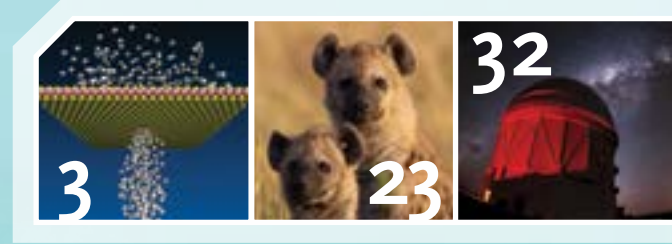


# Research *at* Penn



Page 28

## *Design Strategies for a Greener Future*

*Penn experts tackle dual crises of COVID-19 and climate change*

# Research *at* Penn

*Advances in Knowledge  
from the University  
of Pennsylvania*

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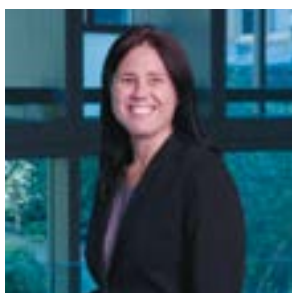
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## Penn's Research Enterprise



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*Interim Provost*



**Dawn Bonnell**  
*Senior Vice Provost  
for Research*

Every Penn student can experience the excitement of research, a commitment that is at the heart of the University's educational mission.

"Research makes students' ideas come alive and helps them think through—and have an impact on—critical real-world challenges," says Senior Vice Provost for Research Dawn Bonnell.

The 2022 edition of *Research at Penn*, the 20th edition, features three-dozen pages of exciting research, examining everything from molecules to the archives of Marian Anderson.

With 189 research centers and institutes, 5,000-plus research faculty, in excess of 5,800 annual awards, and more than \$1.02 billion in annual research and development expenditures, Penn has a robust and expansive research enterprise. The University offers scholars of all levels the opportunity to generate new knowledge in a wide range of fields and specialties, and address some of the world's most pressing concerns.

Just in this past year, researchers in the Perelman School of Medicine led a study that found that residents in majority-Black neighborhoods experience higher rates of severe pregnancy-related health problems than those living in predominately white areas. Experts from the School of Dental Medicine found that a common neuroinflammatory disease in dogs shares key features with multiple sclerosis, which could expand knowledge of the human disease. Physicists and astronomers in the School of Arts & Sciences involved in the Dark Energy Survey published interim results, a key step toward understanding the role of dark matter and dark energy in the accelerating expansion of the universe.

To stay abreast of all University research, visit Penn's research website: [upenn.edu/researchdir](http://upenn.edu/researchdir).



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## BIOCHEMISTRY

# A Four-Minute COVID-19 Test with 90% Accuracy

A study published in the journal *Matter* describes a low-cost diagnostic test for COVID-19 that can provide results within four minutes and with 90% accuracy in test conditions. The diagnostic test known as RAPID 1.0 (Real-time Accurate Portable Impedimetric Detection 1.0) was developed by César de la Fuente, a Presidential Assistant Professor with appointments in the Perelman School of Medicine and the School of Engineering and Applied Science. RAPID 1.0 is made of a screen-printed electrode that can detect SARS-CoV-2 in nasal swab or saliva samples. The results can be interpreted using a benchtop instrument or smartphone. The request to use this test in people has not yet been evaluated by the U.S. Food and Drug Administration.



The diagnostic test known as RAPID 1.0 was developed by Presidential Assistant Professor César de la Fuente.



## HOW BIRACIAL MEN SPEAK ABOUT RACE

People change how they speak based on who they're talking to and what they're discussing, an idea known as referee design. Sometimes the effect can be startling, like findings Nicole Holliday of the School of Arts & Sciences published in the *Journal of English Linguistics*.

Specifically, her research showed that when biracial men discussed race and the police, they used intonation more generally associated with white speakers than African American speakers.

"I was interviewing them about their experiences, about race, how they thought about themselves and society. I never asked about the police, yet they kept telling me these stories," she says. "There was a subtle but noticeable shift."

Much of Holliday's research focuses on how the voice changes during conversation, which words get stressed when.

"In regular conversation, we raise the pitch of our voice to emphasize particular words in a sentence," she says. "The way that happens for Black and white speakers can differ."

To better understand this concept, Holliday recruited 20 college-educated biracial men, ages 18 to 32, from Washington, D.C., and Virginia. They participated in two activities, one with a white peer, the other with a Black peer.

Holliday also interviewed each, asking them 22 questions. In response to one in particular—what message did their parents give them about race—seven participants brought up law enforcement unprompted. Holliday noticed subtle linguistic differences in how they discussed the subject, too.

The participants were doing what's known as code switching, "commanding multiple ways of speaking, dialects, or languages, and knowing which one to use

in every single social situation," Holliday says. "People from marginalized and racialized groups experience negative social consequences if they're perceived as using language 'wrong' in a given context."

It's not something that they could have done consciously, she adds. "If you told me to manipulate my voice in these particular ways, I couldn't do it."

Holliday says she hopes this work raises awareness of this linguistic burden and opens the door to a greater open-mindedness about what constitutes "proper speech." Different races, regions, and age groups may differ in speech norms, but, she argues, none is superior.

*"In regular conversation, we raise the pitch of our voice to emphasize particular words in a sentence. The way that happens for Black and white speakers can differ."*

## 'Climate Classrooms' Broaden Reach of Climate Resilience



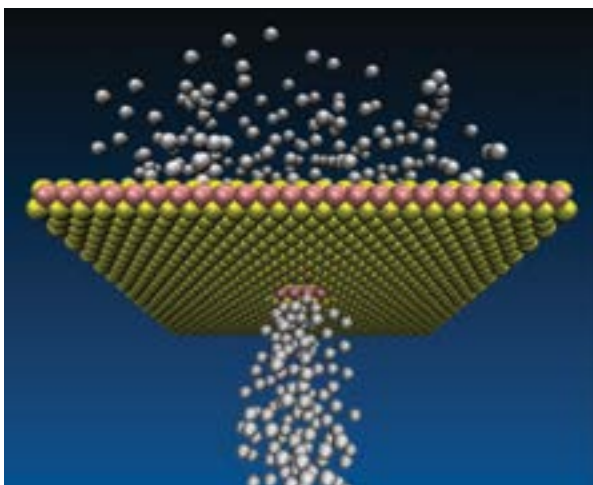
Born from the expressed need by teachers for climate change to be talked about beyond science and sustainability and development curriculums, Bethany Wiggin of the School of Arts & Sciences and the Penn Program in Environmental Humanities led a series of Zoom workshops in

2020 with college-age and high school students to write "Climate Stories."

Now, they're scaling up to co-create 10 "Climate Classrooms" across Philadelphia to show the local impacts of climate change. Select students will be chosen as climate ambassadors and work with Penn students to refine short-film climate stories. The larger goal is to broaden the educational reach of climate resilience.

"We want to support students and teachers to make sense of climate science in their own lives and classrooms, helping them understand and act on their own climate stories," Wiggin says.

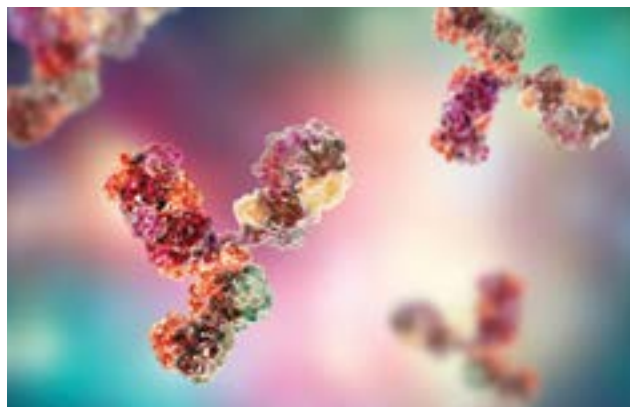
## NANOTECHNOLOGY



A diagram showing how the zero dimensional pores can also be used to filter gases.

## Atomic-Scale Apertures for Liquid and Gas Filtration

Two studies from the lab of Marija Drndić in the Department of Physics & Astronomy in the School of Arts & Sciences demonstrate how to fabricate materials with single atom-sized pores. In a paper published in *ACS Nano*, graduate student Jothi Priyanka Thiruraman and postdoc Paul Masih Das show how these pores can transport ions; a second paper published in *Science Advances*, in collaboration with researchers from Shahid Rajaei University, the University of Antwerp, and the University of Manchester, demonstrates how helium gas flows through these pores. This regime of "zero dimensional" pores has a broad range of potential applications, from water and gas purification to energy harvesting.



A new approach to treating an autoimmune condition uses engineered T cells to precisely kill B cells that produce disease-causing autoantibodies.

## Leveraging Cancer Therapy Learnings to Fight Autoimmune Disease

Chimeric antigen receptor (CAR) therapies have revolutionized cancer treatment. And now an adapted version stands poised to do the same for certain autoimmune conditions.

In a study led by Aimee Payne, a professor of dermatology at the Perelman School of Medicine, taking the CAR T cell construct that has been used to great success to kill cancer cells in patients with certain B-cell lymphomas and leukemias, and "flipping" it to instead target rogue B cells, potentially offers an effective strategy for addressing a serious autoimmune disease.

The work, conducted in preclinical animal models and published in the *Journal of Clinical Investigation*, set the stage for the first-in-human clinical trial that opened in 2020, testing this approach in patients with mucosal pemphigus vulgaris (PV), a disease in which B cells produce so-called autoantibodies, which attack a patient's own cells, causing severe blistering.

"The original 2011 paper by the Penn team including David Porter and Carl June, showing potential cures with CAR T cells, really got our attention," says Payne. "We started thinking, if that was curative for cancer, how can we adapt that technology to potentially help patients with mucosal pemphigus vulgaris? In our research, we took the learnings from CAR T and adapted them to what we call CAAR T cells, or chimeric autoantibody receptor T cells, to determine if they can provide a similarly effective approach for pemphigus."

Because only about 1% of B cells are responsible for producing the autoantibodies involved in mucosal PV, precisely killing them spares the rest of a patient's immune arsenal, helping avoid the risk of drugs that suppress the immune system more broadly.

Clinical trial data thus far show the CAAR T cell approach to be safe and well tolerated by patients. Ongoing studies from the Payne lab show that the CAAR T cell therapeutic strategy could extend to target other B cell-mediated diseases, such as MuSK myasthenia gravis and PLA2R membranous nephropathy.

## SOCIOLOGY

### The Pandemic's Burden on Mothers

**At the same time the pandemic** was expanding the number of people working remotely, children nationwide began attending school virtually. The result? An increase in domestic work that fell disproportionately on the shoulders of mothers, according to a collaborative study by sociologists including Jerry Jacobs and doctoral student Allison Dunatchik of the School of Arts & Sciences. Using data from a nationwide survey conducted in April 2020, the researchers found gender disparities in unpaid labor were most apparent when a mother was the only parent working from home, or when neither parent was able to work remotely. The study was published in the journal *Gender & Society*.



## URBAN STUDIES

### THE UNNATURAL ORIGINS OF RESIDENTIAL SEGREGATION

The Fair Housing Act “implicates every facet of our society,” says Interim Penn President Wendell Pritchett, the James S. Riepe Presidential Professor of Law and Education.

“Where you live affects your health, education, and job prospects and, sadly for those who live in poverty, greatly influences your future opportunities,” he says.

To address the continuing importance of this law, Pritchett co-edited “Perspectives on Fair Housing” along with Vincent Reina of the Stuart Weitzman School of Design and Susan Wachter,

**“How do we define who gets to live together? What are the bounds? What does fair housing look like in a prison? What does it look like in a homeless shelter?”**

co-director of the Penn Institute for Urban Research and a professor at the Wharton School. The book is part of the Penn Press series “The City in the Twenty-First Century;” Penn professors Francesca Ammon, Camille Charles, Amy Hillier, Rand Quinn, and Akira Rodriguez also co-wrote chapters.

The essays in this volume address how residential segregation did not emerge naturally from minority preference but, rather, was enforced



through legal, economic, social, and violent measures.

“Housing choice is shaped by school quality, and if you build good schools, you will see better housing outcomes,” says Rodriguez.

Segregation remains a constant reality, improving “pocket by pocket” in areas that have smaller minority populations, says Charles. “Discrimination is occurring and has always occurred at every step in the process.”

Discrimination plays out for marginalized populations in multiple ways, Hillier notes.

“How do we define who gets to live together?” she asks. “What are the bounds? What does fair housing look like in a prison? What does it look like in a homeless shelter?”

Contributors examine racial land use and zoning practices in the early 1900s; the exclusionary effects of single-family zoning and its entanglement with racially motivated barriers to obtaining credit; and the continuing impact of mid-century “redlining” policies and practices on public and private investment levels in neighborhoods across American cities.

“The issue of fair housing is foremost in delivering spatial equity and overcoming entrenched bias,” says Wachter, citing an urgent need for additional research and data.

“This problem is bigger than any one neighborhood, it’s bigger than any one city, it’s bigger than any one region,” Reina adds. “Therefore, any response needs to be much bigger than that as well.”



## CHINESE HISTORY

# Women Without Men in Song Dynasty China

A significant number of women in Song Dynasty China (960–1279) refused to marry, were deemed unfit to marry, or were married but denied their husbands sexual access—a cluster Hsiao-wen Cheng has characterized as “manless women.”

Cheng, an associate professor of Chinese history and religions in the School of Arts & Sciences, investigates reports of these women and the accompanying public bemusement in her book “Divine, Demonic, and Disordered: Women Without Men in Song Dynasty China,” which was published by the University of Washington Press.

For her research, Cheng used literary tales, popular anecdotes, religious accounts, bedchamber literature, medical treatises, Daoist manuals, exorcism manuals, and Buddhist hagiographies. Almost all of the writings were composed by elite men, and some included very specific details about a woman’s name, family name, date, place, and occupation.

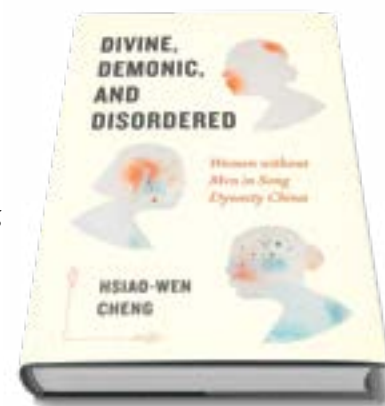
Cheng says different sources explain the presence of manless women in various ways, but all agreed that they were a phenomenon that needed to be explored due to their inconvenience to the patrilineal system.

“It was not a story about women keeping secrets from men. Both men and women were trying to figure out what was going on,” she says.

Some of the manless women were ostracized and accused of being enchanted or possessed by spirits, while others—particularly the women mentioned in religious sources—were considered to be divine and almost akin to female saints. Cheng says it is possible that the women were lesbians, to use a modern term, but it would not have mattered because “the marriage system was rarely about men’s or women’s desires.”

Cheng says she hopes readers take away from the book the fact that they should not take sexuality as a given because the notion that sex is a natural and neutral phenomenon is a very modern invention.

“Things that we now classify as sexual according to our modern standards were not always distinguished in nature from other matters,” she says. “The alignment and classification of bodily and affective behaviors were different and changed over time.”



## INTERNAL MEDICINE

# COVID Deaths in ICUs Cut in Half in 60 Days



At the start of the pandemic, more than 40% of critically ill COVID-19 patients being treated in hospital ICUs died. By July 2020, just 60 days later, that number had dropped to around 19%, according to research from the Perelman School of Medicine’s George L. Anesi, Juliane Jablonski, and colleagues. The work analyzed data from 21 ICUs across five hospitals, focusing on in-hospital mortality. The findings, published in the *Annals of Internal Medicine*, suggest that as the pandemic evolved, clinicians in these settings evolved with it, working quickly to adapt and improve how they treated patients with the novel coronavirus.



## POLITICAL SCIENCE

# Why Polling was Off in the 2020 Democratic Primaries

Penn’s Program on Opinion Research and Election Studies (PORES) collaborated with the American Association for Public Opinion Research on a report that evaluated pre-election poll performance of the 2020 Democratic primaries.

“There are issues that were specific to 2020 where you saw basically three different electorates: in-person Election Day voters, in-person early voters, and mail-in voters,” says PORES Faculty Director John Lapinski, the Robert A. Fox Leadership Professor of Political Science in the School of Arts & Sciences.

The study concluded that nonresponse and late-breaking news contributed to 2020 polling errors. However, there was no evidence that one way of conducting a poll, such as telephone interviews, online interviews, or a mix, was more accurate than the others.

## LIBRARY SCIENCE

# Marian Anderson Collection Online



Penn Libraries has digitized more than 2,500 items from the personal archives of Philadelphia-born songstress Marian Anderson, which were donated to the University before her death in 1993.

The collection includes letters, diaries, journals, interviews, recital programs, and private recordings spanning Anderson's six-decade career as a concert singer and advocate for social justice.

"Through this digitized collection, scholars and students worldwide can read about and conduct research on Marian Anderson's life and career, and further illuminate her social, cultural, and historical impact," says Constantia Constantinou, the H. Carton Rogers III Vice Provost and director of the Penn Libraries.



LEFT: White and colleagues found evidence of a megadrought in a cave called Tham Doun Mai, near the rock shelters pictured.

BELOW: Archaeologist Joyce White (center, standing) has worked in Laos since 2001, with teams like the one shown here.



## ARCHAEOLOGY / Q&A

# A 5,000-YEAR-OLD MEGADROUGHT LASTED MORE THAN 1,000 YEARS

Stalagmites, the tapered columns that form on cave floors, can offer a window into the past. Like tree rings, their layers contain datable signs of changing climate.

As rainwater drips through cracks in a cave's roof, it interacts with a mineral called calcite, creating stalactites on the ceiling. That mixture then drips, forming stalagmites below, layer by layer.

"From those layers, we can interpret the occurrence of various climate events," says archaeologist Joyce White of the Penn Museum and the School of Arts & Sciences.

For two decades, White has worked in Laos' Luang Prabang Province. In 2010, she began collaborating with Michael Griffiths of William Paterson University and Kathleen Johnson of the University of California, Irvine, whose research, in part, included collecting stalagmite samples from a cave called Tham Doun Mai.

"Two of the stalagmites there stopped growing for several hundred years, then started to grow again," White says. Chemical analyses confirmed that the pause happened due to a drought that began 5,000 years ago and continued for more than 1,000 years, results the researchers detailed in *Nature Communications*.

When combined with climate modeling, the cave evidence seems connected to similarly timed vegetation and dust changes in Northern Africa—during the period when the Sahara transitioned from forest to desert. Modeling also showed how such changes in Northern Africa could affect rainfall across Southeast Asia.

White discusses the drought and the possible implications of such a dramatic climate change for societies at that time.

**Q:** Can you describe the drought in any more detail?

**A:** It was a huge drought that lasted for more than 1,000 years in the Middle Holocene, a period from about 6,000 to 4,000 years ago. It's outstanding evidence for the type of climate change that must have affected societies. All biotic life had to adjust. From an archaeological point of view, this really is a game changer in how we understand and reconstruct this period.

**Q:** Before this, what was known about the Holocene?

**A:** We understood that in the Early Holocene, there was hunting and gathering. We also knew that the Late Holocene was agrarian. The link between the two was mysterious, partly because there's a gap in the archaeological record in interior Southeast Asia.

There's a mountain range between Vietnam and the Mekong Valley, where Laos is. On the Vietnam side, there are many Middle Holocene sites, but I wanted to find their counterparts on the Laos side. We knew the Middle Holocene had to be there somewhere. I figured we just didn't quite understand where social groups wanted to live in that landscape yet. This was before we knew about this drought.

**Q:** Why is this megadrought so important?

**A:** It changes the conversation about that whole period across Eurasia and certainly Southeast Asia. The fact that there are profound climatic changes lasting 1,000 or more years at a continental scale in the Holocene timeframe is quite new. When you combine archaeology, paleoclimatology, and modeling, you can more effectively bring out this type of important finding in the future. We've only just begun investigating the implications of this one in particular.



## ONCOLOGY

# Cancer Patients Fight COVID-19 with T Cells

COVID-19 has exacted a devastating toll on millions around the world. But certain populations have suffered disproportionately. One of those groups is people with blood cancers.

“As the pandemic unfolded, we became increasingly aware that mortality for cancer patients was almost 10 times higher than for healthy people,” says Alexander Huang of the Perelman School of Medicine. “And for hematological cancer patients, that number was even higher.”

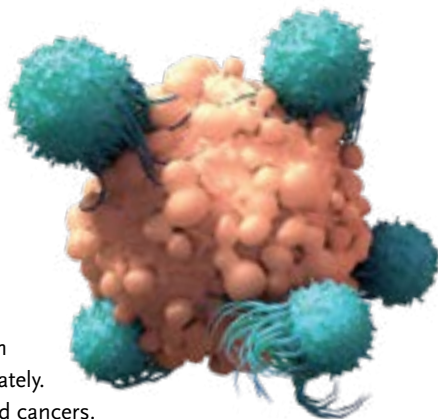
Yet a study in *Nature Medicine* by Huang and colleagues showed that this disparity doesn’t mean these individuals lack all defense against infection. The work, which used a computational approach to study hospitalized patients with both solid tumors and hematologic cancers, found that blood cancer patients with higher CD8 T cell counts—the cell type responsible for killing off infected cells—were three times more likely to survive than patients with lower counts.

Typical therapies for blood cancer deplete the immune system’s B cells and antibodies, which are considered the first line of defense against infections such as SARS-CoV-2. But Huang says the findings indicate that T cells can partially compensate for that loss.

“A good analogy is thinking of terms of war,” he says. “With a balanced immune system, you have your Navy, your Army, and your Air Force, and having all of them work together is best. But if one of those units is down, for example, your Navy is destroyed and allows troops to land, there’s increased pressure for the infantry to fight. In these patients’ immune systems, their Navy is down, and that’s driving the CD8 T cells to fight infection.”

This role for T cells holds significance now that COVID-19 vaccines are readily available.

“People have been asking, can patients who don’t make antibodies obtain protection from a vaccine?” says Huang. “Our paper was pivotal in encouraging distribution of vaccine to cancer patients, knowing they could generate T cell responses.”



## PUBLIC POLICY

# Criminal Incidents and Arrests Dropped During Pandemic

David S. Abrams, a professor of law, business, and public policy at the University of Pennsylvania Carey Law School, published a research paper in the *Journal of Public Economics* documenting the short-term impact of the COVID-19 pandemic on crime.

Titled “COVID and Crime: An Early Empirical Look,” the study shows overall crime rate drops of at least 35% in Pittsburgh, New York City, San Francisco, Philadelphia, Washington, D.C., and Chicago.

Analyzing data from more than 25 large U.S. cities, Abrams’ research details a widespread immediate drop in both criminal incidents and arrests, most heavily among drug crimes, theft, residential burglaries, and a majority of violent crimes, although not homicides or shootings.

He notes that the decline occurred before most stay-at-home orders and coincided with a decline in individual mobility.



## AFRICAN AMERICAN STUDIES

# Rethinking the Role of Diaspora in African American Literature

Margo Natalie Crawford’s book “What is African American Literature?” is, in part, a response to Kenneth W. Warren’s 2012 book “What Was African American Literature?” which contended that African American literature as a category had no integrity after Jim Crow.

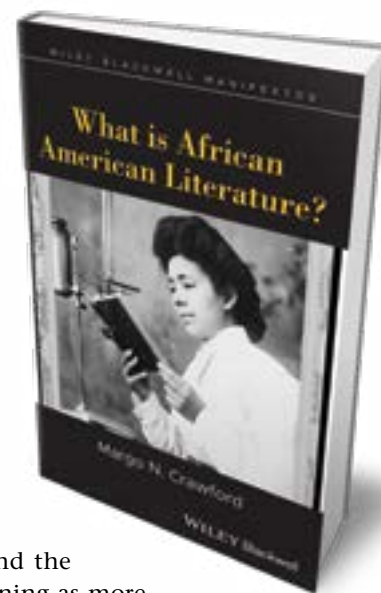
“When a reviewer of one of Nikki Giovanni’s poetry volumes declared ‘feeling is the form,’ I realized that feeling-as-form is a way of understanding the very idea of African American literature,” she says.

Crawford, the Edmund J. and Louise W. Kahn Professor for Faculty Excellence in the Department of English in the School of Arts & Sciences, privileges in the book the lens of the African diaspora, positing that African American literature is profoundly shaped by diasporic exchanges. She also focuses on the textual production of the black book—the book covers and other frames that create the feeling of entering into a black-feeling world.

In addition to rethinking the role of diaspora in African American literature, she rethinks the significance of slavery and the afterlife of slavery as a steady theme in the tradition of African American literature. She says the psychic hold of slavery and the afterlife of slavery is loosening as more room is created in African American literature for depictions of blackness that are less familiar and less legible.

“I’m arguing that African American literature, on the lower frequencies, is an archive of black feeling,” she says.

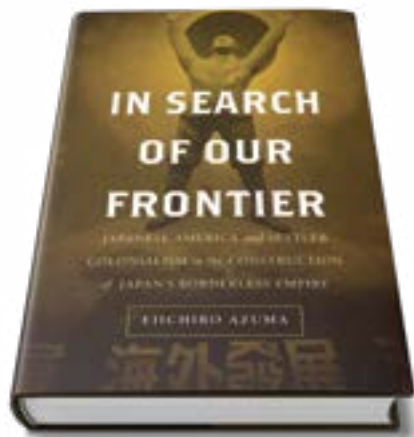
Crawford’s book is in the Wiley-Blackwell Manifestos series that includes other provocative texts, such as “Where is American Literature?” She is currently working on a book, “Late Style Morrison,” which will explore Toni Morrison’s radical reshaping of the idea of African American literature in her last novels. She is also beginning a study of black feminist artists in the United States, Africa, and the Caribbean who are expanding the dimensions of abstract art.



## ASIAN AMERICAN STUDIES

## How Japan Constructed a 'Borderless Empire'

In his book “In Search of Our Frontier: Japanese America and Settler Colonialism in the Construction of Japan’s Borderless Empire,” Eiichiro Azuma, a professor of history in the School of Arts & Sciences, examines Japan’s unique form of “adaptive settler colonialism,” citing examples of Japanese settlers in Hawaii, Latin America, and North America. Altogether, in three parts, the text is a history of Japanese colonialism outside of East Asia, an examination of how ideological constructs created a borderless empire for Japan, and an analysis of case studies of settlements in California and Hawaii, and their relationships with Manchuria and Southern Pacific Islands. Published by the University of California Press, the book is a new contribution to the understanding of Western migrations during Japan’s imperial expansion.



## The Untold Story of Medical Deportations



**When hospitals learn** that a patient is uninsured and undocumented, they may, rather than assume the cost of care, hire a private charter flight to take the patient to their country of origin—a process known as medical deportation.

Researchers in the Legislative Clinic at the University of Pennsylvania Carey Law School and the Free Migration Project collaborated on the report, “Fatal Flights: Medical Deportation in the U.S.,” which unpacks the complexities surrounding medical deportation, identifies potential changes, and proposes a legislative solution.

Authors include Erica V. Rodarte Costa, a third-year student at the University of Pennsylvania Carey Law School and a Toll Public Interest Fellow, recent Penn Law graduate Jacqueline Monnat, and the Free Migration Project’s Executive Director David Bennion and Program Coordinator Adrianna Torres-García.

Here, Rodarte Costa discusses medical deportations.

### **Q: How do these deportations proceed? Is ICE involved?**

**A:** There’s no involvement from ICE, any federal agency, or court proceeding. Sometimes hospitals allege obtaining consent, but in many of those cases, there are language and legal barriers that don’t allow a patient to really understand the medical and immigration consequences of being transported to their country of origin.

### **Q: What does the law say about medical deportations?**

**A:** There’s really no legal framework that currently addresses medical deportation. We spoke to a congressional legislative director and the practice of medical deportation was mind-boggling to her, as was the fact there was no bill or law addressing the issue.

### **Q: Do you know how many people are medically deported each year?**

**A:** It’s really hard to put a number down on it because immigrant families are not always willing to come forward, fearing the repercussions. In 2012, Seton Hall Law reported more than 800 cases of medical deportation across a six-year period, but they just touched the surface.

### **Q: Why does this happen?**

**A:** I think [cost savings is] one of the reasons. Just to clarify, health care bills for uninsured patients requiring long-term care can go up to the millions, so it is a real financial concern. We also don’t know how much bias against immigrant communities plays a role. There’s also the issue of the growing medical transportation industry that’s benefiting from these medical deportations, with flights that can cost as much as \$50,000.

### **Q: How would you like to see this issue remedied or resolved?**

**A:** The first step is to create a reporting mechanism where immigrant patients and their families can feel safe if this is about to happen to them, or this has happened to them. To be able to report it not to the federal government, who may choose to impose immigration consequences, but to a nonprofit organization that’s being funded and is spearheading these efforts. We also need legislation, including universal health care coverage that does not discriminate based on a patient’s citizenship status, and expanded emergency Medicaid coverage that can provide relief to uninsured immigrants with emergency and long-term medical conditions.



## New Molecules for Tracking Parkinson's Disease Progression

The chemical structure of an alpha-synuclein fibril with an "exemplar" molecule, shown as colored spheres, bound to a previously identified binding site.

A study published in *Chemical Science* describes an innovative approach for identifying molecules that can help track the progression of Parkinson's disease. The results of a collaboration between the labs of E. James Petersson of the School of Arts & Sciences and the Perelman School of Medicine's Robert Mach and Virginia Lee, this proof-of-concept study could change the paradigm for how researchers study a wide range of neurodegenerative diseases.

Researchers are actively looking for new ways to study the progression of neurodegenerative diseases before symptoms appear. One candidate for

therapeutic intervention is alpha-synuclein, a protein that forms clumps in the brain and is a hallmark of Parkinson's disease. But while this protein was identified more than 20 years ago, a reliable way to track alpha-synuclein aggregates in patients has yet to arise.

In this study, the researchers developed a high-throughput computational method that allows them to screen millions of candidate molecules for positron emission tomography (PET), a method that uses radioactive molecules called tracers to image tissues and organs. The researchers identified a subset of 20 promising tracer candidates

*"This can be something that takes 10 to 15 years in industry, and we're trying to do it in about five."*

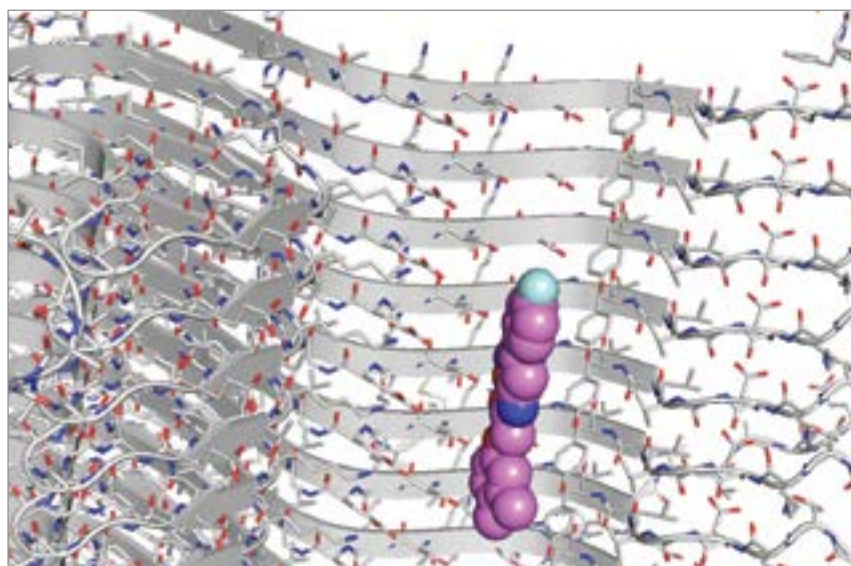
out of 7 million compounds and found two that had a high binding affinity to alpha-synuclein. They also used mouse brain tissues provided by Lee's group to validate their new method.

Now, as part of a large multi-institutional National Institutes of Health U19 grant, Petersson, Mach, Lee, and colleagues are poised to use these results to help develop PET tracers for Parkinson's and other neurodegenerative diseases.

"We're going to apply this same method to the development of other probes that are important but have presented challenges to the field," says Mach, lead investigator of the U19 grant.

By developing reliable high-throughput tools, their goal is to find new tracer candidates and get them into the clinic as soon as they are ready for testing.

"It is certainly accelerated compared to what's typical," says Petersson about the timelines of the grant. "This can be something that takes 10 to 15 years in industry, and we're trying to do it in about five."



## NEUROLOGY

### A Single Head Injury Raises Risk of Dementia

The long-term impacts of head injury have come into the spotlight in recent years, with the plight of professional football players and military veterans who experience traumatic brain injuries receiving

particular attention. But a study led by Andrea Schneider of the Perelman School of Medicine asked, what happens when a broader cross-section of people experience head injury?

The findings, shared in the journal *Alzheimer's & Dementia: The Journal of the Alzheimer's Association*, suggest that the impact can be lasting. Using data from a unique longitudinal study that has followed thousands of participants for more than three decades, Schneider and colleagues found that even a single head injury raised the risk of developing dementia by 1.25 times. Those who had experienced two or more prior head injuries

had more than double the risk of dementia compared to those with no previous head injuries.

"In simple terms, a traumatic brain injury is what we describe as an instance when somebody has a strike to their head that results in a neurologic symptom, like a headache, changes in vision, or dizziness," Schneider says. "What we're seeing here is that the consequences of these injuries are showing up sometimes 25 years later as an increased risk of dementia, with a dose response if there is more than one injury or if the injury was severe."

Schneider says the connection between head injury and dementia is gaining more attention. In 2020, a commission organized by the journal *The Lancet* added head injury to its list of 12 modifiable dementia risk factors. And with more than 23 million adults 40 and older reporting a history of head injury with loss of consciousness, growing focus is well-deserved.

In her current work, Schneider is looking into the mechanisms behind the brain injury-dementia link, hoping to find support for interventions that could decrease risk.

## COMMUNICATION



### False Narratives Harm Undocumented Immigrants

A study from the Peace and Conflict Neuroscience Lab (PCNL) at the Annenberg School for Communication found that Americans dramatically overestimate the number of migrants affiliated with gangs and involved in child trafficking.

This overestimation contributes to the dehumanization of migrants, lack of empathy for their suffering, and to individuals' views on immigration policy.

"We noticed that false narratives about undocumented immigrants as criminals or as having criminal intentions are commonly circulated in the public," says Samantha Moore-Berg, a postdoctoral fellow at the PCNL and lead author of the study.

The researchers developed a successful intervention that increased participants' levels of empathy for immigrants, decreased their dehumanization of immigrants, and increased their support of less punitive immigration policy.



## EDUCATION

### Swinging the Pendulum Toward Project-Based Learning

Project-based learning (PBL) has been in practice in education since the days of philosopher John Dewey, yet it has constantly dipped in and out of favor in U.S. schools. This is what Pam Grossman, dean of the Graduate School of Education (GSE), describes as a "pendulum swing" between more teacher-centered and student-centered approaches to teaching in the United States.

"[Project-based learning] is a promising pedagogy that engages students in actual doing to learn disciplinary knowledge, content, and skills, and also engages them in opportunities to collaborate with one another, communicate effectively, and speak to authentic audiences, but it's difficult to enact well," Grossman says. "And while we frequently invested in curriculum development around PBL, we never invested significantly in teacher learning."

Alongside Zachary Hermann, co-director of GSE's Project-Based Learning Certificate Program, Sarah Schneider Kavanagh, an assistant professor in GSE, and Christopher Pupik Dean, a senior fellow, Grossman spent a year conducting surveys with expert practitioners. The researchers asked them what they saw as the most important components in their practice, related to project-based learning. The team would then take those responses, collate and refine them, and send them back for feedback and rankings. Classrooms were also videotaped for real examples of project-based learning in practice.

The researchers used what is known as a modified Delphi study to find professional consensus, Grossman says, a process used in medicine and other fields. The subsequent study looked at the impact of a professional development program designed to help teachers learn these practices.

The results of the research coalesced around a guide meant to educate K-12 teachers, titled "Core Practices for Project-Based Learning," published by Harvard Education Press. The book lays out three domains and 10 practices for enacting project-based learning and takes a student-centered approach, while acknowledging the complex challenges of designing and carrying out projects—including keeping them well-tethered to disciplinary goals and purposes.

"Our goal is to keep the pendulum swinging toward project-based learning and other forms of student-active learning, which most educators agree is an effective approach for developing content knowledge and other skills identified as 21st-century skills, like collaboration, communication, and one's own agency over how to learn," Grossman says. "It shouldn't be the only tool in an educator's toolkit, but one they should be prepared to enact."



## How HIV Infection Shrinks the Brain's White Matter

Infection with HIV is associated with cognitive impairments, causing symptoms from forgetfulness to motor deficits. It's widely believed that these effects owe to changes in the brain seen in people living with HIV, notably a loss of white matter. As opposed to gray matter, which is composed of the cell bodies of neurons, white matter is made up of a fatty substance called myelin that coats neurons, offering them protection and speeding signal transmission.

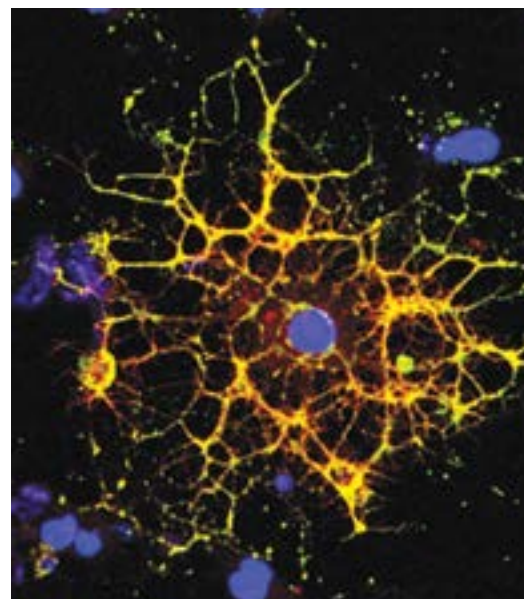
While researchers from Penn and the Children's Hospital of Philadelphia (CHOP) have found that antiretroviral therapy—the lifesaving suite of drugs that many people with HIV use daily—can reduce white matter, exactly how HIV itself contributes to a loss of white matter wasn't clear.

Now, a study by the same team—co-led by Kelly Jordan-Sciutto of the School of Dental Medicine, CHOP's Judith Grinspan, and Lindsay Roth, who earned a postdoc working with both Jordan-Sciutto and Grinspan as mentors—has hammered out a

detailed mechanism. Their work, published in the journal *Glia*, reveals that HIV prevents myelin-making brain cells called oligodendrocytes from maturing, thus putting a wrench in white matter production. When the researchers applied a compound blocking this process, the cells were once again able to mature.

“Even when people with HIV have their disease well-controlled by antiretrovirals, they still have the virus present in their bodies, so this study came out of our interest in understanding how HIV infection itself affects white matter,” says Jordan-Sciutto. “By understanding those mechanisms, we can take the next step to protect people with HIV infection from these impacts.”

“It's clear that myelination is playing key roles in various stages of life: in infancy, in adolescence, and likely during learning in adulthood, too,” adds Grinspan. “The more we find out about this biology, the more we can do to prevent white matter loss and the harms that can cause.”



A confocal microscope image shows a brain cell known as an oligodendrocyte in cell culture, labeled to show the cell nucleus in blue and myelin proteins in red, green, and yellow.

## HEALTH POLICY / Q&A

# SHARED GOVERNANCE IS KEY TO GLOBAL HEALTH EQUITY

Pandemics have a way of revealing a foundation's hidden cracks, says Jennifer Prah, the Amartya Sen Professor of Health Equity, Economics, and Policy in the School of Social Policy & Practice.

“COVID-19 taught us that our global system is not flexible enough to react quickly to a major, time-sensitive experience,” she says.

Prah's Health Equity and Policy Lab aims to improve human flourishing by advancing parity and efficiency in health care and other determinants of health—facets the pandemic exposed as lacking worldwide.

“The COVID-19 burden was disproportionately felt by segments of the population that had already been vulnerable, marginalized, and excluded,” Prah says.

What's needed, she argues, is shared health governance, which promotes the well-being of all, in contrast to a zero-sum approach in which some win and some lose.

**Q: Can you explain shared health governance further?**

**A:** It's trying to understand how we collaborate as a society. A well-organized society—at both domestic and global levels—promotes the common good. That is to everyone's advantage. Enabling people to flourish enables people to be healthy. When we're focused on the common good, we're trying to collaborate and work together to benefit all.



**Q: That didn't seem to happen with the COVID-19 pandemic.**

**A:** We knew there was a pandemic of this nature coming. We had a lot of forewarning. Yet we quickly found out we weren't prepared. The implications and consequences of the pandemic revealed a severely unequal world, part of a global health system that we built over many, many decades.

**Q: Were there any bright spots in the global response?**

**A:** The development of the vaccines. That was a success, a demonstration of the power of science and advancements in the scientific enterprise, of our ability to study and test scientific innovations quickly and safely. I am hopeful we can build on that. There's no reason why we can't learn from just how terrifically focused we were globally and domestically.

**Q: Why did COVID garner more worldwide focus than other diseases?**

**A:** This became such a priority because of its impact on the wealthiest countries. We are a global society of power and privilege. That is embedded in the institutions, policies, and practices that make up our global health system.

**Q: What needs to change?**

**A:** We need to value all lives equally across the planet. Conditions and diseases that affect wealthy countries are no more important than those that affect less-resourced or lower-income countries. If the pandemic showed us anything, it's that we're interdependent. We share vulnerabilities. That means we must show mutual consideration and cooperation to prevent future pandemics and address them once they occur.

## Number of Elderly Homeless Expected to Triple in Next Decade

In 2020, a team of researchers led by Dennis P. Culhane, a professor in the School of Social Policy & Practice, published a projection: Over the next decade, the number of elderly homeless Americans is expected to triple.

This prediction was made as a wave of baby boomers who have historically made up the largest share of the homeless population ages—and that was before a pandemic arrived to stretch what remains of the social safety net to the breaking point.

“If we’re forecasting a flood, where the water will reach up to our heads, it’s already up to our knees,” Culhane says, “and rising very, very fast.”



### HEALTH CARE MANAGEMENT

## DURING THE PANDEMIC, BAD HOSPITALS LED TO BAD CARE FOR BLACK PATIENTS



A study led by David Asch, executive director of the Perelman School of Medicine’s Center for Health Care Innovation and a professor of health care management and operations, information, and decisions at the Wharton School, details how the pandemic exposed racial disparities in health care.

The study, published in *JAMA Network Open*, examined more than 44,000 Medicare-insured patients admitted to nearly 1,200 hospitals in 2020. The team found a significantly higher mortality rate for Black patients, but once a statistical adjustment was made for the hospital itself, those differences vanished. In other words, the higher mortality among Black patients likely resulted from Black patients going to hospitals that provided worse care for all. The authors determined that the death rate for Black patients hospitalized with COVID-19 would be 10% lower if they received care at the same hospitals and in the same distribution as white patients.

“This study suggests that Black patients do worse largely because they go to worse hospitals,” says Asch. “Since people tend to go to hospitals near where they live, this is a story of racial residential segregation that has plagued this country for a century.”

The coronavirus provides a new window through which to view how health disparities arise because it required hospitals to shift quickly to meet the challenge. African Americans faced a greater burden from COVID-19 because of a myriad of factors: occupations with higher risk of exposure to the virus, generally higher rates of other conditions like diabetes and obesity associated with worse outcomes, and also a tendency to be infected in the earliest days of the pandemic, before survival rates improved. But, Asch says, which hospital they were admitted to has a persistent and large effect that seems to overshadow all others.

### HISTORY

## Seeing Clearly Through the Fog of War

**Scientific advancements can both heal and harm.** The discoveries that underlie technologies from the gun to the atomic bomb emerged from the minds of scientists. Consequently, the creators of those and many other technologies have found themselves in moral quandaries resulting from the violent application of their insights.

In her book “Rational Fog: Science and Technology in Modern Warfare,” M. Susan Lindee, the Janice and Julian Bers Professor of the History and Sociology of Science in the School of Arts & Sciences, explores how science and scientists have engaged in the advancement of military might. The title—a play on the “fog of war”—relates to the valorization of rationality.

“When Carl von Clausewitz, a Prussian military analyst, talks about the fog of war,” says Lindee, “he means that the view of a commander moving

into a battlefield is obstructed, that the situation is uncertain and unpredictable. My title extends this idea to technical experts. The fog is a moral and ethical fog. They’re moving forward, trying to make decisions about what questions to pursue and technologies to produce, often doing so without foresight, reflection, or overt ethics.”

Lindee’s text explores the role of universities in the waging of war, including creating new knowledge for national defense organizations.

“There is not any scientific field that did not at some point get pulled into defense interests in the course of the 20th century,” she says.

The reverse is also true: War and defense spending has spawned new scientific knowledge.

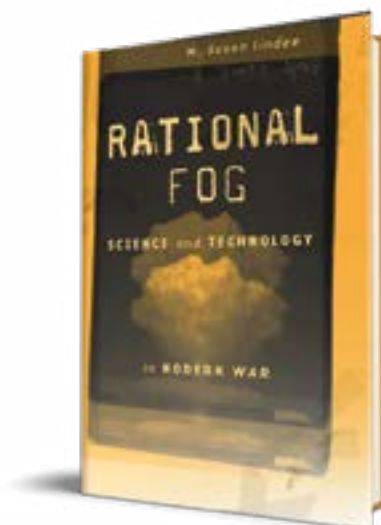
“Battlefields have been significant scientific field sites over the last century,” she notes.

Among the scientific moral quandaries on the horizon, Lindee points to drones and cyberwar.

“Cyberwar is now where significant funding is going,” she says. And “drones are a way of concentrating power in corporate actors, or extremely wealthy individuals.”

There’s an inherent critique in “Rational Fog.”

“What if we turned knowledge to human needs and human benefits instead?” Lindee asks. “One of my friends says the book is subversively pacifist. Maybe that’s true.”





## Gun Violence on TV Doubled, in Parallel with U.S. Gun Deaths

Almost a decade ago, Daniel Romer and Patrick E. Jamieson published findings revealing that, at the time, PG-13 movies showcased more gun violence than R-rated movies.

“That created quite a stir,” says Romer, research director at the Annenberg Public Policy Center. “We looked three years later, and the trend was continuing. We’ve seen this happening in movies for a while now.”

But Romer and Jamieson, director of the Policy Center’s Annenberg Health and Risk Communication Institute, wanted

to know whether such violence was as prevalent in television—by its nature, viewed more frequently than movies—and how it might influence homicides by firearm.

In a *PLOS ONE* paper, the pair showed that gun violence on popular primetime dramas doubled from

2000 to 2018, increasing in parallel with the proportion of deaths by firearm in the United States.

“Though we can’t claim a causal connection,” Romer says, “the findings were consistent with our hypothesis that what happens in the media can be influential. We were not necessarily surprised.”

To draw these conclusions, the researchers turned to data from a long-standing content analysis project called CHAMP, which looks at health-risk behavior trends over time. Research assistants coded five-minute segments of 33 police, medical, and legal dramas for the presence of violence and firearms use.

“Our definition of ‘violence’ was more severe than aggression and included both intent to harm and contact,” Jamieson says. “‘Gun violence’ we defined as ‘a gun was fired and also an animate being was hit.’” Segments with multiple instances of violence counted just once.

All told, Romer and Jamieson analyzed 1,476 hours of coded TV. They found a statistically reliable positive correlation between homicide trends and the trends of violent segments with a gun in top-rated TV dramas. It was strongest for 15- to 24-year-olds.

“People say, ‘Don’t worry about what’s in the media,’” Romer says. “But there’s a tradition of looking at media influence on health-risk behavior, and you can do the same with guns. It’s a public health crisis.”



## Asking About Politics or Religion Could Be a Good Thing

Maurice Schweitzer of the Wharton School, Einav Hart from George Mason University, and Eric VanEpps from the University of Utah published a study in *Organizational Behavior and Human Decision Processes* that discusses the value of not being afraid of asking sensitive questions.

Titled “The (Better Than Expected) Consequences of Asking Sensitive Questions,” the paper explains why participants might too frequently avoid touchy subjects during conversation, whether with strangers, coworkers, or friends.

Researchers define sensitive questions as those that are about topics one might feel uncomfortable discussing. These questions can be inappropriate in a specific context, or solicit information that the other person might want to keep private, such as a financial situation, politics, religion, or relationships.

But Schweitzer says these sensitive questions can have benefits. “One thing that questions do is they express interest in other people,” he says. “They demonstrate that we’re other-focused. That can be extremely important in building relationships, demonstrating concern for others, and helping us signal benevolence and that we’re kind and caring and interested.”

For example, many people are reticent to ask questions that they fear might upset others, such as asking a senior leader if they have a succession plan or asking a friend how much they pay in rent. In many cases, not only would asking these questions yield valuable information, but they are also far less likely to offend people than we expect.

The studies were conducted in groups of two because, according to the researchers, people are most likely to disclose sensitive information in dyads. But the researchers say there are interactions where signaling information and setting norms could be more interesting, and they are thinking about taking some of their research into group settings.

## MUSIC

# HAND-COPIED MUSIC AS A CULTURAL SHOWPIECE OF A NEW NATION

While researching in New England, Glenda Goodman, an associate professor of music in the School of Arts & Sciences, stumbled upon a series of hand-copied books of music from 18th-century America. This was long after people had access to printed music, and hand copying was a laborious, time-consuming task.

Why, she wondered, would anyone bother?

She followed this curiosity straight to archives across the country and eventually found the topic for her award-winning book, “Cultivated By Hand.” Sorting through hundreds of these books, she noticed a pattern: Many were written by children of people who fought in the American Revolution—first-generation Americans whose parents wanted them to seem educated and cosmopolitan. Many of the books were by white women.

“One of the things I realized is these books represent a kind of display to the world that the United States can self-fashion in an impressive cosmopolitan, cultural, genteel, tasteful way, and they do that by copying fashionable music in good handwriting,” Goodman says. “The appearance of the manuscript matters, and if they’re doing this, it’s assumed they could perform it and display it and be impressive in social settings.”

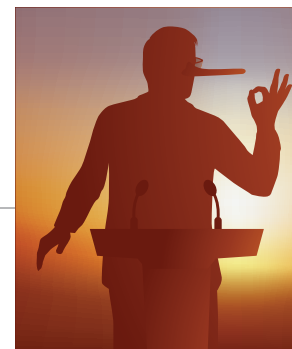
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*“These books represent a kind of display to the world that the United States can self-fashion in an impressive cosmopolitan, cultural, genteel, tasteful way.”*

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She also found these books were deeply personal for some. The margins contain notes describing a piece as their favorite song or dedicating it to a child or parent. In one example, that of Sally Brown, her periods of copying would coincide with life events, and after a series of tragic deaths in her family—including a suicide—she copied a long snippet from a German novel in which the main character commits suicide.

“I think this matters because so many of these people were women and amateur musicians, two categories of historical subjects often overlooked,” Goodman says. “This is the era of George Washington, but these social histories of people deserve to be told because they were such active musicians and their musical labor was instrumental in shaping the cultural life of the new nation.”



## LAW

# Populist Leaders and the Scapegoating of Law

During the fall of 2019, Cary Coglianese, a professor of law and political science, as well as director of the Penn Program on Regulation, delivered a keynote address at an International Association of Legislation conference in Rome about the breaking down of trust in legal systems. Out of that address grew his paper, “Law as a Scapegoat,” released in the University of Pennsylvania Carey Law School’s Public Law and Legal Theory Research Paper Series and published in 2021 in the book, “The Crisis of Confidence in Legislation.”

In his analysis, Coglianese references circumstances in the United States, Brazil, and the United Kingdom to demonstrate how populist leaders have scapegoated the law in a fashion similar to anti-migrant rhetoric. These leaders, he shows, take

unfavorable social conditions and murkily blame them on legal systems and regulatory processes instead of addressing the real underlying causes.

“The point is not just to see populism as a consequence of a breakdown of public trust in government, but to recognize that some populist leaders deliberately work to undermine that trust,” Coglianese says. “Leaders seeking to exploit the rise of populism can find it of tactical value to make the law a scapegoat.”

The three countries cited in the paper were selected because of their prominence as recent examples of the phenomenon of legal scapegoating. Coglianese focuses on the rhetoric of former President Donald Trump, the rise of Brazil’s Jair Bolsonaro, and the public figures behind the Brexit movement.

The Jan. 6, 2021 attacks on the U.S. Capitol in Washington, D.C. have only further borne out his analysis, he says.

“In many ways, January 6 was the culmination of four years of legal scapegoating by the president of the United States,” Coglianese says. “Although January 6 is often described as an attack on democracy, it was also very much an attack on the rule of law.”

Coglianese hopes his work inspires future study. He acknowledges that criticisms of law, and calls for legal change, can be made for legitimate reasons. But, he argues, the law can also be used as a scapegoat. He hopes scholars can better understand the effects of legal scapegoating on society—and identify ways that it can be counteracted.



## The Cost of Reopening Schools During COVID



The Penn Wharton Budget Model (PWBM) examined the cost-benefit analysis of reopening schools in Bucks, Chester, Delaware, and Montgomery counties during the COVID-19 pandemic.

The study estimated that nationally, the average cost of a COVID-19 infection was \$27,230—about five times more than a typical flu infection. But the cost of a COVID-19 infection in the four counties was significantly lower, ranging from about \$8,000 to \$13,000.

Efraim Berkovich, director of computational dynamics at the PWBM, headed the study and concluded that school boards and health policy-makers “should look at the trade-offs of local costs of COVID versus harms to students and families from being out of school.”

Using these cost thresholds provides a transparent, evidence-based approach in the school opening decision, he says.

## Doulas Improve Labor Experiences and Birth Outcomes

Fewer than 10% of people who give birth in the United States each year use doulas. But research has shown that these professionals, who support families during the birthing process, improve birth outcomes.

Now, work from Diane Spatz, a professor in the School of Nursing and a nurse scientist in lactation at the Children’s Hospital of Philadelphia, and Penn Hillman Scholar Stephanie N. Acquaye, demonstrates that doulas can help families meet breastfeeding goals, too. The pair published these findings in *The Journal of Perinatal Education*.

In a conversation with Acquaye, a Penn junior when the research was completed, she describes what it means to be a doula—a role she has held for the past three years—plus why these research results are important.

### Q: Broadly speaking, what is a doula?

A: If I had to sum it up, I would say doulas are people trained to provide physical and emotional support during labor and delivery. They are also there to advocate for laboring people and to make sure there’s open communication with care providers. Often, we view birth as solely a medical process, especially in the U.S., but it can be a lot more. Emotions play a big role, so doulas are there to check in emotionally, too.

### Q: What made you want to become one?

A: I heard about doulas when I was in high school, but my sophomore year at Penn, I learned about the Philadelphia Alliance for Labor Support (PALS). Part of its mission is to increase access to doula care.

I took the PALS training and became a volunteer doula, which means being on call at the labor-and-delivery unit at the Hospital of the University of Pennsylvania and volunteering through a prenatal match program. It’s been one of the most empowering things I’ve ever done.

### Q: What’s the biggest take home from this research?

A: We found that doulas can improve not only people’s experiences during labor but also birth outcomes. That can be quantified

and measured. One such outcome is breastfeeding initiation, which can be improved with doula support.

### Q: Why are these findings important?

A: Doulas can be an amazing tool to improve maternal health outcomes. It’s something we’re increasingly focusing on and paying attention to in the U.S., especially for Black and African American mothers who have disparate rates of breastfeeding. Increasing access to doula support for people of color needs to be an important priority to improve breastfeeding rates and the health of our society.

Stephanie N. Acquaye is a Penn Hillman Scholar.



## NURSING



### Adolescent Drivers Return to the Road Shortly After Concussions

Researchers from the School of Nursing and the Children's Hospital of Philadelphia found that 47% of drivers between the ages of 16 and 19 who sought specialty care for a concussion were back to driving approximately two weeks after injury. Of those who returned to driving, only 28% had resumed exercise and 11% had returned to playing an organized sport. The findings, published in the *Journal of Adolescent Health*, demonstrate the need for evidence-based, standardized guidelines on safely returning to daily activities after a concussion. The researchers also recommend that clinicians and families implement a plan for a gradual return to driving.

## VETERINARY MEDICINE

### A Canine Disease with Striking Similarities to Multiple Sclerosis

The canine disease granulomatous meningoencephalomyelitis (GME), the most common neuroinflammatory disease to affect dogs, shares key features of its pathology and immunology with multiple sclerosis (MS), according to research published in the *Journal of Immunology* and led by Jorge Iván Alvarez and Molly Church, both assistant professors in the School of Veterinary Medicine.

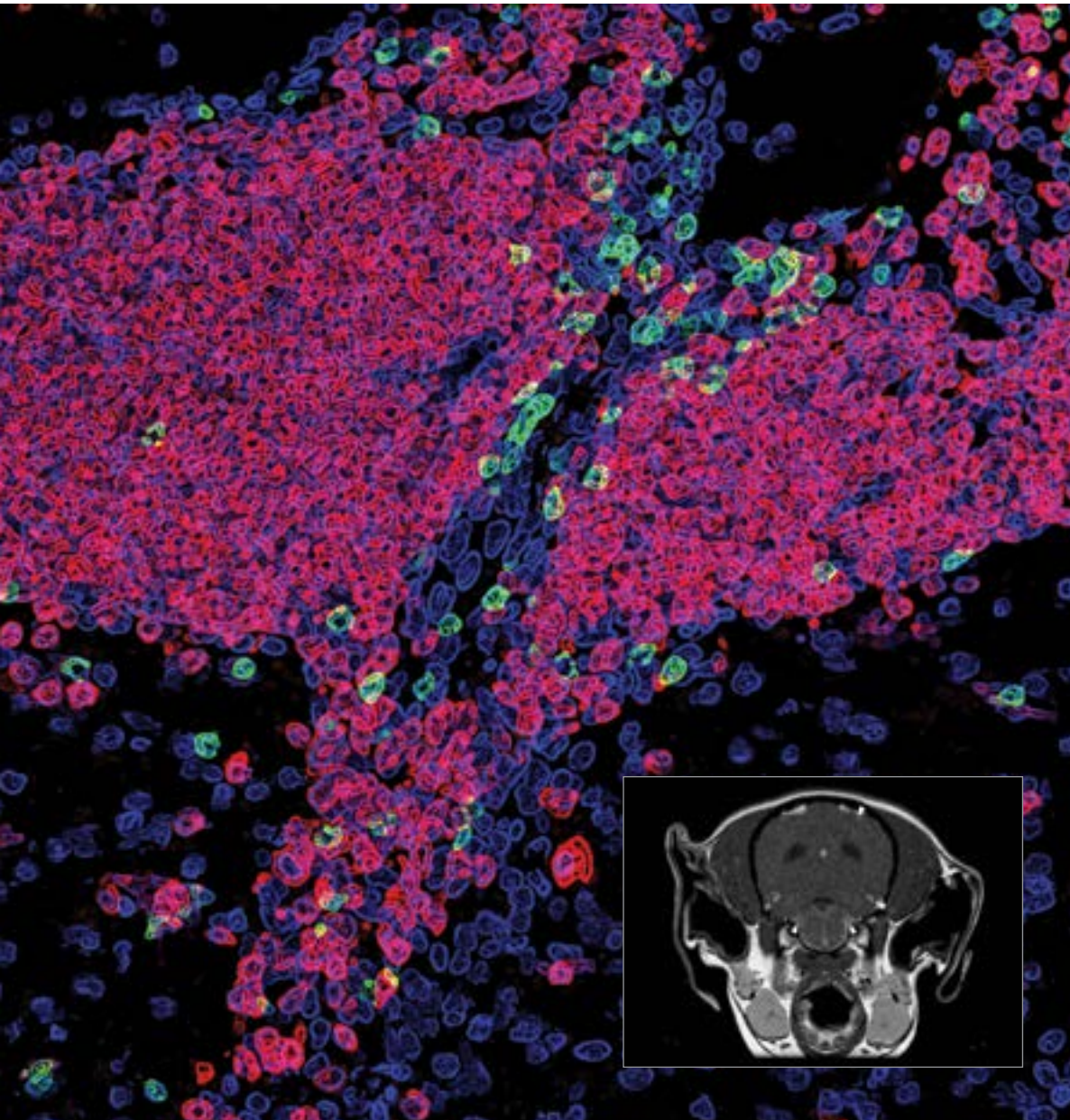
Analyzing MRI images and brain tissue, the researchers found that defining characteristics of MS—notably, the accumulation of B cells in the tissues that line the central nervous system—were also present in dogs with GME. B cells are a type of white blood cell involved in immune response that are normally found in very low numbers in the meninges, the membranes that line the spine and brain.

“That’s a novel aspect of the disease in dogs that is mirroring the pathology in humans,” says Alvarez. “And it’s something that people are not able to replicate in mouse models of MS. We feel that by studying dogs with GME, we can expand knowledge of a human disease and contribute to the pressing need to understand the disease in dogs as well.”

“Describing this new component of GME that hadn’t yet been considered could lead the way to better diagnostics,” says Church, “as well as better therapeutics to augment what is already in use.”

The fact that dogs and humans often share an environment, and that the biology of dogs is more similar to humans than the mice often used in preclinical studies, adds to the value of studying GME as a model of MS, the researchers note.

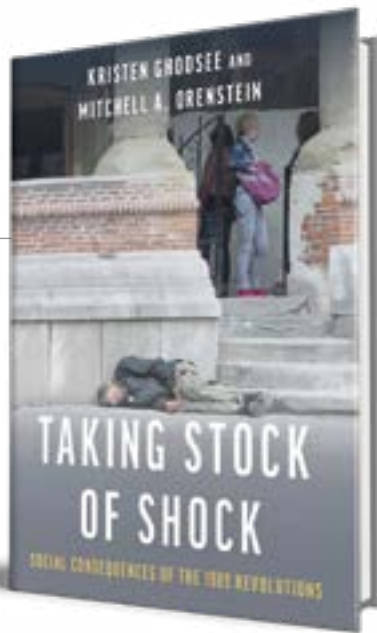
“We can all learn from studying this disease in dogs,” says Church, “certainly as a model for human disease. But the wonderful thing that can come out of comparative studies like this is that we not only help people, we help our canine patients as well.”



A naturally occurring canine disease mirrors many features of multiple sclerosis, including the involvement of B cells (red) and T cells (green) in the tissues that line the central nervous system.

INSET: A dog with GME has an accumulation of B cells, indicated by areas of higher contrast, along the brain and spine.





RUSSIAN AND EAST  
EUROPEAN STUDIES

## POST-COMMUNIST COUNTRIES AFTER THE FALL OF THE BERLIN WALL

Kristen Ghodsee and Mitchell Orenstein, both professors in the Department of Russian and East European Studies in the School of Arts & Sciences, co-authored the book “Taking Stock of Shock: Social Consequences of the 1989 Revolutions,” which provides an interdisciplinary perspective on 30 years of transition in 29 post-communist countries.

While some believe post-communist countries experienced a brief downturn followed by a dramatic return to growth, others portray post-communist transition as an unparalleled economic disaster.

Ghodsee and Orenstein find strong evidence for both perspectives, produced by rapidly growing inequalities among different countries and social groups.



MATERNAL HEALTH

## Living in a Majority-Black Neighborhood Linked to Severe Maternal Morbidity

**Residents in majority-Black neighborhoods** experience higher rates of severe pregnancy-related health problems than those living in predominantly white areas, according to a study of pregnancies at a Philadelphia-based health system led by researchers in the Perelman School of Medicine. The findings, published in *Obstetrics & Gynecology*, suggest that neighborhood-level public health interventions may be necessary in order to lower the rising rates of severe maternal morbidity and mortality in the United States.

Using medical records, the research team analyzed all deliveries—63,334 in total—between 2010 and 2017 at four hospitals with a racially and economically diverse patient population in the University of Pennsylvania Health System and compared health outcomes to U.S. Census data.

Strikingly, they found that the rate of severe maternal morbidity within a neighborhood increased by 2.4% with every 10% increase in the percentage of individuals in a Census tract who identified as Black or African American. “Severe maternal morbidity disproportionately affects Black women. We know these differences are not genetic in etiology, but most likely due to structural racism and neighborhood-level risk factors,” says lead author Jessica Meeker.

While past studies have shown that the risk of severe maternal morbidity and mortality is markedly increased among women of color, individual risk factors alone, such as medical comorbidities, maternal education, or income, have not explained this disparity. Knowing that structural racism and historical segregation of neighborhoods are drivers of other poor health outcomes, the researchers sought to determine whether neighborhood-level factors, like poverty, crime, and housing violations, contribute to severe maternal morbidity.

“Since we found that neighborhood-level risk factors are independent predictors of severe maternal morbidity, this study gives further evidence that differences in race and maternal health outcomes are likely the result of historical and structural racism,” says senior author Mary Regina Boland, an assistant professor of informatics at Penn Medicine. “Improving our communities within the City of Philadelphia can help all individuals living in those neighborhoods, and may result in lowering rates of maternal morbidity for future generations.”



## PALEONTOLOGY

# For Early Amphibians, a New Lifestyle Meant a New Spine

Postdoctoral fellow Aja Carter employs a variety of techniques in her paleontological research, including 3D printing and robotics.

**What unites creatures** as different as humans, dogs, snakes, and even Stegosaurus? The basic shape of their vertebrae.

“They all have this hockey puck-shaped thing, the centrum, fused to these sticky-outy parts, the neural arch, the transverse processes,” says Aja Carter, a paleontologist who earned her doctoral degree from the Department of Earth and Environmental Science in the School of Arts & Sciences and is now a Vice Provost Postdoctoral Fellow for Academic Diversity in the School of Engineering and Applied Science. “But that’s not always how it’s been.”

Go back further in evolutionary time, Carter says, before dinosaurs arose, and one will find a highly diverse set of vertebral shapes. Scientists have long debated whether a particular vertebral shape was important for these ancient animals to colonize land or subsequently recolonize water.

In a study published in *PLOS ONE*, Carter and colleagues, including Penn faculty Peter Dodson and Lauren Sallan, tackled this question, focusing on early amphibians known as temnospondyls. These tetrapods lived 360 to 250 million years

ago, some exclusively on land, some exclusively in water, and some with an amphibious lifestyle.

The researchers analyzed fossil specimens using an approach known as geometric morphometrics, which quantifies shape by assigning points to the outline of a structure. They focused in particular on the intercentrum, a weight-bearing structure, and the neural arch, sites of muscle attachment. Many in the field presumed that a land-based lifestyle required a stiffer spine than one in water, so the team hypothesized that terrestrial temnospondyls would have longer neural arches and longer intercentra to restrict flexibility through the spine.

Yet their analysis revealed no association between the neural arches and the environment in which the animals lived, and, while the intercentrum did correlate with environment, the relationship was not what earlier scientists had predicted. Instead, some terrestrial species seemed to have a high degree of spinal flexibility.

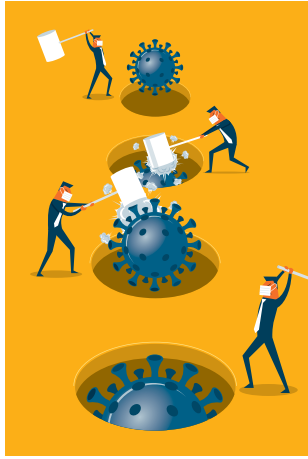
“This tells us there is more diversity than what these labels—terrestrial, aquatic—are saying, when it comes to vertebral composition and shape,” Carter says.

**“This tells us there is more diversity than what these labels—terrestrial, aquatic—are saying, when it comes to vertebral composition and shape.”**

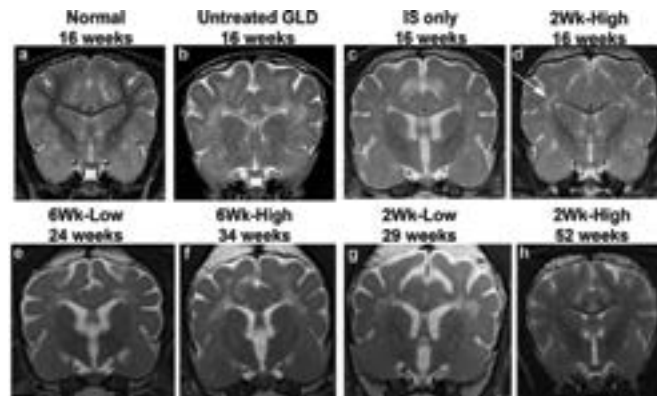


## IMMUNOLOGY

# PROMISING COVID-19 TREATMENT



The Perelman School of Medicine's Sara Cherry and colleagues discovered that a drug called diABZI, currently being tested to treat some cancers, is highly effective at preventing severe COVID-19 in mice. This drug works by boosting the immune signals cells use to detect viruses. Because SARS-CoV-2 hides in the body, the treatment triggers an immune response earlier than the body would have on its own. The findings, published in *Science Immunology*, offer promise that diABZI might thwart the worst effects of this coronavirus and other respiratory viruses like it.



Treating dogs with Krabbe disease with a gene therapy targeted to the brain led to remarkable results.

## VETERINARY MEDICINE

# Progress on a Rare Disease

Babies born with Krabbe disease typically succumb to the inherited disorder before their second birthday. In work with the canine version of the disease, a team led by the School of Veterinary Medicine's Charles Vite has developed a gene therapy that appears safe and has led to lasting results, with treated dogs living to four years of age and beyond with no significant symptoms. The study, published in the *Journal of Clinical Investigation*, highlights the potential for a similar approach to treating children.

## PHYSICS & ASTRONOMY / Q&A

# On Machine Learning and Astronomy



Astronomer Robyn Sanderson of the School of Arts & Sciences.

The all-sky view of a simulated Milky Way-like galaxy from Gaia's perspective.

Machine learning programs automatically identify patterns in data, and astronomers use these tools to analyze the large amounts of information collected by satellites and telescopes.

In Penn's Department of Physics & Astronomy in the School of Arts & Sciences, assistant professor Robyn Sanderson was involved in two recent discoveries using machine learning: A new stellar stream in the Milky Way disk called Nyx, published in *Nature Astronomy*, and a dwarf galaxy that collided with the center of the Milky Way three billion years ago, published in *The Astrophysical Journal*.

Here, Sanderson shares more about her research interests, the challenges of using machine learning, and what the future holds for this field.

**Q:** What type of research is your group interested in?

**A:** Our group focuses on how galaxies form and what is dark matter; the two are related because galaxies and dark matter influence each other. My group uses high-resolution galaxy simulations to study this complex problem.

**Q:** What are the benefits and challenges of machine learning?

**A:** There's so much data that we can't classify by eye, and we can get more statistical power if we leave behind bespoke classification schemes. And while it's often very simple to apply a machine learning model, one challenge is interpretation—the model doesn't know any physics or astronomy, so you have to construct tests, which is where you need simulated data.

On the technical side, there are a lot of ingredients in the galaxy simulations, with many being areas of active research. There are also many different scales—you have something the size of the Milky Way being influenced by the explosions of single stars, for example.

**Q:** What is your group studying now and what are you excited about in the future?

**A:** We're currently working on ways to tell what kind of dark matter we have using tidal streams, when galaxies get ripped apart and form a long string. We are also trying to see whether we can use central structures called galaxy bars as a new probe of dark matter.

Overall, we're trying to make connections between simulations and real data, and we'd like to come up with new ways to do that comparison. Now that we've advanced on both theory and observation, we can make more powerful tests and get at details we couldn't see before.



## Reexamining the Literature on Policing

**Dean Knox**, an assistant professor of operations, information, and decisions at the Wharton School, and Jonathan Mummolo, a professor of politics and public affairs at Princeton, have published a series of papers on racial bias in policing.

“The core problem in policing research is that the data is so limited,” says Knox. “Researchers often rely only on information recorded by police officers, without thinking through what information might not be recorded.”

The studies—published in *Science*, *Proceedings of the National Academy of Sciences*, and the *American Political Science Review*—show how failing to account for a long chain of events from officer deployment to contact with, detainment of, and violence against civilians can lead to drastic underestimates of the severity of the problem.

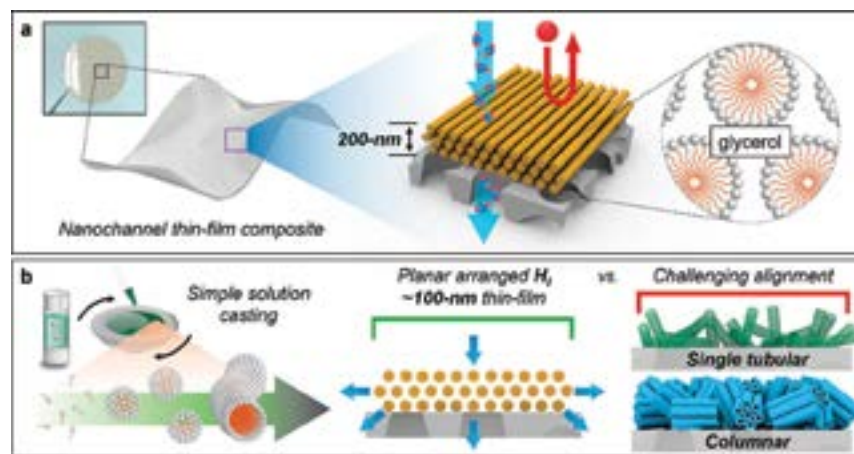
Knox explains, “What our research does is reexamine the literature on policing through the lens of formal statistical frameworks for causal inference, often revealing how fragile these conclusions can be.”



In one case, their findings led to the retraction of a prominent paper, widely cited by opponents of police reform, that erroneously claimed to find no evidence of racial bias in fatal police shootings.

“Our goal is to get this work out to civil rights practitioners and improve the use of data where it really matters,” says Knox.

With the help of Analytics at Wharton, Knox and Mummolo have also co-founded Research on Policing Reform and Accountability, a group that provides rigorous evidence on police-civilian interactions and the efficacy of policing reforms.



By coaxing surfactants into cylindrical shapes that stack in a hexagonal pattern, then crosslinking them into a thin membrane, Penn Engineering researchers have developed a filter with pores that are uniformly one nanometer wide.

## NANOTECHNOLOGY

### Unprecedented Performance for Permeable, Selective Filtration Membranes

Researchers from the School of Engineering and Applied Science have demonstrated a method for better controlling nanoscale pore sizes, paving the way for the creation of new filtration membranes that are both permeable and selective. These thin-film membranes with one-nanometer-wide pores perform as well as or better than currently available nanofiltration membranes, according to the study, published in *ACS Nano*. The work was led by Chinedum Osuji, the Eduardo D. Glandt Presidential Professor in the Department of Chemical and Biomolecular Engineering, and postdoc Yizhou Zhang.

“With this sort of filtration performance, you can think of point-of-use water filtration, treatment of wastewater coming out of industrial facilities, water softening for household use, pervaporation or membrane distillation used in the production of milk and orange juice, and things of that nature,” says Osuji.

At the heart of this technology is a method developed by Osuji and his lab for getting surfactants—chemicals similar to those found in household detergents—to self-assemble into long cylinders that pack into hexagonal arrays within an aqueous medium. This assembly, called a liquid crystal mesophase, is then locked into place with ultraviolet light and the array of cylinders forms itself into a thin membrane.

Thanks to the material’s regular hexagonal packing, the spaces between each cylinder act as uniform pores that are small enough to let water easily pass while blocking larger compounds such as organic contaminants or hydrated salts.

“These membranes are potentially a game-changer for nanofiltration applications due to the pore size uniformity, their compatibility with scalable fabrication techniques, and the fact that pore size can be adjusted precisely in steps as small as 0.1 nanometer,” says Zhang.

This demonstration has already inspired a potential start-up: Osuji’s membranes were featured in 2020’s Y-Prize, a student business plan competition, with the winning team, LiberTech, aiming to use these membranes to remove alcohol from beer and wine while preserving its color and taste. Osuji’s lab has an eye toward making the membranes even more compatible with current mass-production techniques and taking advantage of their intrinsic resistance to bio-fouling, which helps to prevent clogging.



## ENGLISH

### A Detective Tale Starring Otto Albrecht, Penn's First Music Librarian

**Jay Kirk**, a longtime lecturer in the School of Arts & Sciences, published “Avoid the Day: A New Nonfiction in Two Movements,” a narrative centered around a detective chase for a missing Hungarian music manuscript, with Otto Albrecht—Penn’s first music librarian—as the protagonist. The painstakingly fact-checked tale, completed with the help of Kirk’s students and John Pollack of Penn Libraries, uncovers a mystery while also serving as a form of grief memoir, with Kirk peeling back the layers of his relationship with his dying father along the way to solving the central conflict. Kirk conducted most of his research in Penn Libraries’ Kislak Center for Special Collections, Rare Books and Manuscripts.

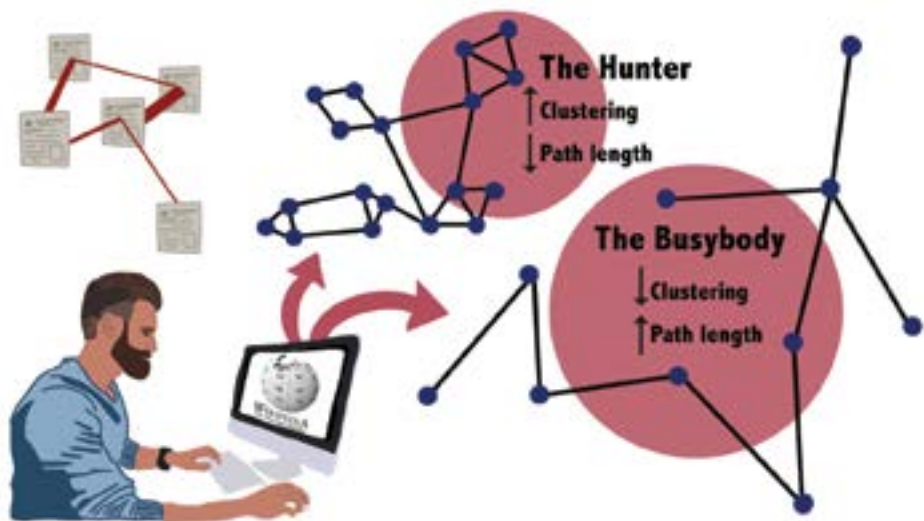
## ENGINEERING & NEUROSCIENCE

### BY STUDYING ‘HUNTERS AND BUSYBODIES,’ RESEARCHERS CAN MEASURE CURIOSITY STYLES

Curiosity plays a role in both learning and emotional well-being, but studying how people explore and obtain new information has remained a challenge. Now, research published in *Nature Human Behaviour* uses Wikipedia browsing strategies to describe different styles of curiosity. This work, developed using tools from graph theory, paves the way for understanding and using an individual’s curiosity style to help improve learning and life satisfaction.

This research was conducted by Dani S. Bassett, J. Peter Skirkanich Professor with appointments in the School of Engineering and Applied Science, the School of Arts & Sciences, and the Perelman School of Medicine; David Lydon-Staley, now an assistant professor in the Annenberg School for Communication; graduate student Dale Zhou; postdoctoral fellow Ann Sizemore Blevins; and Perry Zurn from American University.

In this study, 149 participants were instructed to browse Wikipedia for 15 minutes a day over the course of 21 days. Browsing data were recorded in the format of a knowledge network, where each unique page visited became a node and the relat-



edness between pages (determined by page text similarity) determined the thickness of the edges, or connections, between the nodes. clustering of nodes, thick edges, and short overall path lengths, while “busybodies” exhibited a looser network, with nodes further separated by thin edges and longer path lengths. The researchers also looked at how a person’s tendency either to seek information that could fill knowledge gaps or to seek novel and exciting information could impact their curiosity style.

“With this method, we have a way of capturing between-person differences in how information is collected when we act on our curiosity. This will help us to understand how the informational resources we reap while curious affect our well-being,” says Lydon-Staley.

“We are becoming increasingly aware that students exhibit diverse types of curiosity,” adds Bassett. “By valuing and respecting each style of curious practice, we make way for innovative solutions and new discoveries.”

*Curiosity styles as knowledge networks where each node is a Wikipedia page and the paths between nodes represent the similarity between pages. “The hunter” style is characterized by high clustering and low overall path length, while “the busybody” style is characterized by low clustering and high overall path length.*

**“We have a way of capturing between-person differences in how information is collected when we act on our curiosity.”**

edness between pages (determined by page text similarity) determined the thickness of the edges, or connections, between the nodes.

Participants with a “hunter” curiosity style exhibited a tight network, with relatively high



## BENJAMIN VEITEL EPHRAIM: A BANKER, WRITER—AND A SPY



Liliane Weissberg, the Christopher H. Browne Distinguished Professor in the School of Arts & Sciences, studies German-Jewish culture of the late-18th to the 20th centuries. Her new book, “Benjamin Veitel Ephraim: Kaufmann, Schriftsteller, Geheimagent,” offers both an account of the life and works of Ephraim, and a critical edition of his writings, many published for the first time.

The son of a Jewish banker, Ephraim was one of the wealthiest residents of Berlin. He minted coins and owned lace factories. He was also a student of writer Gotthold Ephraim Lessing and became the first Jew to write a German drama that was staged. Philosopher Moses Mendelssohn encouraged Ephraim to study economics, and he also wrote about politics.

But most remarkable was his secret career as a spy.

On behalf of Friedrich Wilhelm II of Prussia, Ephraim traveled to the Netherlands and France, and became a Prussian spy in Paris during the French Revolution, writing almost daily reports about the events and sending political pamphlets back to Berlin. Ephraim was a monarchist, but he wrote in favor of the French. As a Jew, Ephraim was barred from being a Prussian citizen; in Paris, he experienced a degree of freedom previously unknown to him.

After reading Ephraim’s autobiography—the Free Library of Philadelphia owns a rare copy—Weissberg decided to study his other publications, and search for unpublished texts in archives in Berlin, Potsdam, and Paris. Her book offers more than an account of a single colorful and adventurous life: It rewrites pre-emancipation German Jewish history and adds to the history of espionage.

Weissberg has lectured about her research at universities in the United States and Europe. At Penn, she ran an undergraduate workshop on espionage and secret letters, and is teaching a graduate course, Inside the Archives, to inspire more students to follow archival paths to discoveries.

## Childhood Stress and Early Molars

Children from lower-income backgrounds and those who experience greater adversity get their first permanent molars sooner, according to research published in *Proceedings of the National Academy of Sciences* from neuroscientist Allyson Mackey of the School of Arts & Sciences, graduate student Cassidy McDermott, and colleagues from the School of Dental Medicine and the University of Missouri-Kansas City.

“Right now, we’re relying on when kids hit puberty to spot early maturation. But that might be too late for meaningful interventions,” Mackey says. “It’s really important for us to understand how to detect this sooner.”

Previous research revealed that childhood stress speeds up development and that children who hit puberty earlier are at greater risk for physical and mental health problems in adulthood. The researchers wanted a scalable, objective gauge to measure this—something they found with molar eruption.

It helped that more than 100 4- to 7-year-olds had been participating in two brain development studies at Penn, which included structural and functional MRI scans.

“In one type of MRI scan called a T2 weighted scan, you can visualize the morphology of the tooth pretty well,” says McDermott. These scans showed the researchers just how close to the gum line these molars sat.

Mackey and McDermott then turned to Katherine Hilton, at the time a Penn Dental Medicine student, and Muralidhar Mupparapu, a professor in the Department of Oral Medicine. They developed a novel scale to show how close each tooth was to erupting. Four molars each received a score, which got averaged to provide a single total per individual.

Controlling for factors like age and gender, the researchers looked for associations between early environment and molar eruption.

“We found that income and adverse childhood experiences are both individually associated with molar eruptions status,” McDermott says.

Those results derived from just 117 participants, so despite the clear correlation, Mackey and McDermott wanted to replicate and expand their findings. Models using a publicly available, representative dataset called the National Health and Nutrition Examination Survey, showed similar results.

In the future, the researchers hope to collaborate with dental offices to recruit children into studies based on molar-eruption status. The goal would be to follow them into adulthood in order to get more information on what precisely early first molars may indicate.

**“Right now, we’re relying on when kids hit puberty to spot early maturation. But that might be too late for meaningful interventions.”**

Stage	1	2	3	4
Erupted?	No	Partially	Partially	Fully
Tooth location	Alveolar bone	Soft tissues	Oral cavity	Oral cavity
Follicular Sac	Present	Reduced	Reduced	No evidence
In occlusion?	No	No	No	Yes

Molar eruption rating criteria in MRI. The dashed lines represent the planes of occlusion (i.e., the planes at which the top and bottom teeth meet).

## BIOLOGY

# Hyena Moms Pass their Social Networks to Cubs

**Just like in some human societies**, in hyena clans, the offspring of high-ranking group members benefit from inherited social connections.

In a study published in *Science*, Penn biologists analyzed 27 years of detailed observations of hyena social behavior collected by researchers at Michigan State University. Their work pulls back the curtain on how social structure emerges in this highly social, hierarchical, and matrilineal species.

“We knew that the social structure of hyenas is based in part on one’s rank in the agonistic hierarchy, which we know is inherited from mothers,” says Erol Akçay, a study coauthor and associate professor of biology in the School of Arts & Sciences. “But what we found—that affiliative, or friendly interactions, are also inherited—hadn’t been shown.”

The research team mapped out hyenas’ social networks based on which individuals spent time close together.

Their findings show that hyenas inherit their mother’s social networks, so their social connections resemble their mother’s. However, offspring of higher-ranking individuals more faithfully replicate their mother’s interactions, winding up with social networks that more closely resemble their mother’s than do offspring of females that rank lower on the clan’s social ladder.

Social rank also had an effect on survivorship and reproductive success, with cubs of lower-ranked mothers less likely to survive and have offspring of their own.

For the researchers, the strong inheritance of social ties between high-ranking mothers and their offspring—and its impact—didn’t necessarily come as a surprise.

“That is kind of intuitive because things like that happen in human society as well,” Akçay says. “It happens so much we take it for granted. We inherit social connections, and there’s a lot of social science research that shows that this has a huge influence on people’s life trajectory.”

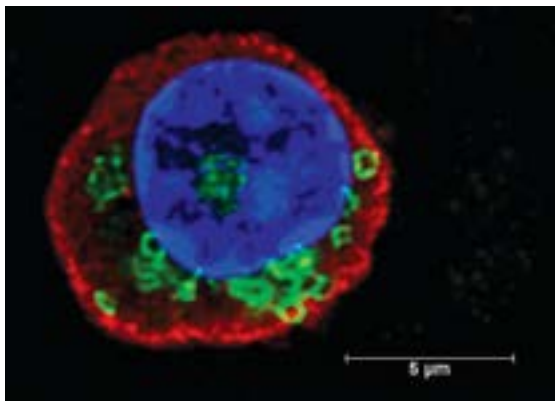


*Hyena social networks are shaped by social connections inherited matrilineally, according to Penn research.*





## Parasitic Worms Reveal the Dual Nature of a Key Immune Regulator



**De'Broski Herbert has a philosophy** that has guided his career researching helminths, or parasitic worms, and their interaction with their hosts' immune systems: "Follow the worm."

"The mantra of my lab since its inception has been that parasitic worms manipulate their hosts in very interesting ways to maintain their survival," says Herbert, a Presidential Associate Professor in the School of Veterinary Medicine.

That focus has revealed a key insight about an immune signaling molecule, the cytokine IL-33, that is important not only in parasite infections, but in a range of other health conditions, such as asthma, obesity, and eczema. In a study published in *Science Immunology*, Herbert and colleagues explain how IL-33 can both help defend the body against parasite infection, but also suppress chronic inflammation in diseases where the immune system is activated inappropriately and causes harmful pathology. A key discovery was that the activity of IL-33 depends upon which cell type is releasing it.

"I'm excited for this work because not only do we find this cytokine in a cell type that nobody was expecting," Herbert says, "but we also present a mechanism that no one was expecting for how it could come out."

Researchers had known that IL-33 could "wake up" the immune system to the presence of a worm infection, allowing for faster clearance. The new study showed that while IL-33 from the epithelial cells, those that line mucosal surfaces, helped in eliminating infection, the same cytokine produced by dendritic cells, which present antigen to the immune system's myeloid cells, significantly slowed clearance. This source of IL-33, the team discovered, supported regulatory T cells, which act to suppress the immune system.

The study paves the way for even more translational work in immunology—and worms are to thank.

"It's kind of the missing link," Herbert says.



ABOVE LEFT: Samples of nasal polyps removed from patients with chronic rhinosinusitis revealed the perforin-2 protein (labeled in green) in the cellular plasma membrane.

ABOVE: De'Broski Herbert of the School of Veterinary Medicine.

## Using Mixed-Methods Approach, Stockton Study Reveals Benefits of Unconditional Cash

In February 2019, Michael Tubbs, then the mayor of Stockton, California, led an initiative to give 125 Stocktonians \$500 of unconditional cash for 24 months. Tubbs enlisted Amy Castro of the School of Social Policy & Practice, along with Stacia West of the University of Tennessee, to organize a philanthropically funded randomized control trial (RCT).

In March 2021, the Stockton Economic Empowerment Demonstration was at last able to release a preliminary analysis of the project's first year, spanning from February 2019 to February 2020.

Ultimately, the analysis found that, when given unconditional cash, and compared to a control group, Stocktonians experienced a measurable increase in mental health and wellbeing, reporting fewer symptoms of depression and anxiety over time. They were able to absorb a \$400 emergency expense more easily, were more likely to find full-time employment, once barriers like childcare were resolved, and had increased cognitive capacity to set new goals.

The results also detailed, importantly, a spillover effect. Stabilizing financial volatility in one person within a household tended to stabilize the finances of people around them, because they were often borrowing from friends and family to make ends meet.

Uniquely, Castro says, the RCT was organized in a way that was transparent and intended to engage the public. A mixed-methods RCT was developed in which the team was able to marry quantitative analysis with qualitative findings from 25 people who consented to be public about their experiences while going through the project. The idea was, she says, to "capture the imagination" of the public by demonstrating real impacts on people.

"If you want a shift in public policy, you need consensus in empirical literature and a shift in public mood," Castro says.

"We knew we had an opportunity to do that with this project."

The other transparent act was to release one year

of results. The next batch of results was released in the spring of 2022, highlighting the effects of the cash on Stocktonians' finances during pandemic.

The project has since birthed the Center for Guaranteed Income Research at Penn, which is currently partnering with 28 cities around the country to pilot guaranteed income projects.





Through the Center for Sustainable Separations of Metals, (from left) Joseph Subotnik, Jessica Anna, and Eric Schelter will combine their expertise to develop new chemical separation strategies to make recycling more economical.

CHEMISTRY / Q&A

## NEW WAYS TO RECYCLE RARE EARTH METALS



Rare-earth metals play a vital role in the creation of cell phones.

In 2019, the Center for Sustainable Separations of Metals (CSSM) was established as a meeting point for fundamental chemistry research focused on improving the recovery of metals from post-consumer products.

Led by chemists from Penn, researchers in the CSSM are working on new ways to recycle rare earth metals, with the long-term goal of reducing pollution, greenhouse gas emissions, and energy use, while promoting political and environmental sustainability.

The CSSM is directed by Eric Schelter, a professor of chemistry in the School of Arts & Sciences, who shares more details about the CSSM's goals, its recent achievements, and what researchers are looking forward to in the future.

**Q: What motivated the launch of the CSSM?**

**A:** My research group has been studying new chemical separations of critical metals for some time, but there is a growing urgency to deliver purified raw materials through diverse supply chains to support renewable energy while reducing environmental harm and minimizing resource conflicts. Based on the unique expertise on campus, and alignment with Arts & Sciences and Vagelos Institute for Energy Science and Technology sustainability priorities, there was an important opportunity to develop leadership in this area.

**Q: What makes Penn's Department of Chemistry a great place to do this type of research?**

**A:** CSSM faculty at Penn provide the heart of the diverse and creative scientific team that we have assembled to work on these important problems. There is an exceptional spirit of collaboration in Penn Chemistry that drives our efforts, and a willingness to learn from each other that enables collective success for our faculty and trainees.

**Q: What do you consider the Center's biggest achievements since its launch three years ago?**

**A:** Through the hard work of our student and postdoc trainees, we've gained insights into selective processes involving the transfer of electrons in chemical reactions, developed new chemistry to make processing 'conflict elements' tantalum and niobium more sustainable, demonstrated new chemistry for recycling tellurium from spent solar panels, and shown new methods to purify lithium for batteries. We've also demonstrated methods to purify gold that eliminate the use of cyanide and mercury.

**Q: What are you most looking forward to in the coming years?**

**A:** We are looking to grow our efforts and have recruited a broader cohort of scientists from both within and outside of Penn. On campus, this has meant engaging scientists from Chemistry, Earth and Environmental Science, and the School of Engineering and Applied Science, and taking a more holistic view of separations systems and practical solutions. Through these interactions, we've identified new concepts—for example, using selective reactions with light—that we are excited to try in the lab.





LEFT: Junior Gabriela Montes de Oca from Houston interned in the lab of Annenberg's Andy Tan and worked on Project Resist.

MIDDLE TOP: An image from the digital humanities project "Sunset over Sunset," which is being led by Penn's Francesca Ammon.

MIDDLE BOTTOM: A still from "The Poldergeist" animated video showing a cartoon figure in a mock therapy session.

RIGHT: Focusing on parasitic nematodes that draw nutrients from plants, sophomore Linda Wu tests whether the parasites are specialists or generalists in the types of plants they infect in the lab of biology professor Corlett Wood.



## RESEARCH & TRAINING

# Training the Next Generation of Researchers

Research is central to Penn's mission, and plays a critical role in contributing to society by educating the scholars of tomorrow across all academic areas, particularly those studying in fields that address the world's most pressing needs.

Training the next generations of researchers begins at the undergraduate level, where students embark on their first inquiries. At the graduate level, students fully develop their research skills, and then, as postdocs, researchers consolidate their training to prepare for faculty or industry positions.

Penn has an abundance of programs to provide students with world-class training and research opportunities to prepare them for the future.

"Research makes students' ideas come alive and helps them think through, and have an impact on, critical real-world challenges," says Dawn Bonnell, the senior vice provost for research. "That kind of discovery is especially valuable for our undergraduates, who may be having their very first experiences with hands-on research work."

The University's Center for Undergraduate Research and Fellowships (CURF) is the hub for all Penn undergrads to deepen their academic experience by participating in research, applying for nationally competitive fellowships, or engaging intellectually with a cohort of scholars.

Karen Detlefsen, the vice provost for education, says CURF provides a host of opportunities for students to do research, especially through the Penn Undergraduate Research Mentoring Program (PURM), which connects undergraduates with faculty for paid summer research projects.

With funding from PURM, Justine Seo and Rebekah Lee of the School of Arts & Sciences and Jenesis Cochrane of the School of Engineering and Applied Science have been working with Simon Richter, a professor of Germanic languages and literatures in the School

of Arts & Sciences, on his "The Poldergeist" animated video series. The goal of the project is to raise awareness about the climate crisis and the dangers of sea-level rise in The Netherlands.

Through an internship facilitated by PURM, Oulaya Louaddi, a sophomore in the School of Nursing, and Gabriela Montes de Oca, a junior Health & Societies major, worked with Annenberg School for Communication researcher Andy Tan on Project Resist, a five-year study funded by the National Cancer Institute aimed at designing culturally appropriate anti-smoking campaigns for young women who identify as sexual minorities.

PURM also supports work by Francesca Ammon, an associate professor in the Department of City and Regional Planning at the Stuart Weitzman School of Design, and juniors Julian Valgora, Gerardo Ramirez Lopez, and Juliette Morfin in the School of Arts & Sciences to catalog and organize photographs for the digital humanities project "Sunset over Sunset," which will use a vast collection of photographs from artist Edward Ruscha to understand the impacts of small-scale changes on the urban environment.

Therese S. Richmond, a professor and the associate dean for research and innovation at the School of Nursing, says the school's undergraduates are frequently hired as research assistants on funded projects. Her office oversees a student pilot grant program in which undergraduate and graduate students can, with a faculty mentor, submit a proposal asking a pertinent question, and receive funding to carry out the research.

Ph.D. students are the linchpin of many aspects of Penn's research enterprise, mentoring the undergraduate students while also prepping themselves to become postdocs or industry leaders. The Presidential



*“Research makes students’ ideas come alive and helps them think through, and have an impact on, critical real-world challenges.”*

Ph.D. Fellows, launched in the fall of 2020, is just one program at Penn that supports doctoral students who are interested in innovative and impactful research programs, especially those that support the University’s commitment to inclusion.

More than 1,300 postdoctoral fellows are conducting research across the schools on campus. The vast majority are in the biomedical realm in the schools of Medicine, Nursing, Veterinary Medicine, Dental Medicine, Arts & Sciences, and Engineering and Applied Science.

Kelly Jordan-Sciutto (see write-up, p. 11), a professor and associate dean at Penn Dental Medicine, also directs the Biomedical Graduate Studies, which features 967 students participating in research from molecules to populations. The program oversees training grants for students to apply to the National Institutes of Health, and offers them cutting-edge research opportunities in laboratories with scholars who are leaders in their fields.

“Another area that we have continued to build on is making sure that students are developing those professional skills beyond the lab that make them successful for the career of their choice,” she says. “Being a good scientist is critical, but so is being able to communicate that science to a variety of audiences, for example. Career development is an area that we’ve significantly expanded the resources provided for our students, which we believe will make them the scientific leaders of tomorrow.”

In all of these programs, Penn students and postdoctoral fellows are exploring research to define innovative new frontiers of knowledge, shaping the future while experiencing the excitement of discovery and advancing their own journeys to become the future leaders of research around the world.

## STATISTICS

### **Black Communities Face Higher Gun Homicide Rates, Regardless of Socioeconomic Status**

According to a study published in *JAMA Network Open* by Dylan Small, a professor of statistics at the Wharton School, and Yuzhou Lin and Audrey Chaeyoung Cheon, undergraduate students in the School of Arts & Sciences, regardless of socioeconomic status, Black communities face higher gun homicide rates.

Using data from the Gun Violence Archive and American Community Survey, the researchers found that, among middle class neighborhoods, the rate of gun homicides is more than four times higher in neighborhoods with mostly Black residents than neighborhoods with mostly white residents.

Small says reasons for the disparity include institutional racism, underinvestment in communities, and housing segregation.

“Black families have systematically lower household wealth than white families, including lower home values,” says Small. “In addition, there tends to be less public and private investment in majority-Black neighborhoods. That can translate into fewer resources in the neighborhood, especially relative to need. For example, a lack of resources for programs for adolescents and young adults that might help them to stay away from gangs and street conflicts.”

Small says America’s history of racially segregated housing puts Black individuals at higher risk of gun homicide than socioeconomically comparable white individuals.

“The U.S. remains highly residentially segregated by race despite improvements since the 1960s,” he says. “Besides residential segregation reducing Black individuals’ socioeconomic status by such mechanisms as inhibiting wealth accumulation through housing value and limiting access to high-quality schools, our findings suggest that even among neighborhoods of the same socioeconomic status, residential segregation may put Black individuals at higher risk of gun homicide.”

The researchers suggest that public policies to reduce gun violence and racial disparities need to go beyond alleviating poverty. They plan to continue researching and analyzing several aspects and results of the project.







## ARCHITECTURE

# ARCHITECTURE AND DESIGN FOR A CHANGING WORLD

ABOVE: A *Building with Nature* project in Demak, Indonesia. *Building with Nature* works from the idea that nature can be harnessed to address multiple sustainable development goals simultaneously.

TOP RIGHT: A simulation demonstrating how higher wall reflectance can lead to “hot spots” (shown as red squares) where UV light leaks into the lower, occupied zone.

The dual crises of climate change and COVID-19 have shed new light on the role and importance of the built environment in addressing both challenges. Over the past year, architects, landscape architects, and planners from the Stuart Weitzman School of Design have developed and shared innovative design strategies that can help society move toward a greener, healthier future.

Associate professor Daniel Barber’s book “Modern Architecture and Climate: Design before Air Conditioning” details how pre-World War II architects used shading devices and other techniques to create comfortable interiors before the widespread use of air conditioners.

Since then, a reliance on heating, ventilation, and air conditioning systems has led to modern spaces that are entirely sealed off from the outside, resulting in increased carbon emissions as temperatures rise, as well as making it more challenging to mitigate the spread of COVID-19.

“Not only will carbon emissions increase with increased ventilation, this could also frustrate numerous efforts to push toward policies and practices that manage air conditioning and manage emissions in more efficient [ways],” says Barber. “In mitigating the effects of one public health crisis [the COVID pandemic], we risk exacerbating another public health crisis, that of climate change.”

Assistant professor Dorit Aviv and her Thermal Architecture Lab are actively working to address some of these challenges. One recent study, published in *Indoor Air*,

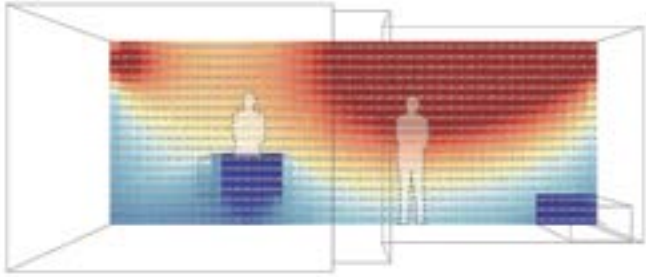
uses simulations to provide guidance on how to best use ultraviolet germicidal irradiation to disinfect occupied rooms. The researchers were able to determine how different design variables impacted the distribution of UV light between a room’s upper zone, where disinfection should take place, and a lower “occupied” zone, where UV light leakage should be minimized.

Another paper by Aviv, published in *Applied Energy*, provides an approach for creating comfortable, well-ventilated indoor spaces through radiant cooling, which decouples temperature control for comfort from ventilation for indoor air quality by relying on surface-level cooling alongside natural ventilation. They found that a combination of natural ventilation and membrane-assisted radiant cooling could reduce energy use across 60 major cities up to 45%.

“This was already something we were pushing for because we realized it had the potential for major energy savings, but when the COVID crisis started, this became even more relevant,” says Aviv. “Now that we’re facing this crisis, we should really reconsider how we design buildings for heating, cooling, and ventilation.”

Matthijs Bouw, a professor of practice in architecture and landscape architecture, recently brought together experts from science, engineering, design, and nonprofits in the book “Building with Nature: Creating, Implementing, and Upscaling Nature-based Solutions.” Edited by Bouw, the

## The Resilience of Latino Immigrants in the Face of Anti-Immigrant Rhetoric



book describes the key concepts of EcoShape, a Dutch initiative to promote eco-friendly building practices through hydraulic structures.

“Building with Nature works from the idea that nature can be harnessed to address multiple sustainable development goals simultaneously, which represents a departure from conservation practice and is especially critical in emerging economies,” Bouw states in his essay “Learning from Place.” “The ambition of EcoShape is to replicate the successful integration of Building with Nature in a range of landscapes and environments elsewhere.”

In “A Blueprint for Coastal Adaptation,” a new volume co-edited by Billy Fleming, the Wilks Family Director at The Ian L. McHarg Center for Urbanism and Ecology, and Carolyn Kousky, executive director at the Wharton Risk Center, researchers identify a bold new research and policy agenda for areas that are at risk from sea-level rise, increased tidal flooding, and intensifying storms.

**“Now that we’re facing this [COVID] crisis, we should really reconsider how we design buildings for heating, cooling, and ventilation.”**

“‘A Blueprint for Coastal Adaptation’ was always intended to offer a bold framework for national investments in climate adaptation to a new administration—this one in particular,” says Fleming. “Its proposals range from incremental interventions at the project-scale to wholesale transformations of the political economy at a national scale, with key insights from scholars of climate law, economics, policy, and design embedded in each step along the way.”

Bouw, Karen M’Closkey, an associate professor of landscape architecture, and Keith VanDerSys, a lecturer in the Department of Landscape Architecture, are counted among the experts who discuss the challenges facing coastal communities.

**Donald Trump’s anti-immigrant rhetoric** and policy proposals were front and center during the 2016 presidential election, and Michael Jones-Correa, the President’s Distinguished Professor of Political Science in the School of Arts & Sciences, wanted to find out how they played into the civic behavior of Latino immigrants.

Jones-Correa, the founding director of the Center for the Study of Ethnicity, Race and Immigration at Penn, together with James McCann of Purdue University, launched a series of surveys tracking immigrants’ attitudes before, during, and after the election of former President Donald Trump. Their findings are laid out in the book “Holding Fast: Resilience and Civic Engagement Among Latino Immigrants.”

Published by the Russell Sage Foundation, the book is unique in that it follows first-generation immigrants across three time periods, examining almost in real-time how immigrants reacted to Trump’s nomination, election, and presidency.

Jones-Correa says one of the surprising findings from their research is that instead of going into hiding in the face of Trump’s xenophobic rhetoric—the prevailing message in the media—Latino immigrants showed resilience by staying engaged and involved in civic and political activities, regardless of their citizenship status. In some aspects, such as volunteering and engaging in protests, they became even more involved.

“There’s a kind of doubling down, with people saying, ‘We’re here and we’re going to make our voices heard,’” Jones-Correa says.

Their findings held true nationally, across more liberal states like California, as well as more conservative states such as Georgia and Texas.

“That surprised us because we thought there might be more variation across regions,” says Jones-Correa. “The overall story that holds up very well across these three waves [of surveys] is a story of continued engagement and resilience in the face of this xenophobic backlash.”

Jones-Correa says he hopes readers take away from the book the notion that immigrants aren’t invisible, and they’re making their voices heard.

“There’s a tendency both among liberals and conservatives to treat immigrants as people who are acted on rather than actors in their own right,” he says. “The message of this book is that immigrants are significant political actors in their own right, and only going to be more so.”







## NEUROSCIENCE

# How the Brain Sees the Familiar and Imagines the Future

The brain is a mysterious entity, one that psychologists and neuroscientists across Penn continue to decode. Their aim is to better understand the processes occurring beneath the surface when someone sees something familiar, for example, or imagines the future.

In *Proceedings of the National Academy of Sciences*, Nicole Rust published findings on the former, based on research funded by the National Institutes of Health (NIH), National Science Foundation, Simons Foundation, and Howard Hughes Medical Institute.

“When a person views a familiar image, even having seen it just once before for a few seconds, something unique happens in the human brain,” says Rust, an associate professor in the Department of Psychology in the School of Arts & Sciences.

Until recently, neuroscientists believed that vigorous activity in a visual part of the brain called the inferotemporal (IT) cortex meant the person

was looking at something novel, like the face of a stranger. Less IT cortex activity, on the other hand, indicated familiarity.

Something about that theory, called repetition suppression, didn’t hold up for Rust.

“Different images produce different amounts of activation even when they are all novel,” she says. Beyond that, other factors like an image’s brightness or contrast result in a similar effect.

As an alternative, she and postdoctoral fellow Vahid Mehrpour, Penn research associate Travis Meyer, and Eero Simoncelli of New York University proposed and demonstrated a new theory, one in which the brain understands the activation level expected from a sensory input and corrects for it, leaving behind the signal for familiarity.

They call it sensory referenced suppression, and better grasping it could have long-term implications for treating memory-impairing diseases like Alzheimer’s.

“By understanding how memory in a healthy brain works,” Rust says, “you can lay the foundations to develop preventions and treatments for all sorts of memory-related disorders.”

Joseph Kable, the Baird Term Professor in the Department of Psychology, works on a different facet of brain function: decision-making. Several recent experiments, funded by the NIH’s National Institute on Drug Abuse, focused on what happens when someone ponders the future.

In a *Journal of Neuroscience* paper, Kable and two former graduate students in his lab, Trishala Parthasarathi, now at the company OrtlebyBio, and

**“By understanding how memory in a healthy brain works, you can lay the foundations to develop preventions and treatments for all sorts of memory-related disorders.”**

Sangil Lee, a postdoctoral fellow at the University of California, Berkeley, discovered that when someone imagines the future, two parts of the brain’s default mode network (DMN) play complementary roles.

The DMN activates in quiet moments, Kable explains, “when people aren’t asked to do anything in particular, as opposed to being asked to do something cognitively.” When someone thinks about the future, it turns out, one part of the DMN helps create and predict an imagined event, what the researchers call the “constructive” function. The other assesses whether that constructed event is positive or negative, what they call the “evaluative” function.

“When psychologists talk about why humans have the ability to imagine the future, usually it’s so we can decide what to do, plan, make decisions,” Kable says. “But a critical function is the evaluative function; it’s not just about coming up with a possibility, but also evaluating it as good or bad.”

According to Kable, the findings offer a first step toward understanding the basis of imaginative abilities. This research asked participants to evaluate an imagined event’s positivity or negativity, but more complex assessments—moving beyond a simple good-versus-bad dimension, for instance—might offer additional clues about this neural process.

That kind of analysis will likely comprise future work for this lab, which has started to parse why people don’t value future outcomes as much as they do those that are immediate.

## CRIMINOLOGY

# A SIMPLE TEXT MESSAGE CAN REDUCE COURT NO-SHOWS

In the United States, low-level criminal offenses can sometimes result in a ticket and court date. Failing to show up to that court appearance can lead to an arrest warrant. Criminologist Aurélie Ouss of the School of Arts & Sciences wanted to know what would happen if that criminal justice process was tweaked slightly. Would some of these missed appearances vanish?

The answer, it turns out, is yes.

In partnership with the New York Police Department and the Mayor’s Office of Criminal Justice, plus colleagues from the University of Chicago and the nonprofit ideas42, Ouss conducted two field studies in New York City and several lab experiments. She and colleagues learned that text message reminders and a better-designed summons improved court appearance rates by 21% and 13%, respectively, and jointly led to 30,000 fewer arrest warrants over three years, findings they published in the journal *Science*.

The work began when conversations with the NYPD revealed that in New York, about 40% of people issued summonses for low-level offenses weren’t showing up to court. Beyond leading to an arrest warrant, this absence potentially cost the defendant \$250 and up to 15 days in jail, and could intensify future encounters with law enforcement.

But the researchers weren’t convinced people skipped court on purpose. Perhaps, instead, they didn’t know they had to show up. After all, the summons ticket from the initial encounter was the only place with notification about an upcoming court date. And the information lived at the bottom, beneath details about the original offense and issuing officer’s name. Warnings about an arrest warrant appeared only on the back.

Ouss and colleagues made some adjustments.

“We put the fact that you had to show up and your date and time at the top,” she says. They also added a bolded note on the front that missing the court date would lead to an arrest warrant. Switching to the new forms decreased the failure-to-appear rate by 13%.

Next, the researchers tried text messages. Defendants who received the new summons could choose to provide a cell phone number to the citing officer, and 23,243 did. The researchers then



randomly assigned participants to one of four conditions, three of which received a text seven days, three days, and 24 hours prior to their scheduled court date. The content of the messages differed.

A “plan-making” group received date and location information, plus a prompt suggesting the need to make a plan. A “consequences” group received a date-and-time reminder, plus explicit information about the issuance of an arrest warrant should they miss it. In a “combination” group, participants received a mix, ending with one text about the penalty for skipping court.

“The combination and consequences messages were most effective,” says Ouss, the Janice and Julian Bers Assistant Professor in the Social Sciences. “But even simple message reminders helped people show up to court.”

On average, text messages reduced failure-to-appear rates by about 21%.

Ouss and colleagues estimate that combined with the redesigned form, text message interventions helped avoid at least 30,000 arrest warrants between August 2016 and September 2019. In addition, because about two-thirds of the people who receive summonses get their case dismissed simply by appearing in court, the researchers estimate these interventions resulted in about 20,000 fully dismissed cases rather than open warrants.

“We operate under the assumption that when people are in the criminal justice context, they’re failing on purpose,” Ouss says. “A lack of awareness can explain this behavior, yet our criminal justice policies are not targeting these kinds of problems. It’s important to design interventions that address this instead of increase penalties.”





*The Blanco Telescope dome at the Cerro Tololo Inter-American Observatory in Chile, where the Dark Energy Camera used for the recently completed Dark Energy Survey was housed.*

## Dark Energy Survey Interim Analysis Sheds Light on the Evolution of the Universe

Interim results of the first three years of data collected by the Dark Energy Survey (DES) offer a key step toward understanding the role of dark matter and dark energy in the accelerating expansion of the universe.

Researchers from Penn involved with the DES, a global collaboration of more than 400 scientists from 26 institutions, include professors Gary Bernstein, Bhuvnesh Jain, Masao Sako, and a team of students, postdoctoral researchers, and staff from the Department of Physics & Astronomy in the School of Arts & Sciences.

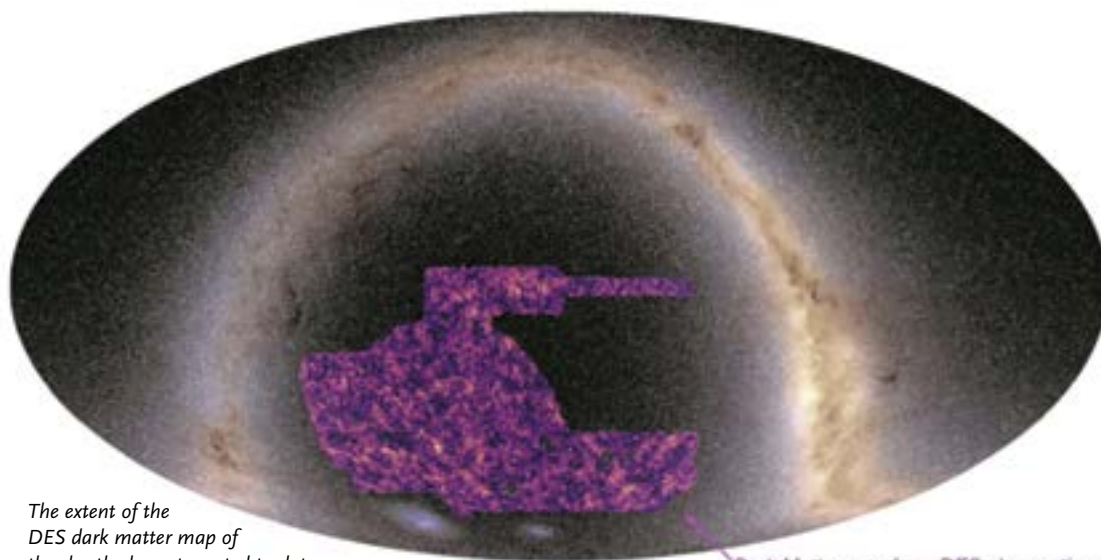
“Here at Penn, we are fortunate to have had a brilliant group of students and postdocs who have led the analysis, spanning pixel-level images to theoretical cosmological inference,” says Jain.

The interim analysis culminated in an impressive 30 papers (either already published or under peer review prior to publication) of catalogs, calibration methods, theoretical models, and cosmological results, including the most precise 3D map of the universe to date.

One milestone result was a comparison of DES data with cosmic microwave background measurements from the European Space Agency’s Planck observatory. While there have been hints from DES and other surveys that the universe is less “clumpy” than predicted, the interim results are consistent with these tantalizing hints, but are still short of being statistically conclusive; if analyses of the remaining DES data no longer agree, however, it could mean that there is an additional as-of-yet undiscovered aspect of the universe.

“We have spent much of the past 20 years developing the theory, techniques, and hardware to conduct these measurements, along with taking the data and analyzing it,” says Bernstein. “It’s a pleasure and a thrill to see these results.”

Additional publications include a method developed by postdoc Carles Sánchez that uses weak gravitational lensing effects to help constrain redshift distributions. A key challenge faced by researchers is using these distributions, an indica-



*The extent of the DES dark matter map of the sky, the largest created to date, using data from the first three years of the survey.*

*Dark Matter map from DES observations*

tion of how far away a galaxy is, while ensuring that redshifts are accurately inferred since they are not directly measured. Sánchez's paper is one of three approaches for obtaining better redshift estimates, allowing researchers to more accurately estimate parameters that are essential for understanding dark matter and dark energy.

"One of the most important things of this analysis is that we've actually advanced the state of the art in the field in several parts, especially in redshift calibration, which was one of the most concerning things for everyone before," Sánchez says.

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***"We have spent much of the past 20 years developing the theory, techniques, and hardware to conduct these measurements, along with taking the data and analyzing it. It's a pleasure and a thrill to see these results."***

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A paper by Ph.D. student Shivam Pandey found that a combination of data sources, including galaxy positions, shapes, and a cross-correlation of the two signals, can be used to determine the density of dark matter and the properties of dark energy from the dataset. In addition, postdoc Marco Gatti is the lead author of a new method for inferring galaxy distance and redshift distributions, as well as an updated weak lensing galaxy shape catalog. He is also the co-lead author on the new mass map, which Gatti says is "a legacy for our collaboration."

The methods developed during the interim analysis are an essential step toward analyzing the complete six-year dataset and will provide an even more precise picture of dark matter and dark energy.

"Very soon, we will be under a deluge of data, so surveys like this are key in testing your modeling or theoretical advances using actual data," says Pandey. "Whatever we test here is directly applicable to future surveys, and these results and the results of the final analysis will be a very important part for the community in general."

There's excitement about what comes next for DES and all of the unanswered questions that researchers hope to address soon.

"We have the best data right now in the world, so everything you do is the first time," Gatti says. "That's a big responsibility, but it gives you also a lot of satisfaction."

## PEDIATRICS

# Infants Experiencing Opioid Withdrawal Treated in Poorer-Quality Hospitals

**Babies exposed to opioids** prenatally can experience withdrawal symptoms once they're born, including higher heart rate, diarrhea, and jerky body movements. When enough indicators surface, a newborn may get diagnosed with neonatal abstinence syndrome (NAS).

Incidence of NAS has increased five-fold in the past decade, in line with an uptick in opioid use and addiction in the United States. Eileen Lake, the Edith Clemmer Steinbright Professor in Gerontology in the School of Nursing, wanted to know where these babies most often receive care.

"I developed an interest in better understanding this unique patient population," she says.

In collaboration with Penn Nursing fellows Rachel French and Rebecca Clark, Kathleen O'Rourke of the Hospital of the University of Pennsylvania, and Scott Lorch of the Children's Hospital of Philadelphia, Lake analyzed data on more than 3,100 babies diagnosed with NAS at 266 different locations.

These newborns, the researchers learned, are more frequently cared for in poorer-quality hospitals, findings the team published in the journal *Hospital Pediatrics*.

The work, which built on Lake's previous research, set out to answer two questions: Where are newborns with NAS being born, and what is the quality and safety of these hospitals? To conduct a retrospective cohort study, they looked at three datasets for the year 2016, the most recent comprehensive data available.



The first, RN4CAST-US, is a survey of hospital registered nurses from California, Florida, New Jersey, and Pennsylvania, states that account for about 25% of U.S. births annually. The researchers also looked at inpatient discharge abstracts from those four states and the American Hospital Association annual survey.

Of 659,403 infants born in those hospitals, about 1% or 3,130 were diagnosed with NAS. But "rather than being sprinkled all over, these babies were concentrated in certain places," Lake says, "poorer-quality facilities that aren't as safe."

She suggests the results offer a wake-up call.

"These babies are going through withdrawal. They're more sensitive to quality and safety than your average newborn," she says. "To care for them is very challenging, and they're in poorer-quality hospitals. It is alarming and unfortunate."



## In Partnership with the State, a Focus on Wildlife Health

When wildlife biologist Matthew Schnupp began his career, the emphasis was on conserving habitat. But he sees a new paradigm emerging as infections like chronic wasting disease (CWD), white-nose syndrome, and West Nile virus take a toll on animals and the people who value them.

“I would venture to say that, in the next 20 to 30 years, the new model for management will be ensuring the resiliency of wildlife populations through wildlife health issues,” says Schnupp, director of the Pennsylvania Game Commission’s (PGC) Bureau of Wildlife Management.

Penn’s veterinary expertise has an important role to play. In 2019, the School of Veterinary Medicine and the PGC joined forces to create the Wildlife Futures Program, an effort to safeguard wildlife health across the state and region. Co-led by Penn Vet’s Julie Ellis, an ecologist, and Lisa Murphy, a veterinarian and toxicologist, together with Schnupp, the program has allowed the school to hire new staff dedicated to wildlife health who collaborate with PGC employees to monitor disease threats, develop research projects, enhance communication and public engagement around wildlife health issues, and respond to challenges as they arise.

“Wildlife health is just so complex,” says Ellis. “It involves, by necessity, multiple disciplines. You need modelers, you need epidemiologists, you need virologists, and on and on. State wildlife agencies generally don’t have those types of people on their staff. Through this program, we’re working with the Game Commission to identify its needs and help it get ahead of some of the problems wildlife diseases can bring.”

“We’re building on established expertise here while bringing in new expertise with the support from PGC,” adds Murphy.

Since its launch, supported by \$10 million in seed funding from the PGC, Wildlife Futures has tackled both established and novel concerns to wildlife health. CWD, a contagious and fatal disease affecting deer, is spread by misfolded proteins called prions. One of the program’s first efforts was to set up a new, USDA-accredited lab space for CWD testing at the New Bolton Center



ABOVE: Investigating chronic wasting disease in deer is a top priority of the Wildlife Futures Program.

RIGHT: Lisa Williams, a state wildlife biologist, examines a ruffed grouse. Wildlife Futures is supporting investigations into emerging diseases such as West Nile virus, which threatens the grouse.

**“Wildlife health is just so complex. It involves, by necessity, multiple disciplines. You need modelers, you need epidemiologists, you need virologists, and on and on.”**





to expedite testing of deer killed by hunters. More recent efforts have looked into whether scent detection dogs at the Penn Vet Working Dog Center can identify the scent of CWD.

With support from Wildlife Futures, other projects are examining the impact of rodent poisons on carnivores in the region, investigating red blood cells in bats and deer with an eye toward developing new diagnostics of blood-based infections, and developing new assays to look for SARS-CoV-2 and other coronaviruses in bats. The program also leapt into action in the spring and summer of 2021, ramping up diagnostic testing when a mysterious illness befell songbirds across the mid-Atlantic region.

As a partner and participant in the new Institute for Infectious and Zoonotic Diseases at Penn, for which Murphy and Ellis serve as associate directors, Wildlife Futures is positioned to continue playing a role in critical issues impacting humans, animals, and the environment we all share.

“There are some real opportunities here in terms of preserving wildlife and the environment they live in as a resource that all people can appreciate and enjoy,” says Murphy. “Whether you hunt, enjoy having wildlife in your backyard, or just appreciate knowing that there are wild areas out there, this program is supporting the health of those animals and those wild places. It really is all tied together.”



## LITERATURE

# POETRY AND POWER IN THE PERSIAN POETIC TRADITION

**Fatemeh Shams**, an assistant professor of Persian literature in the School of Arts & Sciences, grew up in the Islamic Republic of Iran and has been a practicing poet since she was 14. As a poet there, she says, she's lived a sort of “double life,” demarcated by writers sponsored and promoted by the state—state-sponsored newspapers, broadcast stations, for example—and those whose literary output have always remained independent from governmental institutions and challenged the official literary discourse. Shams has since become interested in what she calls an “alternative literati.”

That double life is what inspired her book, “A Revolution in Rhyme,” published by Oxford University Press.

“I always wanted to do something about this duality and make sense of it,” she says.

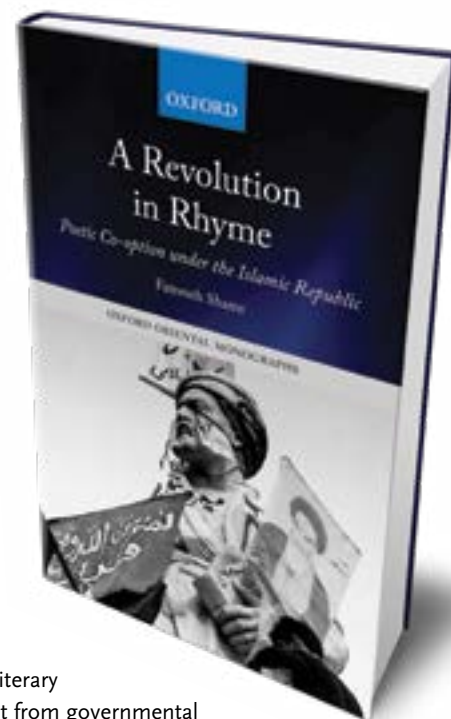
After she pursued her doctoral studies at Oxford, she began to explore poets' relationships with the Iranian government. The book is the result of almost a decade of research and consists of seven chapters that explore the dynamics between power and poetry in the millennium-old Persian poetic tradition.

Early in the text, Shams discusses how the relationship between poetry and power did not begin with the 1979 Iranian Revolution, but is actually linked to poetry and politics in medieval Iran and a pre-modern system of patronage. She goes on, in additional chapters, to explore how some state-sanctioned poets began as grassroots revolutionaries, the role of poets in disseminating the ideology of martyrdom during the Iran-Iraq War in the 1980s, how poems came to be transformed into songs that transcended political ideologies, and how the poetic discourse came to change as political ideologies also did.

This is the first book on the topic of Persian poetry and the Islamic Revolution in which the author reflects on parallel case studies such as Soviet Russia to show similar ways in which the literati respond to revolution and ideological transformation. The book also contains translations of modern Iranian poetry and previously unpublished interviews with Iranian artists and poets.

One core theme of the book, Shams says, is to rethink the relationship between literature and revolution.

“It was important for me to convey to readers that although there is a relationship between literature and ideology and revolutions, revolutions are not the cause of literary change, and vice versa,” she says. “I think it's important to challenge this reductionist and disruptive perspective in the study of literatures and revolutions.”





# The Effect of Humans on Galápagos Sea Lions



*“We confirmed that the increasing population of the Galápagos can change animal behavior.”*



*In collaboration with Penn, Galápagos high school students observed sea lion colonies on the island of San Cristóbal to better understand how the animals' behavior changed around people.*

On Galápagos beaches, sea lions and people share space, but until recently, it wasn't clear how that cohabitation influenced the endangered animals.

After 21 months of collecting data and watching sea lion behavior, a team led by Michael Weisberg of the School of Arts & Sciences, in collaboration with local community scientists, determined that humans conclusively affect sea lions. They published the findings in *Wildlife Biology*.

Specifically, on more-crowded beaches, the animals respond less aggressively to people, likely because they've acclimated to humans or because those with low tolerance for people avoid these sites. Beyond that, as animal group size increases, sea lions get more aggressive toward each other and less aggressive toward humans.

“We confirmed that the increasing population of the Galápagos can change animal behavior,” says Weisberg. “That’s something to take very seriously.”

As sea lion populations dropped from around 40,000 in the late 1970s to about 16,000 in 2001—where they've stayed—the issue has become more urgent, says Justin Walsh, a postdoctoral researcher in the Department of Biology, who co-led the work. “We really wanted to understand the effect of human disturbance on sea lions.”

For several years, Weisberg has partnered with locals to answer pressing scientific questions about the Galápagos. For this project, he, Walsh, and Virginia Tech assistant professor Karen Kovaka teamed up with high school students at the UAE-San Cristóbal School. The students went out twice a week between June and December of 2017 and 2018 to record sea lion behavior on four beaches.

With guidance from the researchers and several Penn undergrads, the students scored and recorded individual animal's aggression, both in response to a person approaching and from afar, following observation. They also took a population census.

Analyzing these data revealed that on the beach most affected by people, the animals reacted the least.

“This is an issue that the community cared about. It's salient in their day-to-day lives,” Weisberg says. “We were able to work together to learn about it. Participating really engaged them deeply in the process of conservation.”

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