2019/2020

GW

# Arts & Sciences

## Saving the Bay
AN ENVIRONMENTAL RESCUE MISSION

## Mapathoners Make Their Mark
WORLD AID WITH THE CLICK OF A MOUSE

## Shadows of Apartheid
A SURVIVOR'S FIGHT FOR JUSTICE

## Lights! Camera! Action!
ALUMNUS CALLS SHOTS FROM THE DIRECTOR'S CHAIR

THE GEORGE WASHINGTON UNIVERSITY
COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Columbian College

# BY THE NUMBERS

## 3 SCHOOLS

- Corcoran School of the Arts & Design
- School of Media & Public Affairs
- Trachtenberg School of Public Policy & Public Administration

**523** FULL-TIME FACULTY

**42** DEPARTMENTS & PROGRAMS

**307** ENDOWMENTS

**283** ACTIVE RESEARCH PROJECTS

**5,456** UNDERGRADUATE STUDENTS

**2,361** GRADUATE STUDENTS

**59** UNDERGRADUATE MAJORS

**65** UNDERGRADUATE MINORS

**31** COMBINED DEGREES

**17** GRADUATE CERTIFICATES

**24** DOCTORAL DEGREES

**53** MASTER'S DEGREES

**60%** CCAS UNDERGRADUATES HOLD INTERNSHIPS

**81,400+** CCAS ALUMNI IN ALL 50 STATES & 120+ COUNTRIES

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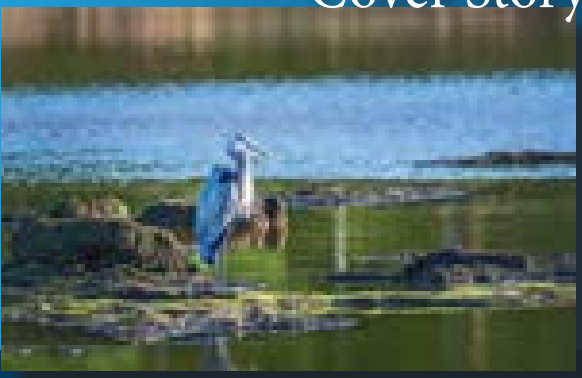
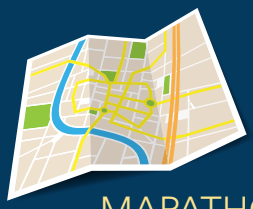


## 12 MISSION: RESCUE THE BAY



## 18 MAPATHONERS MAKE THEIR MARK

## 30 SHADOWS OF APARTHEID

## 46 ALUMNUS CALLS SHOTS FROM DIRECTOR'S CHAIR

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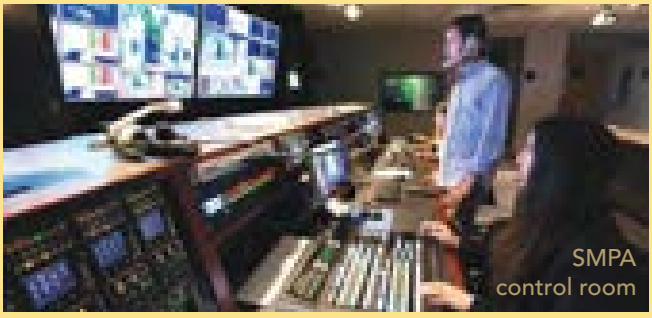
# In Brief


SMPA control room

## NEW INSTITUTE TO FIGHT DIGITAL DISINFORMATION

A $5 million investment from the John S. and James L. Knight Foundation will support the creation of the new Institute for Data, Democracy, and Politics to fight the rise of distorted and misleading information online. Spearheaded by Columbian College's School of Media and Public Affairs, the interdisciplinary research institute will work to educate national policymakers and journalists on strategies to grapple with the threat to democracy posed by digital propaganda and deception. It will draw on the expertise of researchers spanning the fields of political communication, journalism, physics, international affairs, computer science and engineering, and will work with the Poynter Institute and PolitiFact to collaborate on fact-checking research and to conduct trainings.

## CONGRATS, CLASS OF 2019!

The Class of 2019 received an enthusiastic sendoff at the Columbian College Celebration ceremonies held at the Smith Center. Surrounded by family and friends, 891 Columbian College undergraduate, 1,027 graduate and 55 doctoral students received degrees. Later that weekend, more than 25,000 people attended the Commencement ceremonies on the National Mall. NBC News' TODAY co-anchor Savannah Guthrie delivered the Commencement address, encouraging graduates to take a "big, giant, daring leap" in pursuit of their passions.

## NEW FACULTY STRENGTHEN CCAS RANKS

Columbian College welcomed 24 new full-time faculty members this year. They include **Rebekah Tromble** whose work on digital research and ethics is leading to new metrics on assessing incivility and intolerance on Twitter; political scientist **Omar Garcia–Ponce**, who has tracked gun violence across the U.S.-Mexico border; and biologist **Sandy Momoe Kawano**, who follows sharks that can "walk" on land. The new hires strengthen disciplines across the sciences, social sciences and humanities, and bring the total number of full-time scholars at CCAS to 523.

## TSPPPA WELCOMES NEW DIRECTOR

**Mary Tschirhart** is the new director of Columbian College's Trachtenberg School of Public Policy and Public Administration (TSPPPA). A prominent academic voice on nonprofit management and governance, Tschirhart comes to GW from the John Glenn College of Public Affairs at the Ohio State University. She succeeds **Kathryn Newcomer**, who helped guide TSPPPA to its status as one of the leading public affairs schools in the country. In *U.S. News and World Report*'s recent rankings of graduate programs, TSPPPA tied for 14th overall out of 285 schools considered.


Mary Tschirhart

## ALUMNI ON CAPITOL HILL

GW President **Thomas LeBlanc** celebrated the more than 280 alumni working on the Hill at GW's annual Capitol Hill Alumni Reception. The networking event saluted alumni serving in Congress and as staffers. Ten GW alumni are members of Congress, including two from Columbian College: Reps. **Morgan Murtaugh** (D-Calif.), BA '15, and **Gil Cisneros** (D-Calif.), BA '94. Being a GW alumnus "is very important to me," Cisneros said. "It's where I became an adult and learned to take care of myself."


GW President LeBlanc with Rep. Gil Cisneros (right)

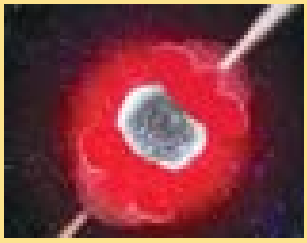
## GUSTERSON GETS GUGGENHEIM

Professor of Anthropology and International Affairs **Hugh Gusterson** was awarded a Guggenheim Fellowship, among the most prestigious of scholarly honors. Gusterson was recognized for his research on nuclear weapons and ethical thinking among scientists who have committed their professional lives to designing weapons of mass destruction. His forthcoming book will analyze how the

United States decided to end nuclear testing in the aftermath of the Cold War. He is also the author of the 2016 book *Drone: Remote Control Warfare*.

## STAR BLAST!

Professor of Astrophysics **Chryssa Kouveliotou** and an international team of scientists got a never-before-seen glimpse into the core of a collapsing massive star as they studied a gamma-ray burst (GRB) 500 million light-years from Earth. The researchers were looking for connections between hypernovae—dying stars five to 50 times more energetic than supernovae—and GRBs, the most powerful explosions in the cosmos. With the first-ever detailed observations of a hypernova, the team discovered a cocoon that carried energy away from the collapsing star, explaining why hypernovae are not always accompanied by GRB explosions.



Hypernovae illustration

## NOT JUST ANOTHER SCIENCE CLASS

Members of GW's Society for Physics Students (SPS) took on the role of teachers for a series of STEM workshops with D.C.-area school children. The annual six-week "I Can Science" program uses objects like magnets and slinkys to teach concepts such as gravity and electricity. SPS students were awarded Future Faces of Physics honors for their outreach efforts and have won the SPS Outstanding Chapter Award four years in a row. "Our priority is learning, but we are making it fun and accessible," said astrophysics and astronomy major **Jason Starita**.

Jason Starita with D.C. students

## A HOME FOR HISTORY

History News Network (HNN), a website and newsletter that brings historical perspective to current events, is now housed in Columbian College's Department of History. HNN features weekly essays by prominent historians and includes archival material from libraries and sources around the world. "We pride ourselves on connecting students to the multiple ways that history is relevant in our complicated world," said Department Chair **Katrin Schultheiss**. "The addition of HNN further expands these opportunities." History alumna **Kyla Sommers**, BA '13, PhD '19, serves as HNN's editor-in-chief.

## FULBRIGHTS' BRIGHT SCHOLARS

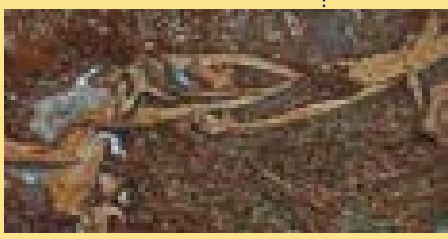
GW has once again ranked among the top producers of Fulbright scholars this past year. Eleven students earned the honor and are now immersed in their work. Among them are four from Columbian College: **Andrew Lindeborg**, BS '18, who teaches English in Peru; **Kara Zielinski**, BS '18, who is in Germany studying brain cells; **Diogo Oliveira**, BA '17, MA '18, who is examining the impact of the slave trade in Mozambique; and **Logan Werlinger**, CERT '17, who traveled to the Czech Republic to explore culture and communities through photography.

## OBJECTS MAY BE CLOSER THAN THEY APPEAR

Prior knowledge about the size of everyday objects—not the perceived size of the objects themselves—impacts how our brains process and interact with the visual environment, according to a study by Professor of Cognitive Neuroscience **Sarah Shomstein**. Published in the journal *Nature Human Behavior*, Shomstein's National Science Foundation-funded research suggests attention allocation can be trained. That finding could lead to significant improvements in efficiently performing many everyday tasks, from a radiologist looking for tumors of different sizes to an airport security agent tasked with searching for threats hidden in luggage.

## DINOSAURS' MISSING LINK

An international team of researchers led by **James Clark**, the Ronald Weintraub Professor of Biology, discovered a new species of bird-like dinosaurs during an expedition to Xinjiang, China. It's the ninth new species identified as part of a partnership between GW and the Chinese Academy of Sciences. The dinosaur—*Xiyunykus pengi*—resembles birds with a slender body and many small teeth instead of the large, sharp teeth of its meat-eating relatives. The discovery fills in a missing link in the evolutionary transition of the *alvarezsaurs*, a mysterious group of dinosaurs that share characteristics with birds.



*Xiyunykus pengi* bones

The Starry Dwarf Frog

## STARRY, STARRY FROG

Biology postdoctoral scientist **S.P. Vijayakumar** led a research team into the isolated hills of Southern India where they discovered an ancient frog lineage. The expedition found the so-called "Starry Dwarf Frog" on the forest floor and grasslands of the Western Ghats mountain range. The frog may solve evolutionary riddles in one of the world's most biodiverse regions. The mountain range, which remains relatively unexplored, faces environmental challenges from climate change and deforestation.

## RICE NAMED CORCORAN INTERIM DIRECTOR

Historian, curator and Associate Professor of Museum Studies **Kym Rice** was named interim director of Columbian College's Corcoran School of the Arts and Design. A former director of the Museum Studies Program, Rice has taught at GW since 1996. As a longtime exhibition developer, Rice has worked with museums and historical organizations around the country, including curating award-winning exhibitions for the Virginia Women's Cultural History Project and the historic Fraunces Tavern Museum in New York City. Rice succeeds **Sanjit Sethi**, who oversaw the Corcoran School's transition to GW. Sethi is now president of the Minneapolis College of Art and Design.

Kym Rice

## POLLINATORS FIND A HOME

As part of an ongoing research project, a group of undergraduate biology students are studying what kind of insects—such as bees, butterflies, flies and mosquitoes—spend their days pollinating Foggy Bottom flowers to better understand how to support the local ecosystem. The students are determining if factors like plant types, proximity to foot and car traffic or the size of the plot impact pollinator diversity.

Biology major Fiona Lupi

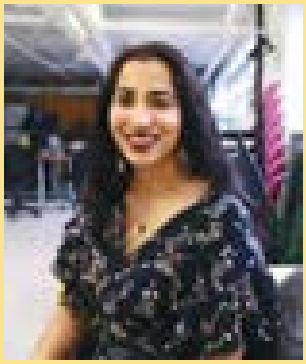
## UNDER PRESSURE, CULTURE IS KEY TO CALM

Keeping your cool in heated disputes largely hinges on your cultural background, according to a study by Associate Professor of Organizational Sciences and Communication **Meina Liu** on how people from Hong Kong and the United States handle high-stakes negotiations. Among study participants, people from Hong Kong sought conciliation through higher authority, threats and pressure tactics, while Americans focused on mutually acknowledged standards, such as contracts or legal terms. Neither of the groups attempted to understand underlying needs and interests. The study was published in the journal *Communication Research*.

## ANCIENT STONE TOOLS FOUND IN ETHIOPIA

A new archaeological site discovered in Ethiopia by an international team of researchers led by Associate Professor of Anthropology **David Braun** shows the origin of stone tool production dates back more than 2.58 million years. Previously, the oldest evidence for systematic stone tool production and use was 2.58 to 2.55 million years ago. The findings were recently published in *Proceedings of the National Academy of Sciences*.

Archaeologists at Ethiopia site



Kyrah Altman

## TRANSFORMING YOUTH MENTAL HEALTH EDUCATION

One in five young people experience a mental health condition every year, and half of all lifetime cases of mental illness begin by age 14. While majoring in human services and social justice, **Kyrah Altman**, BA '19, addressed those statistics head-on through her nonprofit organization LEAD, Inc. (Let's Empower, Advocate and Do). Founded by Altman as a high school student, LEAD seeks to transform youth mental health education by reducing stigma and promoting a holistic curriculum among health educators.

## WHAT'S SO BAD ABOUT ECHO CHAMBERS?

Echo chambers—the practice of viewing social media posts from only likeminded people—were lambasted in the wake of the 2016 presidential election. But a study by Assistant Professor of Media and Public Affairs **Ethan Porter** questions whether social bubbles are really as harmful as we think. Published in the *Proceedings of the National Academy of Sciences*, Porter's research shows that peer learning within social networks can increase belief accuracy even in politically homogenous groups. "Political echo chambers need not necessarily reduce accuracy or increase polarization. Indeed, we find them doing the opposite," Porter said.

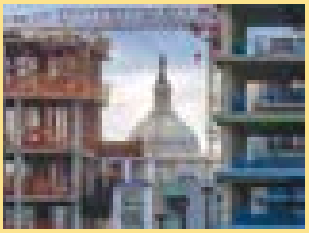
## UP CLOSE WITH GEORGE WASHINGTON

Students separate the man from the myth in Associate Professor of History **Denver Brunsman**'s George Washington and his World class. The highly competitive course selects about a dozen students each fall to explore the finer details of the first president's life and his role in history. Along with research trips to Mount Vernon, undergraduates work closely with historians in the D.C. area. They examine rare collections at the Society of the Cincinnati, the Library of Congress and the Washington Library at Mount Vernon, including hand-written letters and journals from Washington himself dating back to 1780.

Undergraduates at Mount Vernon

## MAPPING GENTRIFICATION'S IMPACT

Geography and political science senior **Gavin Derleth** received a Luther Rice Undergraduate Research Fellowship to analyze gentrification in Washington, D.C. Using a mix of maps and interviews, his research focuses on quantifying the impact gentrification has on the physical space of neighborhoods and the community members who live there. Derleth hopes his data will guide communities toward mitigating some of gentrification's negative consequences while ultimately helping cities plan for more equitable futures.



## HUMAN DIET FORECASTED EVOLUTION

A shift in diet has long been seen as one of the critical adaptations that distinguishes our own genus Homo from earlier human ancestors. But the timing and context of this dietary shift has been hotly debated. A study led by **David Patterson**, PhD '16, from Columbian College's Center for the Advanced Study of Human Paleobiology (CASHP), found that the change reflects a behavioral shift that happened approximately 1.65 million years ago. Building on research he performed in East Turkana in northern Kenya, Patterson and a team of CASHP scientists determined that, unlike other large mammals in the region, the genus Homo incorporated vegetation into their meals, marking a clear divergence point between human ancestors.

Hippopotamus tooth uncovered in Kenya

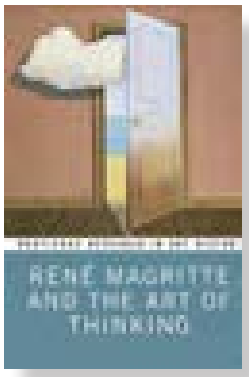
# A SAMPLING OF NEW BOOKS BY COLUMBIAN COLLEGE FACULTY

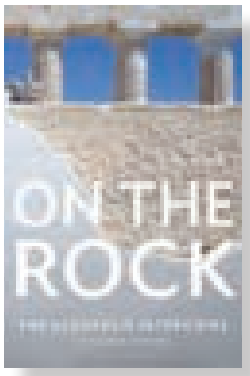

## *AFRICAN AMERICANS AND AFRICA: A NEW HISTORY*

What does it mean to be African American and how does this identity relate to the African continent? Rising immigration levels, globalization and the United States' first African American president have all sparked new dialogue around those questions. In her new book, Associate Professor of History and International Affairs **Nemata Blyden** explores the relationship between African Americans and Africa, from the era of slavery to the present. Investigating fundamental questions to the study of African American history and culture, she examines the diversity of African American identities through relationships with region, ethnicity, slavery and immigration.

## *RENÉ MAGRITTE AND THE ART OF THINKING*

For Surrealist artist René Magritte, painting was a form of thinking. Through depictions of ordinary objects rendered with illusionism, Magritte probed the limits of our perception—what we see and cannot see, the nature of representation—as a philosophical system for presenting ideas. In her study of Magritte's masterpieces and their enduring cultural relevance 50 years after the artist's death, Assistant Professor of Art History **Lisa Lipinski** argues that Magritte's painting is about vision and the act of viewing, of perception itself and the process of how we see and experience objects in the world.



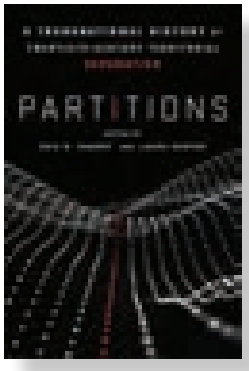



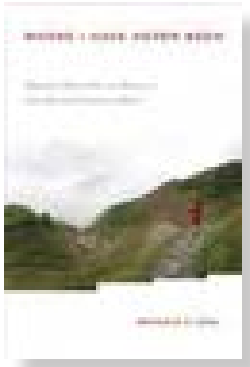

## *ON THE ROCK: THE ACROPOLIS INTERVIEWS*

Greece's marble workers laboring on the decades-long restoration of the Acropolis are the invisible force rebuilding one of the world's most storied monuments. Inheritors of millennia-old tradition, their work is a highly technical amalgam of past and present. Yet what these master marble carvers do and how they do it has gone largely undocumented. In a series of interviews, **Allyson Vieira**, assistant professor of foundations, captures the skilled craftsmen's stories in their own words as she explores their techniques and training. Her book brings together ancient building practices, the teaching of traditional craft, changes in the practice of architectural restoration and the social and class dynamics within the restoration site.

## *PARTITIONS: A TRANSNATIONAL HISTORY OF TWENTIETH-CENTURY TERRITORIAL SEPARATISM*

**Arie M. Dubnov**, the Max Ticktin Chair of Israel Studies, co-edited this first collective history of the concept of partition, the physical division of territory along ethno-religious lines into separate nation-states. Partition is often presented as a successful political "solution" to ethnic conflict. In the 20th century, at least three new political entities—the Irish Free State; the Dominions (later Republics) of India and Pakistan; and the State of Israel—emerged as results of partition. This volume traces the emergence of partition in the aftermath of the First World War and locates its genealogy in the politics of 20th century empires and decolonization.



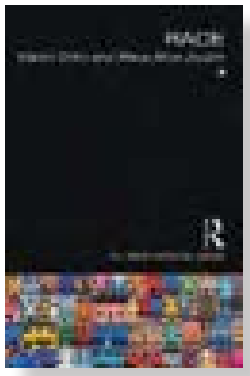


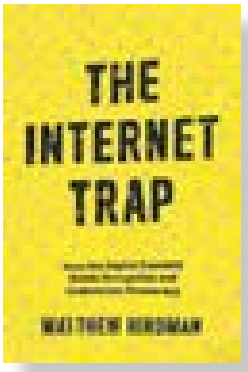
## *WHERE I HAVE NEVER BEEN: MIGRATION, MELANCHOLIA, AND MEMORY IN ASIAN AMERICAN NARRATIVES OF RETURN*

Professor of English **Patricia Chu** presents narratives from 100 diasporic Asian Americans who "returned" to their ancestral countries—both literal return visits by emigrants and symbolic returns in the form of first visits by their offspring. These stories depict migration-related melancholia, question official histories and portray Asian diasporic families as flexible and transpacific. Through these narratives, Chu seeks to remedy widely held anxieties about cultural loss and the erasure of personal and family histories from public memory. She recasts Asian Americans not only as minorities in America, but also as global subjects in tales of educational exchange, commerce and global migration.

## *RACE (THE NEW CRITICAL IDIOM)*

If race is a central part of human identity, can one own or disown one's race? To which community would a multiracial person, immigrant or diasporic subject belong? And is there a future for race as a viable concept? Professor of English **Alexa Alice Joubin** co-authored this new perspective on race studies that places "race" at the intersections of gender, class, whiteness, blackness and "invisible races." Tracing the legacy of race from the Middle Ages to the Renaissance to the 20th century, she examines racialized language throughout the world—South Africa, Israel, India, Western Europe, the United States and East Asia. From Black Lives Matter to the #MeToo movement, she demonstrates that race is profoundly constituted by language and narratives.




## *THE INTERNET TRAP: HOW THE DIGITAL ECONOMY BUILDS MONOPOLIES AND UNDERMINES DEMOCRACY*

The Internet was supposed to fragment audiences and make media monopolies impossible. Instead, behemoths like Google and Facebook now dominate the time we spend online and grab all the profits from the attention economy. What went wrong? In this award-winning book, **Matthew Hindman**, associate professor of media and public affairs, explains why the Internet is not the postindustrial technology that has been sold to the public. He sheds light on the stunning rise of the digital giants and the online struggles of nearly everyone else and reveals what small players can do to survive in a game that is rigged against them.

## *GHETTO: THE HISTORY OF A WORD*

What is a ghetto? A racially-segregated city block? An enclave of immigrants? A walled urban prison? Associate Professor of History **Daniel Schwartz** traces the historical path of the ideologically charged term from its first usage in the Jewish quarter of 16th century Venice to the Nazi holding-pens of Eastern Europe to the streets of New York's Lower East Side. Using the word as a window into the shifting nature of cultural identities, Schwartz explains how "ghetto" has evolved through history. Whether associated with Jews, immigrants or African Americans, it has stood for both oppression and resilience, a sign of segregation and a badge of authenticity, a symbol of bigotry and a synonym for home.

# What's Next For #MeToo?

What has been the impact of the #MeToo movement and where does it go from here? **Kavita Daiya**, associate professor of English and director of Columbian College's Women's, Gender, and Sexuality Studies Program, discussed the movement's setbacks, next steps and the momentum driving its success.


Kavita Daiya

**Q: From an academic standpoint, how do you put the #MeToo movement in perspective? Is calling it a "movement" correct?**
**A:** Yes, I think "movement" is exactly the right word. Sexual harassment and sexual assault have been unevenly acknowledged in the public sphere. For a lot of women, there has been a stigma attached to even disclosing their own experience of sexual violence. What the #MeToo movement has done is opened up the possibility for women to acknowledge publicly—through venues like social media—that they have experienced this too, that this is not something that happened to someone else. #MeToo has become a very powerful signal to the world. And it has catalyzed women from different communities, racial backgrounds, industries and classes. They have mobilized around this movement.

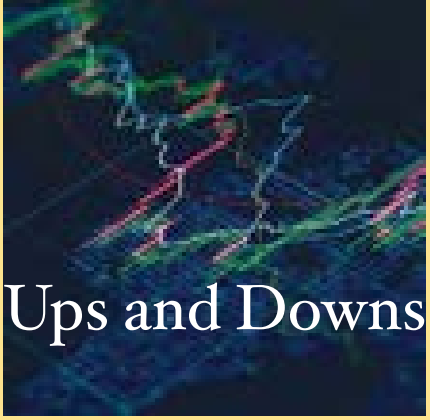
**Q: Historically speaking, have we seen anything like #MeToo before? Is it a uniquely American phenomenon?**
**A:** I think it is unique historically—but it is not uniquely American. While many scholars and activists have drawn attention to the problem of sexual harassment and sexual violence, the #MeToo movement has focalized the issue in a new, public and collective way. The recognition that this is deeply entrenched across different levels of society, and across industries and institutions, is new. The movement has changed—for the better—the way many women and men think about and talk about the experience. It has also had a very positive effect on feminist movements in other countries. Take, for example, the dramatic impact of the #MeToo movement in India [where the minister of state for external affairs resigned after allegations of sexual harassment]. Women around the world are saying, together, "This is not an acceptable part of our culture, this has to change." That is unprecedented.

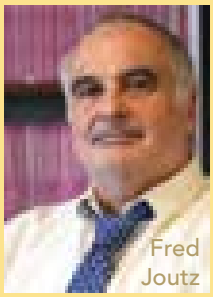
**Q: What do you hear in your classrooms about the movement? What questions are students asking?**
**A:** I've heard mixed responses. I've been in classrooms where students have been willing to talk about it, and to criticize the representations of violence against women they see in literature, films and popular culture. And I have also been in classroom spaces where students don't want to pursue that conversation. And that's OK. The first question I often hear from students is: "What can we do to stop [sexual violence]?" The second question that comes up often is: "What happens when you throw the issue of race into the picture?"

We can't talk about #MeToo in isolation from the experience of racism or the experience of discrimination due to ethnic and cultural backgrounds. That can be a challenge for students to conceptualize in the classroom, and one of the hardest things to get students talking about. Many ethno-racial and queer minorities often get left out of the more mainstream representations of the #MeToo conversation. The experience of sexual assault in the trans-community is marginalized as well. The movement is going to have to complicate and nuance this conversation—and, from what I hear from students, these are challenges that they are very vigilant about.

**Q: So, what's your sense of where we are now?**
**A:** I am very optimistic about where we are now, in part because of this generation of students. They are very intellectually and politically sensitive to the issue. They get it. Our job is to enable them as they start to forge new ideas about the kind of society and world in which they want to live. Change occurs when we participate in political movements as activists. But it is also important to work to become a part of the institutions that make, change and implement laws that affect human rights and equality.

# Forecasting the Economy's Ups and Downs






Are we living in an age of unrivaled economic prosperity or unprecedented economic inequality? For the answer to that question and more, we turned to **Fred Joutz,** professor of economics and co-director of the GW Research Program on Forecasting.

**Q: How would you describe our economy right now?**
**A:** The best way to look at the economy is always through an individual's perspective. Is it a good economy? Well, if you feel secure in your job; if your family has enough income to meet its expenses; if debt isn't a big issue for you; if you're not worried about your next paycheck; then, yes, it's a good economy. But if you don't have a job or you're working only part time; if you're not being trained to improve your skills and your value to employers; if you are struggling to pay rent, buy food, meet your medical expenses; then, of course, it's not a good economy.

**Q: Are those distinctions any more or less prominent today?**
**A:** When I look at macroeconomic data, I ask: Where are we today and what has the economic performance been over the last five to 10 years? Since the recession of 2008-09, the economy has grown every quarter but two. The average growth rate has been about 2.3 percent. That's below what it was in the '90s, but it's steady if not spectacular growth. On the employment side, there has been fabulous news. Since the recession, we have had positive jobs increases for more than 100 months, creating almost 21 million new jobs. And the unemployment numbers just keep getting lower and lower—somewhere below 4 percent.

**Q: And is there bad news?**
**A:** Yes, there is a flip side. If we look from about 1950 to 1980, the income rates of roughly the top 20 percent, the middle 60 percent and the bottom 20 percent of workers all grew at about the same rate. But from 1980 to 2016, there's been a divergence and a fairly sharp one. The middle 60 percent of the workforce have seen income growth of 30 percent. But if you look at the upper 20 percent, it has grown twice as fast as the middle—almost 80 percent. And the very top earners, the 1 to 5 percenters, have grown by 140 percent. Their incomes have more than doubled. That is a shift in income trajectories that we hadn't seen in the previous 40 years. And the gap just keeps getting wider.

**Q: Is the income gap a bad omen for the future?**
**A:** One hypothesis says that the increases in income concentration and wealth will spur greater savings leading to higher investment, which will in turn lead to greater income growth for all. This is known as the trickle-down effect. But it's not entirely clear that [hypothesis] holds. What is clear is that the middle 60 percent are not seeing real income growth. And that's not likely to get better over the coming decades. The U.S. may be on a dangerous path toward creating schisms in society. I'm not going to say the house is on fire, but something is burning, and I don't know if there are fire trucks nearby.

**Q: How does the 2017 tax overhaul fit in this picture?**
**A:** The tax reform act will lead to an increase in the national debt by about $1.7 trillion [by 2027] and the debt-to-GDP ratio will grow from 79 percent to almost 100 percent. Unless the tax cut leads to the investments that its supporters say it will, somebody has to pay for it in the future. In addition, the tax reform has led to large and growing government deficits. Macroeconomic policy since World War II indicates that this is being done at the wrong time in the business cycle. Expansionary fiscal policy is intended for economic downturns, not during economic growth periods like the U.S. is currently experiencing.

**Q: Is your forecasting impacted by stock market fluctuations?**
**A:** Everybody asks economists about the stock market. They believe we have crystal balls. I would never bet my life on the fluctuations of the stock market. Typically, we don't use market fluctuations in economic forecasting because they are caused less by data than by perceptions of uncertainty. We are seeing a lot of rhetoric in this country that has made people uncertain. They aren't sure what's happening today or tomorrow or what may happen in the future. As well as anything else, that explains why the market has been so volatile.

**Q: Is this a time of optimism or pessimism?**
**A:** I'm always an optimist. Let me leave you with this thought: When we talk about improving the standard of living, in the long run what really matters aren't more workers, more jobs or more investments. What matters are changes in technology and the accumulation of knowledge and innovation. And not just over years, but over generations. Right now, sitting in a university, observing how knowledge is sought and students learn, it's easy to be an optimist.


# RESCUE

Keryn Gedan at a saltpan along the Chesapeake Bay (Photos courtesy Keryn Gedan)

# THE BAY

Biology's Keryn Gedan leads her student researchers into the Eastern Shore marshes of the Chesapeake Bay, where the sea level is rising at three times the global average.

Left to right, Phoebe Shaw, Lily Anna Segalman, Keryn Gedan and Emily Kottler build wells in the Blackwater National Wildlife Refuge.

Before Assistant Professor of Biology **Keryn Gedan** invites a student to join her research team, she is upfront about her lab conditions: It's hot, she tells them. It's buggy. They'll spend much of their fieldwork knee-deep in mud, fighting off ticks. And they're as likely to walk away with a nasty case of poison ivy as a scientific breakthrough.

"I have scared away some students," Gedan laughed. "I try to ascertain if they like camping or if they like being outdoors, because that is where the work gets done."

Gedan's laboratory is the Chesapeake Bay, specifically the tidal wetlands of Maryland's lower Eastern Shore. And if they can handle the humidity and mosquito bites, her students are on the frontlines of an environmental drama playing out along America's largest estuary.

Rising sea levels and saltwater intrusion are taxing the Chesapeake Bay's natural ecosystems—creating new challenges for the humans and plants who depend on the region for survival. Across the acres of marshes and farmland, with flocks of herons and egrets gliding over miles of streams,

*"If we can understand how these changes occur here, and learn about management and conservation, then our results will inform the global response to sea-level rise everywhere."*

~Keryn Gedan

A salt-tolerant plant grows in a salt-damaged cornfield in Somerset, Maryland.

Gedan and her team witness the scars of climate change: abandoned corn fields blanketed in salt-crusted soil; 10-foot-tall reeds strangling fields of marsh grass; and "ghost forests" of trees stripped of bark by salt and sun.

Climate change "is happening and it's going to keep happening," Gedan said. "We are feeling the effects throughout Maryland, Virginia and the whole Mid-Atlantic region."

Gedan and her team of undergraduate, graduate and postdoctoral researchers are looking for solutions. They can't turn back the tide of sea-level rise, but they can better prepare bay life for the new ecological realities. Partnering with environmental agencies—with principal funding support from Maryland Sea Grant and the United States Department of Agriculture (USDA)—Gedan's lab is leading bay conservation efforts. They are mapping salts' march through the coastal land, experimenting with alternative crops and growing transition plant species both in the field and at GW's new high-tech greenhouse, located in Science and Engineering Hall.

"The Chesapeake Bay is an icon for estuaries and it is a natural laboratory for understanding sea-level rise," Gedan said. "If we can understand how these changes occur here, and learn about management and conservation, then our results will inform the global response to sea-level rise everywhere."

## Ground Zero

In many ways, the Chesapeake Bay is ground zero for sea-level rise. Due to a combination of climate change and the natural subsidence of already low-lying land, the bay has some of the highest rates of sea-level rise in the world—approximately three times the global average.

*"The Chesapeake Bay is an icon for estuaries and it is a natural laboratory for understanding sea-level rise."*

~Keryn Gedan

Students Justus Jobe (left) and Jesse Wyner collect soil samples from a salinized farm.

Indeed, a recent study in the journal *Nature Climate Change* co-authored by Gedan, (see story, next page), highlighted the growing recognition that sea-level rise will mostly impact rural land like the bay region, rather than cities. As the elevation between land and sea shrinks, ocean saltwater seeps into the surface and groundwater. The salt also releases nutrient pollution that remains in the soil from fertilizers.

That's a disaster for farmers. Many traditional crops—including corn and soy, which dominate the Eastern Shore—are sensitive to high soil salinity. As a result, farmers have been forced to abandon once-fertile fields. "When I see salt-tolerant plants in a farm field, I get a little riled up," Gedan said. "They shouldn't be there." Plant life that is unable to survive in the salty water face stark choices: adapt or drown. Many coastal plant populations have been pushed inland, ceding ground to more salt-tolerant species.

Gedan and her team are working with farmers to introduce new salt-tolerant crops like sorghum and switchgrass to help farmers adapt. (A biofuel crop, switchgrass can also provide material to the region's poultry industry.) During their numerous research trips to the Eastern Shore, they often plant rows of the new crops by hand, with support from affected area farmers.

"These farmers really care about the bay and the environment," Gedan said. "They are trying to make a living in a very tough profession. A lot of them are bird watchers and hunters. Their lives revolve around the bay."

Meanwhile, her team collects seeds and soil from the bay's farms and fields to determine which marsh plants might thrive in the changing environment. They grow the seeds at the greenhouse and introduce plants back to the shore to test their viability.

For **Justus Jobe,** the work can be as rewarding as it is grueling. A doctoral student who has worked in Gedan's lab for four years, Jobe grew up fishing, crabbing and hunting around the Chesapeake Bay. "This passion for the bay is what brought me into the lab," he said. Still, even Jobe has had to adjust to the rigors of taking salt measurements and soil samples in the marshes. "It is physically tough. You can be driven mad by the mosquitoes and black flies buzzing around. In the summer, the sun is beating down on you all day with no shade."

While in the field, students are given the opportunity to work on their own experiments. Jobe has spent two years examining the effects of marsh migration on the shore's deer population. **Maxwell Sall**, who graduated in 2019 with bachelor's degrees in environmental studies and chemistry, measured the effects of salinity on the blue carbon stored in the marsh soil. And biology major **Phoebe Shaw**, BS '19, studied the spread of an invasive marsh grass called *Phragmites australis* throughout the coastal ecosystem.

"I was so lucky to be able to work outdoors in some incredibly beautiful places," Shaw said. "It was so rewarding to work and learn from such amazing people."

The effects of rising sea levels can be seen along the Chesapeake Bay's natural ecosystems, including "ghost forests" of trees stripped of bark by salt and sun.

# NOT CITY-WIDE: SEA RISE THREATENS RURAL LANDS

Most climate observers associate rising sea levels with flooded cities, but a recent study by Assistant Professor of Biology **Keryn Gedan** and researchers from William & Mary's Virginia Institute of Marine Science revealed that rising waterways mostly impact rural land—much of which is privately owned—where decisions involve complex tradeoffs between the value of different land uses.

Environmentalists agree upland-to-wetland conversion provides valuable ecosystem services to the public by improving water quality, supporting marine fisheries and protecting against flooding. But to many landowners, the trade-off is seen as an economic loss because valuable farm acreage is shifted to wetlands.

Gedan's study, published in the journal *Nature Climate Change*, is the first to synthesize the growing number of studies of land conversion driven by sea-level rise. In the Chesapeake Bay region alone, more than 150 square miles of forest have been converted to marshland since the mid-1800s. Rates of forest retreat are accelerating around the world, with mid-Atlantic forests retreating inland more than twice as fast as they were 150 years ago.

"Uncertainty regarding local flood-defense strategies is the key thing that limits our ability to predict land conversion and its impact on coastal ecosystems," Gedan said. "The process of upland conversion could offset or even overwhelm wetland losses expected within the next century, but is highly dependent on the decisions of rural private landowners."

With landowner resistance complicating mitigation efforts, the study offered recommendations to guide future research and land-management decisions in rural areas. They include evaluating the effectiveness of privately maintained barriers such as berms and roads; studying whether planting salt-tolerant crops, leasing land to hunt clubs or harvesting susceptible timber can compensate for changes in the value of private property versus ecosystem services; and examining how federal policy incentives—such as paying farmers to remove environmentally sensitive land from production—might shape the future of upland-to-wetland conversion.

*"We all talk about wanting to make a difference; this is something I can do from campus that will directly impact people around the world."*

~Siri Knudsen

# MAPATHONERS MAKE THEIR MARK

From disaster relief to disease prevention, students are supporting aid efforts around the world—all with the click of a mouse.

Geography major **Siri Knudsen** has helped combat malaria in Mozambique, mud slides in Sierra Leone and an Ebola outbreak in Guinea. She has guided ambulances through earthquake-ravaged streets in Nepal and Puerto Rico, and led rescuers to flood-stranded families in Ghana. And she has done it all with just a click of her finger on her laptop within the confines of GW's Foggy Bottom campus.

For four years, Knudsen, who graduated in 2019, was a member of the Humanitarian Mapping Society, a student-run organization within Columbian College's Department of Geography. The group uses Geographic Information Systems (GIS) technology to map some of the developing world's most vulnerable regions in response to crises from epidemics to natural disasters.

Partnering with NGOs and nonprofits such as the World Bank and the Red Cross, students identify hospitals, roads and emergency management routes from satellite imagery. At "Mapathons," which are held annually in the fall during Geography Awareness Week, dozens of students digitally diagram global landscapes to address a dearth of accurate mapping. This past year, more than 70 students mapped 34,000 buildings and nearly 100 miles of roads in the Philippines. They also led the World Bank's flagship Mapathon in outlining flood-vulnerable regions of Ghana.

"Mapathons are one way [we] can advance the use of open geographic data to empower people to map a more sustainable future," said Geography Department Chair **Lisa Benton-Short**. "This is more than just teaching our students; [these experiences] could transform lives around the world."

## MAPPING MAVERICKS

GW is one of three founding universities that partnered with USAID on its initial 2015 YouthMappers project. Today, YouthMappers is a global network of 140 university chapters in more than 40 countries, including under-mapped nations like Botswana and Tanzania. The majority of students participating in the project are either geography majors or enrolled in the department's GIS minor.

"We all talk about wanting to make a difference; this is something I can do from campus that will directly impact people around the world," Knudsen said. "Even though I'm thousands of miles away, I know that my maps are helping real people on the ground."

"It's empowering because 10 years ago this wasn't a thing," added Humanitarian Mapping Society President **Johanna Belanger**, an international affairs major who graduated in 2019 with a GIS minor. "Now we can map a Nigerian city from a satellite and share that information with YouthMappers in Lagos who can finish the work in their hometowns."

At a Geography Department Mapathon, students traced secure food routes through the Philippines.

Students work with a free-mapping platform called OpenStreetMap (OSM) to collect data points from satellite imagery and geospatial technology. They tag locations on editable maps, labeling, for example, oblong structures that appear to be buildings or long rectangles that look like roads. "When you are remotely mapping, you don't have a bird's eye view, so there is a lot of uncertainty," Belanger said. "You mark what you think looks like a hospital or school but you don't know for sure." In-country mappers verify the information through the OSM open-source platform.

Nicknamed the "Wikipedia of Maps," OSM allows all users to access GIS data and add details to the maps—a critical factor for humanitarian agencies providing services to poorly-charted regions. With little incentive for commercial firms to map some of these areas, the OSM platform may be the only opportunity for a poor community to get themselves literally on the map.

In addition to helping humanitarian workers navigate crisis zones, the maps provide population data that aid organizations in the distributing of everything from vaccinations and medicines to mosquito nets. "The more information they have the better; they can access it and do their jobs," Knudsen explained.

"Be it for disaster preparedness and response or maybe fighting the spread or prevention of disease, the students have a way of making a difference, even though the affected area is on the other side of the world," said **Richard Hinton**, manager of the Geography Department's Spatial Analysis Laboratory.

Occasionally, the student mappers get to see the product of their work first hand. Last winter, Belanger went to Pretoria, South Africa, as a YouthMapper Leadership Fellow to work with GIS professionals and fellow students on introducing geospatial data in local communities. And Knudsen traveled to Botswana where she and Hinton verified some of the same maps produced at GW Mapathons.

"It's a very real feeling to walk the streets and visit those communities you saw in map grids and satellite images," Knudsen said. "It reminds you that even doing something on a small scale can have a big impact in the world."

# SKY'S THE LIMIT: ECO-TELESCOPE LANDS AT GW

From the sidewalks of Science and Engineering Hall to the reaches of the sun, the Chemistry Department's new NASA telescope can measure greenhouse gases in earth's atmosphere—and may transform climate science.


Chemistry PhD student Monica Flores examines a new NASA telescope that takes greenhouse gas readings directly from the sun.

On the south side of Science and Engineering Hall (SEH), students hurrying along H Street are accustomed to dodging traffic and food trucks on their way to class. But on sunny days this past spring, some paused to stare at chemistry PhD student **Monica Flores** as she wheeled what looks like a giant camera on a tripod to the sidewalk. Trailing a tangle of fiber optic cables behind her, she attached the instrument to a laptop. Then she pointed it directly at the sun.

"I get a lot of funny looks out here," Flores laughed. "People are like, 'What is that thing?'"

It may not look like much, but the 100-plus pound device is a telescope—of sorts. It's a one-of-a-kind machine gifted to Professor of Chemistry **J. Houston Miller** by the NASA Goddard Space Flight Center. And while it's not much use for star gazers, its ultra-precise measurements of greenhouse gases in the atmosphere are paving the way for interdisciplinary partnerships and projects that could bring about groundbreaking innovations in climate modeling.

"This is a remarkable instrument. It's the only device of its kind in the world, and we've got it!" Miller said.

Miller characterizes himself as being "in the greenhouse gas business." For more than 20 years, he has used an assortment of sensors and lasers, many of his own design, to track harmful pollutants in the air and in the ground. In 2018, Miller had just completed a major NASA project measuring melting permafrost in Alaska when the space agency approached him with an offer he couldn't refuse. NASA's Jet Propulsion Laboratory no longer needed its laser heterodyne radiometer (LHR), which takes greenhouse gas readings directly from the sun. The instrument was housed at the Goddard Center where a NASA scientist and former doctoral student of Miller's realized the LHR would fit perfectly with his research. She called her former professor and asked if he wanted to take it for a spin.

"They knew me and my lab. They knew GW has a stake in the greenhouse gas measurement game and we knew how to use the technology," Miller said. "I very enthusiastically said 'Yes! We'll take it!'"

## SUNLIGHT AND LASERS

By pointing the LHR at the sun, Flores and other student researchers in Miller's lab record concentrations of greenhouse gases in a vertical column throughout the atmosphere. Horizontal measurement devices—including the permafrost laser Miller invented for his Alaska project—detect ground-level gases, like pollutants from automobile emissions. Vertical data provides a more complete environmental picture of gases rising and mixing around the planet. In the past, scientists relied on satellites for vertical measurements, but they have limitations. Satellites report average concentrations throughout the atmosphere; Miller's method—vertical profiling—hopes to provide concentrations as a function of altitude.

"It's important to understand in precise detail what is happening in all of the atmosphere," Flores said. "The more measurements you have, the more data you can piece together to draw a better climate model."

Carbon dioxide is a well-known climate threat—it accounts for more than 80 percent of all greenhouse gas emissions—but, per molecule, methane is even more potent. Emitted during the production of coal, natural gas and oil, as well as from agricultural sources, methane makes up 10 percent of gas emissions. But it traps atmospheric heat 87 times more effectively than $CO_2$. Once it dissipates into the atmosphere, methane naturally turns into $CO_2$, exacerbating the climate threat.

Miller's telescope is equally efficient at tracking $CO_2$ and methane levels. Its optical fibers collect light from the sun. Then, in the same way an FM radio reads different frequencies, lasers filter the sunlight into single molecules—such as $CO_2$ or methane. Like turning the radio dial between stations, changing the laser lets the telescope "tune in" to different molecules.

"We are always looking for new ways to make measurements," Miller said. "We're always pushing that boundary."

Flores, an atmospheric chemistry specialist, was tapped as the telescope's "champion," Miller said, from the moment the box arrived at his lab last summer.

"It's extremely exciting to have first dibs on this technology," Flores said. From an alcove just off the sidewalk, she can aim the telescope at the sun and let the device do the rest. A built-in heliostat continually optimizes the amount of light collected as it follows the sun across the sky. "Its autonomous sun-tracking capability is one of the least sophisticated and most elegant things about it," Miller noted.

Miller has big plans for his new device beyond the campus sidewalk. He is collaborating with Associate Professor of Biology **Amy Zanne** to take both carbon atmospheric and soil measurements at the Smithsonian Environmental Research Center. And along with LHR manufacturer Mesa Photonics, he is in the early stages of a United States Department of Energy project that will adapt the telescope to detect water vapor, a significant heat-trapping greenhouse gas. In the long term, he envisions a network of miniaturized LHRs around the globe, relaying information on everything from carbon in the Arctic stratosphere to tropical storm surges in the Pacific. As far as the telescope's potential goes, Miller suggested, the sky is literally the limit.

# PHYSICS.
## *Professionally Speaking*

Alexander van der Horst's capstone course equips physics students with the oral, written and ethical expertise needed to succeed in 21st-century careers.

On the first day of his Physics Capstone course, Assistant Professor of Astrophysics **Alexander van der Horst** reveals a hard truth to his class of 20 physics majors who have spent much of their academic life navigating labs and solving complex mathematic equations: Their physics futures, he tells them, may not go as planned.

"Only 5 percent of them will become someone like me," van der Horst later explained, because the overwhelming majority of students majoring in physics won't hold jobs in academia. Instead, they're far more likely to be employed in fields like technology, engineering, finance and even the military. "Anywhere you need problem solving, analytical skills or technical expertise, you'll find physics majors," van der Horst said.

That's the jumping-off point for a revamped capstone course that equips physics students with the knowledge needed to succeed in 21st-century careers. The curriculum includes professional development components and a focus on writing as a form of critical inquiry and scholarly expression. In a mentored learning environment, students are asked to design and conduct research in an ethical manner while acquiring the expertise for disseminating their findings to different audiences.

"Our aim is to deepen the research experience . . . and trigger the students to consider their post-graduation career choices earlier in their degrees," said CCAS Associate Dean of Research and Associate Professor of Physics **Evangeline J. Downie**. "We want to prepare them to be better members of the physics community."

From left: Physics students Rohan Patil, Jason Starita, Muhammad Salis and Jane Peabody

Assistant Professor of Astrophysics Alexander van der Horst

The class itself is collaborative in nature, focused less on lecturing than group work and student participation in understanding the real-world context of theoretical studies. Students are introduced to timely topics within the physics community, like research ethics, diversity and inclusion, as well as broader career skills such as oral presentations and resume writing.

"These are things we don't learn in the lab," said **Jane Peabody**, a senior physics and math major who hopes to work in the energy industry after graduation. "Most physics classes are very technical. This class shows us how to actually function in the professional world. I think of this class as 'How to be a Physicist.'"

According to the American Institute of Physics, physics graduates transition into a wide range of industries and careers because of their diverse skill set. They often find themselves in engineering positions—like systems engineers or computer engineers—or in public sector forums like climate change policy or infrastructure analysis.

That spurred van der Horst to make professional development a centerpiece of his course. His guest speakers have included Industry Career Coach **Sonya Merrill** from Career Services, who led exercises on employment resources and elevator pitches. Brad Conrad, national director of the Society of Physics Students, addressed the class on the spectrum of physics jobs, citing a baker who uses her physics degree to calculate how much jam produces the optimal pastry crunch. Students are also required to visit the Career Services office and create a professional CV.

"We aren't learning about equations in this class, we are learning how to talk about the things we do," said **Lexie Weikert**, a senior physics major and history minor who hopes to work in space policy.

"As an undergraduate physics major, I'm realizing that you can relate what you learn to anything you want to do," added junior astrophysics major **Jason Starita**. "You're not just restricted to doing research, you're not restricted to academia. The skills that you learn are skills that employers want." After a summer interning in a nuclear physics lab at the University of Glasgow, Starita decided his future workplace would be outside the lab. A student in the GWTeach program, he is on a career track to teach high school math and physics.

Van der Horst plans to share his course materials with GW faculty and physics departments at other universities. "There is no standard textbook for what we are doing here," he noted. "Students think they need to have a PhD to call themselves physicists. I tell them, 'No, no, no. You are a physicist the moment you get your [undergraduate] physics degree. And there are many things you can do with it.'"

# MEDIEVAL ASTROLOGISTS AS WEATHER FORECASTERS

Mackenzie White's undergraduate thesis unearthed ancient almanacs that revealed which way the wind blew.


Mackenzie White showcased her study of Medieval meteorology at GW Research Days.

Pity the Medieval Period. The era stretching from 1000 to 1500 is often dismissed as a wasteland of intellectual and artistic darkness. Overshadowed by Enlightenment stars from Da Vinci to Gutenberg, the Middle Ages calls to mind *Game of Thrones*-like jousts, Monty Python-mockery and mud-bound feudal serfs. But the period had its highlights with the founding of universities like Cambridge and Oxford and the invention of vertical windmills, eye spectacles and mechanical clocks.

And art history and political science major **Mackenzie White** added one more overlooked accomplishment to the Medieval short list: Weather forecasting. Over the course of 12 months, she studied how Medieval meteorologists combined science, religion and astrology to predict the weather. She visited historic archives and scoured internet databases to uncover ancient almanacs and learn about pre-Enlightenment prognosticators. Funded by a Sigelman Undergraduate Research Enhancement (SURE) Award, her work attempted to reclaim the Middle Ages from history's scorn.

*"If you were a farming peasant or rising in social class, you wanted to understand weather patterns to create a better yield in your harvest."*

~Mackenzie White

"We think of the Medieval person as uneducated, struggling through the mud and living in a time when everything was terrible," said White, who graduated this past spring. "Then someone flips a switch and we suddenly get the aesthetics and advances of the Enlightenment. But things were changing in the Middle Ages. And it wasn't all for the worse."

For her undergraduate thesis project, White focused on the tail end of the Medieval Period—from 1400 to 1500—in a European landscape ravaged by the Crusades and bubonic plague. But social change was on the horizon. She primarily researched England, where the economy was shifting from serfdom to free labor. More peasants rented acres from wealthy landlords as a new class of yeomen owned and cultivated their own small properties. Even educational expansions began to mirror agriculture growth. "The self-awareness that came with economic independence led to a desire among ordinary people to understand the world around them," White said.

Looking beyond their day-to-day existence, people of that period often turned to astrology—at the time considered an irrefutable science—for answers to questions about the earth. And for Medieval farmers, similar to those tilling the earth today, their concerns often revolved around the weather.

"If you were a farming peasant or rising in social class, you wanted to understand weather patterns to create a better yield in your harvest," White explained. "You wanted to know when it would rain and thunder and even when to travel for feast days and saint's celebrations."

Suddenly, a new occupation took shape: Medieval weatherman. Astrologers used a combination of observations, Christian myths and the zodiac to create elaborately illustrated almanacs that purported to predict the weather. White examined scores of these calf skin-bound booklets and found that, while Medieval forecasters weren't especially good at reading weather beyond observable patterns, the almanacs provided a window into the science, culture and thought processes of a little appreciated era.

## ANCIENT ALMANACS

Most of White's project focused on a 1433 almanac she discovered in New York City's Morgan Library. The five-foot-long by five-inch-wide manuscript was designed to fold into a stack of 38 panels—roughly the size of a pack of baseball cards. At the library, she found the almanac significantly weathered, its vellum cracked and patinaed from frequent rough handling by traveling farmers. Remnants of the original threads that held the pieces together still hung from its seams. White didn't have to don gloves to touch its pages—the risk of tearing a sheet outweighed the threat of skin oil—but she was instructed not to wear nail polish. For the hours that she delicately examined the artifact, a curator stood close by, at one point rushing over to adjust a corner that had shifted off the table's edge.

Almanac owners were often illiterate. In the booklets' pages, symbols substituted for words. White deciphered many of the meticulously rendered drawings by connecting the dots between zodiac signs and the months of the year. For example, Sagittarius—November—was typically represented by an ax, or, in the 1433 document, the image of a wood-chopping farmer. Another scene depicted two men fighting with swords. Above them was a sickle, one of the zodiac symbols for March. "It's like figuring out an art puzzle," she said. "You tease out the meanings from the images."

In contrast to the Medieval world's historical portrayal as intellectually barren, White's work reveals a spark of curiosity in the era that would usher in scientific advances. "Not a lot of great things happened to people in the Medieval era," White said. "But they were becoming aware of a world beyond the patch of land they lived on. And if they couldn't control that world, give them credit for trying to figure it out."

White credits her thesis adviser **Elizabeth Williams**, a former GW Dumbarton Oaks Postdoctoral Fellow and an assistant curator of the Byzantine Collection at Dumbarton Oaks, with encouraging her studies. "Mackenzie's work disrupts any narratives that medieval people were superstitious or blind followers of tradition or religion," she said. "She's able to show that scientific thinking wasn't an invention of the Renaissance or the Enlightenment."

# TRAUMA UNDER FIRE

*English graduate student Jacob Holl has traveled from the battlefield to the classroom. The combat veteran shared his insights with first-year students.*

In **Marshall Alcorn**'s Dean's Seminar on Violence and Trauma, first-year students grapple with trauma in all of its forms. They read neuroscience studies to examine how horrific experiences alter the brain. They explore shifts in cultural perspectives, like the impact of the #MeToo movement on the way we view women's experiences. And they look at depictions of trauma in literature, from the shell-shocked soldiers in Tim O'Brien's Vietnam classic *The Things They Carried* to the childhood abuse that Mary Karr details in her memoir *The Liar's Club*.

First-year student and ROTC recruit Bree Gelin (center) will serve in the army after graduation.

But few lessons have captivated Alcorn's students like the first-hand account by U.S. Army Captain **Jacob Holl**—an English graduate student and a veteran of two tours of duty in Afghanistan—of living in a war zone and his efforts to cope with the violence he witnessed.

"I think of telling my story as my obligation as a soldier, a teacher and just as a person," said Holl, who plans to teach English and philosophy to cadets at the United States Military Academy after graduation. "People struggle relating to combat veterans. They want to honor our service, but they don't know how to talk about it. I see this as a way for us to interact and learn from each other."

Holl was invited by Alcorn, a professor of English, to audit his seminar and contribute a personal dimension on the topics students debate in the classroom. When Holl described the daily firefights he endured as a platoon leader in Kandahar or the explosion that killed a soldier under his command, students gained a window into life-altering experiences and their lingering impact.

"This course looks at the experience of trauma and the difficulty of communicating it to other people," Alcorn said. "When Jacob talked to the students, you could see the respect and empathy between them. It went in both directions."

*"When Jacob talked to the students, you could see the respect and empathy between them. It went in both directions."*

~Marshall Alcorn

Jacob Holl, an English graduate student and U.S. Army captain, speaks to Marshall Alcorn's Dean's Seminar on Violence and Trauma.

## INSIGHTS AND INSPIRATIONS

Alcorn first met Holl two years ago when he was a student in Alcorn's graduate seminar on trauma. A trained psychoanalyst, Alcorn has hosted major international conferences on trauma and contributed influential articles to seminal texts. On the first day of class, he asked if any students were combat veterans. Only Holl raised his hand. Over the next year, Alcorn became Holl's thesis advisor. They often spoke about the veteran's time in Afghanistan and his transition back to the United States. Holl described the constant threats of small arms fire and improvised explosive devices—including the blast that killed one of his solders. Other attacks left two of his soldiers amputees.

Holl was open about coming to grips with, as he put it, both "big-T trauma" like his combat experiences as well as "little-T" stresses like ROTC training and returning home after his deployment. "Trauma is individually experienced but it's very much community-based too," he said. His "inner demons," from combat nightmares to a form of survivor's guilt, still plague him. "Now and then you go down into that bear cave and wrestle with your own personal bear," he said. "Sometimes you get the bear, sometimes the bear gets you."

"Jacob's knowledge of trauma, in addition to the personal anecdotes of traumatic events sustained during his deployment, bring a very hard-hitting and personal perspective to the class," said **Nathan Thomas**, a sophomore who took the course as a first-year student. For Thomas, the experience made him think more about his father, a career law enforcement officer who served on SWAT teams and Drug Enforcement Agency squads. "As a kid, I would always hear his firsthand accounts of traumatic events that he witnessed and see how it changed his mannerisms and daily life," he said.

Holl also made a powerful impression on ROTC recruit **Bree Gelin**, who plans to major in psychology and serve in the army after graduation. Gelin found Holl's contributions sobering and inspiring. "I don't think you can prepare for trauma, but you can think about how you might deal with it," she said. "He talked about things that are really hard to talk about. That's a place I hope to get to someday."

Eve Boyle at the Center for the Advanced Study of Human Paleobiology lab

# THE TORSO CONNECTION

Research findings by human paleobiology doctoral student Eve Boyle challenge the widely accepted scientific theory connecting a primate's torso size to diet.

For decades, human paleobiologists have largely agreed on a simple anatomy lesson: Our primate relatives have large torsos—wider pelvises, broader thoraxes, expanded ribcages—to accommodate a digestive system that processes a diet of leaves, fruit and insects. Humans, with a more nutritional meal plan, require smaller frames. Evolution seems to confirm it: Somewhere between one-and-a-half and 3 million years ago, our hominin ancestors shifted their diets away from plants and bugs toward scavenging and hunting animal prey—and their torsos began to shrink.

But **Eve Boyle**, a PhD student in Columbian College's Center for the Advanced Study of Human Paleobiology, wasn't convinced. For two years, she travelled to museums across the United States and Europe, reconstructing the bones of primates from the last hundred years—using digital calipers and putty—and comparing the size of their torsos with information on their diets. With the help of senior biological anthropology major **Rowan Sherwood**, she devised a method for measuring the cubic volume of primate guts based on their skeletons. They used software to create a 3D "bubble" within the bone scans that replicates realistic gut volumes.

Measuring nearly 450 skeletons and studying the 3D scans of primate bones stored at archives around the world, Boyle all but dispelled the widely accepted scientific theory connecting torso size to diet. A more likely hypothesis, she said, points to body shape changing to meet a primate's range of motion.

"She has shown that factors other than diet drive torso shape in higher primates," said Boyle's research mentor Professor of Human Origins **Bernard Wood**. "So we can no longer base inferences about diet in our ancestors and close relatives on torso shape."

Boyle had always been skeptical of the diet-torso connection. And as she prepared her dissertation research, she realized that no one had ever actually tested if there is a relationship between bone-size and diet in modern primates. "Everyone was making an assumption based on just a few reconstructed skeletons from 20 years ago," she said. "But there were no scientific citations because no one had actually done the measurements."

From the heel bone to the ankle bone to the hip bone, Boyle has connected human and primate anatomy for more than four years at GW. She has been a lead author on papers in prestigious journals such as *PaleoAnthropology* and the *Journal of Human Evolution*, including well-cited studies with Wood. A National Science Foundation Graduate Research Fellow, Boyle has contributed to work that is reshaping the way scientists looks at hominin skeletons—literally from head to toe.

A winner of GW's 2019 Philip J. Amsterdam Teaching Award for her classroom impact as a teaching assistant, Boyle isn't certain whether she'll pursue other research opportunities in the future, but she hopes to continue teaching and mentoring young scientists.

"Teaching is a passion for me," Boyle said. "When you expose young people to all the possibilities in the world, they can picture themselves doing incredible things."

Luther Rice Fellow Lauren Anderson (left) studies lemur deposits with Associate Professor of Anthropology Brenda Bradley.

# Lemur Lessons: An Evolutionary Tale

As a student research assistant in Associate Professor of Anthropology **Brenda Bradley**'s Primate Genomics Lab in the Center for the Advanced Study of Human Paleobiology, **Lauren Anderson** has become a lemur expert. She can list the 111 lemur species, from some as small as a golf ball to a 2,000-year-old ancestor who was as large as a gorilla.

Found only on the island of Madagascar, lemurs evolved independently from monkeys and apes. Their rarely-seen diversity—lemurs living just a few miles from each other can have vastly different appearances, diets and habitats—have made them a research gold mine, even as they've become one of the world's most endangered animals. "Lemurs can inform everything from understanding human biology to conservation efforts and forest management," Anderson explained.

The primate's unique evolutionary journey led to Anderson receiving a Luther Rice Undergraduate Research Fellowship, which is funded by Columbian College to support faculty-mentored student research. Her project focused on a lemur's capacity for color vision within two distinct populations: lemurs from the lush riparian forest and those coming from the arid spiny forest. While lemurs are generally colorblind, some females have been found to possess full color vision, which could be a huge advantage when searching for nutritious red fruits and leaves in the Madagascar jungle.

Females are dominant among lemurs. They lead two-to 13-member packs on foraging missions. Anderson wanted to know if color vision evolved in females to adapt to the needs of their environment. She extracted DNA from fecal samples, which were stored in freezers in Bradley's lab in Science and Engineering Hall. Anderson melted the samples under extreme heat and mapped the melting patterns against known DNA sequencing for color vision. The lemurs from the lush forests had no color vision, Anderson found, but there was some indication that the spiny forest breed were not entirely colorblind.

Image credit: Mark Designers/Shutterstock.com

# SHADOWS OF APARTHEID

Sociology Professor Xolela Mangcu grew up in a segregated South Africa. Twenty-five years after the end of apartheid, he is writing the first African-authored biography of Nelson Mandela—and urging young people to continue fighting injustice.

*"We have to get our students to think and know more about the*

When Professor of Sociology **Xolela Mangcu** remembers his childhood in apartheid-era South Africa, the first image that comes to mind is darkness—both the darkness of living under an oppressive regime and the literal darkness that engulfed his segregated township each night when local authorities cut the electricity. In that pitch black darkness, his family huddled silently while violence swept through their streets. Police raided homes, arresting political dissidents. Fighting on the streets often ended in fatalities.

"Many of the young people I grew up with died in that violence," Mangcu said. "That complete darkness has stayed with me to this day."

It was during those bleak years that Mangcu's political consciousness was formed. He was 10 in 1976 when an uprising in Soweto ended in the slaughter of hundreds of student demonstrators by police. The following year, he marched in his town square to protest the brutal police beating of his idol, activist Stephen Biko. Those events spurred Mangcu into political activism, social-justice journalism and academia, which led South Africa's *The Sunday Times* to call him "South Africa's most prolific public intellectual."

Mangcu is now entering his second year at GW, teaching a graduate class on Comparative Race and Ethnicity and an undergraduate class on Classical Sociological Theory. Previously, he held fellowships at Harvard University, the Massachusetts Institute of Technology (MIT) and the Rockefeller Foundation. He has appeared as an analyst for the BBC, CNN and Al-Jazeera. And he's the author of nine books, including the acclaimed *Biko: A Life*. His current project is a multivolume biography of Nelson Mandela—the first ever written by an African author.

In 2019, as the world marked the 25th anniversary of the end of apartheid, Mangcu remains dedicated to sharing its lessons, whether with his fellow South Africans struggling to overcome what he calls "the invisible wounds" of the era or with his students who, he says, are eager to learn from his personal experiences. "Teaching is the joy of my life," he said.

Professor of Sociology Xolela Mangcu

*world—because knowledge leads to action."*

~Xolela Mangcu

From Cape Town to Washington, D.C., Mangcu encourages young people to remember the history of apartheid and to continue fighting against injustice. "Our challenge as educators is to help our students see politics, freedom and justice as global concepts," he said. "We have to get our students to think and know more about the world—because knowledge leads to action."

## 'A Sense of Possibility'

Mangcu, 53, remembers apartheid—the Afrikaans word for "separateness"—as "an incredibly psychologically traumatic moment." For 50 years, South Africa's white-ruled Nationalist Party reined over a notorious system of institutionalized racial segregation. The white-minority government enacted laws controlling every aspect of the majority black population's lives, from where they lived and who they married to the jobs they held and the schools they attended. Still, Mangcu stressed that growing up in the Eastern Cape Township wasn't continuous misery. His parents—teachers and music composers—tried to give their children the semblance of a normal life. "We had weddings. We played sports and music," he recalled. "In the midst of this horror, we lived life to the fullest."

Eastern Cape was also home to Biko, already a leading anti-apartheid activist and local hero when Mangcu was a child. The young Mangcu was drawn to Biko's "black consciousness" concept of celebrating African dignity and self-worth, rather than Mandela's more moderate "color blindness" approach. "If Mandela was our Martin Luther King, then Biko was our Malcolm X," he explained.

Biko's death shook the township and spurred many, including Mangcu, to become more involved in the nation's black consciousness student movements. He was arrested several times but was lucky to escape official charges that might have landed him in harsh state prisons.

While on a fellowship at MIT and earning his PhD from Cornell University, Mangcu cheered with the rest of the world as apartheid crumbled and, in 1990, Mandela was released from prison after 27 years. "It was a moment of jubilation and euphoria," he said. Apartheid officially ended with the formation of a democratic government and the election of Mandela as president in 1994. After earning degrees in public policy and city planning, Mangcu returned to South Africa in 1999 to help rebuild his country. "There was a great sense of possibility," he recalled.

As an academic and a journalist in the new South Africa, Mangcu frequently met with Mandela, although he often found himself in opposition to the new president's reconciliatory policies. "I thought he was denying the importance of race in history. To me, his mantra was: 'The past is past.' But I was saying: 'No, the past is present.'" Still, Mangcu respected Mandela's position "as a metaphor for global human rights." At Mangcu's urging, Mandela memorialized Biko at a 2004 lecture as "a proud representative of the reawakening of a people."

"As time went on, I became less and less ideological myself and I began to look at Mandela differently—not as an abstraction but as a person who had made historic sacrifices," Mangcu said. "He had this magnanimity that softened me and turned me into the fan I am now." But Mangcu is not shying away from criticism in his upcoming Mandela biography. "The first obligation of the biographer is to the truth," he said.

## After Apartheid

Twenty-five years after apartheid, Mangcu is disappointed with the direction South Africa has taken as it struggles with challenges from HIV to unemployment to widespread corruption. "There is not only a financial collapse but a collapse of the soul," he said. "A disenchantment has gripped us."

Indeed, more than 6 million young South Africans under the age of 30 did not register to vote in the 2019 elections—a shocking statistic in a country where youth have historically been at the forefront of political change. With unemployment running at 27 percent—more than half of it among young people—Mangcu accuses leaders of "betraying our youth."

But, with newly elected President Cyril Ramaphosa promising to reform the government, Mangcu hasn't lost hope for his country. South Africa's future and, he noted, the future of democracies around the world, once again depends on young activists inspired to action. "It's incumbent that young people take up the political agency like we did during our time," he said. "The next generation of Biko's and Mandela's need to make their voices heard."

# ADVENTURES IN ANT LAND

Biology's Scott Powell has traveled the world to capture nature's most amazing ants in action. Can they teach us a better way to transport people and resources?

From his perch along a forest tree branch—whether in the woodland savannas of eastern Brazil, the foothills outside of Tucson, Arizona, or the blazing sunshine of the Florida Keys—Associate Professor of Biology **Scott Powell** spies on colonies of swarming ants.

To an untrained eye, the insect packs look like nothing more than hundreds of thousands of black dots scurrying through low-lying branches. But Powell, who has made ants the center of his groundbreaking studies on evolutionary ecology, sees something very different—not a jumble of scattering specks but a remarkably sophisticated network of activity.

Within a colony of turtle ants, every member has a role to play. Looking down from the tree tops, Powell can point out individual one-eighth inch workers carrying eggs between nests. He can spot soldiers by their plate-shaped heads, nature's armor evolved to protect the colony from invaders. He has seen ants with elaborate shells that they use to bulldoze their way through enemies, and even workers that copy the posture and movements of other ants to steal their food.

Powell's latest research, a four-year, $300,000 National Science Foundation-funded project, will examine the way ants maintain highly-functioning transportation networks for moving food, resources and colony members between nests—even when faced with disruptions in their routes like broken branches and rain-flooded forests.

"Our goal is to see how ants respond to this environmental disruption and use that as a generalized theory for human networks" like humanitarian relief, traffic patterns or even computer connections, Powell said. "Anything that involves efficient delivery of resources through a network—if it's something that can be disrupted and needs to be fixed fast, ants can show us how it's done."

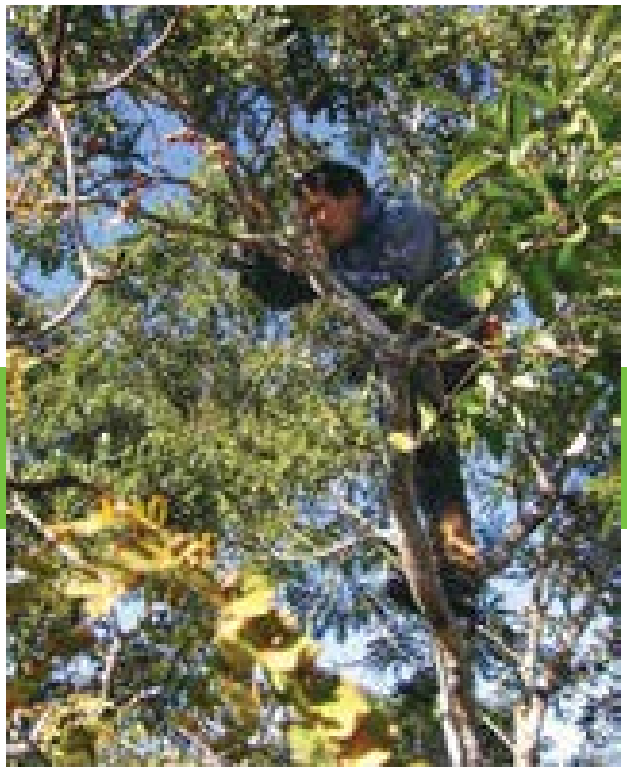
## Soldiers, Imposters and Biters

For many of us, ants are pesky picnic spoilers. But for Powell, they are an insect civilization whose custom and cultures—the way they communicate, interact and jointly problem-solve—have implications for fields from computer science to robotics.

"There are very few animals of any kind that have as sophisticated a social organization as ants," said Powell. "There's a lot humans can learn from ants."

For Powell, whom students affectionately refer to as "Ant Man," ants are evolutionary marvels who have transitioned from isolated insects to living in functionally interdependent societies. With more than 16,000 known species, including at least a dozen discovered by Powell, the highly-diverse ant world has adapted to survive in terrains around the globe. Each colony has at least one queen along with scores of workers and soldiers who adopt a specific duty for life. Some ants are responsible for looking after the "brood" of larvae and pupae. Others forage for food or clean and repair

Turtle ants, like these observed by Scott Powell's research team in Serra do Cipó, Brazil, may offer insights into human transport networks. (Photos courtesy Scott Powell)



Scott Powell observes ants from the top of a cerrado tree in the Brazilian savanna.

*"There are very few animals of any kind that have as sophisticated a social organization as ants. There's a lot humans can learn from ants."*

~Scott Powell

the nest. Soldiers protect the colony. (In the case of turtle ants, an arboreal species that usually make their nests in the abandoned tunnels of wood-boring beetles, soldiers wedge their armored-heads into tree cavities to ward off predators.) Like some social insects including bees and wasps, female ants do all the work. Males die quickly after mating.

Powell has tracked ants throughout the Americas, from a Smithsonian research station in the Panama Canal to the dry woodlands of central Brazil. That is where he made what he considers his strangest discovery. While climbing a 15-foot tall cerrado tree to observe thousands of aggressive acrobat ants, he spotted a single speck that seemed to be moving erratically. "I did a double take. There was something about this one ant that didn't look right," he said.

Powell had stumbled upon a new species of stealthy, parasitic ant that disguises itself as acrobat ants by mimicking their movements. The imposter ant—*Cephalotes specularis* or the "mirror turtle ant"—infiltrates foraging trails of its host to steal food and then quickly darts away. Powell's discovery revealed new examples of how social parasites interact with their hosts.

Meanwhile, his studies on army ants—the hyper-aggressive species that weave their bodies together to build structures like bridges—have served as models for small, swarming robots that may be used for tasks as varied as manufacturing and search-and-rescue missions in the near future.

Powell and his team of two postdoctoral researchers, three PhD candidates and two undergraduate research students often spend six-to-eight weeks a year in the field, searching for ants among tropical tree limbs and forest leaves, usually in stifling heat. Despite the grueling conditions, many of his students have been bitten by his ant enthusiasm.

"I love ants," said **Jignasha Rana**, a third-year PhD student who joined Powell's fieldwork in Brazil. "I'm intrigued by the fantastic diversity of ants in the world. There are ants that are tiny, large, shiny, hairy; ants with sickle-like mouthparts, curvy spines and crazy spikes; and some with horns on their heads!"

Still, if there's one ant Powell's team would prefer to avoid, it's the biting army ants. While evolution has seen turtle ants trade their stingers for armored plates, army ants clamp their sharp mandibles into the skin like ice tongs. Then they stab their victims with a retractable stinger and shoot venom into the wound. (It clings so tightly into flesh that ancient peoples in South America are rumored to have used army ants to stitch wounds.) Their bite is "painful and unavoidable in this line of work," Powell said. "It's an ant occupational hazard."

Malathi Thothathiri (center) with student researchers Maria Braiuca (left) and Kasey Lerner

# FINDING ANSWERS TO APHASIA

People with aphasia can feel like prisoners within their own brains. Malathi Thothathiri and her students are searching for a better understanding of the neurological disorder.

For the more than one million Americans suffering from aphasia, their own brains can feel like prison cells. The severity of the neurological disorder varies widely, but it almost always involves an inability to communicate. People's thoughts and perceptions are usually clear in their minds. But they cannot express them through speech.

Aphasia can make people feel like they are trapped inside their own heads, explained **Malathi Thothathiri**, associate professor of speech, language and hearing science. "You might see, for example, a pencil. You might understand what it is and what it does. But if I held up a pencil and asked you to name it, you would struggle to produce the word."

The disorder, which is mainly due to brain tissue damage from strokes and head trauma, can be so mild that it's not immediately noticeable. A person with aphasia may at first seem to have simply forgotten what they wanted to say. Or, in the most severe instances, they can lose almost all language function, like speaking or understanding speech. Some can no longer read or write.

But while aphasia is more common than Parkinson's Disease, cerebral palsy or muscular dystrophy, there are still more questions than answers on how the disorder affects the brain and the best options for treating it. In a major research study, Thothathiri is tackling another gray area: whether aphasia is solely a language disorder or if there is a broader underlying cause that affects language as well as other abilities.

As collaborators in a five-year, $1.6 million National Institutes of Health-funded project, Thothathiri and her team of graduate and undergraduate student researchers are looking for a link between general decision-making abilities and aphasia-related language impairments. "There's a long history in neuroscience of thinking that language is separate from the other things we do—like controlling our behavior or moving our bodies," she said. "We are challenging that idea more and more."

That debate is front and center in aphasia research. In the past, aphasia has been categorized solely as a language disorder. That definition, Thothathiri noted, implies that the disorder only impacts language functions—not decision making as well.

*"There's a long history in neuroscience of thinking that language is separate from the other things we do. . . . We are challenging that idea more and more."*

~Malathi Thothathiri

Language in itself, she said, involves a series of unconscious decisions. "When you're talking, your brain is making a lot of decisions, such as which particular words to use, which particular sentence structures to follow," she said. "And when you're listening, your brain is constantly deciding what exactly sentences mean. There's a lot going on under the hood." Aphasia damage, she said, may impair a person's ability to make those decisions and connections.

## EXPANDING TREATMENT OPTIONS

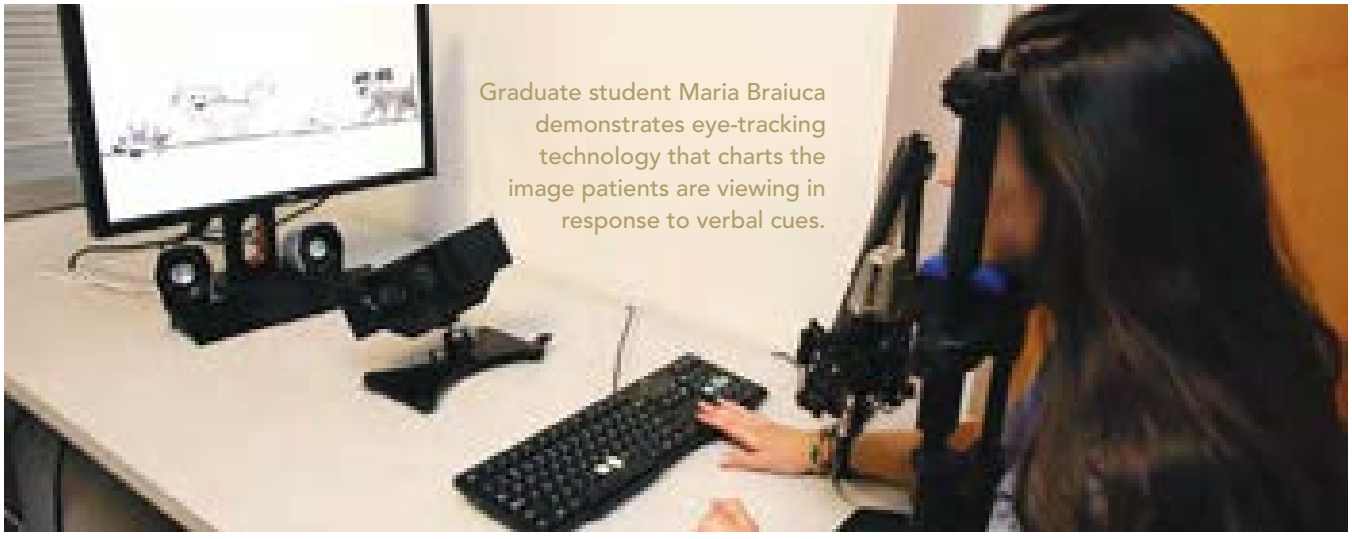
Although some people with aphasia improve over years and even decades, a complete recovery is unlikely after the first few months. It's generally treated through extensive rehabilitation exercises with a speech pathologist. Recently, some specialists have adopted brain stimulation with electrically-charged batteries. By relating general decision making to decision-making-in-language, Thothathiri's study can broaden treatment options.

In a multi-site, collaborative project involving as many as 100 patients, Thothathiri's team is using cutting-edge cognitive neuroscience and experimental psychology techniques. They are mapping brain activity with EEGs and functional MRIs. And they are employing eye-tracking technology to collect moment-to-moment information on how their subjects interpret language. "Our eyes move in accordance with what our brain is thinking," Thothathiri explained.

Second-year graduate student **Maria Braiuca** designed an exercise to follow eye movement as people are asked to choose pictures that correspond to sample sentences. "One picture matches the sentence exactly and the other picture is the exact reversal," she said. "We can see where they are looking on the screen" as the brain weighs a decision.

As part of the project, **Kasey Lerner**, a senior majoring in speech, language, and hearing sciences, put together tests of patients' broader abilities, including short-term memory and decision making.

For both students, the study will provide their first clinical opportunity to work directly with people with aphasia. "I think one of the most important components of working with them is the establishment of a strong patient-clinician rapport," Lerner said. Indeed, Thothathiri emphasizes that her students must show empathy and patience with their subjects, and she reminds them that aphasia is not a mental impairment. "Just because they cannot tell you what their thoughts are, don't assume they don't have clear and concise thoughts," she said. "They just can't put them into words."



Graduate student Maria Braiuca demonstrates eye-tracking technology that charts the image patients are viewing in response to verbal cues.

# FOR ENVIRONMENTAL CHEMISTS, IT'S EASY BEING GREEN

How do you safely design chemicals that won't harm the environment? In her classroom and lab, Adelina Voutchkova-Kostal promotes green chemistry principles. Her latest project may change the way science does business.

From filling consumer orders for shampoos and cosmetics to making life-saving drugs, chemists are skilled at designing molecules to meet societal needs. But, according to Assistant Professor of Chemistry **Adelina Voutchkova-Kostal**, chemists who make commodity chemicals are typically not trained to consider the unintended long-term effects of their work on humans, animals and the environment. "That task has traditionally been left to toxicologists further down the production line," she explained.

Now Voutchkova-Kostal is trying to change the way science does business—both in her research and her classroom. In Columbian College's Environmental and Green Chemistry Program, she is helping students learn how to design safer chemicals through environmentally-friendly methods. "The rules of green chemistry are common sense," she said. "Don't make things that harm people and the environment, and make them in ways that aren't harmful either."

Beyond her work with students, Voutchkova-Kostal is collaborating with Assistant Professor of Chemistry **Jakub Kostal** on a $300,000 National Science Foundation (NSF) research project to devise an environmentally-safe process for converting wood into chemicals. The goal is to make non-toxic solvents that essentially dissolve trees, turning them into a solution that can be used to manufacture chemicals. In the course of the project, "we are applying the principles of green chemistry across the board," she said. "We have a problem and we have to find a green solution and a green path to get there."

## THE CHEMICAL WORLD

There's no escaping chemicals in our daily lives. Commercial cleaners, sunscreens, paints, varnishes—"everything you touch is a chemical formulation of some sort," Voutchkova-Kostal said. More than 65,000 chemicals are currently in the marketplace with 700 new ones appearing each year. Still, there is scant health and safety data for nearly 80 percent of the chemicals in commercial use, according to Voutchkova-Kostal.

Meanwhile, laboratory scientists are continually making new chemicals, but they often do not know how they might be used once they are introduced into the market. For example, the controversial chemical BPA was originally designed as a synthetic hormone. In the 1960s, it was repurposed as an additive to plastics that included consumer goods like food and beverage containers.

In contrast, green chemistry promotes minimizing the risk of adverse biological effects of new chemicals before they are ever synthesized. Rather than measuring their harmful effects after they've been released into the environment, "we can design safer molecules from the start," she said.

That is a key component of the green chemistry program. The interdisciplinary curriculum was created with input from the Environmental Protection Agency (EPA), the U.S. Food and Drug Administration, national research labs and chemical companies including Dow and DuPont. It combines traditional courses like organic and computational chemistry with instruction in chemical toxicology, giving students a big-picture perspective of how their work impacts the world outside the lab.

In Jakub Kostal's Chemical Toxicology and Safer Chemical Design course, for example, a mix of undergraduates, doctoral and master's students assessed the hazards of 20 low-priority chemicals under the EPA's Toxic Substances Control Act. In their final projects, they prepared reports for key stakeholders like the EPA, American Chemistry Council and Natural Resources Defense Council on whether to support or challenge the low-risk claims. The experience helped students understand how science may impact public health and environmental policy.

"There is an emphasis on real-world applicability rather than a sole focus on academic exercises," said **Savannah Sierco**, a master's student in environmental and green chemistry. "That's what is most rewarding to me. You can see where your work could be used to benefit health and safety."

*"The rules of green chemistry are common sense: Don't make things that harm people and the environment, and make them in ways that aren't harmful either."*

~Adelina Voutchkova-Kostal

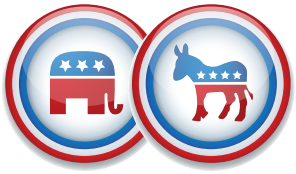
## WOOD CONVERSION

For the NSF project, Voutchkova-Kostal is attempting to move the chemical industry away from its heavy reliance on oil. Most chemicals are petroleum-based; about 20 percent of the world's oil resources are used to make chemicals. But, as Voutchkova-Kostal noted, "we have to find new environmentally sustainable ways of making chemicals." Food crops are a potential alternative but, with food scarcities around the world, they're in short supply as well. "We don't want to touch them," she said.

The best remaining option, scientists agree, is wood biomass, which essentially turns trees into the raw material for chemicals. "Using wood instead of crops. . . to make chemicals ensures that chemical manufacture does not compete with our food production," Voutchkova-Kostal explained. But, she added, converting wood into chemical material offers practical challenges—specifically, "How do you get the tree into a pot? How do you dissolve it?"

The good news, according to Voutchkova-Kostal, is that molten salt solvents have proven effective in melting wood biomass. The bad news is they are also highly toxic. Voutchkova-Kostal is trying to manipulate the molecular structure of the solvent to maintain its effectiveness while reducing its toxic properties. "You modify these molecular building blocks and hope you hit on a formula that satisfies everyone," she said. Along the way, the project is following the same green chemistry guidelines as Voutchkova-Kostal teaches her students in the classroom, creating safer chemicals through safer processes.

"Green chemistry empowers students to seek solutions to the challenging problems of minimizing our impact on the planet," she noted. "Eventually all chemistry will be green. We are a long way from being there. But our students will be the ones leading the way."



# MAKING ELECTION MATH ADD UP

Can mathematics save our election system?
Professors Daniel Ullman and E. Arthur Robinson forecast
the pluses and minuses of how we count votes.

When deciding among a crowded field of candidates in an election, Professor of Mathematics **Daniel Ullman** often finds himself befuddled in the voting booth. His conundrum isn't political, it's mathematical. An outlier candidate could play the role of spoiler, leap-frogging to victory despite holding views that most voters would reject.

With voters restricted to just one choice, the spoiler candidate "could win even though he [or she] is the least popular," Ullman explained. From a mathematical standpoint, he reasoned, there had to be a better way.

When it comes to examining electoral alternatives, Ullman wrote the book—literally. Along with Professor of Mathematics **E. Arthur Robinson**, he co-authored *The Mathematics of Politics*, a seminal text on the role math plays in our political system. Ullman also teaches the undergraduate course Mathematics and Politics. (Robinson taught it in past semesters.) The pair have looked at elections through the lens of mathematical theorems, proofs and equations. Their conclusion? When you do the math, our voting systems don't add up.

Professors of Mathematics E. Arthur Robinson (left) and Daniel Ullman

## BAD AND WORSE

Most American elections for state and federal offices follow two formats: The majority use a basic plurality—voters choose one candidate and whomever receives the most votes wins. The presidential race, however, is decided by the complicated Electoral College system. Ullman and Robinson say both methods are fatally flawed—to the point where a 2010 Swiss survey of political scientists ranked plurality last among preferred methods. The Electoral College didn't even make the list.

Plurality works when choosing between two candidates but fails in a larger field, noted Ullman and Robinson. It doesn't let voters express their preference for more than one candidate. And it can lead to a third party hijacking a crowded race. Take, for example, the disputed 2000 presidential election. In the all-important Florida contest, George W. Bush defeated Al Gore by just 537 votes. Left-leaning third party candidate Ralph Nader received 97,000 votes. It's mathematically reasonable, Ullman and Robinson say, to conclude that Nader spoiled Gore's chances of victory. "If we weren't stuck on plurality, if voters could express preferences for several candidates rather than picking just one, the numbers would have looked very different," Ullman said.

If plurality is broken, the Electoral College is beyond repair, they added. In addition to the possibility that a president can be elected with a minority of the popular vote—it's happened four times, most recently in 2016—the winner-take-all Electoral College doesn't weigh each vote equally. Some votes count more than others. Again in 2000,


Gore carried California handily but lost Wyoming by a narrow margin. A Gore vote in Wyoming had a greater impact on the election than one in California. "Had Al Gore picked up 100 percent of the California vote, he would have been the top choice of a vast majority of the national electorate—and still lost," Ullman said.

## A BETTER WAY?

So is there a better way to count votes? It's a question Ullman and Robinson often hear from their students—and their answer is rarely satisfying. According to a mathematical concept called Arrow's Theorem, no voting system can fulfill all fairness criteria all the time. In other words, "Arrow says you can't have everything," Robinson explained.

But elections must go on. And the professors point to the Swiss poll's first choice: approval voting. It allows voters to check off as many candidates as they like. "You essentially vote yes or no, thumbs up or thumbs down, for all the candidates on a ballot," Ullman said. Frequently used to elect boards of trustees and even the secretary general of the United Nations, approval voting favors consensus candidates and all but eliminates a Nader-like spoiler.

But approval voting isn't perfect either. Voters can't indicate a strong preference for their top candidate. All your thumbs-up votes are given equal weight—which can actually hurt the odds of your first choice winning.

Ranked-choice voting, which is second on the Swiss survey, lets voters show a clear favorite by listing each candidate in their preferred order: first, second, third, etc. In a version called the Hare Method, the candidate with the fewest first-place votes is eliminated—second, third and subsequent choices move up until someone receives a majority. A twist on Hare is the Borda Count, which is essentially a point system. Voters still rank each candidate, but they are then assigned point values; one point for last, two for next-to-last and so on. The person with the most points wins.

Both Hare and Borda have been used to determine real-world elections. (Hare in Australia, Ireland and Malta; Borda in Slovenia and Iceland.) Proponents say ranked-choice tends to elect broadly acceptable candidates. But it can also result in a winner emerging without the most first-place votes.

Neither Ullman nor Robinson expects a major shift in America's national election formats. But local election landscapes frequently experiment with novel voting methods. Municipal contests from Takoma Park, Md., to San Francisco use the Hare Method. And in 2018, Maine became the first state to adopt ranked-choice voting for congressional primaries. Robinson even persuaded a student to use a Borda Count for her sorority elections. It may not be the Electoral College, he joked, "but it's a start."

# INHUMANE OR UNAVOIDABLE? FRAMING ANIMAL RESEARCH ETHICS

With scientists, activists and the public split over the value of animal testing, Philosophy's David DeGrazia hopes to guide them toward common ground.

When is the use of animals in biomedical research justified and when does it go too far? What is the trade-off between scientific experiments that may harm animal subjects and the possibility of breakthrough treatments for diseases like cancer and HIV?

Those are questions that Elton Professor of Philosophy **David DeGrazia** has asked for decades as a scholar with specializations in animal ethics and bioethics, a Senior Research Fellow at the National Institutes of Health (NIH) and author of numerous books including *Taking Animals Seriously: Mental Life and Moral Status*.

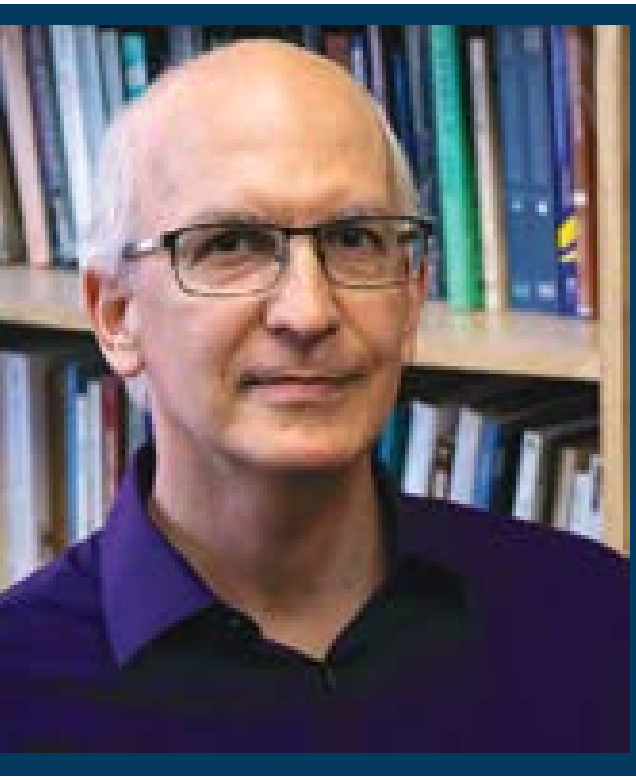
Now, in an upcoming book co-authored with Georgetown Philosophy Professor Tom Beauchamp, DeGrazia looks at new ethical standards on animal testing that emphasize the concept of "unnecessary harm." He hopes these standards will be adopted by the research community and become a condition for funding from public grant-makers like NIH.

"An explicit ethical framework can improve science, improve animal welfare and improve public acceptance," DeGrazia said. "We can pursue the objectives of science while making those goals compatible with animals having decent lives."

Animal testing has long been a hot button issue, pitting animal rights groups' claims that the practice is inhumane against researchers' insistence that it is vital for scientific advancements. But Americans are largely divided. Pew Research Center polls have recently suggested that just over half the public opposes the use of animals in research.

But it's difficult to determine the extent of animal experiments in the U.S., much less worldwide. The United States Department of Agriculture (USDA), the agency that enforces animal welfare regulations, reports that fewer than one million animals are used in research each year. But that number doesn't include rats, mice and birds. Estimates for the total figure range from between 12 and 25 million to over 100 million.

In 2017, biannual USDA statistics showed a 7 percent increase in animal research from 2015. But in the last year, animal activist groups have scored key victories. Congressional action halted monkey and dog studies at several top U.S. research facilities. And lawmakers directed both the NIH and the U.S. Food and Drug Administration (FDA) to produce reports detailing how scientists use the thousands of nonhuman primates in their research centers. In 2019, the FDA shut down a study of nicotine addiction in monkeys and the Trump administration banned most dog experiments at the U.S. Department of Veterans Affairs—both over the objections of scientists.



*"An explicit ethical framework can improve science, improve animal welfare and improve public acceptance."*

~David DeGrazia

Today's research landscape is "all over the place," said DeGrazia, who emphasized that he was speaking only for himself and not for NIH or any other federal agency. "A lot of it is relatively benign. Some is mildly troubling but may be justified based on the potential benefits. And some is very troubling."

## BEYOND THE 3R'S

In 1966, the federal Animal Welfare Act outlined standards of care for animals in research. The law has been updated frequently, but it applies only to mammals other than rats, mice and farm animals. Overall, according to DeGrazia, there has been relatively little change in animal research standards since the mid-1980s.

The mainstream scientific community has traditionally been guided by a 1959 protocol known as the "3R's." It advises scientists to replace sentient animals whenever possible; reduce the number of animal subjects; and refine techniques to minimize pain and distress.

But while the 3R's were a major step in promoting animal welfare, DeGrazia said the guidelines are insufficient today. The proposed new framework, he noted, fills in many of the older standard's gaps. It is based on the assumption that sentient animals—vertebrates and cephalopods, not insects or plants—have a moral status and any justification for harming them must appeal to substantial social benefits. To reach that bar, researchers must demonstrate that the prospect of social benefit exceeds the costs and that no alternative method is available, like mathematical models, computer simulations or even human trials.

The framework's prohibition of "unnecessary harm" may seem like common sense. But DeGrazia stresses that it encompasses not just the scientific procedures themselves, but also the housing, handling and transport of animals—traditionally a blind spot in research ethical standards. He also calls for an expanded understanding of animals' basic needs, beyond food, water and shelter to adequate exercise, sufficient rest and access to veterinary care.

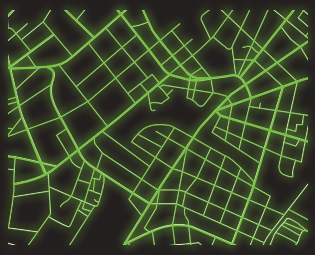
"The field of animal ethics has grown so much and public opinion has become so much more informed that there is a lot of room for nuance, as opposed to just polarized positions," he said. "We are trying to find common ground and build a framework that nearly anyone can buy into. This isn't about being purists. It's about building bridges."

# Major New Research Grants

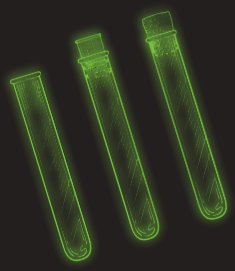
The following Columbian College faculty were recipients of grants of $250,000 and above over the past academic year:

**Andrei Afanasev**
(Physics): $363,700 from the U.S. Army Medical Research and Materiel Command to study interactions of twisted light at sub-wavelength scales.

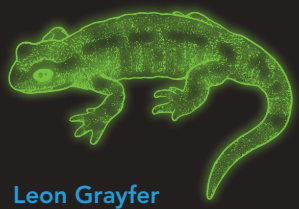
**Lisa Bowleg**
(Psychology): $3,226,000 from the National Institutes of Health/National Institutes on Drug Abuse for research on reducing drug use among African American males and addressing related co-occurring negative mental and physical health issues.



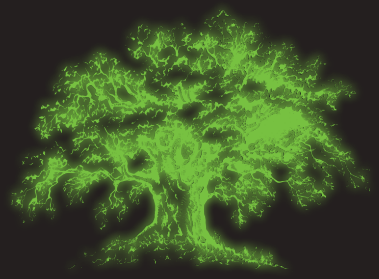
**Nuala Margaret Cowan**
(Geography): $491,900 from the United States Agency for International Development to expand the YouthMappers University Consortium's mission to build open spatial data for economic development and community resilience.



**Cynthia S. Dowd**
(Chemistry): $516,400 from the National Institutes of Health to develop novel, potent antitubercular and antimalarial agents by inhibiting the metabolic pathway of certain organic chemicals.



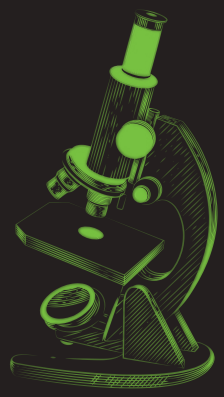
**Leon Grayfer**
(Biology): $750,000 CAREER award from the National Science Foundation for research on amphibian immune responses to ranaviruses that contribute to the worldwide decline in the amphibian population.



**Jakub Kostal**
(Chemistry): $367,400 from the National Science Foundation to devise an environmentally-safe process for converting wood biomass of trees into chemicals. (See story, page 38.)

**Vera Kuklina**
(Geography): $394,500 from the National Science Foundation to study the impact of undocumented transportation pathways on remote communities in Siberia.

**Hua Liang**
(Statistics): $448,000 from the U.S. Department of Defense to develop software for pharmacodynamics and bioassay studies.

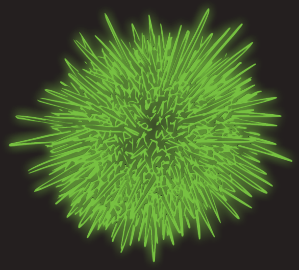


**Michael Massiah**
(Chemistry): $450,000 from the National Science Foundation to investigate the function of a key class of enzymes called RING E3 in cellular protein recycling.

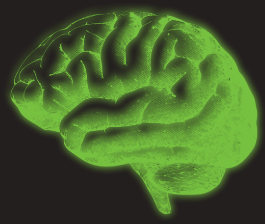
**Weiqun Peng**
(Physics): $598,100 from the National Institutes of Health for research on enzymes that regulate follicular helper T-cells for the human body's immune systems.

**Scott Powell**
(Biology): $287,800 from the National Science Foundation to develop a new framework for explaining how ant colonies create well-functioning transportation systems via a process of gradual modification rather than design. (See story, page 34.)

**Nikolay Shiklomanov**
(Geography): $1,261,800 from the National Science Foundation for Circumpolar Active Layer Monitoring, a program to measure the impact of climate change through long-term observations of permafrost.



**L. Courtney Smith**
(Biology): $775,000 from the National Science Foundation to study anti-pathogen activities of sea urchin protein.

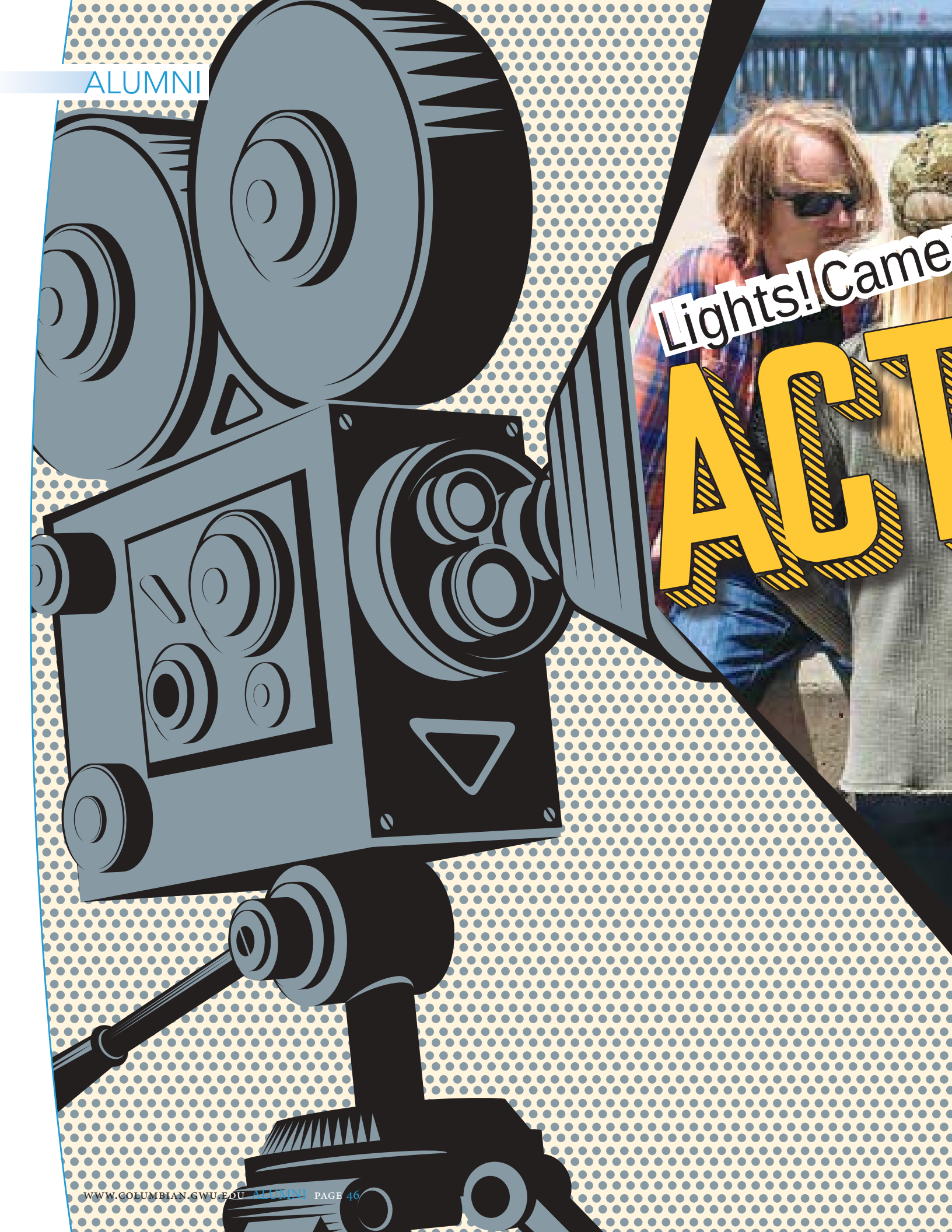


**Malathi Thothathiri**
(Speech, Language, and Hearing Sciences): $1,663,000 from the National Institutes of Health to research cognitive control and sentence processing among people with aphasia. (See story, page 36.)

**Akos Vertes**
(Chemistry): $1,300,000 from the Intelligence Advanced Research Projects Activity for the Proteos Program, a multi-year project to develop a new human identification method based on the analysis of proteins metabolomics.

**Gabriela Rosenblau**
(Psychology): $495,000 from the Simons Foundation to examine computational neuroscience-derived predictions of learning abilities.

*Note: Dollar figures are rounded to the nearest thousand.*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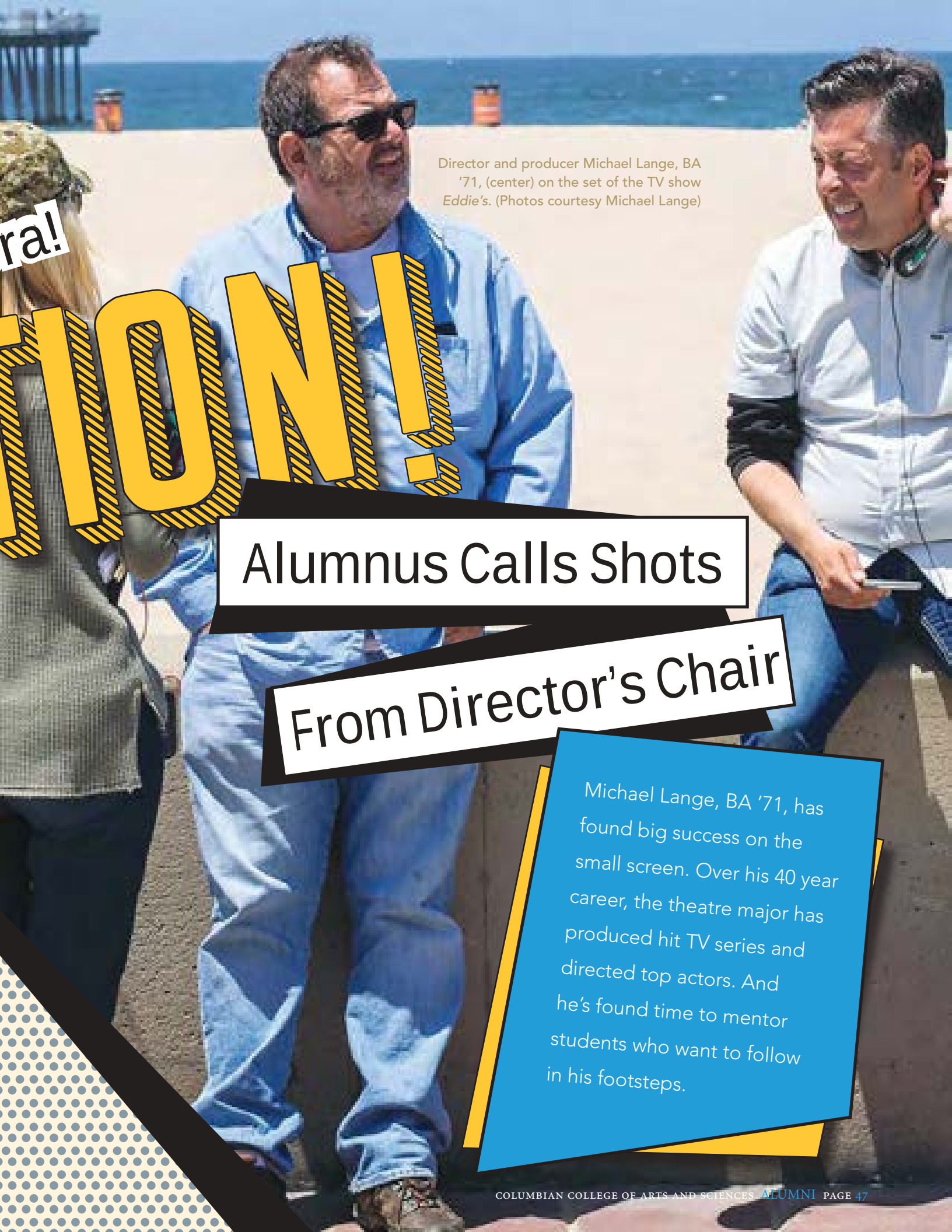


Director and producer Michael Lange, BA '71, (center) on the set of the TV show *Eddie's*. (Photos courtesy Michael Lange)

ra!

TION!

# Alumnus Calls Shots From Director's Chair

Michael Lange, BA '71, has found big success on the small screen. Over his 40 year career, the theatre major has produced hit TV series and directed top actors. And he's found time to mentor students who want to follow in his footsteps.

No matter how many times veteran TV director and producer **Michael Lange**, BA '71, shows up on a set, one thing always surprises him. Whether he's cuing actors from *The Fall Guy* or *The X-Files*, positioning cameras for close-ups or collaborating with electricians and carpenters, when he shouts "Action!," the cast and crew spring to life.

"In the real world, if I yelled out 'Action!' nothing would happen—except people would look at me like I'm nuts," Lange laughed. "On the set, the director says 'Action!' and—like magic!—everything starts moving."

A television set is like a second home for Lange. Since 1982, he has directed more than 250 episodes of some of TV's most acclaimed series such as *The Larry Sanders Show*, *Northern Exposure* and *Buffy the Vampire Slayer*. But each day he sits in the director's chair still feels like the start of a fresh creative journey. "It's like being the captain of a ship," he said. "You're asking 100 people to walk in a certain direction. To be a good director, you have to believe that they'll follow right behind you."

When Lange is asked for tips on breaking into show business, he replies with his go-to advice: "If there's anything else you are good at, do that instead." In TV, he explains, the hours are unforgiving, the egos are overwhelming and most of the day is spent waiting on sets while eating cold cut spreads from Styrofoam plates. Still, he doesn't expect aspiring directors to heed his warning. "Directors have to take rejection and still persevere in trying to create something original and beautiful," he said. "The kind of people who are wired that way don't give up easily."

## From Street Theater to Hollywood

Lange's own show biz career was almost derailed before it ever started. As a student at GW, his parents wanted him to be a doctor. They even threatened to cut off his tuition payments if he majored in theatre. Lange called their bluff. "I pointed out that there are almost the same letters in 'doctor' and 'director,'" he joked. "And if I screwed up as a director, nobody would get hurt."

In the late 1960s, Lange said, the theatre program (which is now part of Columbian College's Corcoran School of the Arts and Design) was small, but the energy on campus was exhilarating. He tried his hand at every production role from direction to stage craft to acting. At the height of the Vietnam War, he wrote and directed anti-war plays and performed Foggy Bottom street theater. "It was a very exciting time to be a student and to be rebellious," he said.

Most influentially, he fell under the sway of the late Professor of Theatre **Nate Garner**. Under Garner's mentorship, Lange learned how to interact with actors, how to simply and efficiently tell a story and how to keep a crew at its creative best through 12 hour days. "I learned my whole directing style from him," he said. "To this day, I think of him on every scene I direct."

After graduation, Lange embarked on a career in advertising. For eight years, he served as head of television and radio production at renowned Madison Avenue firms. "I was a Mad Man!" he joked. Seeking more creative satisfaction, he moved on a whim to California—with no prospects and two years of salary in the bank. He landed his first job as a post-production assistant and second unit director for the hit action show *The Fall Guy*. Suddenly, Lange was directing stunts and car chases. "I had no idea what I was doing but


*"It's like being the captain of a ship. You're asking 100 people to walk in a certain direction. To be a good director, you have to believe that they'll follow right behind you."*

~Michael Lange

Michael Lange (right) on the set of *Royals*—one of the many TV shows he has directed— with (from left) actors Jake Maskall and Elizabeth Hurley

I had a fake-it-'til-you-make-it mentality," he recalled. He relied on the experience of his camera crew and assistant directors. "As a director you don't need to know how to get what you want. You need to know how to express to other people what you want—because they'll get it for you."

The work is challenging. Even a simple scene may take three hours to shoot. And while Lange has collaborated with performers he considers geniuses—notably the late Gary Shandling in *The Larry Sanders Show*—he's also massaged egos, like a well-known TV actress who insisted he speak to her through her dog. "In TV, you step on the set to do a job," Lange noted. "You strive to maintain your creativity and your excitement in telling the story. But the director always has to remember that there's a job to do every day."

In addition to TV, Lange directed the feature film *Intern* and hosts a streaming radio show called *From the Set*. He and his former GW roommate **Peter Gorin**, BA '71, produce song parodies of Broadway tunes with a Jewish spin. And Lange is currently writing his second musical, a re-telling of Macbeth set on Wall Street titled *Fair is Foul*.

Still, he makes time to connect with his GW roots, returning to campus for guest lectures and events. While hosting a student workshop at a campus alumni event, Lange was so impressed by theatre major **Maggie Contreras**, BA '06, that he told her to look him up if she was ever in L.A. "He couldn't promise anything except that he would buy me a cappuccino," Contreras said. "Well, I did—and he kept his promise!" In addition to the coffee, he cast Contreras in her first professional acting role in the series *Greek*, which Lange co-executive produced and directed. "I brought her in to audition and she nailed it," he said. Lange has also directed Contreras in the TV drama *Criminal Minds*.

"On set, Michael is a no-nonsense director who works at an appropriately fast pace, fosters a fun-yet-focused environment and requires his actors to do what they were trained to do so he can do his job effectively," Contreras said. "Everyone on Michael's sets love him being at the helm because it's sure to be an enjoyable and on-schedule day."

A documentary film producer, Contreras also frequently asks Lange to offer notes at her test screenings, "I want Michael in the room," she said. "He knows how to tell a good story and has a keen sense for what does and does not work. Also, he's a really fun guy to have cappuccino with!"

# CLOSING COLD CASES

*Forensic sciences alumni are clearing a massive backlog in untested sexual assault kits. Their findings bring peace of mind to victims and put criminals behind bars.*

Bode Technology analysts Jaclyn Benjamin, MFS '14, (left) and Lauren Macdonald, MFS '15, performing DNA extraction. The Virginia forensic sciences lab employs more than 20 Columbian College graduates. (Photos courtesy Bode Technology)

Each morning, delivery trucks pull up to the loading dock at the Bode Technology headquarters in Lorton, Va. They carry hundreds of cardboard boxes from around the country—10 from Houston, 20 from Detroit, sometimes as many as a thousand from one city alone. Inside each box are piles of envelopes marked "Evidence."

The boxes are sexual assault kits—commonly known as rape kits. The envelopes contain swabs of bodily fluids, hair clippings and even underwear and clothing. They all represent evidence collected by nearly 200 crime laboratories and law enforcement agencies from victims of alleged assaults. Some are recent, some date back decades.

And none of them have ever been tested.

"There is a crisis of untested sexual assault kits," said **Mike Cariola**, MFS '99, the CEO, president and owner of Bode, a forensic sciences lab that employs 20 graduates of Columbian College's Forensic Sciences Program among its 150 DNA analysts, investigators and technicians. With as many as 400,000 sexual assault kits sitting in evidence lockers and police labs across the country, CCAS alumni are at the forefront of clearing the backlog using cutting-edge technology to identify an assailant.

"My work might find some resolution for the victim or it might free someone who isn't a match," said DNA Analyst **Lauren Macdonald**, MFS '15. "At the end of the day, I'm just trying to help people."

## MAKING A FORENSIC IMPACT

Every 98 seconds, someone is sexually assaulted in the United States. In a sense, the victims' bodies become part of the crime scene. Many submit to photographs, swab analysis and invasive examinations. Still, most assailants aren't caught—let alone convicted. The United States has only a 20 percent arrest rate for rape crimes and only a 40 percent clearance rate, according to Department of Justice figures.

Sexual assault kits that have not been processed are part of the problem but, noted Cariola, the reasons for the backlog are varied, from a lack of law enforcement resources and manpower to ignorance about the forensic usefulness of the kits. If, for example, a victim already identified the attacker, police might not examine the kit, even though it could contain DNA linking the assailant to other unsolved crimes.

There is no federal law requiring the examination of rape kits. But a 2017 report by the National Institute of Justice recommended all kits connected to a reported crime be submitted to a lab for DNA analysis. And since 2016, victims advocates have helped pass 34 testing laws and four resolutions in 26 states.

Some of the kits that arrive at the Bode loading dock are too degraded to offer usable evidence. DNA Analyst **Jaclyn Benjamin**, MFS '14, said she has worked on moldy kits from damp warehouses and water-damaged samples from Hurricane Katrina sites. "DNA breaks down over time, especially if it's kept in wet or hot conditions," she said. "Sometimes we try our best, but we just can't get good information from them."

But sometimes the results can be startling. In 2000, Cariola worked with New York City officials to clear a backlog of 6,000 rape kits. Since then, New York's sexual assaults arrest rates jumped from 40 percent to 70 percent. In 2009, more than 11,000 rape kits were found in an abandoned Detroit storage facility. The tested kits have identified 821 rapists who had committed crimes in 40 states and Washington, D.C. And the testing effort is still ongoing.

"Forensic scientists have an immediate impact on society," said Associate Professor of Forensic Sciences **Daniele Podini**. "As educators in this field we are well aware of the importance of the job our graduates do, and we do our best to prepare them with both technical and theoretical knowledge."

*"My work might find some resolution for the victim or it might free someone who isn't a match. At end of the day, I'm just trying to help people."*

~Lauren Macdonald

At Bode, teams of DNA analysts examine hundreds of boxes a month. The laborious process involves cutting samples from individual swabs or clothing, extracting the DNA through chemical and automated processes and then determining whether the samples are distinctive enough to construct a DNA profile. "Over 99 percent of our DNA is the same from person-to-person," Cariola said. "We are looking for those rare markers that individualize each person."

A high-tech sample-extracting robot has helped yield faster DNA profiles. Rather than technicians preparing each sample by hand, Bode's robots can process 80 at a time. Keeping abreast of the field's fast-moving technology is critical for forensic analysts, a fact that Podini stresses in his classes. "The technology changes so rapidly that students must always be learners," he said. "I can teach them the technology they will use on their first case. But I have no idea what technology they will use on their last case before they retire. It probably hasn't been invented yet."

The analysts often know only the bare minimum facts of each sample: a case folder on the assault; the ages, gender and medical condition of the victims; and, perhaps, a physical description of a suspect. Limiting their case-knowledge prevents them from introducing their own personal biases. "The less we know, the better," Benjamin says. "We are reporting hundreds of cases a month. We have to push the personal side to the back of our minds and concentrate on what's in front of us."

Whether she's unraveling microscopic strands of DNA or testifying in court, Benjamin said her forensic science studies gave her a firm footing in the most important aspect of her work: the science. "Some days I'm trying to explain DNA to a jury or a detective and some days I'm looking at evidence on a molecular level," she said. "Either way, having a good background in the science that goes into DNA testing has always been the bottom line in getting the job done."

Inside the Bode Technology labs in Northern Virginia

# ALUMNI UNICORNS SPELL BUSINESS MAGIC

Do you believe in magic? Just ask four Columbian College alumni business wizards whose startups topped $1 billion in valuation—and earned them a spot as "unicorn" entrepreneurs.

An exercise revolution. Food that can save the planet. An innovative approach to online learning. And the Uber of garbage.

What do they have in common? They're the brainchildren of Columbian College alumni "unicorns"—entrepreneurs who founded businesses that surpassed $1 billion in valuation since 2005. GW ranked among the top 15 unicorn-creating universities nationwide according to *Medium* magazine, based on the success of four savvy alumni: Peloton's **Tom Cortese**, BA '02; JUST's **Josh Balk**, BA '03; 2U's **Christopher "Chip" Paucek**, BA '92; and Rubicon Global's **Nate Morris**, BA '03.

"Successful entrepreneurs need to have at least three traits: They want to make a difference, they think innovatively and they have a bias for action," said **Jim Chung**, GW's associate vice president for research, innovation and entrepreneurship. "GW tends to attract these kinds of students. As a result, our alumni have done especially well in the entrepreneurial world."

"We are particularly proud that all four of GW's unicorns are Columbian College graduates," added **Paul Wahlbeck**, interim CCAS dean. "Their incredible success demonstrates the value of a broad-based liberal arts education."

On the following pages, each of these entrepreneurs share their secrets for turning their education into startup wizardry.

## FIGHTING FOR THE UNDERDOGS (AND COWS AND CHICKENS)

Josh Balk has always had a soft spot for underdogs—especially when they're actual animals.

"Animals can't speak up for themselves," said the political science major. "Someone has to be on their side."

Balk is coming to the rescue of animals and humans alike. As vice president of farm animal protection for the Humane Society of the United States, he teamed up with the food industry to eliminate veal crates, gestation pens for breeding pigs and battery cages for chickens.

At JUST, Inc., the food company he co-founded with high school classmate Josh Tetrick, Balk markets affordable, sustainable plant-based products that include dressings, dips, cookie dough, liquid eggs and vegan mayo. His healthy, humane menu is so earth-friendly that Bill Gates called JUST "the future of food."

Plant-based food "is dramatically better for the planet," Balk said. "It relieves animal suffering . . . and it leads to reductions of greenhouse gas emissions, land use and water use. It happens to be darn delicious too."

Balk's advocacy has earned him accolades like *Inc. Magazine* "35 under 35" honors and the publication's "top 15 entrepreneurs to watch." In 2015, he was elected to the Animal Rights Hall of Fame by global animal welfare leaders.

Balk credits GW with opening doors to his activism—literally. As a senior, he strolled into the Humane Society's Washington, D.C., offices and landed an internship on the spot. "GW was wonderful at encouraging students to get involved," he said. "Whether it was interning or volunteering, GW made me feel like I could go out and make a difference."


Josh Balk


Christopher "Chip" Paucek

## HIGHER ED'S 'HOME' WORK

South Florida native Christopher "Chip" Paucek saw his first snowfall when he arrived at GW. The political communication major also met his wife while studying at Foggy Bottom. And he forged a philosophy that would transform online education. "I can't overstate the impact GW had on my life," he said in an interview with *HuffPost*. "From then on, I became convinced that higher education has the power to fundamentally change the lives of people everywhere."

Paucek is the co-founder and CEO of 2U, Inc., described by *Forbes Magazine* as the "nation's leading provider of software" for educational institutions. He partners with colleges and universities on online education platforms that bring digital versions of campuses into students' homes.

A first-generation college student, Paucek understands the value of quality higher education. But he also recognized that some people are so hamstrung by time constraints and commitments that a degree can seem out of reach. The right online education, he realized, opens academic doors for busy adults. "For the first time ever you don't have to pick up your life, quit your job and move to attend a great school and really become the person you want to be," he said.

Paucek has earned a string of honors, including the Ernst & Young Entrepreneur of the Year Award in 2012, the Goldman Sachs 100 Most Intriguing Entrepreneurs Award in 2013 and multiple Highest Rated CEO awards from Glassdoor. In 2017, he was listed among America's best chief executives in *Institutional Investor* magazine.

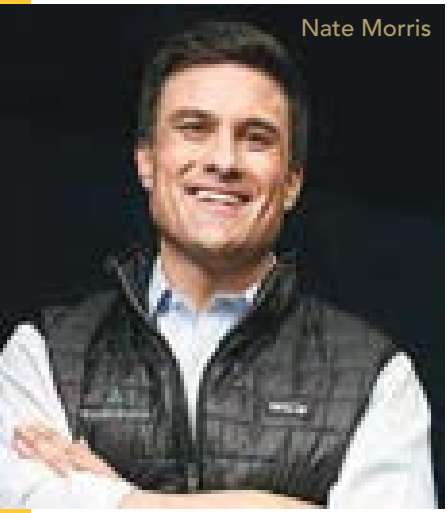
But Paucek is quick to credit his team of creative professionals for 2U's success. "I look for talent that brightens the room," he said. "You can train the skillset, but you can't train the spirit."

## THE UBER OF GLOBAL GARBAGE

Nate Morris, who majored in political science, has heard his company Rubicon Global referred to as the "Uber of garbage." His novel approach to waste management does indeed sport some ride-sharing similarities; it matches multinational clients with local haulers.

But Morris founded Rubicon in 2008 with a loftier mission: "To end waste," he said.

A worldwide leader in sustainable waste and recycling services, Rubicon has expanded to all 50 states and across 18 countries on five continents. Using cloud-based technology, Morris' firm helps small businesses compete for waste industry contracts by letting consumers pick their own trash collectors. At the same time, he is disrupting the traditional landfill model through an emphasis on recycling the largest amount of materials possible.


Nate Morris

That approach has led to Rubicon being recognized as "One of the World's Most Innovative Companies" by *Fast Company* magazine and as an "Industry Disruptor" by *Inc Magazine*. And Morris has been named one of *Fortune's* "40 under 40" business leaders, a Young Global Leader by the World Economic Forum and a 2018 Most Admired CEO by the *Atlanta Business Chronicle*. His work with his nonprofit Morris Foundation to improve the lives of Kentucky's working families through strategic giving earned him a spot in the Kentucky Entrepreneur Hall of Fame.

Born in Lexington, Ky., Morris was raised by a single mother with help from his grandfather, a union leader and Army veteran, and his grandmother, a homemaker. He studied at GW as a Scottish Rite Scholar. "I was immersed in a world that allowed me to develop my leadership skills and probe important public policy challenges related to the environment," Morris said. "I remain immensely grateful for my time at GW, and especially for my professors who continue to serve as mentors today."


Tom Cortese

## THE STATIONARY BIKE OF THE STARS

Several years ago, Tom Cortese and a small band of tech workers wanted to make working out at home more accessible and maybe even fun.

"Once you have kids, families, all the stresses of a job, fitness doesn't have as much of a place in your life," said Cortese, who majored in philosophy at GW.

Their brainstorm solution was Peloton, a stationary bicycle and exercise-content company that live streams fitness classes to users pedaling along at home. Founded in 2012, Peloton sold its first bike in 2014, and now counts all-star clients like David Beckham, Ellen DeGeneres, Hugh Jackman and Leonardo DiCaprio among its bike-owners.

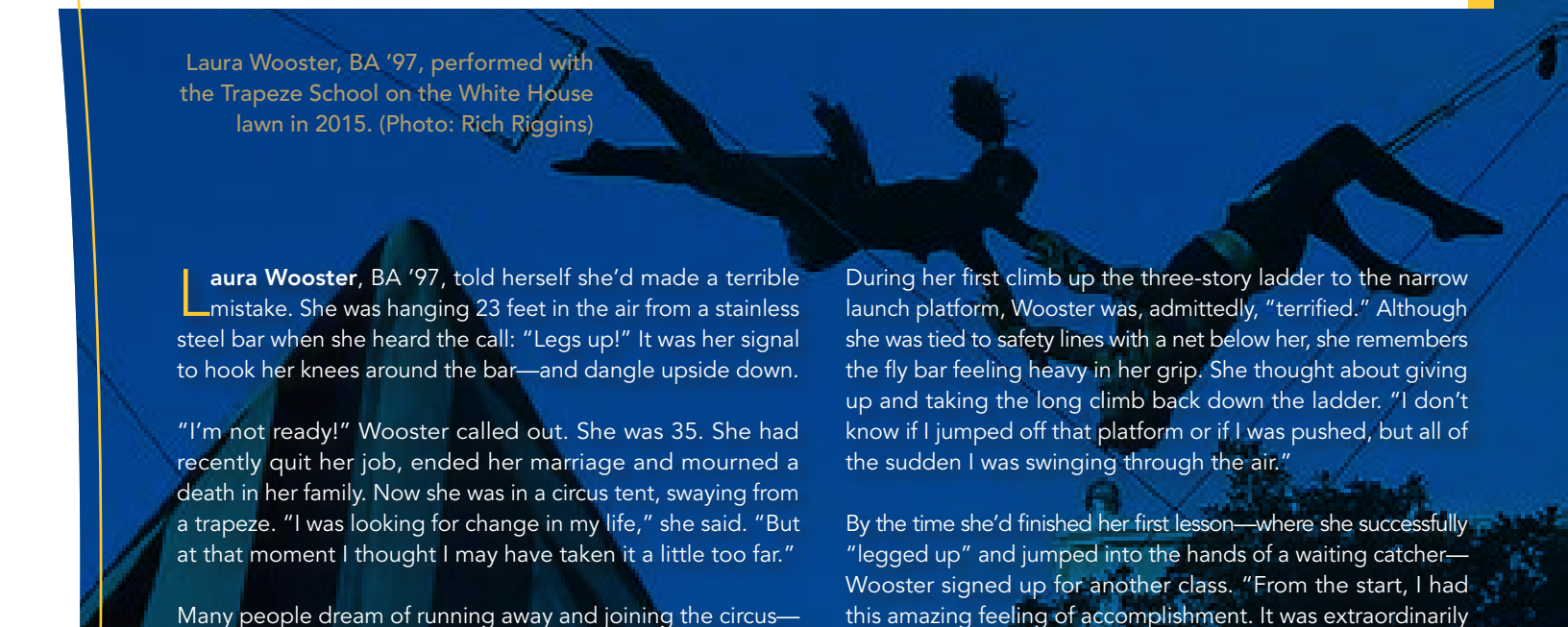
Cortese, the company's co-founder and chief operating officer, never set out to make an exercise bike company. "We wanted to solve a bigger problem, which was moving fitness into the comfort and convenience of home," he said. "Virtually everybody told us that our idea wouldn't work at all. But we had lots of people say if you can pull it off, it's exactly what we want."

Merging media, technology and exercise, Cortese built a platform that brought a community of clients together around shared experiences. "For us, it was: Let's take what's working, let's make sure we're focused and understand what the consumers love and what's resonating for them," he said. "Let's figure out how to scale it and bring it into a convenient location, which is the home."

For Cortese, the stationary bike was the ideal vehicle to help launch his fitness revolution. "The beautiful thing about the bike is it's an incredibly approachable piece of equipment. People understand the concept of a bike. You can adjust the resistance and cadence yourself. There's no machine that's driving you. To us, it was a really great starting point."

# The Daring Alumna on the Flying Trapeze

*In her mid-30s, Laura Wooster, BA '97, swung into a career as a trapeze artist. She's taken her aerial expertise from circus big tops to the White House.*



Laura Wooster, BA '97, performed with the Trapeze School on the White House lawn in 2015. (Photo: Rich Riggins)

**Laura Wooster**, BA '97, told herself she'd made a terrible mistake. She was hanging 23 feet in the air from a stainless steel bar when she heard the call: "Legs up!" It was her signal to hook her knees around the bar—and dangle upside down.

"I'm not ready!" Wooster called out. She was 35. She had recently quit her job, ended her marriage and mourned a death in her family. Now she was in a circus tent, swaying from a trapeze. "I was looking for change in my life," she said. "But at that moment I thought I may have taken it a little too far."

Many people dream of running away and joining the circus—but Wooster actually did it. Seven years after her first swing on a fly bar, the political science major is a professional trapeze artist and instructor with the Trapeze School New York at its D.C. Navy Yard facility. She has performed with circuses and trapeze troupes throughout the D.C. area, including a show on the White House lawn with President Barack Obama in the audience.

When she's not perfecting her mid-air somersaults and backflip dismounts, Wooster is an independent marketing and public relations consultant. And while her Columbian College professors would be surprised to see her under the big top rather than up on the Hill, "if there's one thing I learned at GW it's that I can do anything," she said.

Wooster didn't have Cirque du Soleil dreams as a child, but she remembers seeing a circus as a toddler and telling her grandparents that anything the trapeze fliers could do, she could do better. She was a mediocre gymnast in high school and never imagined herself on a trapeze until she saw Sarah Jessica Parker try it on an episode of *Sex and the City*. She toyed with the idea of taking classes before the pressure of real life took over. Wooster was working at a Washington, D.C., PR firm and struggling in her marriage when her younger brother passed away. On the one-year anniversary of his death, she vowed to make changes. Hungry for a creative outlet, she left her corporate job, renewed her interest in photography and yoga and enrolled in a Trapeze School class.

During her first climb up the three-story ladder to the narrow launch platform, Wooster was, admittedly, "terrified." Although she was tied to safety lines with a net below her, she remembers the fly bar feeling heavy in her grip. She thought about giving up and taking the long climb back down the ladder. "I don't know if I jumped off that platform or if I was pushed, but all of the sudden I was swinging through the air."

By the time she'd finished her first lesson—where she successfully "legged up" and jumped into the hands of a waiting catcher—Wooster signed up for another class. "From the start, I had this amazing feeling of accomplishment. It was extraordinarily empowering," she said.

Soon Wooster took a job as the troupe photographer and shortly after became an instructor and trapeze artist herself. She has toured across the D.C. region with the Trapeze School, as well as with the Capital City Circus and Sweet Spot Aerial Productions, a professional circus arts company that hires and highlights LGBTQ artists and themes. Her favorite performance came in 2015 when the Trapeze School participated in the White House Halloween celebration. Wooster even tried to coax President Obama on to the South Lawn trapeze rig. He politely declined on the advice of his Secret Service detail.

With her consulting business in full swing, Wooster uses her free time to build her strength, flexibility and balance. And she works on perfecting new tricks—like a crowd pleaser called hocks salto, which involves leaping upside down into a backward somersault. She hopes her aerial feats can inspire others to step into the ring.

"People can be intimated when they see performers flying in the air, but there really is something for everyone in the circus arts," Wooster said. "You can take a juggling class or do acrobatics or clown training. Even if you never step into the spotlight, it's a great way to build your confidence and strength, and prove to yourself that anything is possible."

# CHASE YOUR

# ALUMNI ADVICE TO

"What I wish I knew when I graduated was the importance of just being nice. So many of us are caught up in having the best resume, strongest portfolio and background—and don't get me wrong that's all essential to your journey—but being genuine and nice will get you so much further."

**Nana Agyemang, BA '16** (Journalism, Mass Communication)
Founder and CEO, EveryStylishGirl

"Give back to your community and create opportunities for others. There is no greater feeling than making a difference in the life of another person."

**Gil Cisneros, BA '94** (Political Science)
Member of Congress (D-Calif.)

"Be grateful for whatever it is you are about to accomplish professionally. It's healthy to be ambitious but don't let ambition cause you to miss out on the pride you will deserve to feel."

**David Holt, BA '01** (Political Science)
Mayor, Oklahoma City

"Keep an open mind and make sure you have grit and perseverance. When you are getting started with your career and trying new things, the highs are high and the lows are really low. Make sure you have a professional and personal support system to help you through the tough times."

**Jennifer L. Maher, BA '04** (Psychology, Criminal Justice)
Chief Executive Officer, 1776

"Don't be afraid to chase what excites you and find a way into your dream job. Remember, you can learn a lot from people who have already been where you want to be and who are willing to share not only how they succeeded, but also how they've failed."

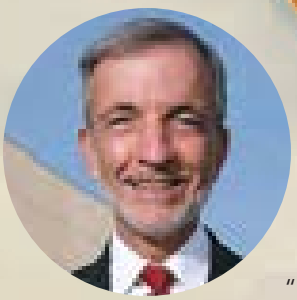
**Chris Cerbo, BA '95** (Radio, Television)
Senior Vice President, Marketing Partnerships,
Twentieth Century Fox

# DREAMS

# NEW GRADUATES

"I was a pre-med student because I wanted to be a doctor since I was six. I didn't like the sight of blood and that should have been a clue. Fortunately, I was accepted into Macy's Executive Training Program after graduation. I found my true passion. I rose up the ranks and became a buyer. Then, I became aware of my entrepreneurial streak and founded my own eyewear company. Follow your passion—you will find your success!"

**Corinne McCormack, BA '76** (Pre-med)
Founder, Corinne McCormack, Inc. and Corinne McCormack Consulting



"First, be passionate about life. Life is short; tomorrow comes quickly. Second, follow your passions, be they your career, avocation or family. Finally, dream big. One never achieves happiness without reaching beyond what you thought, or what others have told you, are your limits. Oh, and have fun. Life is great."

**Alex Nyerges, BA '79, MA '82** (Anthropology, American Civilization)
Director, Virginia Museum of Fine Arts

"Life is an adventure. If you're not happy, don't get into the mindset that you're stuck in a bad situation. You CAN change everything and you will live through it. As the Eagles sang: 'Sometimes we live our lives in chains never knowing we have the key.'"

**Charles Frank, BA '74** (American Literature)
President, Z. Frank, Inc.

"Practice listening to yourself. What is it that you really, really want? Not what sounds good or looks good on paper. Only you have the answer to that. Do quality work no matter how crappy the job might be. Learn to manage your money, especially if you are a woman."

**Claritza Jimenez, BA '05** (Political Communication)
Senior Producer, POLITICO

# Family Tree

The Columbian College family of alumni is branching out in fun and fabulous ways!

**Amanda Baker**, BA '09, is the owner of Pilates with Amanda in New York.

**Sam Slater**, BA '07, produced the theatrical feature film *Hearts Beat Loud.*

**Jamie Blynn**, BA '13, is *Us Weekly*'s senior entertainment editor. She serves as the magazine's book critic and co-hosts a *Bachelor* video series and the "#TBT With *Us*" podcast.

**Sharon W. Chamberlain**, PhD '10, authored the book *A Reckoning: Philippine Trials of Japanese War Criminals.*

**Elizabeth Acevedo**, BA '10, won the 2018 National Book Award for Young People's Literature for her debut novel, *The Poet X.*

**Candice Cain**, BA '98, created *New Dogs, Old Tricks*, a college-based comedy show on Amazon Prime.

**Ricardo Mehedff**, BA '91, directed his first narrative feature film, the award-winning *Inner Court.*

**Monika Eyers**, BA '99, is the east coast editor of *Better Homes & Gardens.*

**Eileen McKeon Butt**, BA '84, is a visual artist in Austin, Texas. Her "science art" focuses on astronomy and particle physics.

**Juliette E. Lippman**, BA '90, is president of the Florida Bar Foundation.

**Kristin Adair**, MA '17, produced the documentary film *Becoming Free*, which premiered at the By The People festival in Washington, D.C.

**Tara Dorfman**, BA '11, is a talent agent at Creative Arts Agency in Los Angeles. She was named to the *Forbes* 30 Under 30 2019 list.

**Kaitlin Yarnall**, MA '08, is the senior vice president of storytelling for the National Geographic Society.

**Habiba Belguedj**, BA '11, co-founded Baytna à Vous (translated as "Our Home for You"), a student-led initiative to help the transition of Syrian refugees to new homes in Europe.

**Gil Cisneros**, BA '94, is a member of the U.S. House of Representatives from California's 39th Congressional District.

**David Brunori**, MA '95, is a fellow at the National Academy of Public Administration.

**Darley Newman**, BA '01, hosts the PBS series *Travels with Darley.*

**Musadiq Bidar**, BA '15, **Bo Erickson**, BA '17, **Cara Korte**, BA '15, and **Ellee Watson**, BA '17, were named to the CBS News 2020 Campaign Team.

**Andrew Hartman**, MA '03, PhD '06, won a Fulbright U.S. Scholar Program award and co-edited the book *American Labyrinth: Intellectual History for Complicated Times.*

**Megan Nipe**, MA '14, is a professional basketball player in Portugal.

**David Holt**, BA '01, is the youngest mayor of Oklahoma City since 1923. He is also the youngest current mayor of a U.S. city over 500,000, and Oklahoma City's first Native American mayor.

**Corinne McCormack**, BA '76, authored the book *From Living Room to Boardroom, How I Launched and Sold a Multi-million Dollar Business.*

**Jennifer Maher**, BA '04, is CEO of 1776, the Northeast Corridor's largest network of entrepreneurial incubators.

**Michelle Cohan**, BA '11, produces long form content for CNN's international network, including the shows *Inside the Middle East*, *Inside Africa* and *African Voices*.

**Lee Colan**, MPhil '87, PhD '93, published the book *The Power of Positive Coaching: The Mindset and Habits to Inspire Winning Results and Relationships.*

**Ellen Kurtzman**, PhD '16, was awarded a Robert Wood Johnson Fellowship through the National Academy of Medicine.

**Craig Kauffman**, PhD '12, published *Grassroots Global Governance: Local Watershed Management Reforms and the Evolution of Sustainable Development.*

**Jessica Turtletaub**, BA '08, is head of public relations for theSkimm.

**Jennifer Nichols**, BA '12, is a primate keeper at the Birmingham Zoo in Alabama.

**Cathy Cranberg**, BA '95, created the card game "How Do You See The World?" for Authentic Agility Games.

**Ana Cvetkovic**, BA '15, launched BLOOM Digital Marketing, an agency that helps the hospitality and tourism industries reach millennials.

**Thomas Hargrove**, Grad Cert '07, founded the nonprofit group Murder Accountability Project, which assembles the nation's most complete record of homicides.

**Mark Esper**, PhD '08, is the U.S. secretary of defense.

**Emily (Enberg) Packer**, BA '08, launched Coldharbour Tiles, which transforms plastic waste from East Africa into high-quality, recycled wall tiles.

**Allen Gannett**, BA '12, authored the book *The Creative Curve: How to Develop the Right Idea, at the Right Time.*

**Jeffrey Feser**, BA '06, is a major in the U.S. Army. During his deployment in Iraq, he helped rebuild Mosul by encouraging businesses to return to the city.

**Brian O'Dwyer**, BA '66, was the grand marshal of the 2019 New York Saint Patrick's Day parade.

**Brittany Shepherd**, BA '16, was named national politics reporter at *Yahoo!* News, where she will cover culture and politics during the 2020 campaign.

**John Edmonds**, BFA '12, exhibited his photographs at the 2019 Whitney Biennial at the Whitney Museum of American Art in New York City.

**Rich Zahradnik**, BA '82, won the 2018 Shamus Award for Best Paperback Private Eye Novel for his mystery, *Lights Out Summer.*

**Tara Rosenblum**, BA '00, has been an anchor/reporter with News 12 in Westchester, N.Y., for 14 years. She has won a National Edward R. Murrow Award and 17 Emmy awards.

**Kimberly Holton**, PsyD '14, is a U.S. Navy lieutenant, serving aboard the aircraft carrier USS George H. W. Bush as the ship's psychologist.

**Scott Rosenbaum**, BA '91, wrote the screenplay for the forthcoming film *The Nazi Titanic.*

**Kelia Cummins**, BA '00, is a U.S. Diplomat serving in Bern, Switzerland.

**Sally Nuamah**, BA '11, is the founder of the TWII Foundation, which helps low-income girls become the first in their family to attend college. She was named to the *Forbes* 30 Under 30 2019 list and published her first book *How Girls Achieve.*

## Stay Connected

**Alumni are an important part of the Columbian College and GW community. Stay connected and get involved in these ways:**

**Join** an industry-based alumni network and connect with fellow alumni through both in-person and virtual networking opportunities. (alumni.gwu.edu/networking)

**Connect** with alumni, faculty and students at one of our 300+ events around the world. (alumni.gwu.edu/calendar)

**Volunteer** to mentor students, plan a reunion, present a webinar and more. (alumni.gwu.edu/volunteer)

**Update** your contact information to receive event invitations, read our newsletters and learn about benefits and services. (alumni.gwu.edu/update-your-contact-information)

**Support** our students, enhance our programs and break new ground in research through a philanthropic gift to an area that is most meaningful to you. (alumni.gwu.edu/ways-give)

For more information, contact Anita Ponchione at ccasalum@gwu.edu.

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