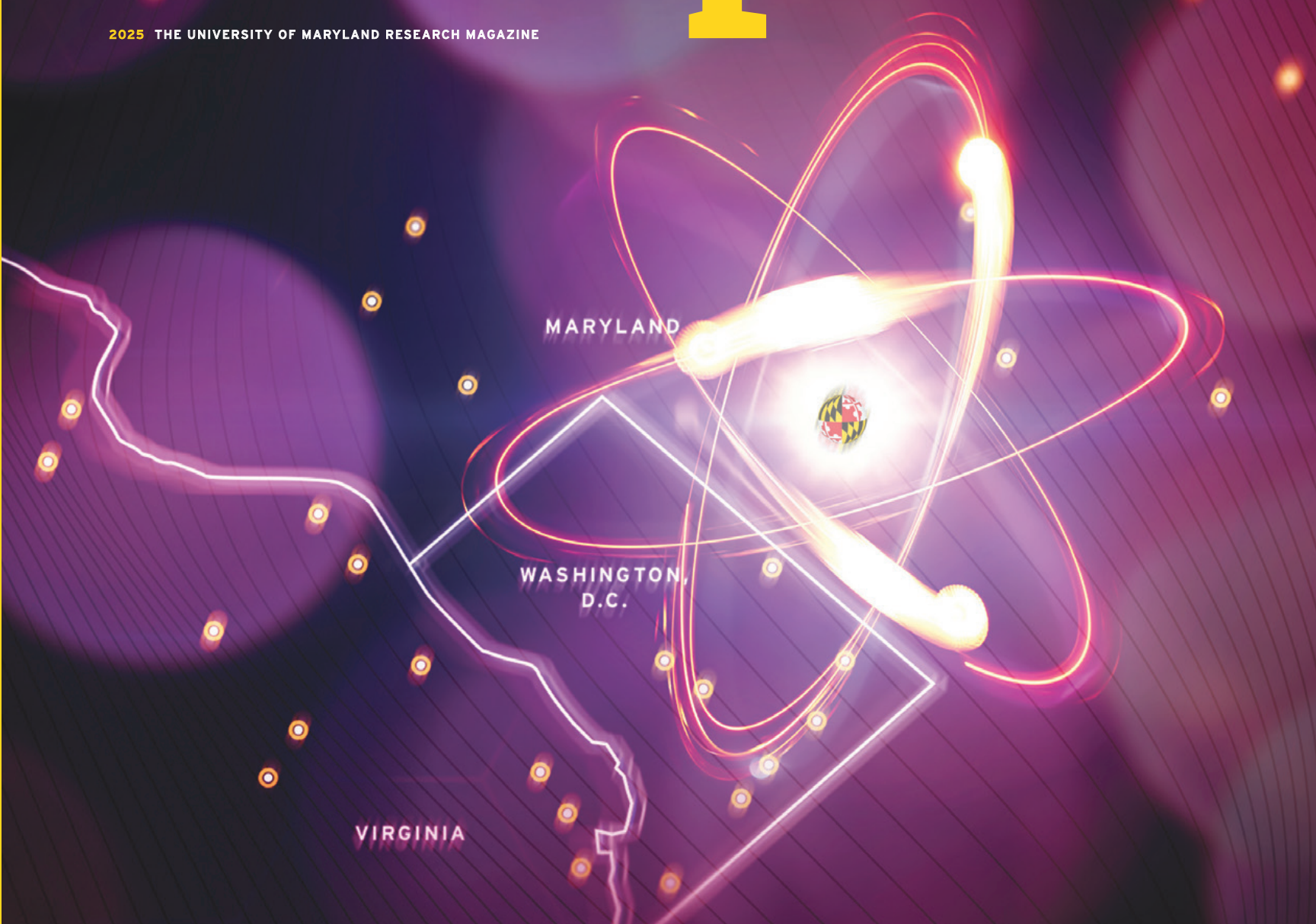
TAKING "AIM" AT NEXT-GEN AI 2 › NEW REFLECTION ON HISTORY 16 › RESEARCHERS BATTLE BIRD FLU 26

# Enterprise

2025 THE UNIVERSITY OF MARYLAND RESEARCH MAGAZINE




## Building the Capital of Quantum

UMD AND THE STATE OF MARYLAND MAKE A BILLION-DOLLAR BID TO ANCHOR A SCIENTIFIC AND COMMERCIAL REVOLUTION 20

From the

# Vice President for Research

**RESEARCH UNIVERSITIES** nationwide are grappling with unprecedented challenges and uncertainties caused by rapidly changing federal policies, and the University of Maryland is no exception. What has not changed is our commitment to our core mission of education, research and service. Every page of this magazine offers a compelling testament to our continued dedication to science and scholarship that make a positive impact on people in the state of Maryland and beyond.

For example, you'll read about a bold initiative the university is leading, along with Gov. Wes Moore and a range of other partners, to attract $1 billion in investments and transform our region into a world-leading hub of quantum research and innovation. This will help ensure everyone can reap the benefits of this burgeoning field, which could remake entire economic sectors.

You'll also meet UMD researchers working to better understand bird flu and curb its spread—from tracking the virus' rapid path across the country to providing biosecurity guidance on farms and developing new methods to uncover the origins of avian influenza itself. It's a prime example of university researchers tackling a complex problem from multiple angles and disciplines to find innovative solutions.

This fourth 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 it serves as both a reminder of all the ways a leading public research university like ours contributes to society and a reason to remain optimistic about the future.

Go Terps!

**Gregory F. Ball**
*Vice President for Research*



# In This Issue







Learn more about the University of Maryland's diverse, dynamic research enterprise at ***research.umd.edu***.

# UMD Takes "AIM" at Next-Gen AI Development

New Institute Will Support Interdisciplinary Research, Education While Promoting Responsible AI Use

**THE UNIVERSITY OF MARYLAND** in May celebrated the launch of a new institute that will engage every academic unit across campus in creating the future of artificial intelligence, one in which the burgeoning technology works for the good of all.

The Artificial Intelligence Interdisciplinary Institute at Maryland (AIM) is a collaborative hub to support faculty research, offer innovative and experiential learning opportunities to boost the AI workforce and inspire new generations of leaders, and forge partnerships to focus on responsible and ethical AI use.

"Establishing the AI Interdisciplinary Institute at Maryland is a pioneering step in AI research and education," said University of Maryland President Darryll J. Pines. "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. We're not just adapting to the AI age but shaping its future."

UMD has long been a leader in AI, and the new institute was founded upon existing expertise, 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.

"We're fortunate to have AI leaders in fields ranging from computer science and engineering to journalism, education, social sciences, business and the arts—a unique breadth of expertise that Maryland brings to the table," said UMD Senior Vice President and Provost Jennifer King Rice. "By uniting our efforts under one institute, we will not only become a magnet for ethical AI development and research but a global leader in preparing students and the workforce for an AI-infused world."

In addition to enabling research, the institute will coordinate new academic degree and certificate programs, build government and industry partnerships, construct a new high-performance computing cluster tailored for AI's complex computational challenges, and create chaired professorships and postdoctoral fellowships.

Hal Daumé III, a Volpi-Cupal Family Endowed Professor in the Department of Computer Science, serves as AIM's inaugural director. The university also appointed Neda Atanasoski, professor and chair of the Harriet Tubman Department of Women, Gender and Sexuality Studies, as associate director of education and Sheena Erete, associate professor in the College of Information, as associate director of research.

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

ILLUSTRATION VIA ADOBE STOCK

# $10M Gift Spurs New Center for Translational Engineering and Medicine

MPower State Initiative Adds $12.75M to Investment From Edward and Jennifer St. John

**A $10 MILLION GIFT** to the University of Maryland, Baltimore (UMB) and the University of Maryland, College Park (UMCP) will launch a transformative collaboration to tackle a broad spectrum of health challenges and drive medical innovations.

The Edward & Jennifer St. John Center for Translational Engineering and Medicine, named in honor of the benefactors, is further supported by a $12.75 million grant from the University of Maryland Strategic Partnership: MPowering the State (MPower).

The center will foster partnerships among clinicians at the University of Maryland School of Medicine (UMSOM) at UMB and bioengineers at the A. James Clark School of Engineering at UMCP.

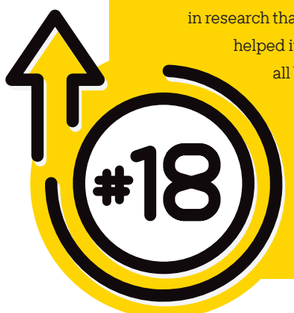
"This collaboration will be one of the premier partnerships in the country that fully bridges the gap between engineering and medicine to rapidly accelerate solutions on public health, disease and wellness," said UMCP President Darryll J. Pines. "Whether it is the invention of new devices and instruments or improved analysis, this center will be leading the way in advancing how clinicians work and how patients heal."

The MPower grant will support research and education as well as new offices, labs and faculty at CTEM, a state-of-the-art shared space at the University of Maryland BioPark in Baltimore. MPower is a state initiative that leverages the complementary strengths of UMB and UMCP to pursue research and impact beyond what each could do independently.

Edward St. John '61 earned an engineering degree at UMD and went on to become a noted Baltimore-based business leader and philanthropist. He previously gave $10 million to help build the Edward St. John Learning and Teaching Center on the College Park campus. His new gift will establish endowed and current-use professorships in bioengineering, undergraduate and graduate student awards in translational engineering and medicine, and ongoing operating funds for the center.

PHOTO BY STEPHANIE S. CORDLE

# UMD Climbs in NSF's Research Spending Ranking



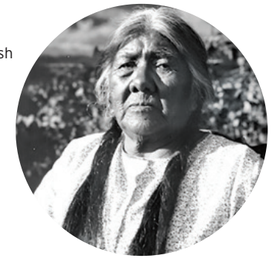

The University of Maryland's growing investment in research that takes on society's biggest issues helped it move up a spot to No. 18 among all U.S. institutions in the National Science Foundation's latest Higher Education Research and Development (HERD) survey, the most widely recognized national ranking for universities engaged in sponsored research.


UMD also ranked 11th nationally among public institutions in research and development spending in fiscal year 2023. The University of Maryland, College Park and the University of Maryland, Baltimore are linked as one research enterprise in the survey and reported combined research expenditures of almost $1.4 billion, an increase of nearly $157 million from the previous year.

ILLUSTRATION VIA ISTOCK

# $3.6M Award to Strengthen Indigenous Archives Access

## Mellon Grant to Help UMD Research Overhaul "Antiquated" Methods of Cataloguing Materials



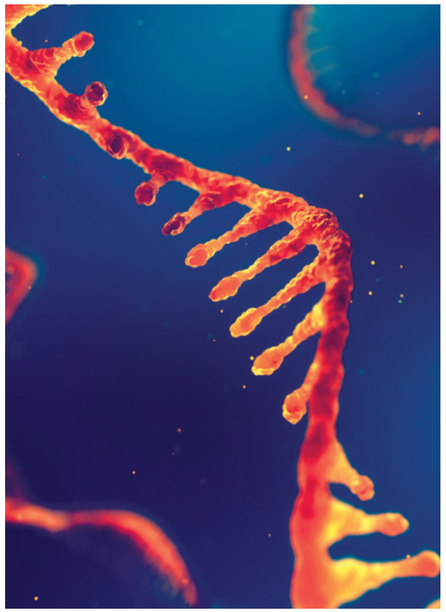
**INDIGENOUS RESEARCHERS** seeking records of their communities have long faced outdated catalog systems, inaccessible descriptions and limited access to archival materials of deep cultural and historical significance. UMD is taking transformative steps to address these challenges, supported by a new $3.6 million grant from the Mellon Foundation.

The project is led by Diana Marsh, principal investigator and College of Information assistant professor, and Shelbi Nahwilet Meissner, co-principal investigator, assistant professor in the College of Arts and Humanities and director of UMD's Indigenous Futures Lab.

"A big goal is trying to think differently about how we can describe, represent and search for information that is fundamentally essential to Native and Indigenous communities," Marsh says. "The antiquated ways are totally impenetrable to any average person, let alone an Indigenous person who's trying to understand where their materials have gone."

The collaborative effort includes the Indigenous Description Group within the Social Networks and Archival Context Cooperative (a digital research project that obtains records data from archives, libraries and museums), the University of Virginia Libraries, an Indigenous advisory board and four tribal/First Nations organizations. Together, they are working to ensure archival practices uphold Indigenous values and traditions.

"UMD has the potential to be a key hub for Indigenous research, especially on the East Coast," Meissner says. "This is a great opportunity for us to set up best practices for how to interface with communities to set up strong protocols around archival sovereignty."**–LR, JW**



# Worm Study Paves Way for Better RNA-Based Drugs

## Researchers Find Broader Degradation of "Gene-Silencing" Effects Over Time

**THE RISE OF** RNA interference (RNAi) therapeutics is spurring hopes for more effective ways to precisely target and "silence" genes behind various diseases and disorders, but fundamental questions remain about how long RNAi benefits can last and whether the effects can be fine-tuned.

In new findings published in August in *eLife*, UMD researchers unveiled RNA mechanisms that may lead to more effective, durable and targeted treatments for conditions like high cholesterol, liver diseases and cancers.

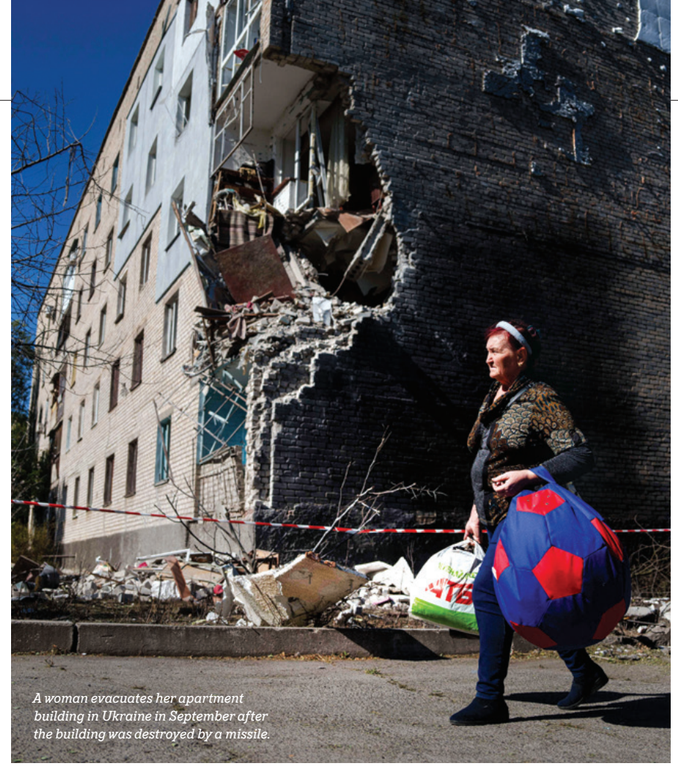
Cell biology and molecular genetics Associate Professor Antony Jose and his team used quantitative modeling, simulations and experiments with roundworms to dig deeper into RNAi. They confirmed earlier research results that gene silencing could wear off over time, but they also discovered something surprising.

"It makes some sense to expect that constantly dividing cells could eventually dilute an RNAi-based drug," Jose says. "But the real head-scratcher is how the drug's efficacy is lost even in cells that don't divide."

The work reveals that there must be some mechanism beyond dilution that degrades the effects of RNAi over time, he said. The findings highlight the need to consider drug resistance when developing RNAi-based treatments, he said. The study also offered new insights into how different regulatory proteins within the worms' cells worked together to control gene silencing.**–GJ**



TOP PHOTO BY EDWARD H. DAVIS/SAN DIEGO HISTORY CENTER; BOTTOM PHOTO VIA ADOBE STOCK



*A woman evacuates her apartment building in Ukraine in September after the building was destroyed by a missile.*

# What Data Says About How Wars End

## DOD Awards $2.5M for UMD Study on 80 Years of Armed Conflict

**WHEN RUSSIA LAUNCHED** its full-scale invasion of Ukraine in 2022, most predictions leaned toward one outcome: the smaller country's quick defeat.

Why the war remains unresolved three years later is one of the questions that University of Maryland researchers seek to answer in a three-year study of how conflicts since 1945 have concluded, supported by a $2.5 million U.S. Department of Defense award.

"There's a conventional wisdom about how wars start and how wars end, which is that all these things kind of look a little bit like World War II" with decisive endings, says government and politics Assistant Research Professor Jacob Aronson, part of UMD's Center for International Development and Conflict Management (CIDCM). "The real world is a lot more messy than that."

To capture data about how military leaders adapt to changing circumstances, a team including Professor Paul Huth, CIDCM director and the study's leader, will use AI-assisted techniques, analyze satellite imagery and develop case studies to understand common characteristics of post-World War II conflicts, and the role of military adaptation in their termination.

"We hope that the project will contribute to ongoing debates about how the U.S. can help to terminate wars more quickly and on terms more favorable to the U.S. and its allies," says Huth.**–RG**

# AI Confronts Ship-Sinking "Rogues"

## New System Predicts Emergence of Dangerous Giant Waves

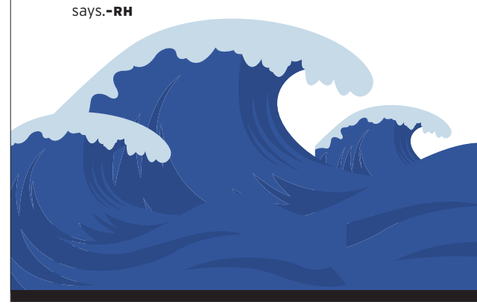
**ONCE DISMISSED AS** seafarers' tall tales, monstrous waves that loom suddenly are now thought to be regular culprits in the sinking of large ships. But a new tool from UMD researchers could give mariners up to a five-minute warning of these "rogue waves" so they can prepare.

The system was developed by postdoctoral researcher Thomas Breunung and mechanical engineering Distinguished University Professor Balakumar Balachandran and presented in July in *Scientific Reports*.

To create the tool, they trained a neural network to distinguish ocean waves that will be followed by a rogue wave from those that will not. The training data consisted of billions of regular waves and thousands of their unusually large counterparts, recorded in 14 million 30-minute-long samples of sea surface elevation measurements from Pacific Ocean buoys.

After training, the system correctly predicted the emergence of 75% of rogue waves one minute into the future and 73% of rogue waves five minutes into the future.

"Our data-driven approach could be useful for understanding and predicting other extreme events associated with, for example, climate change," Balachandran says.**–RH**



TOP PHOTO BY AP PHOTO/EVGENIY MALOLETKA; RIGHT ILLUSTRATION VIA ADOBE STOCK

*A small sensor mounted on an Annapolis, Md., dock is part of a UMD-led coastal network to help predict flooding.*

# Sensor Project Casts a Wide "Net" to Predict, Prepare for Floods

Researchers, Local Leaders to Track Real-time Data in State's Waterfront Communities

**AMID ANNAPOLIS' PICTURESQUE** Colonial-era buildings, brick-lined streets and sailboats gliding along the Severn River, a small solar-powered sensor perched atop a pylon just off City Dock is easy to miss.

The low-cost device, though, is the star of a new University of Maryland project to track the water level in a city familiar with flooding. The HydroNet is a system of some 20 sensors along the Chesapeake Bay and its tributaries that help researchers and local government leaders predict when, where and how much future flooding will occur.

"Projects such as the HydroNet are really the best symbol for what institutions of higher education like the University of Maryland can help accomplish," university President Darryll J. Pines said during an unveiling event with city, state, and Anne Arundel and Charles County leaders in June. "It shows how we can support the good of everyone by taking discoveries from a whiteboard in a research lab to the real world."

Led by atmospheric and oceanic science Associate Professor Tim Canty, the Maryland HydroNet is part of the university's Climate Resilience Network, funded by a UMD Grand Challenges Grant to prepare communities for the impacts of climate change. The Mid-Atlantic Regional Association Coastal Ocean Observing System provided additional financial support.

"The health of the Chesapeake Bay is vital to the health of the Maryland economy, but our coastal communities face increasing flood risks as sea levels rise," Canty says. "This project is the first step in providing the state with a larger network of water level monitors to help better allocate resources and prioritize assistance for communities facing the most imminent risk."

The system is a "sibling" of the Maryland Mesonet, a $4 million Grand Challenges grant-supported project that UMD's Department of Atmospheric and Oceanic Science researchers are overseeing for the state that provides meteorologists and emergency officials with advance warning of dangerous weather through a rapidly growing network of weather towers. The project is also intended to provide farmers with actionable data on growing conditions as climate change causes weather to become more volatile.

The sensors for the state's coastal counterpart, HydroNet, were created by Hawaii-based company Hohonu. Made of PVC-like pipe measuring less than 2 feet tall, they use high-frequency sound waves to measure the distance to the water below; the system then streams those measurements to the web.

"That's the magic, making it cheap and easy and able to be put out anywhere," says Brian Glazer, founder of Hohonu and an associate professor of oceanography at the University of Hawaii.**–AE**



PHOTO BY JOHN T. CONSOLI

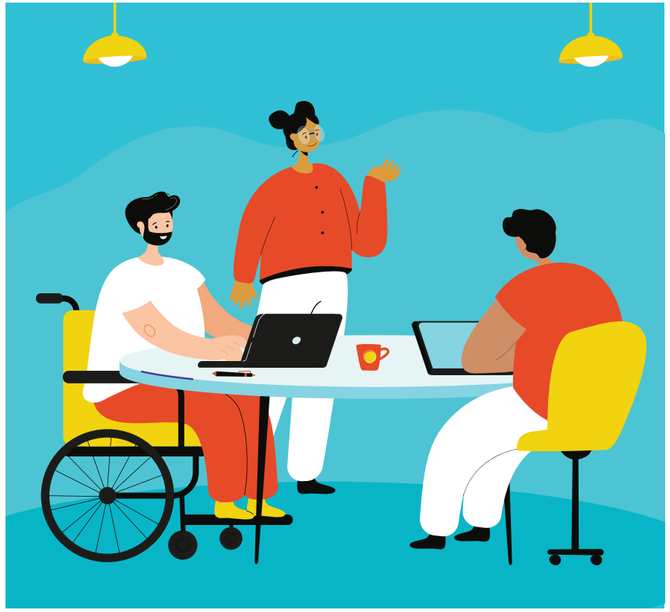


ILLUSTRATION VIA ADOBE STOCK

# Tackling Tech Roadblocks on School-to-Adulthood Transition

$10M Grant to Streamline Agencies' Data Systems to Support People With Disabilities Seeking Jobs, Higher Education

**FINISHING HIGH SCHOOL** and successfully moving on to jobs, higher education and other aspects of adulthood can be challenging for anyone, but young people with disabilities face higher hurdles. One of them could be transition services hampered by incompatible information technology systems across various agencies.

The U.S. Department of Education awarded a University of Maryland team $10 million to tackle the issue in the Old Line State. The funding will support education and computing researchers who are developing a data analytic tool to tie together masses of confidential data—from medical test results to school performance records—administered by Maryland's 24 school districts and other agencies involved in the school-to-adulthood transition.

The goal: to create a single, easy-to-use source of information that practitioners, counselors and others can use to help their clients build fulfilling lives.

Kelli Thuli Crane and Christy H. Stuart, assistant research professors in the Department of Counseling, Higher Education, and Special Education as well as co-directors of the College of Education's Maryland Center for Transition and Career Innovation, are leading the project. Derek Yarnell, the director of computing facilities for the University of Maryland Institute for Advanced Computer Studies (UMIACS), is overseeing software development for the Transition Linkage Tool.

The researchers hope that insights from the project help policymakers evaluate what works and what doesn't.

"The state of Maryland does not have a good handle, from a data science standpoint, on how these students are faring post-graduation," says Yarnell. "And if you can't measure it, you can't change it."**–AH**

## Major Federal Research Partnerships

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

**RECORD INVESTMENT**

UMD received a new contract with a $500 million ceiling from the Department of Defense—the largest contract in UMD history—to support the Applied Research Laboratory for Intelligence and Security (ARLIS) and its mission of tackling complex national security problems using a multidisciplinary approach. One of 15 designated Department of Defense University Affiliated Research Centers (UARCs) around the nation and the only UARC dedicated to intelligence and security, ARLIS leverages technology and science to meet intelligence and security challenges with a human-centered focus.

**SYSTEMS APPROACH**

The National Oceanic and Atmospheric Administration awarded UMD a five-year, $388 million cooperative funding agreement for collaborative research in Earth system science. The agreement renews the Cooperative Institute for Satellite Earth System Studies, a national consortium of researchers from more than three dozen academic and nonprofit institutions that are addressing the grand challenge of understanding how human activity and Earth's environment function as a coupled system.

# The Eyes Have It: New AI Tool Can Predict Behavior

Business Research Helps Develop Algorithm That Crunches Eye-Movement Data From Screen Users

**WINDOW TO THE SOUL?** Maybe, but the eyes are also a flashing neon sign for a new artificial intelligence-based system that can read them to predict what you'll choose next.

A University of Maryland researcher and two colleagues combined eye-tracking technology and a new deep-learning AI algorithm to predict study participants' choices while they viewed a comparison website with rows and columns of products and their features.

The algorithm, known as RETINA (Raw Eye Tracking and Image Ncoder Architecture), could accurately zero in on selections before people had even made their decisions.

"This is something AI technology is very good at—using data to make predictions," says Michel Wedel, a Distinguished University Professor and PepsiCo Chair in Consumer Science in the Robert H. Smith School of Business. He worked with Moshe Unger of Tel Aviv University and Alexander Tuzhilin of New York University to develop RETINA, which they presented in December in the journal *Data Mining and Knowledge Discovery*.

Researchers who turn to eye movement data typically synthesize it into aggregated chunks of information, which can miss certain types of eye movements. With their advanced machine-learning method, Wedel and his colleagues could use the full scope of raw data from the eye-tracking rather than the snippets current methods record.

Unusually, the algorithm can incorporate eye movement data from each eye, Wedel says.

"It's a lot of data—several hundreds of thousands of data points, with millions of parameters—and we use it for both eyes separately," he says.

The algorithm could be applied in many settings by all types of companies. For example, a retailer like Walmart could use it to enhance virtual shopping experiences it is developing in the metaverse.**–CH**

## Americans United in Cynicism, Journalism Scholars Find

**MANY PUNDITS HAVE DESCRIBED** the 2024 presidential election outcome as a broad-based win for Republicans. But a recent report co-authored by a UMD journalism professor questions the classic "left versus right" narrative, finding that most Americans are fiercely united in key attitudes that propelled President Donald Trump to victory over former Vice President Kamala Harris: distrust in institutions and pessimism over the country's future.

The report, cowritten by Louisiana State University's Manship School of Communication and NORC at the University of Chicago, surveyed a nationally representative sample of 3,031 Americans and found that Republicans and Democrats have similar fears about American democracy. Only a quarter believe the country's best days are ahead, while just one in five believe the government will do the right thing. One in 10 feels represented well, and a quarter says the country needs a total upheaval to get back on track.

"In dark hues, we actually have more in common we might think, which is distressing, because what we share are doubts," says Tom Rosenstiel, the Eleanor Merrill Scholar on the Future of Journalism and professor of the practice at UMD's Philip Merrill College of Journalism and a senior fellow at NORC.**–JT**

## Study Finds Civilian 911 Responders Boost Public Safety

**DEPLOYING PARAMEDICS,** social workers and others to non-criminal emergency calls can strengthen police responses to criminal calls while reducing negative community interactions, UMD researchers found.

A study based on Baltimore Police Department data and published in *Justice Quarterly* showed that up to 57% of 911 calls could be assigned to non-police responders, which would free up at least 59 full-time officers, or about 9% of the department's patrol personnel.

The study led by Luke Spreen, assistant professor of public policy, and Greg Midgette, assistant professor of criminology and criminal justice (CCJS), introduced a model to assess the impacts of call diversion programs, offering policymakers a tool for evidence-based decision-making.

"Public safety is one of the most significant categories of municipal spending," Spreen says. "Focusing exclusively on the costs of operating a civilian responder program ignores positive downstream benefits it is likely to generate, such as reductions in arrests." The study was supported by Arnold Ventures and Abell Foundation grants.


Co-authors also included Distinguished University Professor Peter Reuter in public policy, and Associate Professor Lauren C. Porter and Assistant Professor Brooklynn K. Hitchens, both of CCJS.**–GD**


## How a "Quantum Nose" and Other Innovations Could Fight Hunger

UMD Team Receives $5M Grant for Tech Solutions to Reduce Food Insecurity and Waste

**THE JOURNEY** of a lowly surplus tomato from a grower to a hungry family may start with a "quantum nose": a portable sensor created by a University of Maryland engineer that uses advanced physics to detect if the tomato is still fresh.

It's integrated with a UMD data scientist's app that can match the fruit (and a pile of its friends) to a community pantry. If the nose sniffs spoilage, the tomato can be composted or converted into fertilizer or bioenergy through a system developed by a professor of environmental science and technology (ENST).

This multidisciplinary team has been awarded $5 million from the National Science Foundation to put this food insecurity-fighting system into practice at first locally and eventually nationwide. Called NourishNet, it will unite a network of producers, donors and distributors to fill food pantries with fresh produce and reduce food waste.

"This project has several ambitious goals, but our main focus is to deploy NourishNet on a national scale to increase food accessibility for all populations, and reduce spoilage to build a more sustainable and responsible food system," says ENST Professor Stephanie Lansing, lead researcher on the project.

Other team members include Cheng Gong, an assistant professor of electrical and computer engineering and a Quantum Technology Center fellow who developed the quantum nose, and Vanessa Frias-Martinez, an associate professor of information studies with an appointment in the University of Maryland Institute for Advanced Computer Studies, who developed the app.**–GB**



PHOTO AND ILLUSTRATION VIA ADOBE STOCK

TOP PHOTO COLLAGE BY VALERIE MORGAN; BOTTOM ILLUSTRATION VIA ISTOCK

## Better Highways Needed—for Wildlife

### Black Bear Study Finds Not All Wildlife Corridor Designs Are Equal

**A BLACK BEAR** padding through a suburban backyard. A hesitant deer family trying to cross a busy highway. Your dog straining at the leash in a growling showdown with a coyote on an evening walk.

Such encounters underline a growing need to set aside corridors of undeveloped land where wildlife can travel safely, helping to ensure their long-term survival as human population and development continue to expand. But a September UMD-led study in the journal *Landscape Ecology* reveals that current methods of designing and evaluating wildlife corridors may be lacking, and that smarter frameworks are needed to ensure wildlife protection.

University researchers tested different wildlife corridor designs against black bear movement data in Florida and found that each achieved very different results, and none was sufficient to contain all the bears' movements.

The work highlights the complexity of the issue and shows that, while there is no one best method, the purpose of a corridor, which can vary widely, will directly impact what approaches should be considered to achieve conservation goals.

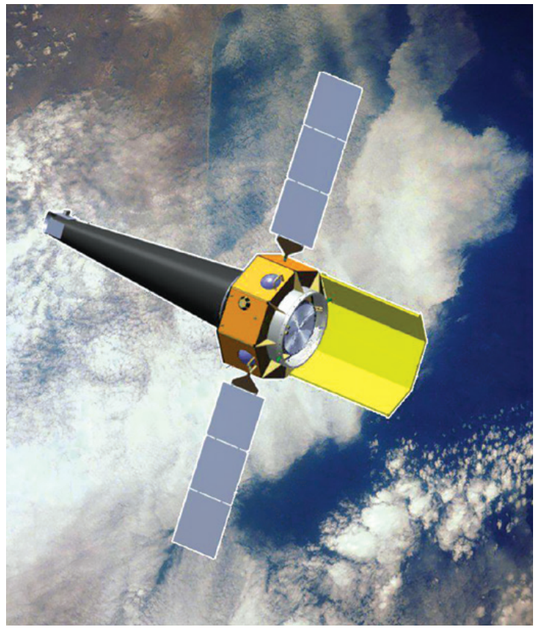
"If we don't get these corridors right, our efforts at conservation will be wasted, and we could see more human-wildlife conflicts," says Jennifer Mullinax, an associate professor in UMD's Department of Environmental Science and Technology and senior author of the study.**–KC**

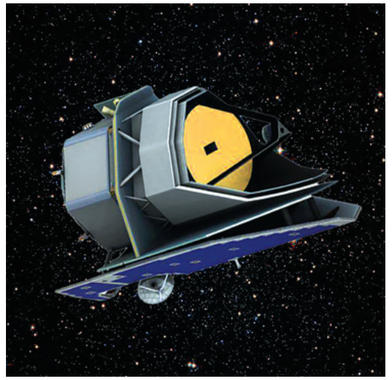
## $1.6M FTA Grant Supports Communities Coping With Transit Construction

**UMD RESEARCHERS WILL WORK** to preserve affordable housing, protect neighborhood assets and create access to green space for the 200,000 residents living along the state of Maryland's coming light-rail line.

The two-year project is supported by a $1.6 million Federal Transit Administration grant and led by the Purple Line Corridor Coalition (PLCC); it prioritizes vulnerable residents and small businesses, particularly around the $10 billion Purple Line's 21 transit stations, including five on or near UMD.

"Our research has shown that transit-oriented development without protections and policy in place can be a major agent of displacement," says Sheila Somashekhar, director of the PLCC, a part of UMD's National Center for Smart Growth. "This grant will allow us to proactively address this need, ensuring the people who already live there can reap the benefits."**–MH**





*Renderings show AXIS (left) and PRIMA in action. NASA plans to select a mission to move forward in 2026.*

## 2 UMD Space Probe Proposals Advance in $1B NASA Mission

### Projects Each Awarded $5M to Further Develop Plans, Prototypes

**NASA IN OCTOBER** selected two proposals for space probes to proceed to the next round of consideration for a $1 billion mission set to launch in 2032—and both are led by University of Maryland astronomers.

The **ADVANCED X-RAY IMAGING SATELLITE (AXIS)** mission, led by Professor Christopher Reynolds, would peer "further and wider" into the early cosmos than previous X-ray observatories. AXIS would "be able to detect X-rays from the first supermassive black holes in the first 500 million years of the universe," among other cosmic phenomena, he says.

Reynolds also hopes to study how central black holes influence the formation of stars and other celestial objects around them. While the James Webb Space Telescope (JWST) has already made significant strides in black hole research, Reynolds says that AXIS could complement or even expand on its findings.

**PROBE FAR-INFRARED MISSION FOR ASTROPHYSICS (PRIMA)**, with Professor Alberto Bolatto as a co-investigator and NASA Goddard Space Flight Center researcher and led by Adjunct Professor Jason Glenn, would pick up on far-infrared radiation, an "underserved" wavelength, to explore the formation of black holes and stars in the early universe, as well as protoplanetary disks and space dust, Bolatto says.

With PRIMA, researchers also plan to analyze protoplanetary disks—collections of gas and dust orbiting young stars that are the birthplace of planets—to determine how much water is needed for different types of planets to form. Doing so could even uncover where Earth's water came from, a mystery that has not been definitively solved.

Each project will receive $5 million to further develop plans and prototypes over the next year. NASA will then re-review the proposals and select one mission to move forward in 2026.

"This is terrific news—Chris, Alberto and Jason are true leaders in their fields," says Andrew Harris, chair of UMD's Department of Astronomy. "They, along with colleagues at NASA Goddard and other institutions, have made the scientific cases that drive these exciting missions forward to the next stages possible."

This announcement follows NASA's creation of a new class of astrophysics observatories, called probes, which are smaller than "flagship" missions like the JWST but still capable of tackling the big questions in astrophysics. NASA plans to select either a far-infrared or X-ray observatory to investigate the birth of planets, as well as the evolution of galaxies and black holes, in the early universe.**–EN**



PHOTO VIA ISTOCK; ILLUSTRATION VIA ISTOCK

IMAGES COURTESY OF CHRISTOPHER REYNOLDS AND ALBERTO BOLATTO

# A "Street View" of Accident Hot Spots

AI Study Finds Greenery, Sidewalks, Streetlights Mean Safer Roads

**MOST PEOPLE USE** Google Street View to help find their way, but UMD researchers employed it to locate spots where your journey might abruptly end.

In a study published in June in the *British Medical Journal of Injury Prevention*, the research team analyzed the imagery—which offers 360-degree views of streets around the world—with artificial intelligence tools to identify key environmental elements influencing the frequency of collisions involving cars, pedestrians and cyclists.

The team led by former epidemiology and biostatistics Professor Quynh Nguyen (now at the National Institutes of Health) manually annotated 18,000 Google Street View images, highlighting five features used to train an AI-enabled computer vision model: sidewalks on at least one side of the road; streetlights; single-lane roads; road construction and overall street vegetation.

Once trained, the AI system found sidewalks had the greatest impact on reducing crashes. Streetlights and stop signs were associated with fewer car accidents involving pedestrians or cyclists, while road construction meant more collisions.

The study is an example of how many of the public health issues facing communities are solvable with innovative approaches to data, says Xiaohe Yue, a data analyst in the UMD School of Public Health and study co-author.

"Emerging technologies and access to extensive data sources have been helpful in finding solutions to some of the public health issues that plague populations," Yue says.**—SAM**

## Researcher Seeks Extreme Events-Disease Links

$1.8M Grant Supports Study of How Wildfires, Extreme Heat Impact Kidney Disease Patients

**AS INTENSE HEAT** and rising air pollution from wildfires pose increasing threats to human health, new UMD research aims to understand the risk for a particularly vulnerable group, and to identify solutions.

A new project, funded by a $1.8 million grant from the federal Agency for Healthcare Research and Quality and directed by Professor Amir Sapkota, will analyze 25 years of U.S. electronic health records to study how hazards influenced by climate change affect end-stage kidney disease (ESKD) patients.

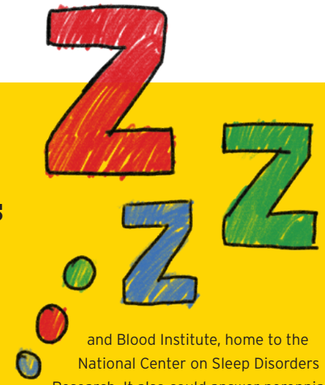
"During extreme heat, the damaged kidneys of people with ESKD do not regulate fluid levels very well, leading to electrolyte imbalances and other potential complications," says Sapkota, chair of the Department of Epidemiology and Biostatistics and an expert on climate change and health.

The study is being conducted along with investigators from the UMD School of Public Health, Renal Research Institute, Indiana University School of Public Health and University of Maryland School of Medicine.

The team will seek to understand how wildfire-related air pollution as well as extreme heat events affect the risk of hospitalization and death among people living with ESKD, and how the risks vary across different regions and based on different preexisting conditions and socioeconomic backgrounds.**–FT**

## Putting to Bed Questions About Preschoolers' Naps

Researchers Co-lead $6M Study on Brain Development



**A CHILD'S TRANSITION** away from naptime may be a bit of a heartbreaker for harried parents, but it also may be a sign that their developing brains are increasingly able to process information.

That's the theory researchers from UMD and the University of Massachusetts-Amherst are testing with a $6 million grant from the National Heart, Lung, and Blood Institute, home to the National Center on Sleep Disorders Research. It also could answer perennial questions about whether it's harmful to keep tired preschoolers awake through the day so they sleep better at night.

Tracy Riggins, a professor in UMD's Department of Psychology; Gregory Hancock, a professor in UMD's Department of Human Development and Quantitative Methodology; and Rebecca Spencer, a psychology professor at Amherst, are tracking the brain development—specifically the development of the hippocampus, responsible for memory and learning—along with memory performance and nap status of 180 children ages 3 to 4 ½ over the course of one year.

The researchers hope that their study will be of use to educators, whose programs' nap policies vary from preschool to preschool, and to policymakers considering the possibility of universal pre-K, as well as to parents.**–RG**

## UMD Information Experts Take on National Archives' 10B Undigitized Pages

Team Pursues Advanced Digital Solutions to Ease Historical Research

**IMAGINE TRAVELING THOUSANDS** of miles to the National Archives in College Park, waiting hours to access a single box of documents and discovering it doesn't contain what you were looking for.

Such boxes of the nation's records fill vast storehouses of 43 National Archives and Records Administration facilities. They hold well over 10 billion pages, with perhaps 2% digitized. Research can feel like searching for a historical needle in a very large haystack.

UMD researchers, with assistance from information experts from Japan, are working to develop information retrieval tools that will rely on machine learning algorithms and sophisticated cameras to better identify and categorize important historical records.

Douglas W. Oard, a professor in the College of Information and the University of Maryland Institute for Advanced Computer Studies, is leading the project, with assistance from colleagues Diana Marsh, an assistant professor of archives and digital curation, and Katrina Fenlon, an assistant professor specializing in digital collections. An expert in information retrieval, Oard envisions an advanced system where even before arriving at the Archives, scholars can input their requests using natural language.

"The project poses new challenges, but the potential to transform access to historical documents is what drives us," Oard says. "We're not just building technology—we're working to enrich the future of historical research, one box at a time."**–MB**



LEFT PHOTO BY STEPHANIE S. CORDLE; TOP PHOTO VIA ISTOCK

PHOTO VIA WIKIMEDIA COMMONS

# Welcome to the Hotel Influenza

## Volunteers Check in to Get Sick for Science in a Groundbreaking Experiment

**THE STATELY 23-STORY** hotel in Baltimore opened at the height of the Jazz Age, but less than a year later, Wall Street's 1929 implosion snuffed out the revelry there.

Today, reputedly haunted by the ghosts of those who lost it all in the Great Crash, the establishment is hosting University of Maryland researchers and colleagues tracking a more threatening unseen presence.

Each year, seasonal influenza kills up to 650,000 people, according to the World Health Organization; while science has clarified much of the biology of flu and other respiratory viruses, it hasn't precisely explained how they pass from person to person. Did flu come from a doorknob or a sneeze in the face? Or as recent research at UMD suggests, do viruses "haunt" indoor air, waiting to be inhaled?

> Maybe this tragedy will get us past our fear of the idea of airborne transmission and prepare to control it, which could help us to avoid all this next time.
>
> —**Donald K. Milton**
> *UMD MPower Professor of Environmental and Occupational Health*

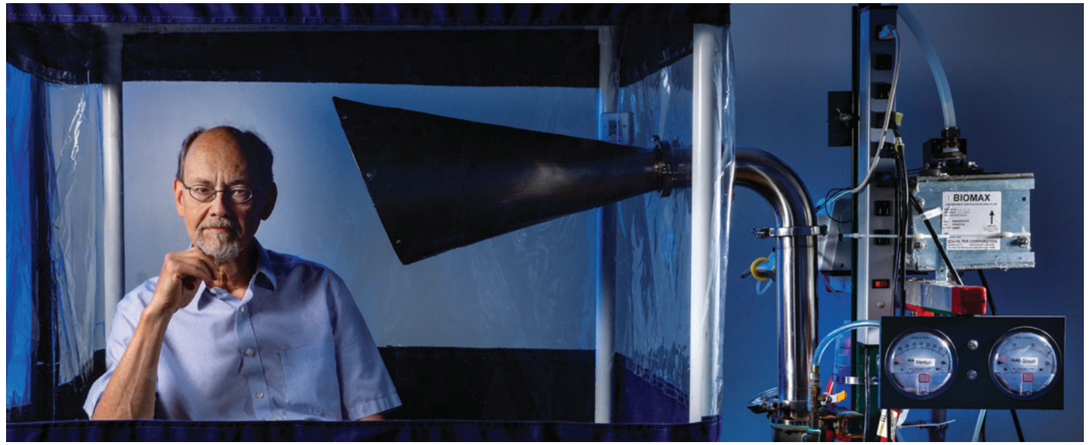
To answer such questions, paid volunteers have checked into a sealed-off floor of the hotel in recent winters. During two-week stays, they participated in a randomized, controlled trial with a surprising objective: to spread, or catch, the flu for science.

Supported by $20 million in grants from the National Institutes of Health and Balvi Filantropic Fund, the study brings together a multidisciplinary team from UMD's School of Public Health and A. James Clark School of Engineering, and the School of Medicine at the University of Maryland, Baltimore, led by UMD MPower Professor of Environmental and Occupational Health Donald K. Milton.

He has spent much of his 40-year career analyzing airborne pathogens and advocating for society to take greater precautions. It took the COVID pandemic—when he helped change national and global health authorities' minds about masking—for his ideas to gain traction. But it was too late to avoid widespread lockdowns and millions of deaths.

"Maybe this tragedy will get us past our fear of the idea of airborne transmission and prepare to control it, which could help us to avoid all this next time," Milton says.

Many prominent physicians still believe the primary routes of infection are the spray of a sneeze or cough directly into the face, or contaminated surfaces. The developing idea that "aerosols," fine particles that can remain suspended in the air for considerable periods, can hold viruses able to cause infection increasingly brought Milton into conflict with the medical establishment.




One of his papers, examining the possibilities of airborne smallpox soon after the 2001 anthrax attacks, prompted livid responses from reviewers, including charges he was a "quack and a charlatan," he says. The resistance is underlain by the idea that "this is how we've always done it," he says. "It's dogma, not science. I'm allergic to dogma."

To show what's in the air, he developed a machine, the Gesundheit II; for a 2013 study in *PloS Pathogens*, he used it to demonstrate that flu virus could be captured from infected people's breath and cultivated. The study also found that surgical masks cut influenza virus escaping into the air from an infected person by 70%.

At the start of the COVID-19 pandemic, Milton and several co-authors posted a paper online that was later published in *Nature Medicine*. Using Gesundheit II, it showed surgical masks could stop coronaviruses when worn by infected people, helping lead to widespread mask use.

*Milton (top) poses with his Gesundheit II machine, which captures viruses from people's breath. Researchers and students from Milton's lab (right) test technology used to track study participants at the hotel.*

Milton became a go-to expert for journalists and officials and joined various global public health advisory boards.

"It took a pandemic … for his work to finally receive an appropriate level of attention, given its implications," says Jonathan M. Samet, professor and former dean of the Colorado School of Public Health.

Milton's latest major study began in 2021 with $15 million in funding from the National Institutes for Health, with fieldwork at the hotel starting in 2022 and concluding in 2024.

"The design of this study gives more understanding of every step along the way than we have ever had before," says Professor Jelena Srebric, the Margaret G. and Frederick H. Kohloss Chair in Mechanical Engineering, one of Milton's co-principal investigators. "We'll know what made you sick and what didn't make you sick."

Unlike previous controlled trials of virus transmission, the hotel-based protocol quarantined flu recipients in their rooms when not being intentionally exposed to infected flu "donors," rather than allowing them to leave and potentially pick up flu elsewhere.

Participants regularly convened in a common room for card games, yoga or karaoke, with Srebric and colleagues testing room ventilation rates to see if cleaner air resulted in fewer infections. To examine other modes of infection, randomly chosen participants used hand sanitizer and wore face shields; others were unprotected. All participants were then instructed to pass phones and other objects around for researchers to test for infection via touch.

Rapid PCR testing using machines donated by the Balvi Filantropic Fund tracked who was infected, while the Gesundheit II allowed the scientists to measure how much virus donors put in the air; molecular sequencing at NIH tracked what strains virus donors bring in. The Balvi gift also funded a test of whether a new type of germicidal ultraviolet light devices prevents infections.

While the hotel-based portion of the study has ended, Milton says, a new phase of the project this year calls for the researchers to study controlled exposures in a state-of-the art environmental chamber operated by UMD's Department of Mechanical Engineering while continuing to enroll flu donors and recipients from the campus population.—**CC**



ILLUSTRATION BY NOMA BAR; PHOTOS BY STEPHANIE S. CORDLE

# New Reflection on History

Physicist Who Sent Mirrors to Moon on Apollo 11 Launches an Improved Model

**IN JULY 1969,** four UMD faculty members traveled from College Park to Kennedy Space Center in Florida to provide last-minute instruction to a noteworthy pupil: an Apollo 11 astronaut about to become one of the first humans to set foot beyond Earth.

Just days later, lunar module pilot Buzz Aldrin would follow mission commander Neil Armstrong onto the moon's surface to deploy a UMD-led experiment. The suitcase-size array of retroreflectors—hunks of glass able to reflect light directly back to its source from any angle—would serve as a target for powerful lasers on Earth and provide the first accurate measurements of the distance between the planet and its satellite.

At a later lunar workshop, then-Assistant Professor Douglas Currie, an expert in laser light, recalls that Aldrin scoffed about the procedural instructions, "Ahh, it was so easy I decided I could give it to Armstrong."

But the wisecracking fighter pilot with a Ph.D. in astronautics had done his homework. For the last 55 years, that array and two more placed by successive Apollo missions have yielded a wealth of data for NASA's Lunar Laser Ranging experiment, helping scientists detect our moon's liquid core, bolstering Einstein's theory of general relativity and providing a better understanding of the evolution of the Earth-moon system.

Now the university has done it again with the launch of the Next Generation Lunar Retroreflector as part of a mission that touched down on the moon on March 2, 2025; the mirror began operations the next day. This time, Currie is principal investigator for the retroreflector project, a position held on the Apollo 11 project by the late physics Professor Carroll Alley.

"When NASA announced back in 2004 they were going back to the moon, I said that instead of an array of 100, we need to have one big one, and I've been playing with that since then," says Currie, now a professor emeritus and senior research scientist in the Department of Physics.

He and NASA hope the next-gen device boosts precision in distance measurements by perhaps a factor of 30, from several centimeters of uncertainty to less than one millimeter.

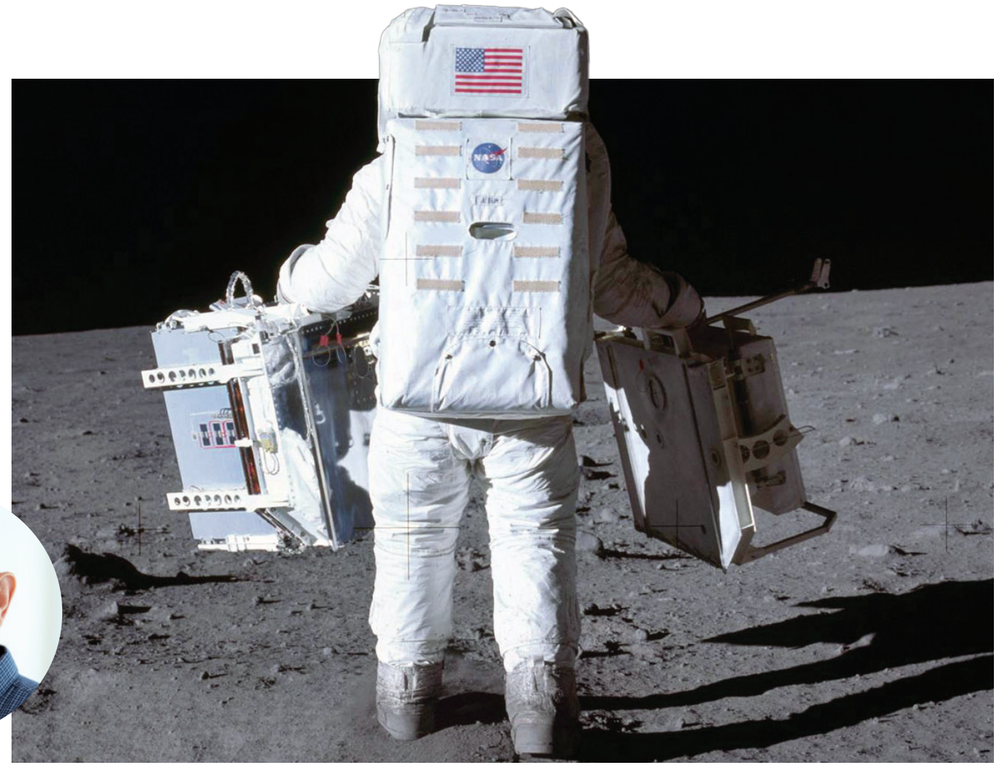
The new setup also has the advantage of being shiny and new. Evidence suggests the Apollo 11 mission array is significantly blocked by lunar dust; the new device should be 10 times as bright as the current arrays, says Stephen Merkowitz, who oversees lunar laser ranging as Space Geodesy Project manager at NASA Goddard Space Flight Center.

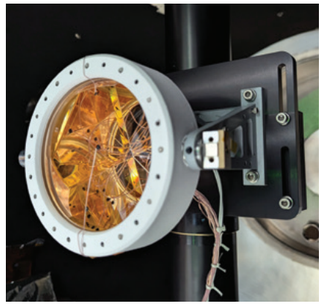
Solving these problems will contribute to another one, however. The hefty chunk of glass making up the new single retroreflector mirror soaks up and sheds more heat during frigid lunar nights and blazing days, creating a greater possibility for temperature gradients and distorted reflections. Currie and his partners at the National Laboratories of Frascati in Italy worked to minimize that with the retroreflector's housing design.

"A lot of what we're looking to do today builds directly on what was done more than 50 years ago, so Doug's experience working on Apollo is valuable in the present," Merkowitz says.

Currie chuckles looking at a photo he keeps in his office in the Physics Building: It shows Aldrin strolling across the moon, swinging the original UMD mirror array in one hand and another priceless experiment in another. Times have changed.

"Now we're told the astronauts have to carry it in both hands, even though it weighs only a fraction of what Buzz was carrying," he says. "They want you to do one thing at a time, I guess."**–CC**





*During the 1969 Apollo 11 mission (above), astronaut Buzz Aldrin carries a lunar reflector designed by Douglas Currie (left) and other UMD faculty. In an undated photo, Currie seated (left), discusses the project at McDonald Observatory, Texas. The new reflector (below) awaits testing at NASA Goddard Space Flight Center in Greenbelt, Md.*

## Back to the Moon—but First, Arizona

Researcher Leads Safety Planning for NASA's Artemis Lunar Test Mission

**TWO ASTRONAUTS** trudge across a barren landscape, pushing science equipment to collect rock samples. But when cows wander by, the illusion breaks: They're not on another planet, but in Arizona, where NASA is preparing for the first crewed mission to the moon in nearly 50 years when Artemis III takes off in 2026.

Last spring, University of Maryland and NASA Goddard Space Flight Center Associate Research Scientist Patrick Whelley served as the field safety officer for a two-week test mission out at the San Francisco Volcanic Field near Flagstaff. He oversaw a team of 10, including medical professionals, to ensure things went smoothly for the astronauts and a broader crew of about 50.

The mission focused on communications with mission controllers and scientists at NASA's Johnson Space Center in Houston. The test crew conducted day and night "moonwalks" and tried out different space suit iterations.

"Going to the moon is difficult," Whelley says. "There are so many people working together toward this common goal. … There's a lot of folks, like engineers and technicians, who don't go out in the field a lot. My role is to make this experience comfortable and positive and productive for everyone."**–KS**



PORTRAIT BY JOHN T. CONSOLI; ADDITIONAL PHOTOS COURTESY OF DOUGLAS CURRIE

PHOTO FAR RIGHT COURTESY OF NASA / JOSH VALCARCEL

*Cheri Hendrix, UMB's physician assistant program director, works with an actress simulating a stroke in UMCP's HoloCamera.*

# Advanced Camera System Brings Medical Training to Life

University of Maryland Collaboration Introduces VR for Stroke Assessment

**A 76-YEAR-OLD PATIENT** suddenly becomes mute and can't move her right arm—classic stroke symptoms. Cheri Hendrix, director of the physician assistant program at the University of Maryland, Baltimore (UMB), goes into assessment mode, her voice growing urgent. "Tell me what day it is," she says. "Tell me where you are."

The scene isn't playing out in real life. Students outfitted with virtual reality (VR) goggles are able to immerse themselves in this 3D training experience, watching Hendrix evaluate the patient as if they were with her—even "walking around" in virtual space to watch from different vantages.

The imaging facility used to create the scene, called the HoloCamera, was built by University of Maryland, College Park (UMCP) computer visualization experts in response to studies showing that people retain more information in immersive training environments.

"Sitting still and using a desktop and mouse doesn't aid in forming memories as well as experiencing things in an embodied context," says Amitabh Varshney, a professor of computer science, dean of UMCP's College of Computer, Mathematical, and Natural Sciences, and lead investigator of the project.

During an anatomy education demonstration at the HoloCamera studio in College Park, two clinical students stepped into a virtual environment featuring an animation of the human cardiovascular and neurological systems overlaid on the patient from head to toe. A UMCP team member triggered a visual representation of an irregular heartbeat, sending a blood clot to the patient's brain and connecting the outward symptom of immobilization with internal causes.

> "This will be a boon to education all over. Sky's the limit."
>
> — ***Cheri Hendrix***
> *Physician Assistant Program Director, UMB*

The HoloCamera relies on 300 high-resolution cameras precision-mounted in a green room studio to film subjects in 360 degrees. The collective ultra-high-definition footage was fused together with UMCP-developed hardware and software using artificial intelligence.

The project was partially funded by a $1 million National Science Foundation grant led by Varshney and forged through the MPowering the State initiative, a strategic collaboration between the two universities.

The HoloCamera was developed amid an increased demand by clinical training facilities for instructional tools that feature lifelike environments.

In the years ahead, the team plans to apply the tool to anatomy education and surgical training at the University of Maryland Medical Center at UMB.

Not only will the technology help students in College Park and Baltimore, but it can also be scaled to assist practitioners in rural areas and far-flung countries, bringing the talents of Maryland professors and clinicians to populations in need, the developers say.

"This will be a boon to education all over," says Hendrix. "Sky's the limit."**–JT**



IMAGE COURTESY OF UNIVERSITY OF MARYLAND INSTITUTE FOR ADVANCED COMPUTER STUDIES

INSET IMAGES VIA ADOBE STOCK

## Wearable Sensors Could Help Pinpoint Parkinson's

Researchers Aim for More Accurate Way to Diagnose Disorder

**DIAGNOSING PARKINSON'S** disease, particularly in its early stages, usually entails having patients perform a variety of mobility tests—a lengthy, labor-intensive process for both clinicians and patients.

Researchers in UMD's Center for Bioinformatics and Computational Biology (CBCB) are working with colleagues at the University of Maryland, Baltimore and elsewhere to use machine learning algorithms to analyze data from wearable, movement-tracking sensors to help automate parts of the process. It could ultimately lead to more accurate diagnoses and earlier interventions for the often-devastating movement disorder.

The project was funded by a $150,000 seed grant from the MPowering the State initiative, designed to foster collaboration between the two institutions for a disorder affecting 500,000 in the U.S.

Rana Khalil, a Ph.D. student in computer science at UMD and lead author of research published in August in the journal *Sensors*, worked on the project with her adviser, Michael Cummings, a biology professor and director of CBCB.

"The diagnosis of mobility disorders is very difficult," says Cummings, who has an appointment in the University of Maryland Institute for Advanced Computer Studies (UMIACS). "Much of the process is subjective, and as such, isn't highly accurate."

Using a sophisticated machine learning framework, the researchers demonstrated a single sensor on the lower back could accurately diagnose Parkinson's, resulting in far less complexity and higher accuracy than earlier attempts with wearable sensors.**–AH**

## USM Among Nation's Top Patent-Producing Institutions

**THE UNIVERSITY OF MARYLAND** ranks among the world's best academic institutions at transforming research and discovery into patents, according to a recent National Academy of Inventors report.

Together with other schools in the University System of Maryland (USM), the University of Maryland, College Park (UMCP) in 2024 ranked eighth among U.S. public institutions—up a spot from 2023—and 22nd in the world for patents awarded. The U.S. Patent and Trademark Office last year granted 114 patents to five USM institutions; of those, UMCP holds 71—up from 59 the prior year.

"Patents empower universities to protect their innovations, foster collaboration, attract funding and turn research into real-world solutions, driving both academic advancement and economic impact," says Ken Porter, the College Park executive director of UM Ventures, part of the MPowering the State initiative. "A robust patent portfolio creates opportunities not just for our faculty researchers and inventors, but for the entire university, state and region."**–SG**

# Building the Capital of Quantum

## UMD and the State of Maryland Make a Billion-Dollar Bid to Anchor a Scientific and Commercial Revolution

BY CHRIS CARROLL // PHOTOS BY JOHN T. CONSOLI

**THE GLENN L. MARTIN WIND TUNNEL** opened in secret at the dawn of the Cold War. A gift to the University of Maryland from the aircraft industry titan whose name it bears, the facility was used to develop U.S. military planes and missiles for a looming showdown with the Soviet Union. Long since declassified, it still works with government agencies as well as civilian companies, though it might be best known locally for giving guests a hair-whipping thrill at UMD's annual open house.

Early this year, the 76-year-old facility briefly slipped back into its shadowy security role. University officials gave the startup company Patero, based in a UMD business accelerator, a chance to test its technology by locking down the tunnel's computer systems—not against midcentury spycraft, but a futuristic form of cyberattack that doesn't yet exist.

The work lay in the quantum arena, where firms and nations are racing to introduce the first powerful quantum computer, a machine that could potentially sow chaos by quickly defeating currently invulnerable data security measures. But it could also be used to create revolutionary, life-enhancing advances in pharmaceuticals, ultra-secure networking, the fabrication of new material with unheard-of properties, and other areas.

To help ensure society reaps these benefits while fending off risks, the University of Maryland is redoubling its efforts, along with the state and a range of business partners including Patero, to cement the region as a global hub of quantum research and innovation.

Gov. Wes Moore announced this strategic initiative, dubbed "The Capital of Quantum," in January. It includes plans to attract $1 billion in investments over the next five years to support quantum research and training across the university and beyond, including new faculty hires and facilities; a deepening of the relationship with IonQ, a world-leading quantum computing and networking firm spun off from UMD research and headquartered in the university's Discovery District; support for academic degrees and educational programs to help expand the quantum workforce; and investment funds to grow the expanding ecosystem of quantum startups and firms around College Park.

"With extraordinary assets and partnerships, Maryland can—and should—lead in this new emerging sector, and we are moving forward with a clear strategy to make that vision a reality," Moore said at the initiative's launch event at IonQ.

The funding will come from a combination of state funds, matching federal grants, private-sector investments and philanthropic contributions, and includes an initial $27.5 million submission in Moore's FY26 state budget request that is expected to catalyze an additional $200 million in state funds from the university and its partners.

### Quantum Foundations

UMD President Darryll J. Pines coined "the Capital of Quantum" as a geographical call to action, playing on the university's advantageous location adjacent to Washington, D.C., and its reputation as the site of many quantum discoveries over the decades.

"A few years ago, I realized this worldwide competition was developing around quantum," he says. "We have to maintain the university's academic lead in this area, and we can't let the state of Maryland lose out on the economic benefits of this potential industry as it emerges."

> "The governor's announcement here at UMD puts a competitive stake in the ground."
>
> —**Darryll J. Pines**
> *President, University of Maryland*

Quantum science itself isn't new—Einstein and other physicists explored how matter and energy at the scale of atoms and below make up the universe more than a century ago. Later, their discoveries formed the basis for transistor radios, computers, medical imaging machines and more.

In 1994, "quantum" assumed a broader meaning when computer scientist Peter Shor of Bell Labs demonstrated a quantum algorithm that allowed for an exponential speed-up of prime number factoring, which is the basis of data encryption, but only with the right hardware.

"That's what really stimulated everyone everywhere to start thinking about this: How do we build a quantum computer?" says Steven Rolston, professor and chair of UMD's Department of Physics.

UMD was already strong in basic physics research, and its physics department soon struck up a more formal link with the National Institute of Standards and


*From left: IonQ Executive Chair and Chairman of the Board Peter Chapman takes Maryland Lt. Gov. Aruna Miller, Gov. Wes Moore and UMD President Darryll J. Pines on a tour of the company's College Park headquarters. The world's first publicly traded quantum hardware and software company, IonQ was founded on trapped-ion computing technology developed in UMD labs.*

RIGHT PHOTO BY STEPHANIE S. CORDLE


*Clark Distinguished Chair Professor Saikat Guha, a recent transplant to the Capital of Quantum, sets up his lab in the Kim Engineering Building with help from doctoral student Jack Postlewaite. Guha, co-director of the NSF-funded Center for Quantum Networks, arrived in 2024 from the University of Arizona's College of Optical Sciences. Alongside his academic work, his quantum startup company, Diffraqtion, is developing ultrasharp machine vision sensors as an affiliate of UMD's Quantum Startup Foundry business accelerator. He's also co-founder of the quantum network technology firm Qunett.*

Technologies (NIST), in 2006 combining to launch the Joint Quantum Institute (JQI) with UMD's Laboratory for Physical Sciences as a third partner. JQI quickly grew into a major center of quantum theory and experimentation, with more than 200 scientists and scores of Ph.D. students each year turning out hundreds of publications. In 2014, NIST and UMD launched the complementary Joint Center for Quantum Information and Computer Science (QuICS), which shares many faculty and fellows with JQI.

"This really puts us at the top in terms of quantum research," Pines says. "They very intentionally and strategically brought in people from across the important domain spaces in quantum. That led to the recruiting of a young faculty member who helped push things to the next level for UMD."

That faculty member was physics Professor Christopher Monroe, hired at UMD in 2007. Early on, he made headlines around the world for using atoms to "teleport" quantum information across space using quantum entanglement, in which particles are "linked" so that what affects one affects both. Entanglement was also part of what allowed Monroe and colleagues to use ions of the element ytterbium as natural "qubits." These are the quantum equivalent of "bits," which are represented by zeros and ones in regular, or "classical," computers. Unlike classical bits, though, qubits counterintuitively can represent a zero and one at once, opening the possibility of vastly accelerating calculations.

## The Unicorn

Along with collaborator Junsang Kim of Duke University, Monroe founded IonQ in 2015. (Both have returned to academia full-time as professors at Duke.) The fledgling firm received financial backing after venture capitalist Harry Weller, a general partner at New Enterprise Associates, delved into Monroe's "trapped ion" computing research. Before long, the tiny startup was making waves with its early-stage quantum computers and was being mentioned in the same breath as giants like Microsoft, IBM and Google in the race to build the first broadly useful quantum computer system.

After years of expansion, the firm debuted on the New York Stock Exchange in 2021 as the world's first publicly traded "pure play" quantum hardware and software company; it was valued at more than $1 billion as it prepared to enter the exchange, aka a "unicorn." Early in 2025, the company's value reached 10 times that amount.

In the back of the company's headquarters off Campus Drive, technicians exactingly assemble quantum processors in a clean room, while giant racks of quantum computers in another room serve customers around the world looking to stay current on the state of the field. A next-gen computer slated to come online late this year will nearly double the number of qubits in IonQ's flagship machine, which the company expects to boost computing power to about 250 million times that of the current computer. That should be game-changing in terms of moving quantum computers from objects of study to useful tools—not replacing conventional computers, but starting to be necessary alongside them, says the company's chief financial officer, Thomas Kramer.

"It will be a computational power the world has not yet seen," he says. "At that point, we think use cases (for quantum computing) will start to become more obvious."

In true startup fashion, IonQ is based in a repurposed warehouse, but intends to relocate to a new headquarters in the Discovery District, a move the university is helping to support.

Other plans call for an expansion at the company's current location of an IonQ-UMD collaboration—the National Quantum Laboratory at Maryland (QLab). This user facility provides an opportunity for researchers from around the world as well as UMD students and others to access IonQ's

MAP BY HAILEY HWA SHIN

> We're here because essentially the best place for quantum on the East Coast wanted to invest in us.
>
> —**Hussain Zaidi,** *CEO, QC82*

quantum computing technology and interact with its experts. Former UMD quantum scientist Norbert Linke, who helped develop trapped-ion computing, will return to the university this fall to serve both as QLab director and a professor of physics.

The QLab is a node on Mid-Atlantic Region Quantum Internet (MARQI), which was designed by Professor Edo Waks and Tripti Sinha, assistant vice president and chief technology officer with the Division of Information Technology. With funding from NSF, it has more than 2 kilometers of fiber optic cable that extend across UMD, serving as a testbed for quantum networking technologies that will enable the transmission of quantum information using current "classical" Internet infrastructure.

"The Internet has proven the power of aggregation and distribution by networking resources, and we believe we can build on quantum computing the same way," Sinha says. "It's still in the future, but the University of Maryland could be poised to be the first place where quantum computers communicate on a network."

At IonQ HQ, Kramer points to a wall of plaques commemorating IonQ's hundreds of patents, evidence of a company that is surging.

"As the company grows and matures, more patents have now been generated by IonQ as opposed to coming from our university partners, which shows our commitment to generating new, groundbreaking IP in-house," he says.

*Engineering and physics Professor Ronald Walsworth (left) works with bioengineering doctoral student Smriti Bhalerao in the Quantum Technology Center, which he directs. Walsworth also runs a private business incubator, Quantum Catalyzer (Q-Cat) in UMD's Discovery District.*

## Reaping "Capital" Gains

What's needed now is infrastructure—backed by UMD and the growing regional quantum ecosystem—for companies to build on the promising commercial foundation IonQ has been laying.

Its rise as a publicly traded spinoff quantum company was a towering achievement for UMD—a feat no other university or group trying to create a quantum hub elsewhere has replicated, says Ronald Walsworth, a professor of engineering and physics who directs UMD's Quantum Technology Center (QTC).

"Realistically, we're probably not going to get another IonQ anytime soon—but we can help grow additional successful companies across the quantum ecosystem," he says.

The focus of QTC is to "innovate, translate, and educate in quantum technology," Walsworth says. He and his colleagues and students focus on the wide range of promising quantum innovations—not just quantum computing. Walsworth is widely known for his work in MRI and sensing, while others in the center (including Waks, the associate director) focus on creating quantum networks, which could promise ultimate communications security when linking quantum computers.

Walsworth's own startup, Quantum Catalyzer (also known as Q-Cat) currently sells an invention from his and his colleagues' labs—the quantum diamond microscope, which harnesses atomic-level faults in diamonds to allow unprecedented views of everything from microelectronics to ancient meteorites to biological samples. In turn, those sales help Q-Cat, which was primarily conceived as a quantum business incubator, to support the development of other quantum startups; its first spinout company, EuQlid, uses the quantum diamond imaging technology in inspection for flaws in advanced semiconductor chips.

If the Capital of Quantum Initiative succeeds in attracting new sources of private capital—Weller jumping on the IonQ train early was a key factor in the company's success—the quantum hits should keep coming for UMD, Walsworth says.

Funding opportunities—existing and hoped-for—brought another startup to UMD. QC82, a University of Virginia quantum computing hardware spinout, was lured by the opportunity to join the Quantum Startup Foundry, launched in 2021 to guide startups confidently through their early steps, whether obtaining office space, finding investors or navigating paperwork.

"We take a very bespoke approach, one that is extremely tailored to the company," says Piotr Kulczakowicz, QSF director. "We define their needs and assess how we can help them with their needs, and then we are there to help in too many ways to list, really."

QC82 also received an investment from UMD's Discovery Fund, which distributes up to $1 million a year to innovative startups. One of only two photonics quantum computing startups in the country, QC82 touts core technology that allows room-temperature computing, unlike many competitors that must chill their qubits to near absolute zero.

"We're here because essentially the best place for quantum on the East Coast wanted to invest in us," says Hussain Zaidi, QC82's CEO. "What we do is very hardware-intensive; it requires significant capital to bring revolutionary technology to market. The vision that the university and the state are showing by making this long-term commitment will go a long way to attracting investors that companies like ours need."

## A Stake in the Ground

The Capital of Quantum initiative brings a laser-like focus to leverage decades of related achievements, Pines says.

"The governor's announcement here at UMD puts a competitive stake in the ground that says here's what we intend to build: an emerging industry with the University of Maryland and all its strengths in quantum at the center," he says. "This will bring great economic benefits for our state along with immense potential to create solutions to some of the world's pressing problems."

Projections of global quantum spending in coming years are eye-popping, says Ken Ulman, UMD's chief strategy officer for economic development and president of Terrapin Development Co., a partnership between the university and its nonprofit financial arm that is leading several local quantum projects. McKinsey and Co. recently estimated the market size could reach $90 billion within a decade, with up to a $2 trillion economic impact across the chemical, life sciences, transportation and finance industries.

Within two weeks of Moore's announcement, more than a dozen U.S. and international companies contacted the university to line up tours and talk about joining the growing hub, Ulman says. UMD's slate of offerings is compelling: office space in its increasingly vibrant Discovery District alongside federal science agencies and IonQ, the QSF's business development programs and an ecosystem featuring hundreds of quantum researchers—plus graduates to potentially hire.

"With our unique strengths in quantum, why wouldn't we go after this?" Ulman says. "When you look at all the attributes, we're one of the few places in the world where you could actually build something worthy of being called the Capital of Quantum."

Beyond business support, UMD's physics department has long prepared graduates for quantum careers in government labs and the tech industry. In recent years, other parts of the university, including engineering and computer science, have joined in to train the quantum workforce the U.S. needs to compete in this important arena.

UMD recently launched a Master of Science in quantum computing program and its new program in quantum science and engineering will begin as a minor to provide footholds for undergraduates to enter dynamic careers.

Peter Bentley '88, chief operating officer of Patero, the company that tested its "post-quantum" cybersecurity suite at UMD's Wind Tunnel, says the university's support has helped put his College Park-based company in a leading position as firms and government agencies begin contending with the risks and opportunities of the rise of quantum, and move to secure their online presence.

"This market is about to flex, and as an alumnus, I kind of love it that Maryland wants to lead this," Bentley says. "Because of the level of support we've gotten from the Quantum Startup Foundry, and the way the university has aligned itself with its government partners, Patero is now the first post-quantum company out of the gate."

# SOLUTIONS TO BIRD FLU HATCHED

*On the Farm and in the Lab, Researchers Are Fighting a Virus That's Pushing Up Food Prices and Threatening a New Pandemic*

BY KAREN SHIH '09



**THAT CHILL IN THE EGG AISLE** isn't just refrigeration. Grocery runs these days can feel a bit Soviet, with signs announcing carton rationing and apologizing for low stock. Even Waffle House—known for holding the line on prices—added a 50-cent surcharge to egg dishes.

The once-affordable source of protein has become scarce for one reason: the latest strain of avian influenza, H5N1, a highly contagious and fatal virus. Over 168 million birds have either died of the virus or been culled over the last three years. Most of those were egg-laying hens, which drove the average price of eggs up more than 60% by the end of 2024, with the U.S. Department of Agriculture (USDA) predicting a 40% spike in 2025.

The disease is spreading rapidly through wild birds, decimating waterfowl and even killing our national bird, the bald eagle. Alarmingly, it's jumped to mammals as well. Cats are particularly susceptible, including pets, wildlife and zoo animals like lions and tigers; dairy cattle are a new host, putting at risk another grocery staple, milk.

And as of March, 70 people have been infected after contact with diseased animals and one has died, fueling worries about human-to-human spread and a possible next pandemic.

But long before most of us had heard of bird flu, University of Maryland researchers were already working to better understand it and curb its spread. Extension specialists are developing and disseminating the best biosecurity guidance to keep farms secure. Epidemiologists are tracking the virus' path into and across the country. Lab researchers are using novel methods to understand the origins of avian influenza itself.

"We have to prepare for the worst and hope for the best," says veterinary medicine Assistant Professor Mostafa Ghanem. "We have to do our best to contain it outside of humans as much as we can. No one can predict how (bird flu) will evolve."

Researchers have tracked "low-pathogenic" strains that produced mild symptoms like weight loss or lower egg production. In the 1990s, however, the far more dangerous H5N1 emerged in China and spread among wild birds, before conquering other nations in Asia and moving west. (In 2015, a related H5N2 strain reached the U.S.; farmers were able to eradicate it the next year by culling more than 50 million birds at a cost of $1.6 billion.)

Then the H5N1 strain evolved and reemerged in 2021 to affect more wild birds, including raptors like owls and scavengers such as black vultures. It has since spilled over into domestic poultry as infected birds stop at a farm or surrounding areas, leaving virus particles in saliva, nasal secretions or feces. Outbreaks are most common during fall and winter migrations.

Now the virus persists year-round, says Associate Professor Jennifer Mullinax of the Department of Environmental Science and Technology. "We're not seeing the drop-off we expect. The normal pattern is changing."

**OUT WHERE MARYLAND'S** Eastern Shore shrinks to a narrow strip, sandwiched between the Chesapeake Bay and the Atlantic Ocean, sits Farhan Nasir's poultry farm. He rises every day at 5 a.m. to check his 18 chicken houses in Pocomoke City, where he's raised about 1.25 million broilers—meat chickens—each year for Perdue Farms for more than a decade.

When bird flu reemerged with a vengeance this winter, striking eight farms on the Delmarva peninsula in January, he and his fellow farmers were terrified. Nearly half of Maryland's agriculture production comes from chickens, and on the Eastern Shore, it rises to about 75%.

"There's a general sense of doom around," says Nasir. "It's very stressful psychologically and financially for the community."

When bird flu strikes, chickens show symptoms like coughing plus swelling and discoloration in the legs

PHOTO BY STEPHANIE S. CORDLE

*Clockwise from left: Associate Professor of environmental science and technology Jennifer Mullinax prepares tranquilizer to study the possible spread of avian influenza to deer and bears; backyard chickens in Ridgely, Md.; UMD Extension poultry specialist and Principal Agent Jonathan Moyle regularly educates farmers on biosecurity measures.*

and head. The state Department of Agriculture then works to quickly contain and "depopulate" a farm's entire flock. Next, the affected farm must wait at least two weeks—but sometimes months—and test negative for environmental contamination before it's eligible to bring chickens back, creating major financial losses for farmers.

To help farmers stave off catastrophe, UMD Extension has created an education and outreach campaign on the importance of "biosecurity" procedures. These include having dedicated clothes and shoes, for each chicken house, as well as bleach footbaths (facing page), to avoid tracking in contaminants that could contain avian flu; sanitizing trucks and cars carrying deliveries to the farm; frequent hand-washing and cleaning of high-touch items like glasses and cell phones; and scaring wild birds away with dogs, coyote silhouettes and even auto dealer-style inflatable tube men.

The economic consequences have farmers taking serious measures to secure their flocks, says UMD Extension poultry specialist and Principal Agent Jonathan Moyle, a former chicken farmer who has worked on biosecurity measures for more than a decade. "When I first came here, I was told what we're seeing today, like changing shoes and using foot baths, would never happen. Now our farmers are doing all of it."

Nasir followed every recommendation, then asked for instructional videos in Spanish for his employees, which the Extension quickly provided. And when buzzards started plucking chicken carcasses from the compost, Moyle helped him test various methods of discouragement until finally, reflectors and plastic buzzards kept the scavengers away, preventing further spread of the virus.

Soon, Nasir and his colleagues will have a new and improved tool to pinpoint farms that are most at risk, thanks to a College of Agriculture and Natural Resources team.

Mullinax and researchers from her Applied Spatial Wildlife Ecology Lab have been tracking H5N1 since it emerged in the U.S. in 2022. They documented its routes across the country, examining where it's spilling over from waterfowl into domestic poultry, between farms and occasionally, back into the wild.

"The virus itself is constantly changing," says Mullinax. "I wish we could tell you, 'It's this bird in that place' (carrying it), but that's not reality. It's a wickedly complicated system."

Now she and postdoctoral researcher Matthew Gonnerman, in collaboration with Diann Prosser of the U.S. Geological Survey, have developed a model incorporating waterfowl habitats, environmental factors like waterways and topography, the prevalence of disease in different avian species, as well as farm locations and biosecurity measures. Once they publish their data, they'll release their models for broader use, tailored for state and federal agencies as well as commercial and backyard farmers, who can use the results to prepare for oncoming waves of the virus.

> The virus itself is constantly changing. … It's a wickedly complicated system.
>
> —**Jennifer Mullinax,** *Associate Professor of Environmental Science and Technology*

With more data, "we hope to not just understand correlation, but be able to predict what's coming next, and who's most vulnerable throughout the year," Mullinax says.

**WHAT'S COMING, UNFORTUNATELY,** could bring economic and health consequences far broader in scope than just wild birds and chicken farms.

In March 2024, H5N1 was detected in dairy cattle in the U.S.—the first infection in cows anywhere. Cattle respond differently; rather than exhibit respiratory symptoms, they had reductions in milk production and mild fever, so farmers initially didn't think to check for avian flu or take steps to stop it. The disease has since spread to cattle in 16 states.

The virus was likely introduced by wild birds and then transmitted from cow to cow, says Ghanem, who studies the molecular epidemiology of infectious diseases and manages a USDA-funded project on bird flu biosecurity.

Then it made another jump. As of March, 41 people have been infected with bird flu via dairy cows, reported the Centers for Disease Control and Prevention (CDC), though human symptoms have mostly been mild. The challenge is that dairy farms require far more human workers than poultry farms, which are largely automated, Ghanem says. Milking is still done manually, and many people interact with the milk as it's processed.

"We don't want the virus to adapt to humans," he says, so increased biosecurity efforts, ranging from personal protective equipment to better testing, is key.

While the average person can avoid cows and drink entirely safe pasteurized milk, rather than raw, another critter caught in the outbreak is harder to ignore: cats.

Felines have long been susceptible to avian influenza, dating back at least 20 years to cases in Asia among both large cats on wildlife preserves and barn cats. The newest strain is particularly deadly, with about a 90% mortality rate, presenting a clear risk for the more than 74 million pet cats in the United States.

Cats "are not being monitored for H5N1. It's a big black box," says School of Public Health Assistant Professor Kristen Coleman, an airborne infectious disease researcher who previously studied animal-human spillover events in Asia. She's found a drastic increase in the number of cats reported with the disease, starting in 2023.

Along with outdoor feral colonies contracting it from wild birds, the virus started showing up in indoor-only cats. The culprit is raw pet food, an unregulated industry that can source its meat from anywhere, including wild game, Coleman says.

"In the best-case scenario, pets remain a dead end and don't become a vector" to humans or other species, she says. "But even in that case, cats are the victims, and a lot of people's hearts will be broken if they lose their pets."

Coleman is now working to collect blood samples with animal rescues and veterinarians in California, where several cat deaths have been connected to cattle outbreaks as well as to contaminated pet food, and in Maryland, where cat cases are starting to emerge. She'll identify how widespread the virus is and eventually alert workers in those industries about what precautions to take.

The CDC reported two possible cases of spread between felines and humans from May 2024, and there was at least one confirmed case in 2016. "Cats open up a whole new vulnerability," she says.

**YOU'RE PROBABLY NOT THINKING** about ducks when you're on day three of the flu, shivering under your sheets and surrounded by a pile of used tissues. But it's deep in their guts (or the bowels of fellow waterfowl) that all flu viruses originate. Human seasonal flu—which likely jumped from birds to humans many years ago—is even part of the same family, influenza A, as bird flu.

To better understand how new influenza viruses develop, avian and animal science Assistant Professors Andrew Broadbent and Younggeon Jin, and cell biology and molecular genetics Associate Professor Margaret Scull, supported by a UMD Grand Challenges Grant, are using "organoids"—lab-created stand-ins for intestines and tracheas



TOP LEFT PHOTO BY STEPHANIE S. CORDLE; ALL OTHER PHOTOS BY EDWIN H. REMSBERG

*Animal and avian science Assistant Professor Andrew Broadbent (left) examines poultry gut "organoids" under a microscope. Below, two mammal species susceptible to avian influenza meet in a barnyard—a setting where cows have recently passed the virus to humans.*

> We're trying to understand: How are new strains of avian influenza made?
>
> —**Andrew Broadbent**
> *Assistant Professor of Avian and Animal Science*

cultured from tissues of chickens, turkeys and ducks—a more humane option than infecting live birds.

"We're trying to understand: How are new strains of avian influenza made? Is it more likely to happen in duck hosts or chicken hosts? Which cells is it happening in?" says Broadbent.

As they infect the organoids with various strains of avian influenza, they'll compare how the viruses interact with different types of cells, including how they break through the body's natural protective barriers, and evolve within different bird species (and they hope to create organoids from other duck breeds and other wild bird species like gulls in the future). Eventually they'll be able to determine which virus mutations make certain fowl more susceptible, which could help field researchers determine the strains most likely to jump from wild birds into different types of poultry.

Their work to date has focused on low-pathogenic strains, though they plan to move into high-pathogenic strains in the future. Their findings will have long-term implications, because avian influenza is here to stay. There's no way to eradicate it from waterfowl, so even if this deadly strain is stopped, others will pop up again, whether next year or next decade.

But there's good news: Scientists already know a lot more about influenza than about coronavirus. The USDA also has conditionally approved a vaccine for poultry, though it is not currently used because of poultry export agreements (some threatened wild species, like condors, have been immunized, however). Now, Broadbent is partnering with School of Medicine Assistant Professor Lynda Coughlan through a University of Maryland Strategic Partnership: MPowering the State grant to test a new H5N1 vaccine in chickens this spring.

"This situation is very different from COVID, where we had to start from scratch," he says, noting that vaccines exist for humans as well, though they haven't been deployed because bird flu is still rare in people. In addition, "H5N1 is sensitive to antiviral (treatments), which we didn't have against coronavirus."

As of March, there are still no cases of human-to-human transmission, and the CDC considers the public health risk low. So while you might have to work in some egg substitutes and keep Mittens from slipping outside, it's OK to keep living your life, UMD researchers say.

"We don't need to go into panic mode," says Mullinax. "The people at risk are the ones working in the industries every day. But we should be aware of what's happening, because we will likely have to deal with this long-term."

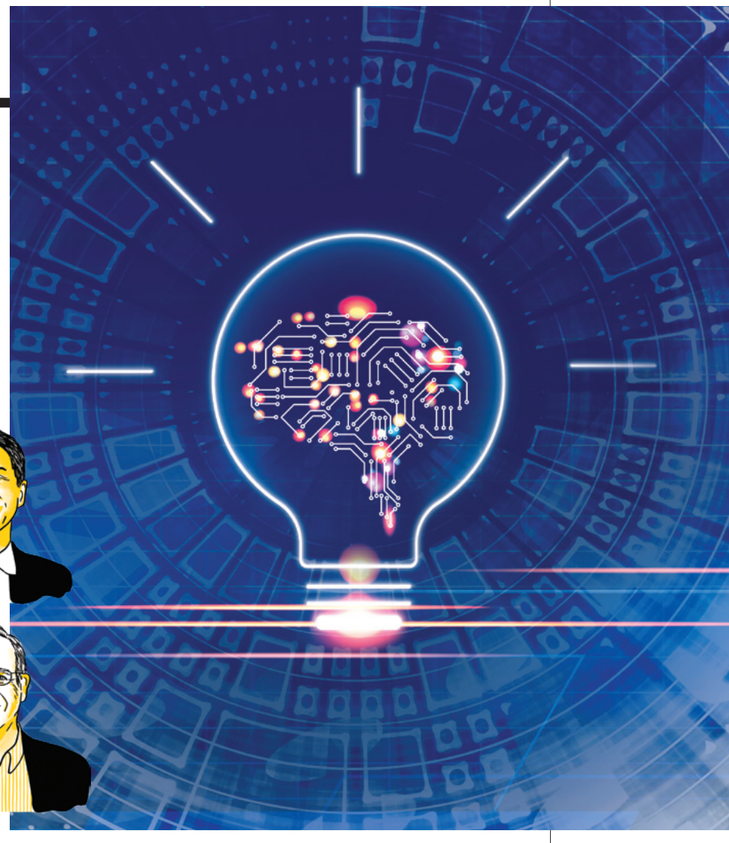


TOP LEFT PHOTO BY STEPHANIE S. CORDLE; TOP RIGHT PHOTO VIA ADOBE STOCK



# Accolades

Awards and Honors Earned by Faculty and Staff Researchers in 2024



## 2 Maryland Engineers Named to National Academy of Inventors

**YANG TAO**, a professor in the Fischell Department of Bioengineering, and **UZI VISHKIN**, a professor in the Department of Electrical and Computer Engineering and Institute for Advanced Computer Studies, were among 170 fellows named in 2024 to the National Academy of Inventors.

As principal investigator of the Bio-Imaging and Machine Vision Lab, Tao focuses on developing machine vision-guided automated systems and smart manufacturing technologies to enhance quality, safety and efficiency across various industries, including advanced food manufacturing, biomedical engineering and agricultural automation.

Tao holds 16 U.S. patents and four international patents, including one in 2022 for an automated system he invented for picking crab meat; several of his technologies have been implemented in large-scale processing lines. He is a fellow of ASABE and a member of the Biomedical Engineering Society.

Vishkin's research in parallel computing and parallel computer architecture is internationally recognized. Along with his research team, he introduced a desktop supercomputer concept in 1997 known as XMT or PRAM-On-Chip; it was inspired by the question of how to resolve parallel programming challenges with a unique approach of using the parallel algorithmic theory to guide the design of a computer system—both hardware and software.

Vishkin holds nine patents; two of them that integrate parallel processing accelerators with central processing units (CPUs) led computer design into a new era. The best-known example is CPUs with integrated graphics processing units, present in well over a billion laptops, desktops and other devices built since the 2010s.

Tao and Vishkin join 14 other current faculty and staff members from UMD previously elected to the NAI.

"Our new NAI fellows epitomize the spirit of problem-solving for the public good," says UMD President Darryll J. Pines.–**LT, DL, MA**

ILLUSTRATION VIA ISTOCK; ILLUSTRATED PORTRAITS BY VALERIE MORGAN

# Faculty Q+A

BILL BOWERMAN

## A Soaring Success

### Bald Eagle Expert Joins Legendary Explorers Club Honorees

**APOLLO 11 ASTRONAUT** Buzz Aldrin. Everest conqueror Edmund Hillary. *Titanic* discoverer Bob Ballard.

Environmental science and technology Professor Bill Bowerman recently joined their ranks when he received the Lowell Thomas Award from the Explorers Club, founded more than a century ago to honor groundbreaking scientific field work.

Since 1986, Bowerman has kayaked down rivers, flown in helicopters and climbed trees—some more than 10 stories tall—to find bald eagle nests and collect data on population health and environmental contaminants. Thanks in part to his work, the bird has soared back from the brink of extinction, now inhabiting 49 states. He's also lent his expertise to raptor researchers worldwide.

He spoke in an interview about why America's national bird—so named by former President Joe Biden in December 2024—is a "canary in a coal mine" for environmental health and the rising threat of avian influenza. **–KS**

**Why bald eagles?**
I grew up in a very small town on Lake Superior, surrounded by forests. I'd hunt with my uncles for ruffed grouse each fall. When I was 16, we were out at an inland lake in the Upper Peninsula, and I saw a bald eagle perched on a tree. That was it. I wanted to understand: Why was this the first time I had seen one? Where I grew up, there should have been lots of them.

**What was the state of the population in 1986?**
We didn't know if there were going to be bald eagles in 2000. Since the 1950s, chemicals like DDT and PCBs had caused thin shells and deformed chicks. DDT was banned in 1974 but lingered in the ecosystem. Even after a decade, the population hadn't rebounded.

I submitted my first proposal to study nestling eagles, which are easy to handle when they're between 5-9 weeks old and can't fly, and I've been doing it every summer for almost 40 years. Eagles, as top predators, are good indicators of the health of the environment. For example, the first samples of PFAS (the "forever chemicals" found in nonstick pans, raincoats, cleaning supplies and more) in wildlife were from my bald eagle samples in 1993.

**What's a day in the field like for you?**
Bald eagles primarily eat fish, so I'll trudge through gnarly swamps to get to the nesting sites, which we find by aerial surveys. A team member will climb the tree, then carefully hook the nestling by its legs to put it into an eagle bag. We bring it down to band it and take samples of blood and feathers to test for mercury and other contaminants. Then we climb back up, put it back, and repeat.

**How is climate change affecting bald eagles?**
They're nesting earlier. In the 1960s, researchers banded chicks in mid-June. Now, we go out on May 1. It's a six-week change, and our data shows it's accelerating in recent years. Warming temperatures may also be causing them to shrink, because traditionally, they're bigger where it's colder, like in Alaska. Eagles have adjusted so far, but continuing climate change could burn their forest habitats, change the available prey or cause heat stress.

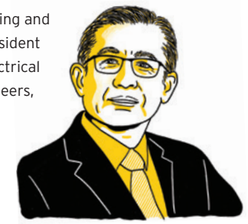
**What's happening with avian influenza?**
There's only one thing in 39 years in the field that's scared me, and that was the first nest we found in 2023. All we saw were bones and feathers—white ones showed an adult had died. In 2022, 37% of the bald eagle mortalities in Michigan were from avian influenza. It's a grave impact. I'm working with a population modeler to understand how much. Did we lose a year? Five years? A decade? Eagles have a 25-year reproductive span, so this could be significant.



TOP PHOTO BY KATHY KOENIG; PORTRAIT COURTESY OF BILL BOWERMAN



## Wireless Innovator Elected to National Academy of Engineering



Former Distinguished University Professor **K.J. Ray Liu**, known for his groundbreaking work in wireless communications and signal tracking, was elected in 2024 to the National Academy of Engineering.

The academy cited Liu, who retired from UMD in 2021 after more than 30 years in the Department of Electrical and Computer Engineering (ECE), for innovations in "signal processing for wireless sensing with communications." He is one of 134 new members in the academy.

Liu is also a fellow of the National Academy of Engineering and served in 2022 as president of the Institute of Electrical and Electronics Engineers, a global professional association of over 400,000 members.

In 2013, Liu founded Origin Wireless, a company developing new wireless artificial intelligence analytic technologies for smart home systems. Origin invented the world's first centimeter-accuracy indoor positioning/tracking system, and the company's patented Time-Reversal Machine Technology has been applied to motion detection, home security, well-being monitoring, human breathing monitoring and fall-down detection without wearables or cameras.

## Astrophysicist Earns 2 Early Career Fellowships

A University of Maryland astrophysicist working to explain the mysteries of deep space was named a 2024 Packard Fellow for Science and Engineering, and also received a 2024 Sloan Research Fellowship. Both are among the most competitive and prestigious honors awarded to early-career scientists.

The five-year, $875,000 fellowship from the Packard Foundation will allow physics Assistant Professor **Sasha Philippov** to develop computational codes capable of running on the world's biggest supercomputers. In his research, he uses computational astrophysics to study some of the most mysterious objects in the universe, including neutron stars and black holes. He is the seventh UMD faculty member to receive the Packard Fellowship since its 1988 launch.

The two-year, $75,000 Sloan award will enable Philippov to delve deeper into the study of plasmas—hot, ionized gas that surrounds neutron stars and black holes, which he describes as "some of the most mysterious and exotic objects in the universe." Since 1955, 71 UMD faculty members have earned Sloan Fellowships. **–AR**

## 2 Researchers Elected to National Academy of Education

Distinguished University Professor **Melanie Killen** and Professor Emeritus **Allan Wigfield**, both of the College of Education, were among 14 leaders and scholars elected to membership in the National Academy of Education in 2024.

The two joined UMD Distinguished University Professor Patricia Alexander, elected to the academy in 2020.

Killen, a professor of human development and quantitative methodology and an affiliate professor of psychology, focuses on children's social and moral development and theory of mind, including how their interpretations of others reflect bias and prejudicial attitudes. She designed a school-based intervention shown to help reduce bias, change group norms and increase positive expectations of friendships with peers from diverse backgrounds. Killen is a fellow of the Association for Psychological Science, American Psychological Association and Society for the Study of Psychological Issues, and holds a professorship at the University of Kent at Canterbury, United Kingdom.

Wigfield, who retired from the Department of Human Development and Quantitative Methodology, is a fellow of the American Educational Research Association, the American Psychological Association and the Association for Psychological Science, and holds honorary professorships at the Universities of Heidelberg and Tübingen in Germany, and Korea University. His research centers on how children's motivation in different areas develops across the school years. He has designed interventions to improve children's reading motivation and comprehension, as well as to improve students' STEM motivation and participation.

"Their research on how young people grow and develop—socially, morally and academically—has a vital impact on our understanding of human development and how educators and communities can better support all children's growth and learning," says Kimberly Griffin, College of Education dean.**–ES**

## Avian Endocrinologist Named AAAS Fellow

Distinguished University Professor **Tom Porter**, a globally recognized UMD poultry researcher, was named a fellow of the American Association for the Advancement of Science, the world's largest general scientific society. The honor brings the university's number of AAAS fellows to more than 110.

Porter is recognized for work in molecular and cellular endocrinology aimed at regulating growth and alleviating heat stress in broiler chickens and controlling reproduction in turkey hens. He is a Poultry Science Association fellow.

## Ecologist Joins American Academy of Arts and Sciences

A UMD researcher focused on the relationship between society and nature is among 250 new members of the American Academy of Arts and Sciences.

Distinguished University Professor **Margaret Palmer**, a professor of entomology and director of the National Socio-Environmental Synthesis Center (SESYNC), was recognized for work on watershed science and restoration ecology, a field she pioneered.

Palmer conducts research at the interface of water science and policy, having served as a technical adviser and innovator to help build teams that solve problems with a mix of social, legal, policy and scientific aspects. She also engages in science matters associated with water policies and actions, particularly those affecting the Appalachian region.

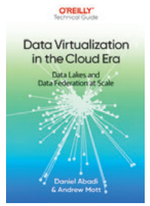
She has been awarded more than $50 million from the National Science Foundation to establish SESYNC, widely known for creating research communities and cultures that other centers around the world seek to emulate. Palmer is a fellow of the American Association for the Advancement of Science and the Ecological Society of America and an honorary member of the British Ecological Society.**–AR**



TOP PHOTO VIA ADOBE STOCK; ILLUSTRATED PORTRAIT BY VALERIE MORGAN

# Bookshelf

Books Written by UMD Faculty in 2024




### DATA VIRTUALIZATION IN THE CLOUD ERA

*O'REILLY MEDIA*

Daniel Abadi, Professor of Computer Science, and Andrew Mott

### MESOSCOPIC THERMODYNAMICS FOR SCIENTISTS AND ENGINEERS

*WILEY*

Mikhail A. Anisimov, Distinguished University Professor Emeritus of Chemical and Biomolecular Engineering, and Thomas J. Longo, Adjunct Assistant Professor in the Institute for Physical Science and Technology

### THE ANGER RULE: RACIAL INEQUALITY AND CONSTRAINTS ON BLACK POLITICIANS

*CAMBRIDGE UNIVERSITY PRESS*

Antoine J. Banks, Professor and Chair, Department of Government and Politics, and Ismail K. White

### SOCIAL ENTREPRENEURSHIP FOR DEVELOPMENT: A BUSINESS MODEL

*ROUTLEDGE*

Meg Brindle, Senior Lecturer of Public Policy

### HUMAN MOTIVES: HEDONISM, ALTRUISM, AND THE SCIENCE OF AFFECT

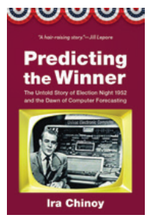
*OXFORD UNIVERSITY PRESS*

Peter Carruthers, Distinguished University Professor of Philosophy

### PREDICTING THE WINNER: THE UNTOLD STORY OF ELECTION NIGHT 1952 AND THE DAWN OF COMPUTER FORECASTING

*POTOMAC BOOKS*

Ira Chinoy, Associate Professor of Journalism




### A ROAD TO THE JOY OF LEARNING: A PRACTICAL GUIDE FOR A SUCCESSFUL COLLEGE CAREER & BEYOND

*INDEPENDENTLY PUBLISHED*

Kyu Yong Choi, Professor of Chemical and Biomolecular Engineering

### GEOPOLITICS, TRADE BLOCS, AND THE FRAGMENTATION OF WORLD COMMERCE

*LEXINGTON BOOKS*

Uri Dadush, Research Professor of Public Policy

### THE MARVELOUS ILLUSION: MORTON FELDMAN'S THE VIOLA IN MY LIFE I-IV

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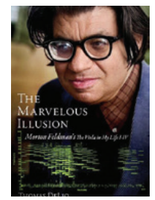


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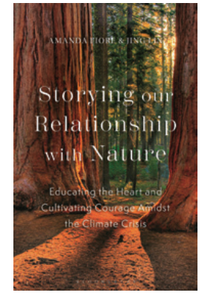


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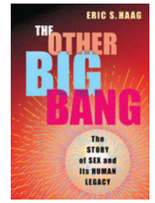


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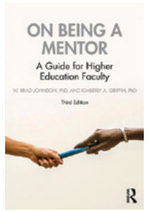


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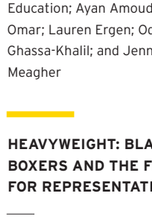


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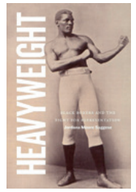


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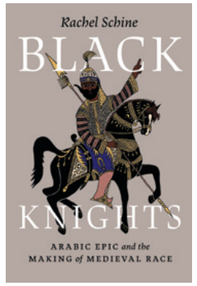


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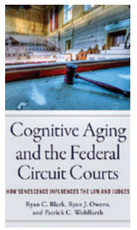







## A Breath of *Fast* Air

A. Wiley Sherwood, founding chair of the Department of Aeronautical Engineering, adjusts the angle of a wedge-shaped test object in a six-inch supersonic wind tunnel in this 1950s photograph. Unlike the much larger (and slower) UMD Glenn L. Martin Wind Tunnel that Sherwood had opened—powered by a repurposed airplane propeller—the mini tunnel creates its wild breezes via vacuum power: Massive air tanks outside the Engineering Laboratory Building are first evacuated, and when nozzles are opened, air is pulled through the tunnel at more than twice the speed of sound. The since-renamed Department of Aerospace Engineering operates far more advanced facilities today, including hypersonic wind tunnels, but still uses the six-inch tunnel for instruction. The wind tunnel company that Sherwood created, Aerolab, remains a major player in the field—and it's led by a Terp.

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