeck, Professor of Information Studies; and Stacey Colino



THE EVOLUTION OF THE VEHICLE ROUTING PROBLEM

SPRINGER

Bruce Golden, France-Merrick Chair in Management Science; Xingyin Wang and Edward Wasil

THE POWER OF HOPE: HOW THE SCIENCE OF WELL-BEING CAN SAVE US FROM DESPAIR

PRINCETON UNIVERSITY PRESS

Carol Graham, College Park Professor in the School of Public Policy

INTERSECTIONALITY IN HEALTH EDUCATION

HUMAN KINETICS

Cara D. Grant, Kinesiology Lecturer; and Troy E. Boddy

METAREASONING FOR ROBOTS: ADAPTING IN DYNAMIC AND UNCERTAIN ENVIRONMENTS

SPRINGER

Jeffrey Herrmann, Professor of Mechanical Engineering and Director of Graduate Education Programs, Institute for Systems Research

WHEN WE WERE TWINS

PLAMEN PRESS

Danuta Hinc, Principal Lecturer of English

FOUNDATIONS OF INFORMATION LAW

ALA NEAL-SCHUMAN

Paul Jaeger, Professor of Information Studies; Jonathan Lazar, Professor of Information Studies; Ursula Gorham, Senior Lecturer of Information Studies; and Natalie Greene Taylor Ph.D. '15

THE STUDY OF BILINGUAL LANGUAGE PROCESSING

OXFORD UNIVERSITY PRESS

Nan Jiang, Professor of Second Language Acquisition



TEACHING YOUNG  
MULTILINGUAL  
LEARNERS: KEY ISSUES  
AND NEW INSIGHTS

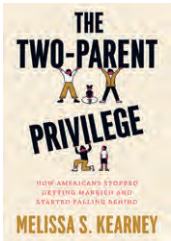
CAMBRIDGE UNIVERSITY PRESS

**Loren Jones**, Associate  
Clinical Professor of  
Education, and Luciana  
C de Oliveira

THE TWO-PARENT  
PRIVILEGE: HOW  
AMERICANS STOPPED  
GETTING MARRIED  
AND STARTED FALLING  
BEHIND

THE UNIVERSITY OF CHICAGO  
PRESS

**Melissa S. Kearney**, Neil  
Moskowitz Professor of  
Economics



LANGUAGE AND  
ANTIRACISM: AN  
ANTIRACIST APPROACH  
TO TEACHING (SPANISH)  
LANGUAGE IN THE USA

MULTILINGUAL MATTERS

**José L. Magro**, Lecturer,  
School of Languages,  
Literatures, and Cultures

WHAT EVERY ENGINEER  
SHOULD KNOW ABOUT  
RELIABILITY AND RISK  
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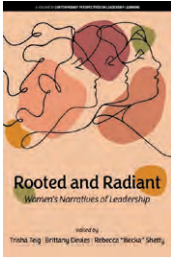
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Prepping for  
Piglets

Where scientists today might employ computer vision systems and AI algorithms, they made do with an '80s version of "high tech" using simple light-sensing photocells and data tracked on an early IBM PC. At UMD's Central Maryland Research and Education Center in Clarksville, Swine Unit Manager Benny Erez (left) and researcher Thomas Hartsock were joined by a curious friend as they looked over information about activity patterns of sows prior to birth. "Six to eight hours before farrowing, they become very active," says Hartsock, now a professor emeritus of animal and avian sciences. "We placed photocells to 'see' those changes in position and record the information. We could check the files before going to bed, and if that active behavior had not yet started, we knew we had six or so hours to sleep."







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