Bulletin of the American Academy of Arts & Sciences

HEALTH AND OUR OCEANS
Featuring Kimberly A. Prather

THE WORLD IN 2025
Featuring Kwame Anthony Appiah, Michael Froman, Anne-Marie Slaughter, and Adam Tooze

Science and Creativity

Featuring Cynthia M. Friend, Andrea M. Ghez, Thomas F. Rosenbaum, Kip S. Thorne, and Risa H. Wechsler

SPRING 2025

THE MEMBER GUIDE

The Member Guide is a new publication this year developed to illuminate ways in which members can connect to one another and the Academy. This resource offers an overview of Academy activities, projects, and processes with highlights throughout to indicate how members can get involved and who to contact with questions.

To view online, visit www.amacad.org/members or scan the QR code. To request a physical copy, please contact **Patrick Meade**, Membership Engagement Manager (pmeade@amacad.org).

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An aerial photo of the Tijuana River

Features

ON THE COVER: The Milky Way and stars above a silhouette of mountains reflected in a lake in Phang Nga, Thailand.

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From the President

As I reflect on my first few months as president of the Academy, one of the great joys has been getting to know our extraordinary fellowship of members. As of this writing, I have had the opportunity to visit our vibrant member communities in North Carolina, Washington, D.C., Atlanta, New York, Southern California, Chicago, and, of course, the Academy's home in the Boston-Cambridge area. In each location, I have been awed by our fellow members: their achievements, their passions, their hopes for the future. The articles in this issue also represent the power of the local – with deliberations in San Diego, New York City, and Los Angeles.

As you might expect, our members have also shared their worries related to this tumultuous time in our national life. Whether in person, online, or in writing, the message has been clear: these are the times the Academy was made for. The Academy must respond.

Our members are right. The Academy was founded in 1780, one of the most trying years of the American Revolution. During that year, the British seized Charleston, South Carolina, the currency's value plummeted, continental soldiers mutinied in New Jersey, and the treason of Benedict Arnold was revealed.

We should take inspiration from the fact that, at such a time of upheaval, our founders had the vision to create an Academy with the purpose to "cultivate every art and science which may tend to advance the interest, honor, dignity, and happiness of a free, independent, and virtuous people."

And so we will respond. First, as we face unprecedented threats to higher education, the research enterprise, the free press, and an independent judiciary and legal profession, the Academy is gathering the nation's leading minds for a series of virtual events to address such issues as constitutional crises, cuts to science funding, tariffs, and executive power. I hope you have had the chance to join some of these discussions and that you will participate in future sessions.

Second, the Academy's Board has also released a formal statement (an infrequent event in the Academy's history) reaffirming the Academy's founding values and committing "to urge public support for the arts and sciences and also work to safeguard the conditions of freedom necessary for novel discoveries, creative expression, and truth-seeking in all its forms." The statement is available online at www.amacad.org/news/board-statement-values-april-2025.

Third, the Board statement does not just reaffirm our values, it also provides a vision to guide us in the years to come. In a strong move that focuses our work, we are placing democracy at the center of the Academy's efforts, emphasizing its essential relationship to our projects in the areas of American institutions, science, education, global security, and the arts and humanities.

We also hope to call attention to the many dimensions of the word – starting with the constitutional democracy that *Our Common Purpose* has emphasized. In our activities in these areas, we hope to ask the important questions again, in and for this time: What is democracy's relationship to republic? To the pursuit of truth and the creation of knowledge? To the common good? To bridging and working across ideological difference?

As we developed the Board statement, we gained an appreciation for an underrecognized element of the Academy's history: the motto on our seal, SUB LIBERTATE FLORENT, "they flourish under freedom." In it our founders offer us both a truth and an exhortation. Let us work together to preserve the freedom so essential to the pursuit of knowledge.

Yours cordially,
Laurie L. Patton

The Golden Age of Dutch art included many portraits of children and families. Gabriël Metsu's painting *The Sick Child* effectively portrays both how ill and helpless the child is (Metsu painted the work during a plague in Amsterdam) and how the child's condition elicits care and concern from the mother in the picture, as well as the viewer. Four hundred years later, it's still hard to look at this picture without wanting to help. *The Sick Child* (c. 1660) by Gabriël Metsu. Oil on canvas, 32.2 cm × 27.2 cm.

Recent *Dædalus* issue explores The Social Science of Caregiving

"The Social Science of Caregiving" features the following essays:

Introduction: The Social Science of Caregiving
Alison Gopnik, Margaret Levi & Zachary Ugolnik

How Do Infants Experience Caregiving?
Ashley J. Thomas, Christina M. Steele, Alison Gopnik & Rebecca R. Saxe

What Developmental Science Has to Say About Caregiving
Seth D. Pollak & Megan R. Gunnar

Caring for Children in Lower-SES Contexts: Recognizing Parents' Agency, Adaptivity & Resourcefulness
Monica E. Ellwood-Lowe, Gabriel Reyes, Meriah L. DeJoseph & Willem E. Frankenhuis

Looking Back to Look Forward: Leveraging Historical Models for Future-Oriented Caregiving
Maisha T. Winn & Nim Tottenham

Why Do Women Care More & Men Couldn't Care Less?
Toni Schmader & Katharina Block

The Human Geography of Care
Claire M. Growney, Caitlin Zaloom & Laura L. Carstensen

Technology & the Dynamics of Care for Older People
Elizabeth Fetterolf, Andrew Elder, Margaret Levi & Ranak B. Trivedi

Imagining Yourself in Another's Shoes versus Extending Your Concern: Empirical & Ethical Differences
Eric Schwitzgebel

Divine Care: Care as Religious Practice
Zachary Ugolnik

Care of the Dead: Ancestors, Traditions & the Life of Cultures
Phil Ford, Jacob G. Foster & J. F. Martel

Computational Frameworks for Human Care
Brian Christian

Paying for Expanded Care Provision
Robert H. Frank

A Worldview of Care & a New Economics
Elizabeth Garlow & Anne-Marie Slaughter

The Social Life of Care
Gregg Gonsalves & Amy Kapczynski

Expanding the Community of Fate by Expanding the Community of Care
Margaret Levi

O, Responsibility
Jane Hirshfield

Gallant and Goofus: The Daughter-Caretaker Edition
Roz Chast

Caregiving is essential to the health and well-being of society. It is also a fundamental human experience: almost all of us will care for others and be cared for during our lives.

But despite the importance of care work in all its forms – paid and unpaid, in our families, in health care, in education and public services – and despite the demographic changes speeding us toward a care crisis, this work has been largely invisible in the social and human sciences.

"The Social Science of Caregiving," the Winter 2025 issue of *Dædalus*, edited by **Alison Gopnik**, **Margaret Levi**, and **Zachary Ugolnik**, offers essays examining what we know about care, what we need to know, and what we need to do to meet the health challenges of a rapidly aging and technology-reliant society. The authors approach their topics from a wide range of perspectives in the sciences and social sciences, consider more abstract philosophical and sociological themes, and propose policies to support caregivers and promote the autonomy and well-being of the cared-for.

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The *Dædalus* volume on "The Social Science of Caregiving" is available on the Academy's website at www.amacad.org/daedalus/social-science-caregiving. *Dædalus* is an open access publication.

The Academic Humanities Today:
Findings from a New National Survey

By **Robert B. Townsend**, *Director of the Academy's Humanities, Arts, and Culture Programs and Codirector of the Humanities Indicators*

Few need to be told that the academic humanities have been beset by challenges over the past fifteen years, but the evidence tends to be scattered. To provide a clearer picture of the state of the field, the Academy's Humanities Indicators project recently released the results from a new national survey of humanities departments in fourteen humanities and humanities-adjacent disciplines, the fourth such survey since 2008. Drawing on responses from more than two thousand department chairs, the report demonstrates both the challenges the field experiences today and the resilience of many departments in the face of those difficulties.

The challenges facing many of the humanities disciplines became evident early in the study. While developing the sample for the survey, the Indicators staff found that the number of colleges and universities awarding degrees in most of the humanities disciplines had been declining in recent years – a clear reflection of contemporaneous reports about departments being shuttered and majors eliminated. This finding was particularly

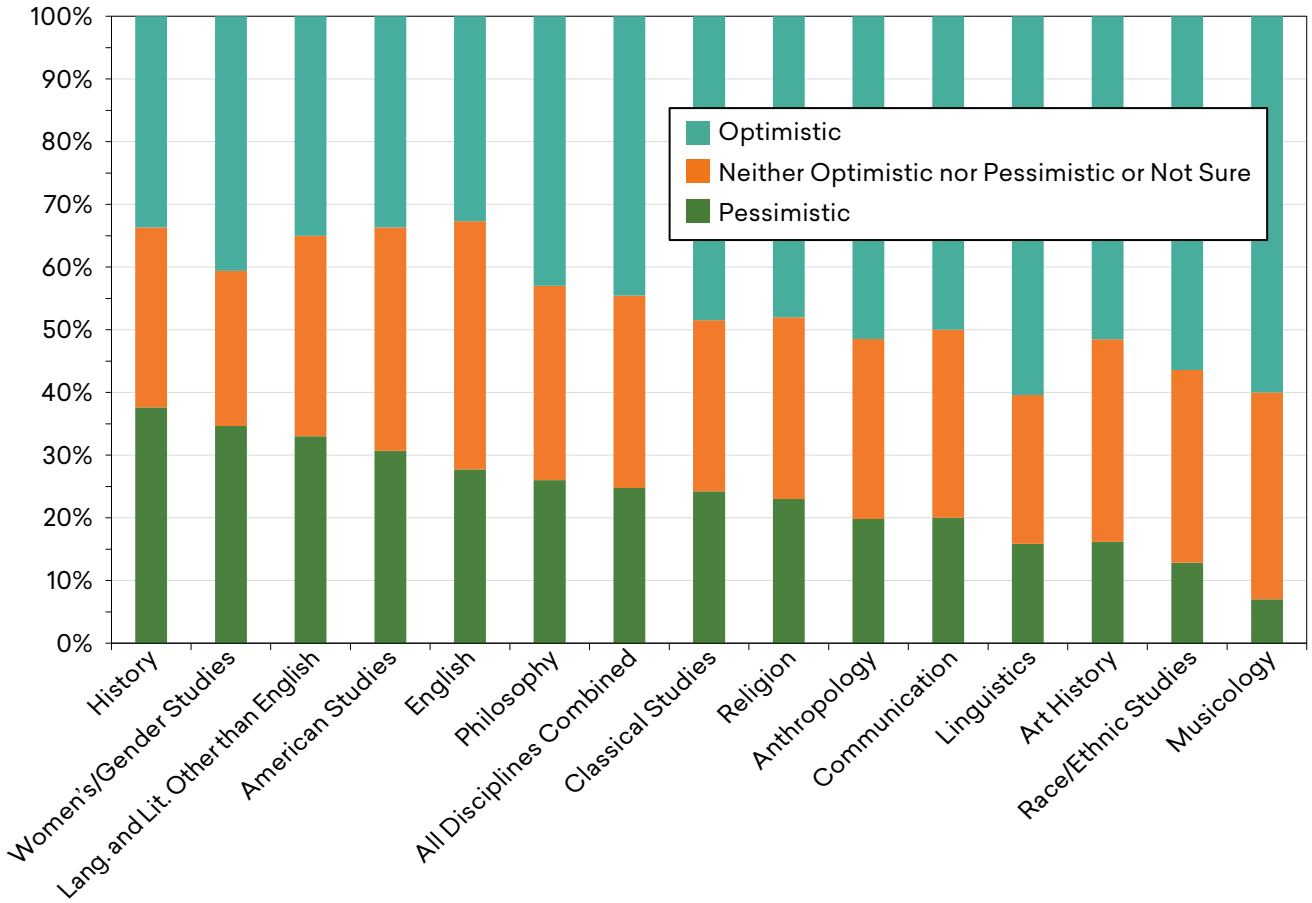
notable because in the three previous rounds of the survey, the number of institutions awarding degrees in most disciplines had been increasing. For example, from 2017 to 2022, the number of institutions awarding degrees in most of the traditional humanities disciplines in the survey fell by at least 4 percent (in English) but the declines were as high as 17 percent in American studies and 16 percent in religion.

The approximately 8,200 departments granting degrees in the fourteen disciplines included in the survey employed about 131,160 faculty. However, only in linguistics, musicology, and race/ethnic studies did a clear majority of department chairs express optimism about the future of the discipline at their institutions (**Figure 1**). The survey also found a significant split between departments based on type of institution. While a slight majority (51 percent) of department chairs at research universities were optimistic about the future of their discipline, only 29 percent of chairs at master's institutions shared this outlook, with more than a third of them noting they were pessimistic.

This sense of ambiguity about the future among many department chairs was best expressed by one chair, who observed that "the position of the humanities at our institution is fragile. We have seen many retirements go unreplaced, with the number of faculty in humanities departments shrinking. This has required that existing faculty teach courses in new areas or leave central areas uncovered in the curriculum. The possibility of program closure has been in the air as well, making it stressful for all of us." As that comment suggests, pessimism about the future tended to correlate to reported declines in the numbers of tenure track faculty and undergraduate majors in response to other questions in the survey.

While a majority of departments in every discipline except English saw their tenure track faculty numbers remain steady or increase from 2020 to 2023, a sizeable share of departments in every discipline reported a decrease of one or more

Figure 1: Share of Department Chairs Feeling Optimistic or Pessimistic About the Future of Their Discipline at Their Institution, by Discipline, 2023–24



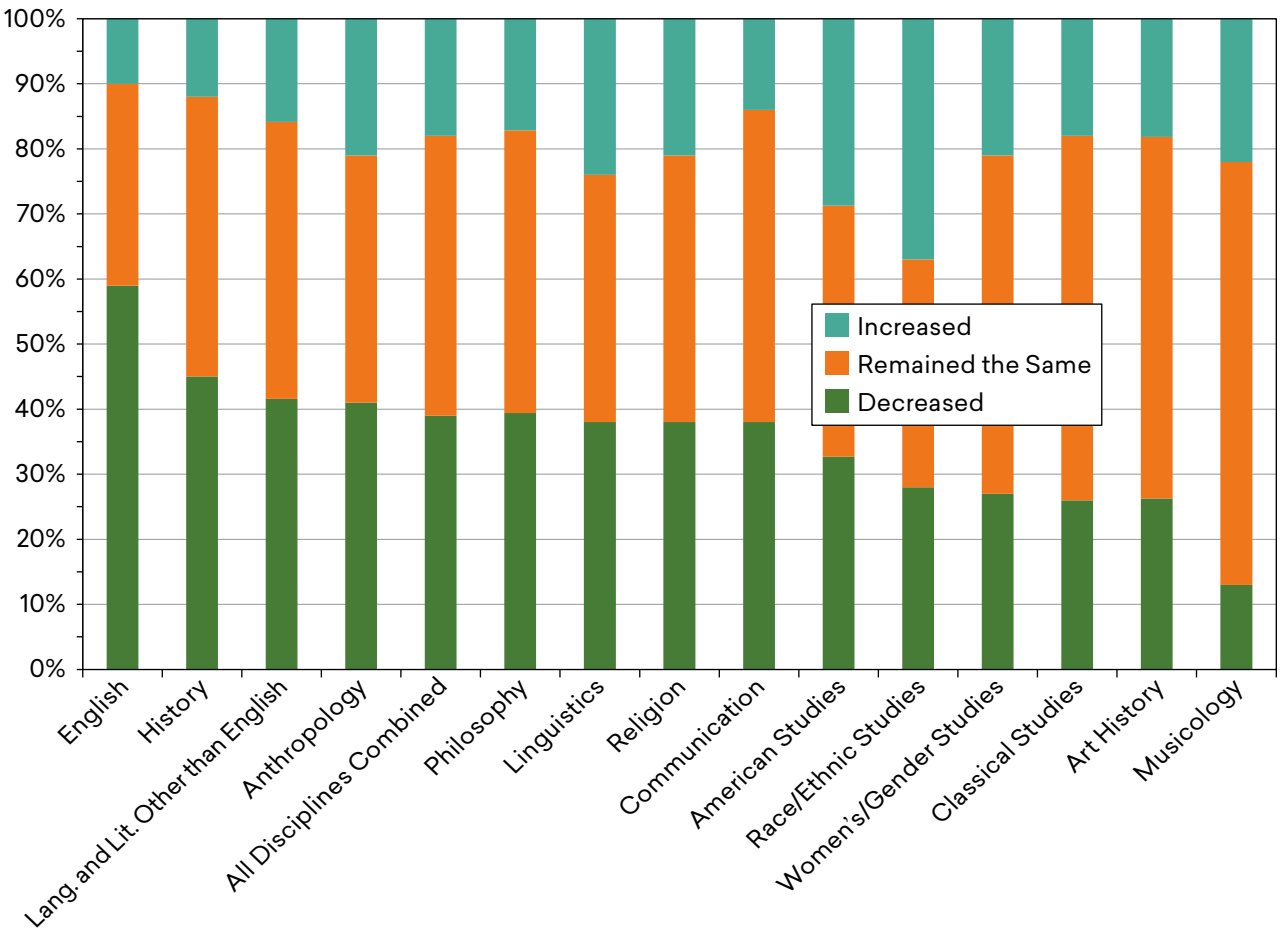
tenure-line faculty over the previous three years (**Figure 2**). English departments stood out in this regard, with 59 percent of such departments reporting a decrease. More than 40 percent of history, anthropology, and languages other than English (LOTE) departments also reported a decline in tenure-eligible faculty.

Departments in every discipline surveyed were more likely to indicate that they had seen an increase in the number of nontenure-track faculty members in their departments than a decrease. For the first time in four rounds of the survey, the share of nontenure-track faculty in the disciplines exceeded 40 percent. In most disciplines, 60 percent or more of the faculty were either tenured or on the tenure track, but in the three largest disciplines (English, LOTE, and communication) a majority of the faculty were employed off the tenure track. Many of the disciplines that could be compared to an earlier survey showed a small decrease in their share of tenure-line faculty.

Looking ahead, most department chairs expected that the number of tenured/tenure-track faculty members in their departments would either remain the same or increase over the next three years. However, in four disciplines (history, religion, American studies, and English) more than a third of department chairs anticipated a decrease in the number of faculty.

Despite some declines in the number of faculty, the disciplines continued to teach a substantial number of students. In fall 2023, the fourteen disciplines included in the survey had a total enrollment (these are "duplicated" counts, so a student enrolled in more than one course in the subject would be counted in each course) of over 5.6 million students in undergraduate courses and approximately 422,070 juniors and seniors majoring in these disciplines. Graduate programs had 88,530 students, with 181,900 enrollments in graduate-level courses.

Figure 2: Share of Department Chairs Reporting a Change in the Number of Tenure-Line Faculty from Fall 2020 to Fall 2023, by Discipline



The communication discipline stood out for the largest number of declared majors (an average of 115 per department), but a relatively small number of student enrollments (390 per department). In comparison, English and history departments had an average of 67 and 63 majors, respectively, but an average of 1,174 undergraduate enrollments per department in English, and 864 per department in history.

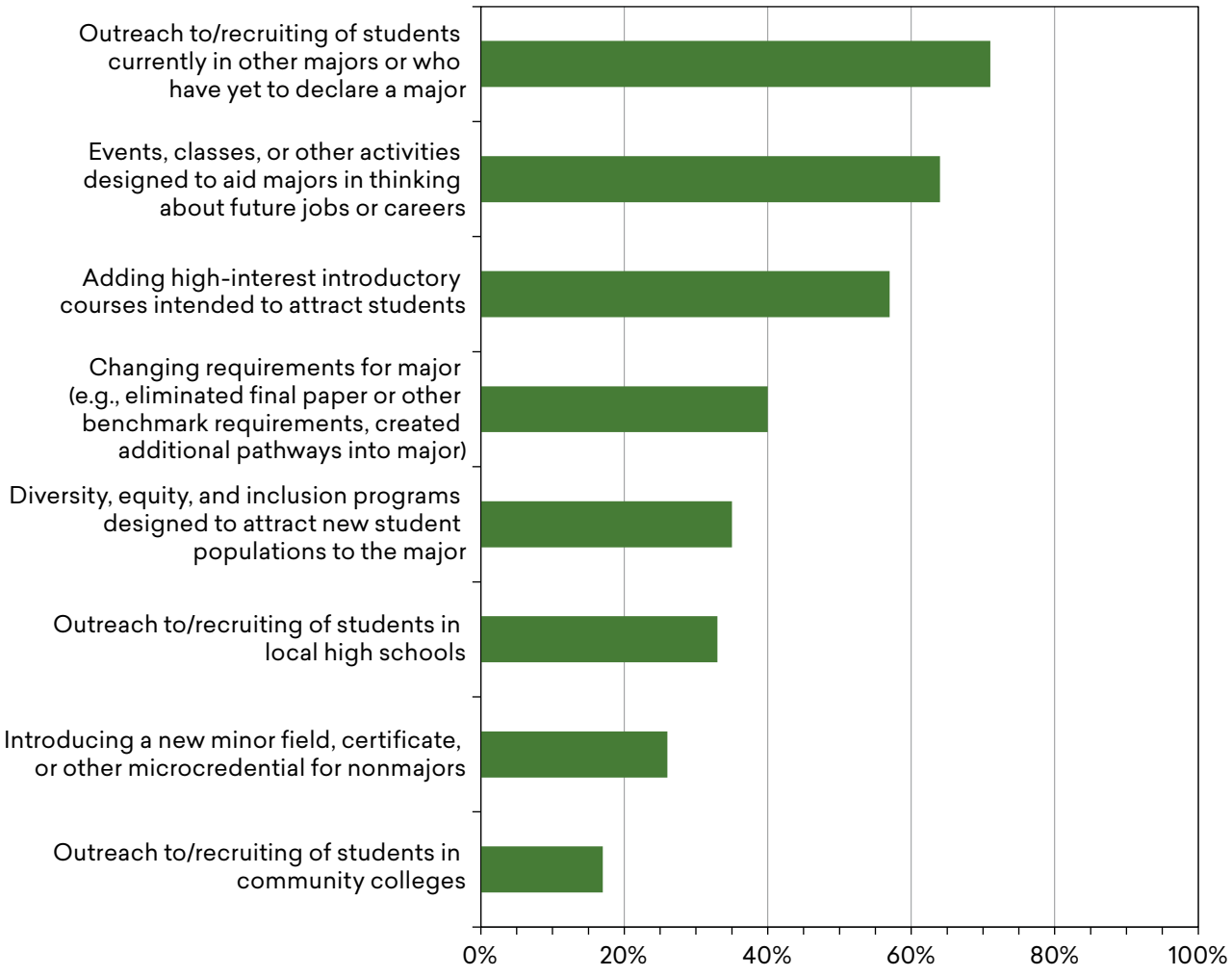
The survey also included information on the number of minors, certificates, and other microcredentials awarded nationally in humanities disciplines. LOTE departments were notable for the large number of minors awarded among the humanities disciplines, with a median of 15 per department, while communication departments awarded the largest number of certificates and other microcredentials (a median of 18 per department).

Notably, while more than half of the departments in most disciplines award minors, awarding certificates and other microcredentials was relatively rare. Women's and gender studies programs were an exception, with 46 percent of the departments awarding certificates and other microcredentials, whereas in all other disciplines only a third or less of the departments did so.

The survey also found that more than a third of the departments had experienced at least a modest decrease in undergraduate enrollments from 2020 to 2023, with the largest disciplines being the most likely to report declines. A majority of LOTE and communication departments reported a decline in undergraduate enrollments (54 percent each), and well over 40 percent of English and history departments saw declines. In every other discipline except classical studies, more than one-in-five departments reported an enrollment decrease.

In the four largest disciplines (communication, LOTE, history, and English), departments reporting a decline in enrollments were distributed across institution types, with one-third or more of departments in each Carnegie classification reporting a small decline in

Figure 3: Share of Departments Employing Various Strategies to Attract Undergraduate Students, Fall 2020 to Fall 2023



enrollments. However, the largest shares of departments reporting declines were found at master's colleges and universities. This trend was also observed in most of the other disciplines surveyed.

Almost all of the departments used one or more recruitment strategies to attract students and increase the number of majors in their discipline (**Figure 3**). Slightly more than 70 percent of departments indicated that they were engaged in some kind of outreach to students in other majors or those without a declared major. More than half of the departments reported offering "events, classes, or other activities designed to aid majors in thinking about future jobs or careers," and adding "high-interest introductory courses intended to attract students."

Recruitment practices varied widely among the disciplines. Around 80 percent of departments in classical studies, race/ethnicity studies, and women's/gender studies indicated that they were focused on attracting students from other departments at their own institutions. In contrast, 80 percent of the religion departments prioritized outreach to students from community colleges – the only discipline to prioritize that approach. Most of the larger disciplines placed greater emphasis on events, classes, and other activities to support their students' future careers.

The Academy's Humanities Indicators project recently released the results from a new national survey of humanities departments in fourteen humanities and humanities-adjacent disciplines, the fourth such survey since 2008. Drawing on responses from more than two thousand department chairs, the report demonstrates both the challenges the field experiences today and the resilience of many departments in the face of those difficulties.

The survey found that most departments offered three types of programs to help their undergraduate and doctoral students prepare for future careers. For students at the undergraduate level, internships in a work setting were the most common, with 72 percent of departments providing this opportunity. Additionally, more than 60 percent of departments offered their undergraduate students occupationally oriented presentations by employers and alumni. However, in every case far fewer departments *required* students' participation.

In addition to capturing broad trends in the field, the survey also provides vital benchmarking data for individual departments and administrators. An accompanying website (at www.amacad.org/humanities-indicators/academic-humanities-today-findings-2024-department-survey) offers a more comprehensive overview of the findings, as well as detailed profiles for each of the disciplines with tables that provide comparisons by Carnegie classification, highest degree offered by the department, and institutional control. Departments have historically used benchmark numbers to guide their fundraising efforts, securing funds for scholarships and faculty support to help "bring their numbers up to the national average."

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We welcome questions about these findings and suggestions for further areas of research. Please direct any inquiries to Robert Townsend, codirector of the Humanities Indicators, at rtownsend@amacad.org.

Listening Sessions for the Commission on Opportunities After High School

By **Catherine Van Ness**, *Program Officer for Education*

Students who entered college in 2018 faced significant challenges, including a global pandemic. Despite this, the percentage who graduated with a credential by 2024 rose slightly from previous years to 61 percent. However, this indicates that, on average, institutions are earning a D-minus grade in achieving their goal of conferring degrees on their students.

The American Academy's Commission on Opportunities After High School launched in early 2024 with the vision of a future wherein all students can choose, and succeed in, the postsecondary path that best serves their needs and aspirations. Led by **Nancy Cantor** (Hunter College), **Harrison Keller** (University of North Texas), and **Bridget Long** (Harvard Graduate School of Education), commissioners have discussed the societal, economic, and education obstacles that impede a student's progress and analyzed promising pathways from high school into higher education or directly into the workforce.

Members of the commission bring a wealth of professional experience and expertise to these discussions from the arts, business, K-12, higher education, medicine, military, philanthropy, service, and technology. Commissioners identified a need to complement their knowledge and inform the commission's work by listening to students

currently making decisions about their own postsecondary paths and the people supporting them.

During fall 2024 and spring 2025, the Academy held listening sessions in California, Colorado, Indiana, Maryland, Massachusetts, North Dakota, Pennsylvania, Texas, and Washington, D.C. Participants included high school and college students, K-12 administrators and teachers, higher education administrators and faculty, employers, philanthropic leaders, and community partners.

For students, their hopes for future success included housing stability, mission-driven careers, and financial security. They defined financial security as being able to support their parents and family, cover monthly bills without worrying, and have disposable income for travel. One student shared their dreams for their future by saying, "I think a successful life for me would be . . . to have my own personality and know who I am. And even if certain things go wrong or whatever, I could still be able to handle it."

For students, their hopes for future success included housing stability, mission-driven careers, and financial security.

The participants at the listening sessions were diverse in age, race, ethnicity, gender, geography, and family income level. High school students and administrators were recruited from public schools, career academies, adult learning centers, and magnet schools. College students and administrators came from two-year public community colleges, four-year private and public state universities, technical colleges, a public historically Black university, and a tribal college.

Some of the key takeaways from listening sessions with students included the high degree to which their postsecondary plans were influenced by, but not limited to, their family members' and near peers' experiences, the lack of capacity in many career and technical education programs for mobility between pathways if a student found their first choice was not a good fit, and anxiety related to transitioning to college and adulthood.

Administrators, faculty, and teachers in K-12 and higher education acknowledged that better coordination across siloes would benefit their students. However, many of them recognized that there was a lack of mutual understanding within the systems, making it difficult to navigate conflicting standards, regulations, or norms. Participants also expressed a desire to offer more guidance on financial literacy or different postsecondary options but often felt constrained by time, curriculum demands, or uncertainty about how to provide this support.

In describing a dual enrollment program at a local college, a high school student shared, "I heard about it from my brother since he did the program. He told me to do it. It could save a lot of money and time."

Employers involved in work-based learning recognized its value and saw it as a worthwhile investment as part of a long-term strategy to build their talent pipeline. However, they acknowledged several challenges, such as administrative barriers and limited capacity for effective mentorship. Philanthropic and community partners emphasized the positive effects of increased student engagement at school through career- and college-connected educational opportunities that help students understand the value and importance of attending school.

Although many participants highlighted systemic barriers that can hinder student progress, it was clear that everyone wanted the best outcomes for students. As one administrator said, "I'm here because we're passionate about improving the high school experience for our students and making sure that they have a plan for the day after graduation and they have the skills and dispositions in order to be successful in this world."

The commission thanks all of the participants in these listening sessions for sharing valuable insights on the challenges students face, the conditions needed for thriving and successful partnerships, and what is most important to students as they make decisions about their futures. The commissioners are dedicated to ensuring that all students, particularly those from historically underserved communities, can thrive and find rewarding jobs in an ever-changing global economy, and become active contributors to society.

The Commission on Opportunities After High School is generously supported by the William T. Grant Foundation, Spencer Foundation, Carnegie Corporation of New York, and funding from anonymous sources.

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For more information about the Commission on Opportunities After High School, please visit www.amacad.org/project/opportunities-after-high-school.

UN armored vehicle in Goma, Democratic Republic of the Congo, January 29, 2025

System Under Strain:
International Humanitarian Law and Modern Armed Conflict

By **Mitch Poulin**, *Program Associate for Global Affairs and International Affairs*

On March 5 and 6, 2025, the Academy's Global Security and International Affairs program area convened an exploratory meeting at the House of the Academy to examine the effectiveness, limitations, and trajectory of international humanitarian law (IHL) in the context of the changing character of armed conflict and a weakening commitment to the rule of law. Titled "The Future of the Laws of Armed Conflict," the meeting was led by the cochairs of the Academy's Committee on International Security Studies, **Jennifer Welsh** (McGill University) and **Scott Sagan** (Stanford University), and included international legal experts, policymakers, and global security scholars.

Participants generally agreed that IHL is facing a crisis due to several significant challenges, including widespread and flagrant violations of key legal principles; intensifying geopolitical tensions and the risk of great power war; new technological developments such as autonomous weapons systems and the application of artificial intelligence in military operations; and the global erosion of democratic norms. The discussion highlighted five key areas of concern among participants: 1) whether IHL remains relevant in shaping the behavior of belligerents in today's armed conflicts; 2) the evolution in nuclear weapons

doctrines in key states and whether such doctrines can be compatible with the laws of armed conflict; 3) the effectiveness (or ineffectiveness) of international courts in ensuring compliance; 4) the limitations of IHL in addressing the full range of civilian harms; and 5) the intended audience of IHL – who it applies to and whose behavior and attitudes it influences.

Although there was some consensus that IHL is still relevant in shaping the behavior of states and non-state actors, participants disagreed both on how effective it remains and on the efficacy of various approaches to strengthening compliance. Some believed that states' strong assertions of compliance demonstrated IHL's enduring influence, even when legal experts view states' actions as clear violations. Others pointed out that some actors frequently reinterpret IHL principles, such as proportionality, in ways that justify excessive civilian harm and advance belligerents' pursuit of victory.

Participants also explored the various mechanisms for enforcing IHL compliance. The International Criminal Court (ICC) was discussed at length, recognizing its role in identifying and adjudicating wartime actions that constitute international crimes, though its power to enforce its judgments is limited. While some viewed courts as essential for upholding legal frameworks, others noted that sanctions and diplomatic pressure might be more effective in encouraging compliance. The discussion also focused on the extent to which state militaries, non-state armed actors, and policymakers use IHL in their decision-making processes.

Another area of focus was the limitations in the scope of IHL. While this body of law provides a legal framework for regulating combatant activity and protecting civilians from certain kinds of harm, there are also key gaps that have been addressed – to varying degrees – through other legal and political mechanisms, such as restrictions on arms transfers, prohibitions on the use of particular weapons, and the application of human rights laws in armed conflict situations. The participants also discussed nuclear proliferation and potential scenarios for the use of nuclear weapons. Many agreed that nuclear use in wartime is fundamentally incompatible with IHL, given its inherent challenge to principles such as proportionality and the distinction between combatants and non-combatants. At the same time, there was recognition that the nuclear doctrines of key states are in flux, raising more general questions about how international law struggles to regulate modern warfare effectively.

There was recognition that the nuclear doctrines of key states are in flux, raising more general questions about how international law struggles to regulate modern warfare effectively.

Participants also discussed the audiences for whom IHL is most relevant. While IHL has been studied primarily by legal scholars and political scientists, and is referenced by state militaries, lawyers, and humanitarian actors, participants noted the growing interest among the general public in understanding and condemning IHL violations during ongoing conflicts. The discussion emphasized the need to raise awareness of both IHL's strengths and limitations. Participants also noted that politicians are often influenced by public attitudes and pressure, and though most constituents may not always interpret IHL correctly, research suggests that their moral instincts generally align with IHL's fundamental principles. Some expressed hope that increasing public awareness of and engagement with IHL could influence the decision-making of conflict parties, and ultimately improve IHL compliance.

In the context of the broader erosion of an international rule of law, IHL faces an uncertain future. The meeting highlighted IHL's ongoing relevance, but also stressed the urgent need for a recommitment to its principles, the development of more creative and effective strategies to bring about compliance, and efforts to address the broader trend in declining respect for law. Participants noted that though IHL has faced crisis before, maintaining a legal framework to regulate today's armed conflicts and protect civilians is a particularly daunting challenge, necessitating renewed efforts from researchers, governments, international organizations, and civil society.

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For more information about projects in the Global Security and International Affairs program area, please visit www.amacad.org/topic/global-affairs.

The Hellman and Simons Fellowship
in Science and Technology Policy

By **Mark Murphy**, *Director of Institutional Giving*

The American Academy of Arts and Sciences is pleased to announce the creation of a new endowed fund to support its premier fellowship program in science-related policy. Previously named the Hellman Fellowship in Science and Technology Policy, the rebranded program will now be known as the Hellman and Simons Fellowship in Science and Technology Policy. The new name reflects the contributions of two families, the Hellman Family on the West Coast and the Simons Family on the East Coast, with strong philanthropic ties to the Academy and longstanding commitments to the critical importance of basic and academic science research in America.

Through the generosity of the Hellman and Simons families, the fellowship that bears their names is now perpetually funded and will continue to:

- support and guide early-career professionals who want to develop expertise on issues of science, engineering, and technology policy;
- increase the number of science-policy professionals who are engaged in substantive discussion of science and engineering research questions and their social implications; and
- expand the scale of Academy projects and studies focused on challenges facing scientific research and science education.

The Academy's science policy work is uniquely interdisciplinary, bridging the humanities and social sciences with the natural and physical sciences to strengthen national understanding, belief, and trust in science and discovery. As science drives innovation and economic growth, the need for scientists to inform policy is greater than ever before. The Hellman and Simons Fellowship equips emerging leaders with the skills to effectively apply their scientific expertise across public and private sector roles.

THE HISTORY OF THE FELLOWSHIP

In 2007, Academy member Warren Hellman and his wife Chris made a commitment of $1 million to launch the Hellman Fellowship in Science and Technology Policy at

the Academy. The grant was part of a broader family philanthropic effort launched in 1995 within the University of California system that was inspired by their daughter Frances Hellman, a noted Professor of Physics and of Materials Science and Engineering, former Chair of Physics, and former Dean of the Division of Mathematical and Physical Sciences in the College of Letters and Science at UC Berkeley; former President of the American Physical Society; and member of the Academy, elected in 2013. Early in her academic research career, Frances had noted that young researchers and faculty without tenure were most in need of funding support that would allow them to think boldly about their research and take their academic careers to the next level. The Hellman family addressed this need by providing financial awards for early-stage researchers in many institutions, helping to build the confidence and credibility of the next generation of faculty research professionals.

Chris and Warren Hellman saw this grant, one of the few made outside of the University of California system, as an investment in the Academy's capacity to support and guide early-career professionals who want to develop expertise on issues of science, engineering, and technology policy. In doing so, they hoped to increase the number of science-policy professionals who are engaged in substantive discussion of science and engineering research questions, with a broad understanding of their social implications.

The Hellman Fellowship in Science and Technology Policy became an immediate boon to the Academy's Science, Engineering, and Technology Program team. In the years following the deaths of Warren (2011) and Chris (2017), the Hellman family made additional grants to further support their parents' inspirational vision. When the Hellman Foundation announced its plan to spend down its assets and close the foundation's doors by the end of 2034, a new commitment of support made $1 million available in the hopes of finding a philanthropic partner to

Jim Simons, **Marilyn Simons**, and **David Spergel**

permanently endow the Academy's fellowship program.

When presented with the challenge of raising an additional $1 million in endowment funding the Academy's first call was to Jim and Marilyn Simons and the Simons Foundation. Jim was an award-winning mathematician, a legend in quantitative investing, and a dedicated philanthropist. With his wife Marilyn, they gave billions of dollars to hundreds of philanthropic causes, particularly those supporting math and science research and education. The Simons Foundation supports scientists and organizations worldwide in advancing the frontiers of research in mathematics and the basic sciences. Their historic $500 million endowment gift in 2023 to Stony Brook University was the largest unrestricted donation to an institution of higher education in U.S. history.

Elected to the Academy in 2008, Jim was an enthusiastic and engaged member who believed strongly in the institution and its work. He was a greatly admired and respected advisor on the Academy's Science, Engineering, and Technology program committee, where for many years he helped shape a body of work that included important projects such as ARISE – Advancing Research In Science and Engineering: Investing in Early-Career Scientists and High-Risk, High-Reward Research; The Public Face of Science; and Challenges for International Scientific Partnerships—all projects that benefited from the involvement of the Academy's Hellman Fellow.

Jim sadly passed away in 2024. His wife Marilyn (elected to the Academy in 2024) and Simons Foundation President David Spergel (elected in 2012) have continued his legacy at the Academy with a matching grant of $1 million to complete the endowment for the rebranded Hellman and Simons Fellowship in Science and Technology Policy.

Frances Hellman

"One of the driving goals that Jim and I always had for the foundation was to support basic science by funding critical but underfunded work and people. This fellowship does that wonderfully, by providing early-career researchers expertise in the intersection of science and policy. Jim always understood that government and science together were only as strong as their nexus," Marilyn Simons said.

David Spergel added, "We at the Simons Foundation are pleased to join the Hellman Foundation in supporting this important program and helping to support the development of early-career scientists who have a deep interest in policy. These scientists/policymakers will likely play an essential role in addressing some of society's most pressing problems."

Through the generous commitments of both the Hellman and Simons families, this uniquely placed policy-oriented fellowship program will continue to serve the Academy and future generations of young science policy professionals for years to come.

As Frances Hellman has expressed, "The Hellman Family was honored to learn that we would be partnering with Jim and Marilyn Simons to create an endowment for the Hellman and Simons Fellowship to ensure long-term support of science expertise in policy. My family, through the Hellman Foundation, has been funding early-career research fellowships at universities for three decades. It is a privilege to be a part of this Fellowship, which will also be an enduring legacy for my family's philanthropy."

Past Hellman Fellows

The fourteen individuals who have held the Hellman Fellowship have significantly advanced the Academy's science policy work while also launching impactful careers. Here's a look at where these Hellman Fellows are now.

Carson Bullock (Hellman Fellow in 2024)
Policy Analyst for the Massachusetts Department of Energy Resources

Kelsey Schuch (Hellman Fellow from 2022–2024)
Program Officer for the Board on Behavioral, Cognitive, and Sensory Sciences at the National Academies of Sciences, Engineering, and Medicine

Sophia Charan (Hellman Fellow from 2021–2022)
Associate Engineer at the RAND Corporation

Amanda Vernon (Hellman Fellow from 2019–2021)
Science and Engineering Policy Analyst at the National Science Board

Dr. Vernon provides high-level analysis on national science policy issues and acts as a liaison to two NSB Committees: the Committee on National Science and Engineering Policy, which oversees the development and release of the U.S. Science and Engineering Indicators, and the Committee on Awards and Facilities, which is responsible for the National Science Foundation awards.

Erica Palma Kimmerling (Hellman Fellow from 2017–2019)
Senior Advisor for Science Engagement Policy and Partnerships at the Association of Science-Technology Centers (ASTC)

Dr. Kimmerling served for three and a half years in the White House Office of Science and Technology Policy (OSTP) during the Biden administration. At OSTP, Dr. Kimmerling advanced policy on a wide range of topics, including public participation in science, the Biden Cancer Moonshot, clean indoor air, and environmental drivers of health. In January 2025, she resumed her role at ASTC and leads efforts to partner and drive policy development with other organizations working at the intersection of science and the public.

Keerthi Shetty (Hellman Fellow from 2015–2017)
Scientist I and Project Manager at Dana-Farber Cancer Institute

Alison E. Leaf (Hellman Fellow from 2015–2017)
Senior Director for Scientific Program Management at Velsera

Zackory Burns (Hellman Fellow from 2014–2015)
Technology Transactions Attorney at Wilson Sonsini Goodrich & Rosati

Dorothy Koveal (Hellman Fellow from 2013–2015)
Instructor in the Department of Biomedical Engineering at Emory School of Medicine and Georgia Institute of Technology

Nathan Yozwiak (Hellman Fellow from 2011–2013)
Head of Research in the Gene and Cell Therapy Institute (GCTI) at Mass General Brigham

Before joining the GCTI in 2023, Dr. Yozwiak was Senior Director for Viral Genomics at Ring Therapeutics, a biotech startup, and Associate Director of Viral Genomics at the Broad Institute of MIT and Harvard. He has advised the World Health Organization on public health emergencies and helped establish the World Bank–funded African Center of Excellence for Genomics of Infectious Disease at Redeemer's University, Nigeria.

Kelly M. Stewart Marsh (Hellman Fellow from 2010–2011)
Director of External Innovation for Oncology at Servier Pharmaceuticals

John C. W. Randell (Hellman Fellow from 2009–2011)
Principal Alliance Manager for the Human Cell Atlas at the Broad Institute of MIT and Harvard

Following his Hellman Fellowship, Dr. Randell joined the Academy staff as a Program Officer for Science, Engineering, and Technology, eventually rising to hold the positions of John E. Bryson Director of Science, Engineering, and Technology Programs and Senior Program Director and Advisor to the President at the Academy. In February 2020, Dr. Randell joined the Broad Institute of MIT and Harvard, where he serves as Executive Director of the Human Cell Atlas Project applying his experience to science policy topics, such as international data sharing, equity in science, and the governance of large-scale international science projects.

Kimberly J. Durniak (Hellman Fellow from 2008–2010)
Senior Director of Internal Operations & Strategy at Mass General Brigham Data Science Office

Dorit Zuk (Hellman Fellow from 2008–2009)
Deputy Director of the National Institute of General Medical Sciences

Gates Palissery, the Inaugural Hellman and Simons Fellow

The Academy recently selected Gates Palissery as the inaugural Hellman and Simons Fellow in Science and Technology Policy. Gates is a PhD candidate in the Translational Biology, Medicine, and Health Program at Virginia Tech, where she has also completed a graduate certificate in Science, Technology, and Engineering Policy (STEP). She will join the Academy upon completing her PhD in June.

Gates grew up in Dallas, Pennsylvania, a small town south of Scranton. She has been interested in being a scientist for as long as she can remember. In middle school, after she understood why people called her grandfather "Dr. Raj," she decided she would also get her PhD.

Gates has a B.S. in neuroscience from Carnegie Mellon University, with a concentration in neurobiology and an additional major in creative writing. After graduating, Gates worked as a lab manager at Northwestern University, where she realized she was interested in studying social behavior in people. This led her to Virginia Tech, where she works under the supervision of Drs. Pearl Chiu and Brooks Casas studying social risk-taking in people with borderline personality disorder.

Gates's interest in science policy began in fall 2020 in the middle of the COVID-19 pandemic. The pandemic emphasized the crucial role of science and scientists in policymaking, which sparked her interest and prompted her to enroll in the STEP graduate certificate. Gates sought practical experience to complement her coursework, actively participating in local science policy efforts through the Science Policy Education and Advocacy Club at Virginia Tech, which she led from 2022 to 2023.

In 2024, Gates was selected as a Commonwealth of Virginia Engineering and Science (COVES) in Policy Fellow. She was placed in State Senator Lashrecse Aird's office, where she studied artificial intelligence policy and collaborated with the Senator and her team to develop regulatory legislation for Virginia. Her fellowship concluded with a report and legislative recommendations, which were accepted by Virginia's Joint Commission on Technology and Science.

Gates sees education, especially a PhD, as an immense privilege and feels a responsibility to use it for the benefit of her community. She co-founded Flip the Fair, an outreach partnership with the Roanoke Public Library and Roanoke City Public Schools. Over the last several years, Flip the Fair has connected hundreds of fifth graders with graduate students and their research, inspiring the young students to see their own potential as future scientists. ■

Science and Creativity

2133rd Stated Meeting | March 9, 2025 | California Science Center, Los Angeles, CA

On March 9, 2025, the Academy's Los Angeles Committee hosted an event for members and guests on Science and Creativity. The program began with welcome remarks from Academy President **Laurie L. Patton**, followed by the presentation of the Rumford Prize to **Andrea M. Ghez** and then a brief introduction from **Cynthia M. Friend** (The Kavli Foundation; Harvard University). The program continued with a discussion on how creativity and imagination fuel scientific discovery, and how science inspires artistic expression. The discussion, moderated by **Thomas F. Rosenbaum** (California Institute of Technology), featured **Andrea M. Ghez** (University of California, Los Angeles), **Kip S. Thorne** (California Institute of Technology), and **Risa H. Wechsler** (Stanford University). An edited transcript of the program follows. The event was supported in part by The Kavli Foundation.

The Rumford Prize Awarded to Andrea M. Ghez

Citation

Established in 1839, the American Academy's Rumford Prize recognizes contributions in the fields of heat and light. The prize is named for physicist and inventor Benjamin Thompson, Count Rumford, whose challenges to established physical theory were part of the nineteenth-century revolution in thermodynamics. The Rumford Prize recognizes scientific discoveries and their potential applications that could fundamentally alter our understanding of heat and light. In the words of Count Rumford, the award is for work that "in the opinion of the Academy tends most to promote the good of mankind."

For remarkable achievements in "heat and light," the American Academy of Arts and Sciences hereby recognizes **Andrea M. Ghez** for her groundbreaking contributions to our understanding of black holes and their profound implications for the nature of light and gravity.

Through her pioneering work in high-resolution infrared imaging, she has revolutionized the study of the Milky Way's center, providing definitive evidence of a supermassive black hole at the heart of our galaxy. Using cutting-edge adaptive optics, she and her team have developed innovative observational techniques that have enabled the precise tracking of stars orbiting Sagittarius A* and provided the most direct empirical proof of Einstein's general theory of relativity in extreme gravitational conditions. Her work has transformed our understanding of the interplay between light and gravity, revealing how these forces shape the universe at its most fundamental levels. Her innovative methodologies and leadership in astrophysical research have set new standards for the field, her dedication to public outreach has enhanced the public's appreciation of space science, and her contributions to science communication have helped make complex astronomical concepts more accessible to a global audience.

Nobel laureate, passionate educator, beloved mentor, and tireless advocate for science education, your influence extends far beyond the research community. You have inspired generations of scientists to follow their passion to explore new ideas and fostered a broader public appreciation for the mysteries of the cosmos.

Awarded the Ninth Day of March, Two Thousand and Twenty-Five

Andrea M. Ghez

Andrea M. Ghez is Professor of Physics & Astronomy and Lauren B. Leichtman & Arthur E. Levine Chair in Astrophysics at University of California, Los Angeles. She was elected to the American Academy in 2004.

I'm touched and honored to receive this award from the American Academy of Arts and Sciences and, in particular, to receive it here in LA. The work that's being recognized today started in LA and has continued over the last thirty years. It started when I first got my job at UCLA, when all I was thinking about at that time was how to get tenure. It began as a very small, short-term, three-year, small investment, high-risk project. And the first telescope proposal was turned down. That's when I really learned to embrace what has now become my favorite expression: every challenge is an opportunity. The opportunity then was to learn to communicate better, to write a better proposal, to understand the importance of giving talks and convincing your colleagues that this is a good idea. Fortunately, we succeeded, and the following year we were off and running. It's a project that has grown beyond our wildest imagination. Frankly, I could not have imagined where we would be today in terms of the scientific questions that we're asking. We'll talk a little bit more about that later, so I'll leave it at that. This was and continues to be a team effort. It is, without a doubt, a great example of where the whole is greater than the sum of the parts. Let me acknowledge and thank the team members who are here today: Eric Becklin, Mark Morris who couldn't make it at the last moment, Tuan Do, Shoko Sakai, Greg Martinez, and Chris Borgman. Thank you once again for this recognition.

We often think of science as being factual, as being analytical – and, of course, it is. But I think it's essential to recognize that creativity is very important in science. You cannot have a scientific breakthrough, an emerging idea, without creativity.

Cynthia M. Friend

Cynthia M. Friend is President and CEO of The Kavli Foundation and the Theodore William Richards Professor of Chemistry and Professor of Materials Science, Emerita, at Harvard University. She was elected to the American Academy of Arts and Sciences in 2018.

Congratulations, Andrea, on receiving the Rumford Prize. It's a pleasure to be here and to see so many people interested in our topic: creativity in science. The Kavli Foundation is a strong supporter of basic science and of scientific research in astrophysics, nanoscience, neuroscience, and theoretical physics. And we are committed to all of this for the long run.

The idea for this event originated about a year ago at another Academy event held at The Getty that focused on creativity in the arts. Several of us, including Tom Rosenbaum, our moderator today and president of Caltech, wanted to underscore the creativity that goes into great scientific breakthroughs and ideas. We often think of science as being factual, as being analytical – and, of course, it is. Some people would say science is boring and geeky, and maybe that's true. But I think it's essential to recognize that creativity is very important in science. You cannot have a scientific breakthrough, an emerging idea, without creativity. Luckily with Geoff Cowan's help and guidance, we were able to bring this topic to fruition.

Today, when it's more important than ever to underscore the value of creativity in science and the vital role that scientific research plays in our world, we are fortunate to have a talented group of panelists who exemplify and illustrate the creativity that I'm talking about. It is my pleasure to introduce them. Andrea Ghez is the Lauren B. Leichtman & Arthur E. Levine Chair in Astrophysics and Professor of Physics and Astronomy at University of California, Los Angeles. She is a Nobel laureate, a member of the American Academy, and now the recipient of the Rumford Prize. Not only is Andrea a world-class scientist, but she's also an incredible communicator and has inspired countless numbers of scientists. She is devoted to fostering the next generation of scientists in astrophysics.

Kip Thorne is the Richard P. Feynman Professor of Theoretical Physics Emeritus at Caltech. He was elected to the American Academy in 1972, and won the Nobel Prize in physics in 2017 for his work on the Laser Interferometer Gravitational-Wave Observatory (LIGO) and for his groundbreaking work in gravitational research. In addition, he writes poetry and books and has been involved in a number of movies, most notably *Interstellar*.

Our third panelist is Risa Wechsler, Professor of Physics and of Particle Physics and Astrophysics at Stanford University. She's also the Director of the Kavli Institute for Particle Astrophysics and Cosmology at Stanford. And she was the coleader of the Dark Energy Spectroscopic Instrument (DESI) experiment. In addition, Risa is a prolific ambassador for science and is devoted to science communication. She was elected to the American Academy in 2023. It is my pleasure now to turn the podium over to my colleague, Tom Rosenbaum, President of Caltech, Sonja and William Davidow Presidential Chair, and Professor of Physics, who will moderate today's discussion.

Thomas F. Rosenbaum

Thomas F. Rosenbaum is President of the California Institute of Technology; Sonja and William Davidow Presidential Chair; and Professor of Physics. He was elected to the American Academy of Arts and Sciences in 2010.

Thank you, Cynthia, and welcome all. It's wonderful to see old friends and new friends, especially at fraught times, to remind ourselves that what we do is an important endeavor. I hope that in this exploration with our distinguished panel, we'll have an opportunity to do just that. Now it is my pleasure to turn to Kip Thorne.

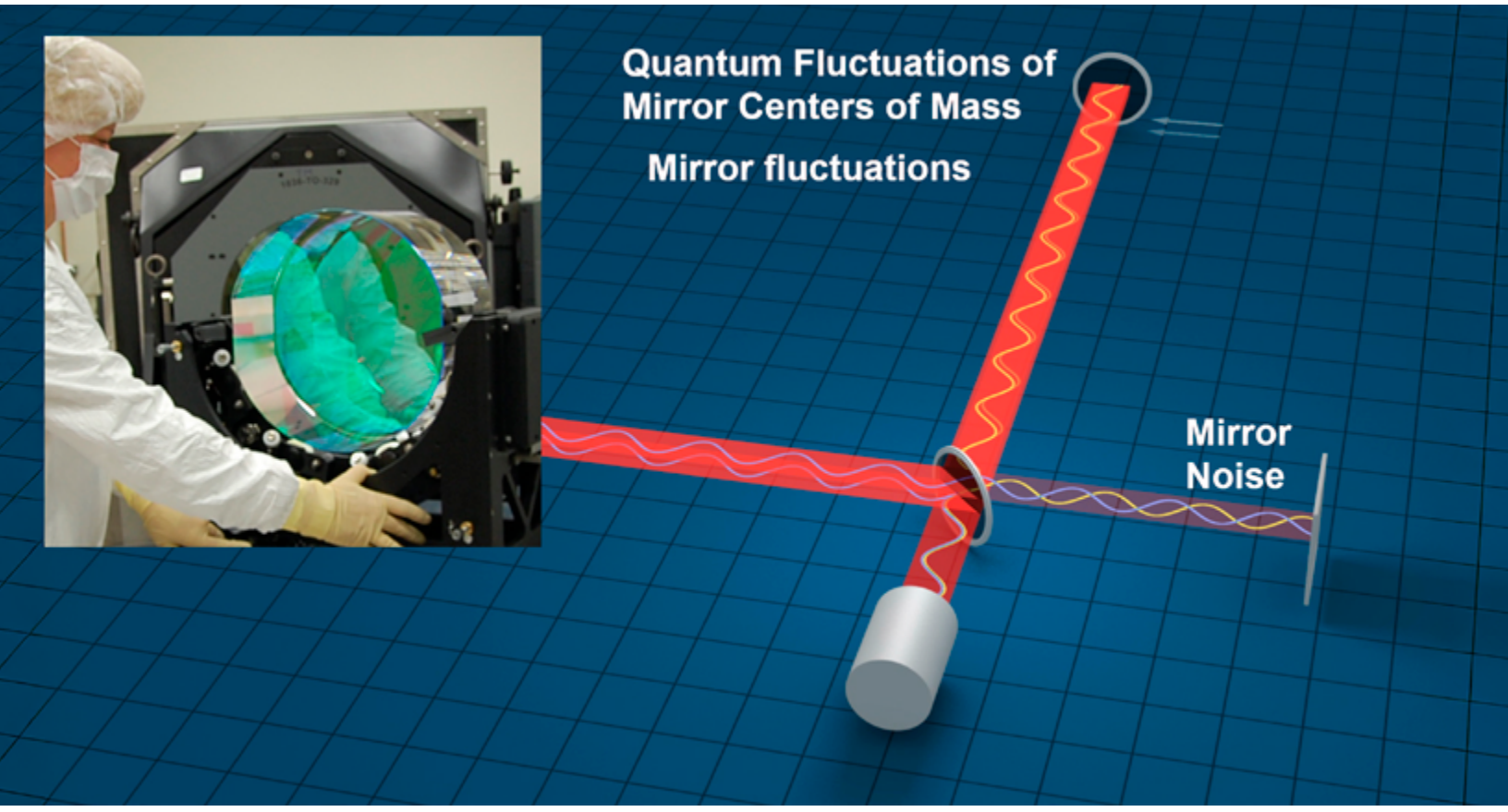
Kip S. Thorne

Kip S. Thorne is Richard P. Feynman Professor of Theoretical Physics, Emeritus, at California Institute of Technology. He was elected to the American Academy of Arts and Sciences in 1972.

Thank you, Tom. I would like to describe a creative and beautiful breakthrough in 1981 by one of my students, Carlton Caves, that will serve as a foundation for some of the remarks that I'll make later in the program. Caves's breakthrough is on its way to impacting twenty-first-century technology in a big way. The concept underlying Caves's breakthrough is vacuum fluctuations. If we take a box and remove from it everything that possibly can be removed, then the laws of physics dictate that there remain incredibly tiny fluctuations of everything that could have been in the box. For example, protons, electrons, and photons fluctuating in and out of existence randomly. Virtual particles, they are sometimes called.

As further background for Caves's breakthrough, the universe manipulates vacuum fluctuations in amazing ways. For example, there is much observational evidence that the universe was born in a big bang explosion, with space expanding or, as we say, inflating exponentially rapidly. And it was born containing the minimum amount of matter that is allowed by the laws of physics: just vacuum fluctuations. These vacuum fluctuations have voracious appetites. In our universe's earliest moments, the vacuum fluctuations fed off the energy of the inflating space, extracting just the right amount of energy to convert themselves into all the matter and all the radiation that we see in the universe today. This was familiar to Caves, along with other powerful ways in which the universe manipulates vacuum fluctuations.

In 1981, when Caves was just completing his PhD with me at Caltech, my colleagues and I were working on R&D for LIGO, an observatory for detecting gravitational waves and thereby creating gravitational wave astronomy. In a simplified version of LIGO, two mirrors hang from overhead supports at the ends of two arms of an L. A laser produces a beam that gets split in two, with the two beams going down the two arms. Each beam bounces off the mirror at the end of its arm, and the beams then return to the beam splitter. If the two arms have identical lengths, then the beams completely interfere and no light goes into the photodetector. When the gravitational wave stretches and squeezes the arms, the interference is modified, so the photodetector sees rising and falling light intensity – the gravitational wave signal arriving at LIGO's output port. In the figure below, we see a photo of one of the mirrors thirty years later. It's big and heavy – 40 kilograms, 88 pounds. The laser beam records the motion of each mirror's center of mass, the average location of all of the mirror's atoms. That center of mass oscillates in response to the gravitational waves by such an incredibly tiny amount that quantum fluctuations of the center of mass position, 100 million times smaller than an atom, were a serious worry for us in 1981. Those mirror fluctuations produce noise in the output signal – call it mirror noise – that might be big enough to hide the gravitational waves we were seeking.



In our universe's earliest moments, vacuum fluctuations fed off the energy of inflating space, converting themselves into all the matter and all the radiation that we see in the universe today.

Caves had the crucial insight that vacuum fluctuations of light entering LIGO through its output port and traveling into the two arms and onward to the end mirrors will beat against the laser light to produce random fluctuations of light pressure on the mirrors' faces, and thereby control the mirror fluctuations, and the mirror noise in the gravitational wave signal that is exiting the output port. Caves also had a second insight – and these insights were so radical that no one else in the community had come close to them before. His second insight was that the vacuum fluctuations themselves returning to the output port will beat against the light signal there to produce random fluctuations, called shot noise, that contaminate the signal. And this led Caves, with some help from his friend Bill Unruh, to the biggest insight of all: By manipulating the incoming vacuum fluctuations in a very clever way, called frequency-dependent squeezing, the shot noise and the mirror noise in the output signal can be made to cancel each other.

That was a radical insight, and it was completely unexpected. LIGO can be completely protected from both quantum noises, at least in principle. Caves told us what needed to be done: squeeze the vacuum fluctuations. Jeff Kimble, down the hall from Caves at Caltech, figured out how. He invented and demonstrated the technology for this frequency-dependent squeezing. Bringing that technology to fruition has been a near forty-year concerted effort, mostly by the LIGO team. The result, called *quantum precision measurement technology*, has now been fully implemented into LIGO and is one of the major keys to LIGO now seeing several collisions of black holes each week. This quantum precision measurement technology is closely related to quantum computing and quantum cryptography and will have many other applications beyond LIGO in the coming years.

At Caltech, a new building with underground laboratories, called the Ginsburg Center for Quantum Precision Measurement, is under construction. Caltech and a number of start-up companies are now pursuing quantum precision measurement on the atomic and nanotechnology scale, under the alternative name of quantum sensing. So that's where this has all led in the end. Thank you.

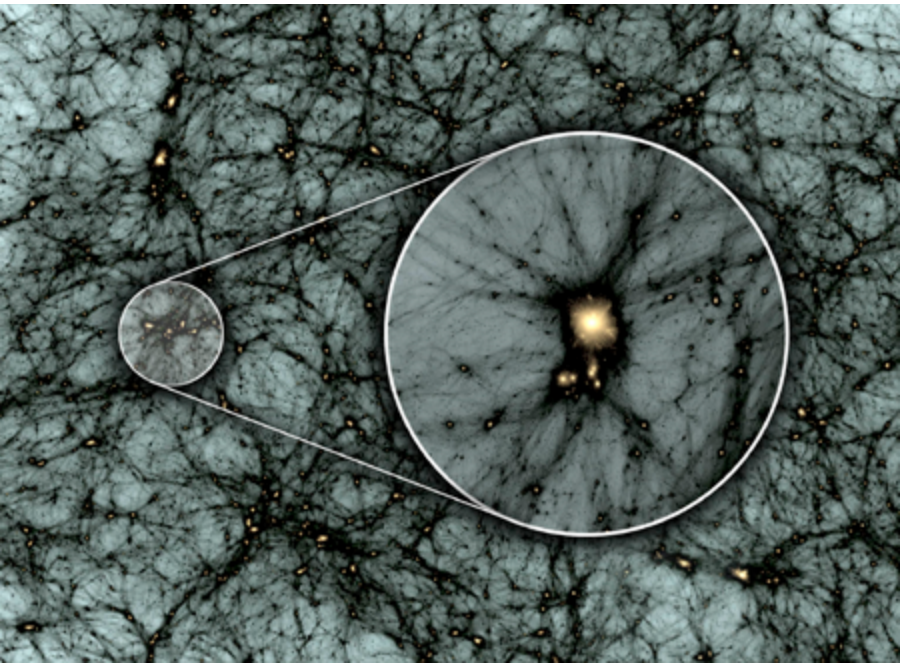
ROSENBAUM: Thank you, Kip. We wanted to make this real and give you a sense of the objects and machinery that are used in the scientific creative process. Continuing on that theme, let us now turn to Risa.

Risa H. Wechsler

Risa H. Wechsler is Director of the Kavli Institute for Particle Astrophysics and Cosmology; Humanities and Sciences Professor; and Professor of Physics and of Particle Physics and Astrophysics at Stanford University. She was elected to the American Academy of Arts and Sciences in 2023.

Thank you. It is a pleasure to be here. I would like to talk briefly about the kind of work I do and highlight both the collaboration and communication of this work. I'm a cosmologist, so I study the entire universe. I'm interested in how the last 13.8 billion years unfolded – what happened over that time, how we use measurements of galaxies to learn about what the universe is made of at its most fundamental level, and how galaxies like our Milky Way formed. We use very large cosmological simulations run on supercomputers to help us do this. A wonderful thing about these simulations is they enable us to see what is happening in the universe over 13.8 billion years and make predictions for what we measure when we survey the universe.

We think every one of the hundreds of billions or trillions of galaxies in the universe forms in the center of a clump of dark matter. One thing that the three of us on this panel have in common is that all of us, in different ways, use gravity to teach us about what the universe is doing – the influence of gravity on light teaches us about the things we can't see – from dark matter to black holes. For me, the key thing that we can't see is dark matter, but these calculations enable us to see it. One of the things I love about my work is we can map the universe at high precision with large telescopes, and I work with incredibly large teams to do this. In the first image below, the middle of the image shows a galaxy like the Milky Way, and what you see here is the structure surrounding that galaxy. With the kinds of surveys that we are able to do now, we are starting to make maps that look like this, and we are seeing this structure, which we were predicting for a long time.

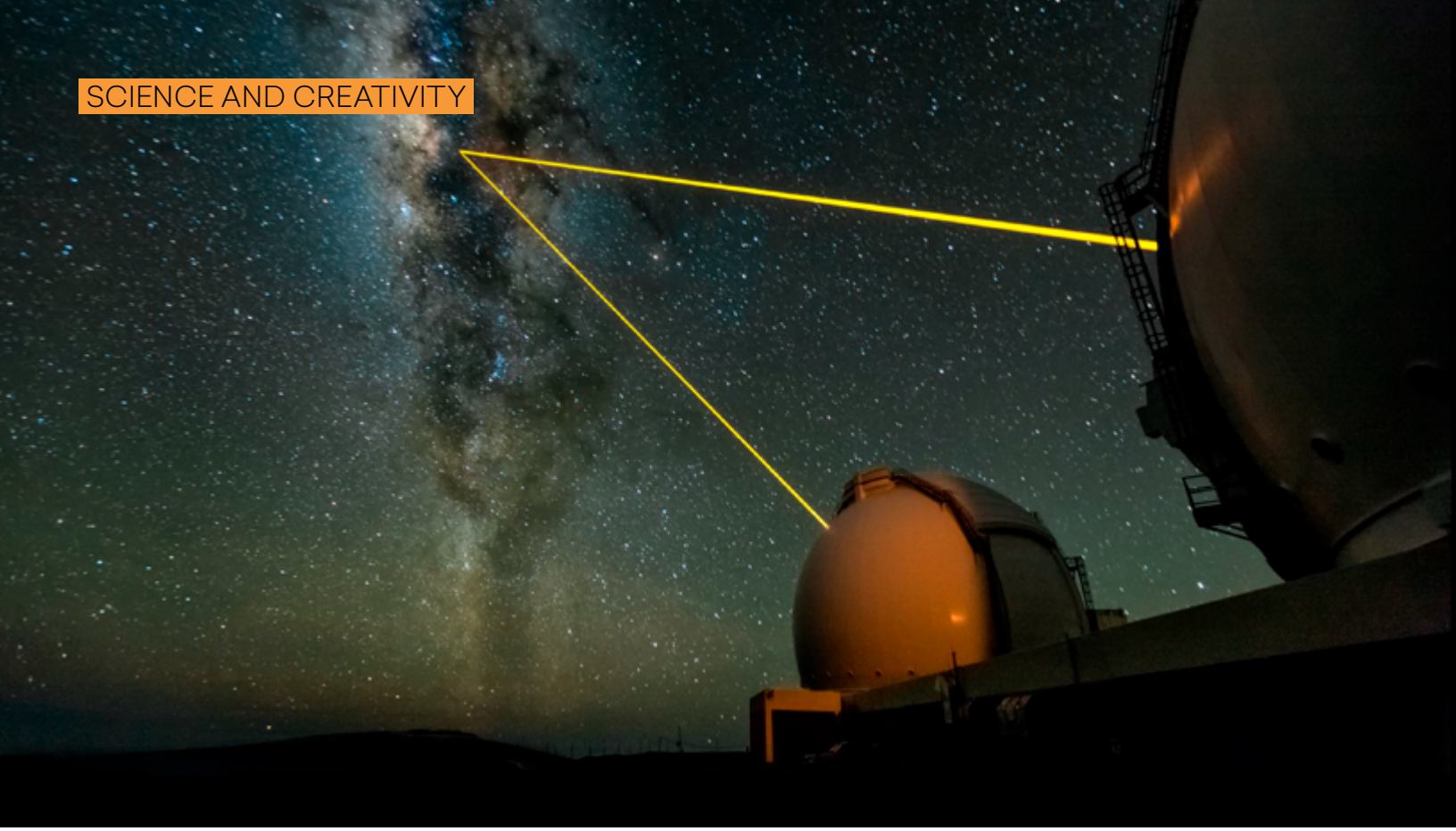


I would like to end by telling you about an interesting collaboration. I am working with Camille Utterback, an incredible artist who is a professor of art practice at Stanford. We have been friends for about a decade and have been talking about the universe: how we think about it and how we explain it to people who are not cosmologists. She is not a cosmologist. She does a lot of large installation work, which includes interactive video. Recently she was commissioned to develop a permanent work for Stanford's new data science building, which has an incredible three-story stairwell. Her installation uses five different triangles, which represent different kinds of data – from the first mechanical histograms to studying water in the Seine to Jacquard weaving, which was a complicated way to track various kinds of data.

The triangle on the left that we see in the image below is an example of a piece of the universe that forms the Milky Way. It is a beautiful, etched, hand-painted piece of glass. We received a grant last week to start working on incorporating new data into the exhibit. There's an incredible telescope called the Vera Rubin Observatory that is operated jointly by the NSF NOIRLab and DOE's SLAC National Accelerator Laboratory at Stanford. We built a 3.2-gigapixel camera for this new observatory, and it was installed just three days ago. This telescope is going to be surveying the entire southern sky starting in a few months. We are excited that the Rubin data will give us a better understanding of our universe and delve into the mysteries of dark energy and dark matter. In addition to the many scientific discoveries that we hope to make, we are also thinking about how we communicate that to people in very broad ways. And so with Camille, we're working on ways to incorporate those new data and discoveries into her installation. Thank you.

ROSENBAUM: Let's turn now to Andrea Ghez.

"Fathom" by Camille Utterback



Andrea M. Ghez

I grew up in a household with lots of art, and one of my favorite pieces is Robert Mapplethorpe's photograph of bodybuilder Lisa Lyon. I had a poster of this photograph on my bedroom door when I was in high school. Today, the photograph is in my living room. I love this piece of art on many levels. There's an obvious juxtaposition of masculinity and femininity, and it doesn't take a genius to figure out why that appealed to me as a young girl going into the sciences and headed off to MIT. But today, I think of it slightly differently, in the sense of what happens when you bring together ideas that we think conflict, and the resolution of those ideas leads to something that's very beautiful.

As a scientist, my tools are different but similar to what Mapplethorpe used. I also use a camera like Mapplethorpe but my cameras are the largest telescopes in the world, co-owned by Caltech and the University of California. In fact, they were just opening as I started my faculty job. It's why I wanted to work at UCLA. I was interested in using these telescopes in a new and different way.

Astronomers love big telescopes. They let us see things that are very faint so we get to study the distant universe. But they also let us see a lot of detail, which has been harder for us to achieve. Much of my work is focused on overcoming the blurring effects of the Earth's atmosphere. The analogy that I like to make is to Pointillism, about getting closer to a painting to see the details, and that's possible in the universe. It's been a long journey of technological development – about forty years. And we can now see the universe in a completely new and different way, which has upended our notions of how the universe works.

We've been trying to understand if there's a supermassive black hole at the center of the galaxy. And that involved discovering stars and showing that you could actually measure the orbits. It was a long process of figuring out that we could measure these orbits and do this kind of work. The evidence has been increased by a factor of 10,000,000 for the existence of a black hole at the center of our galaxy. This was also a unique opportunity to understand the interplay between the black hole and its host galaxy, which really gets at what Risa was talking about in terms of the role black holes play in the formation and evolution of galaxies. The wonderful thing about technology is that not only are you able to answer the question that you set out to answer, but often, you have surprises. In this process, we've discovered more questions than answers. And that's the fun of science.

> One of the amazing things about the field of astronomy and astrophysics is that gateway into exploring your curiosity about science.

ROSENBAUM: Thank you, Andrea. To get our discussion going, I'll start with Kip, but I hope everybody will jump in. How did you first become interested in science and technology? Were you drawn to both from the start, or did one lead you to the other?

THORNE: When I was about eight years old, I wanted to be a snowplow driver. I grew up in the Rocky Mountains and the plows pushed the snow three times higher than my father was tall. But then a lecture about the solar system broke my fixation on snowplows and in its place enchanted me with the vastness of the solar system. My mother showed me how to do calculations to scale the solar system down to where the sun was a four-foot circle on the sidewalk in front of our house and the Earth was about a centimeter in diameter in front of the third house down the street. Just seeing that and the vast emptiness in between inspired me.

For me, science and technology are so intimately intertwined that it's not clear where one ends and the other starts. The motivation for Carlton Caves's insights was the challenge of detecting gravitational waves, an enormous technological challenge. His insights were based on science: a deep understanding of quantum physics. He was immersed in a research group that had lots of ideas floating around, and they triggered his insight into how to control quantum fluctuations. The result was today's technology. So the science and the technology are totally intertwined.

> The evidence has been increased by a factor of 10,000,000 for the existence of a black hole at the center of our galaxy.

ROSENBAUM: Risa, tell us about your intellectual journey.

WECHSLER: I was always curious about everything. I was one of those annoying kids who asks "why" about every topic. I love to be in nature. I grew up in the Pacific Northwest and spent a lot of time in the mountains, and I was always interested in how things worked in the world around me. But the biggest questions also inspired me, and for that reason I decided to be a physicist. I thought physics was asking the biggest questions, such as what is the universe made of? How did it form? I feel incredibly lucky that today I still get to ask these types of questions. To me, that's the most wonderful thing about a scientific career in cosmology. There is such universal interest in questions about astronomy and that keeps me curious every day.

What's interesting is that initially I didn't have a real interest in technology. But I have learned to appreciate that in physics and really in the last thirty years in astronomy the data have driven all of our discoveries, and technology has enabled us to make those measurements. I've had many collaborations with people who are building precision instruments that enable the kinds of discoveries that we've been able to make. And those collaborations have been so valuable.

ROSENBAUM: Andrea, your mother ran an incredibly famous art gallery in Chicago. Did that influence your pathway into science in some way?

GHEZ: That's an interesting question. My mom was a great role model. She also was an example of the American dream because she started in an art gallery as the administrative assistant and then became the director who was well-known for identifying artists. And that's the kind of soup I grew up in: fearless and no barriers. What enables you to go in that direction is really curiosity. For me, the scientific seed that I can identify is the moon landing, when I was four years old. It completely captured my imagination. My parents gave my sisters and I a telescope, and we looked at the moon for a while, then we started looking at people's apartments, so the telescope went away! But it seeded this idea that there's something so much bigger than what we can see. One of the amazing things about the field of astronomy and astrophysics is that gateway into exploring your curiosity about science. By the way, I also wanted to be a ballet dancer and drop out of school when I was sixteen, but I quickly discovered I had more talent in science than dance.

In college at MIT, there was a group that played an important role in X-ray astronomy, which

opened up studying about black holes. I first got introduced to the power of technology when I went off to Caltech, thinking I was going to follow high energy astrophysics. And then there was this cool, new technique that people were advertising that could solve all these problems about black holes, so I drifted over there. But it didn't deliver on its promise. I wanted to share this because there's an interesting juncture when students often have to decide between pursuing the science or the technology. I decided to stick with the technology. That was my journey.

ROSENBAUM: Thank you. I would like to share a quote from France Córdova, who was director of the National Science Foundation and she earned a PhD in physics from Caltech. About seven or eight years ago, she wrote, "Perhaps surprisingly, the single thing that most prepared me to persevere with the trials of graduate school was rock climbing. Climbing requires trust in one's partners, patience, practice, and more practice. The moments of expansiveness when you are at rest, perched on a crag hundreds of feet above a valley floor with your mind roaming freely, can lead to epiphanies." So tell us about your epiphanies, whether you're on a crag hanging above the ground or not.

THORNE: My epiphanies usually come in the middle of the night. If I've been struggling with some issue, I have many different aspects of it in the front of my brain, and at night, my subconscious can somehow make connections between things that the front part of my brain doesn't make. There just seems to be too much going on during the day. I'm one of those people who wakes up in the middle of the night with an idea. I write it down, and frequently, it's a good idea!

WECHSLER: Like Andrea, I was a ballet dancer when I was young, and ballet taught me the perseverance that I needed in order to be a physicist. Ballet actually has a lot of things in common with physics. There's rigor, and you have to practice and practice. There's a vocabulary, but you can be creative within that vocabulary. I'm not like Kip. I don't have brilliant thoughts in the middle of the night. They are mostly too jumbled. Most of my epiphanies come from collaboration and discussion. And that's why I try to get brave with the kinds of collaborations that I have. I hire postdocs in my group who have very different expertise than I do. I like to collaborate with artists and musicians because they help me see my own work in different ways. They help me look at a problem in a new way.

GHEZ: My most productive or creative place is the pool because I like to swim. When you are swimming you really have to be one with your thoughts. You can't put headphones on, you can't listen to a podcast, you can't distract yourself in all sorts of ways. It's similar to having your best ideas in the shower. It's a place where you can let your brain rest. But there's also something about the activity that gets your brain in a different state. Some of my lane mates are here. They know when I'm in that mode and lose count of my laps.

> "I love teaching undergraduate cosmology to nonmajors. These are people for whom this may be their first and last science class in college, and in that environment, I like to share the excitement, passion, and joy I have as a scientist – the fact that we are able to have this incredible curiosity and then make real measurements of our universe.

ROSENBAUM: All of that resonates with me in terms of letting your mind go. I've written the first few paragraphs of papers in my head while running! We're all in the business of training the next generation. How do you communicate this incredible and palpable sense of the excitement of science to your students?

THORNE: I'm not in that stage anymore, but for nearly fifty years, I had a research group at Caltech, which I patterned after the research group that Robert Oppenheimer had at Berkeley and Caltech many years earlier. I had grad students. I had postdocs. I had research faculty and visitors. I built a group in which there was a rich plethora of ideas so people were always bathed in exciting ideas. Some of them deep, some of them not so deep,

Moderator **Thomas F. Rosenbaum** and panelists **Risa H. Wechsler**, **Andrea M. Ghez**, and **Kip S. Thorne**

some tied to technology, some tied to science. And my students' inspiration often came from being immersed in that ambience.

GHEZ: I think there are two forms of mentoring students. One is in the research world, where we're training them on how to do research, and to figure out those structures that allow you to be unstructured. In my group, those opportunities often come from using the telescope in what we call traditional ways. You're assigned your night, and then you stay up all night controlling the instrument yourself. But the cloudy nights are actually the most interesting because that's when you work on the new ideas, and that's when you brainstorm. My group and I have spent many very productive cloudy nights together. And that's when I really see students light up because they get much more than just the mechanics and how to do problem sets. It is the opportunity to interact with them that is exciting. And when COVID took that away, I began to appreciate how important it was to our work. The other form, of course, is teaching in the classroom, and I've discovered the joys of teaching at the introductory level, because that's when the students are keen to learn. That's when you really can share the joy of doing science with them. So I think bringing the research into the classroom is important.

WECHSLER: I love teaching undergraduate cosmology to nonmajors. These are people for whom this may be their first and last science class in college, and in that environment, I like to share the excitement, passion, and joy I have as a scientist – the fact that we are able to have this incredible curiosity and then make real measurements of our universe. In my research group, I try to give every person agency for their own career and their own research questions. I really see my role as helping them figure out what that vision is and then giving them the tools to achieve it.

ROSENBAUM: Before turning to questions from our audience, let's finish with a lightning round. You have two bricklayers, and one says, "I'm laying bricks" and the other says, "I'm building a cathedral." What cathedral are you building right now?

THORNE: I was a conventional professor for about fifty years, and decided that for my next half century, I wanted something different that was equally exciting and equally enjoyable. I chose

communicating science to the world through the arts. I tried through the movie *Interstellar* to inspire people about science and about what I like to call the Warped Side of the Universe, which is the venue in which that movie exists. I started that movie together with Linda Obst, who sadly passed away a few months ago. But it was really Christopher Nolan and Jonathan Nolan who turned *Interstellar* into the great success it was. Collaborating with them was a tremendous joy. I also have had a wonderful collaboration with Lia Halloran, who is a fabulous painter. I think about the laws of physics visually. My mental pictures help me to decide what research directions are worthwhile. Lia has converted my mental pictures into enchanting paintings, and we are using tightly integrated paintings and verse – her paintings; my verse – to try to communicate science to nonscientists. And it's all enormous fun.

WECHSLER: I think that humans have been building this cathedral of trying to understand how the universe works since the first humans tried to understand why the stars and planets were moving as they were. And I feel so lucky to be a part of this quest: to understand how the universe formed and what it's made of. I've spent a long time trying to figure out what this dark matter is that makes up most of the mass in the universe, and it's a really hard problem. We may not solve it in my lifetime, but it would be worth several cathedrals if we could figure it out. So that's my cathedral, and I feel lucky to be able to put a few bricks in.

GHEZ: I'm sure this won't surprise anyone, but for me it is the big telescope. This technology is bringing the world together. It's a project that crosses many different countries, and it is an important role that science can play in terms of global participation and cooperation.

AUDIENCE MEMBER: What do we do in the face of relentless attacks on science and scientific money funding the universities that all of you are a part of? You are fantastic communicators. Please tell us how to communicate that what scientists do is important.

GHEZ: This is really the intent of the comment about every challenge is an opportunity. We have an opportunity now to think about the role of higher education in a democracy. It is an opportunity for us to think deeply about our mission and how we communicate that. There are certain structures that we work with that are hard to explain, and I think it behooves us, in this moment of complexity, to come together outside our specific disciplines to seize our opportunity.

THORNE: What I'm struck by is the extent of disinformation and misinformation that we are being bathed in from Washington and elsewhere. Let me give you an example. I had an Uber driver a couple of days ago who was caught up in misinformation about vaccines, so we had a conversation. I told him that there are places where you can go to learn the truth. There are reliable sources, like the CDC, but you need to know where to find those reliable sources. Unfortunately, the general public has not learned how to identify reliable sources of information, and I think a huge part of the challenge is to communicate this issue to the broad public and try to help them identify reliable sources of information. Universities are and should be one of those sources.

> "I feel so lucky to be a part of this quest: to understand how the universe formed and what it's made of.

ROSENBAUM: Let me put in a plug for the Caltech Science Exchange.

WECHSLER: I don't have any real answers, but I think a place to start is to articulate what we are trying to do over the long term and think deeply about how we have a conversation across disciplines and outside of academia about building knowledge and having access to knowledge as a fundamental human value.

AUDIENCE MEMBER: In thinking about the intersection between science and the arts, science and creativity, if you ask any thoughtful person about these intersections, high on the list would be religion. Is there a connection between cosmology and religion?

Johanna Drucker (UCLA) poses a question to the panelists.

WECHSLER: There are many ways in which both religion and our study of the universe are fundamentally about trying to understand how things work. It's also about awe. That is something that cosmology and religion have in common, which resonates with a lot of people. I think we should look for opportunities to share our wonder and our awe in the universe in ways that don't conflict with people's beliefs.

GHEZ: The Templeton Foundation is interested in this intersection between science and religion, and a lot of astronomers have been supported in that arena. To me, it makes perfect sense.

AUDIENCE MEMBER: We are all mortal creatures. If you could come back fifty years after your death, what question from your scientific research would you be most interested to see answered, especially through the work of a student, researcher, or someone who carried your research forward?

GHEZ: I would like to know, what is a black hole?

WECHSLER: I want to know, what is dark matter?

THORNE: I want a reliable understanding of the birth of the universe and the laws of quantum gravity, which presumably controlled the birth of the universe.

ROSENBAUM: So we will reconvene in fifty years, and you will hear the answers to those questions. I thank our esteemed panelists for this extraordinary conversation, and I thank our audience for joining us.

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To view or listen to the presentation, visit www.amacad.org/events/los-angeles-members-reception.

The World in 2025

2132nd Stated Meeting | February 5, 2025 | New York City

On February 5, 2025, the Academy's New York Committee hosted a discussion for members and their guests about the most pressing issues facing the world in 2025. The event featured **Kwame Anthony Appiah** (New York University), **Michael Froman** (Council on Foreign Relations), and **Adam Tooze** (Columbia University) in conversation with **Anne-Marie Slaughter** (New America). Academy President **Laurie L. Patton** delivered the opening remarks. An edited transcript of the conversation follows.

Anne-Marie Slaughter

Anne-Marie Slaughter, a member of the American Academy since 2002, is the CEO of New America and the Bert G. Kerstetter '66 University Professor Emerita of Politics and International Affairs at Princeton University.

I'm delighted to be here this evening to moderate this discussion with our distinguished panelists. Let me take a moment to introduce them. Anthony Appiah is Professor of Philosophy and Law at New York University. He has written on many different subjects and for tonight's purposes it is very notable that he writes "The Ethicist" column for *The New York Times*. Adam Tooze is the Kathryn and Shelby Cullom Davis Professor of History and Director of the European Institute at Columbia University. He also chairs the Committee on Global Thought. Michael Froman is the recently appointed President of the Council on Foreign Relations. Before that he was the Vice Chairman and President of Strategic Growth at Mastercard and he served as the U.S. trade representative from 2013 – 2017. I had the pleasure of serving in the Obama administration with him.

Our topic is the world in 2025, and that world has changed quite dramatically since January. This evening, we are capturing a frozen moment in time and giving ourselves an opportunity to pause, reflect, and interrogate how things are in our world today.

Anthony, let me start with you. One of your many books is on cosmopolitanism. In many ways, you embody an ideal of cosmopolitanism in your own person, in your life, and in your writings. But cosmopolitanism isn't exactly the flavor of the day in the United States and Europe right now. We are seeing a resurgence of nationalism. Is this a standard pendulum swing? We were globalists and now we're nationalists? Or is there something deeper happening that is challenging the notion of cosmopolitanism as you've developed it?

Kwame Anthony Appiah

Kwame Anthony Appiah is Professor of Philosophy and Law at New York University. He was elected a member of the American Academy of Arts and Sciences in 1995.

Since I don't think of myself as a prophet, I'm not sure I can tell you what's going to happen. But I think you're correct that a spirit of cosmopolitanism that was somewhat exemplified in the rhetoric and discourse of the Obama administration is ending. We are not seeing that type of cosmopolitanism in contemporary American politics. It's also not there in Indian politics. It's not there in Nigerian politics, and it's definitely not there in Europe right now.

The story is complicated. We failed to take proper advantage of what the globalization of the economy gave us. Globalization produced huge amounts of wealth in ways that affected Asia, in particular, by reducing poverty. If you're a left-leaning anti-globalization person, you need to explain why you're against something that took hundreds of millions of people out of poverty in India and China and made a bunch of people you may not like very rich. In principle, this was a good for everybody. Let me give an example. The typical American owner of an iPhone wouldn't have been able to afford their iPhone if we hadn't had globalization because the iPhone would have cost $15,000. I know it seems like we are moving in that direction now, but there was a period when an iPhone was affordable for a lot of people. The Davos elite failed to distribute those enormous gains that came from being deeply interconnected economically.

A few days ago, when I was thinking about what I could bring to the conversation tonight, I thought of global health and the ways in which international cooperation in that domain has been enormously productive. The president has closed down a part of the government that is central to that. But to keep the focus tonight on the world, our colleagues in Europe, in Scandinavia, and to some extent in China are going to have to continue to take up some of the slack. And that will reduce the United States' significance. And to be honest, I'm not too unhappy about that. I think a large imperial America is not terribly attractive and the fact that the president is explicit about not thinking of the United States any longer as a moral force in the world, but merely just a larger Paraguay . . .

SLAUGHTER: That may be the line of the night. We're a larger Paraguay.

APPIAH: The president wants us to leverage our resources for our own interests. He seems to think that we have no moral or political obligations to anybody else. It doesn't matter whether he gets to change the government in that direction. Just having a president talking in that way means that our colleagues are going to have to think about how to manage these things better. I think that will have some good effects in the domain of global health because the Germans, the French, the Scandinavians, and the British are more inclined to work on health infrastructure. USAID and the WHO have tended to focus on diseases, especially infectious diseases. But some of the most serious diseases are not infectious diseases. For example, sickle cell is not an infectious disease but it is a debilitating problem in Africa. And that's important because by the end of the century, a majority of the world's children will be born in Africa. The median age in the European Union is forty-five; it's nineteen in Africa. Nigeria, where my brother-in-law is currently the minister of finance, is a huge and powerful country that is thinking about its role in the world. Nigeria has been collaborating with us to deal with some of the problems in the Sahel, but some of that collaboration may disappear. We have a quarter of the world's GDP. So, if we pull out of these types of collaborations, there's a big gap to fill.

SLAUGHTER: We're going to come back to this point about the benefits to the United States of assuming it's the only leader. I do want to note, however, that Trump pulling out of the World Health Organization does not mean that Americans are not still deeply involved in global health. During the first part of the pandemic, universities and companies collaborated with their Chinese and European counterparts. U.S. foreign policy is not just a function of what the government does; it involves a wider and more complex set of actors.

> "A spirit of cosmopolitanism that was somewhat exemplified in the rhetoric and discourse of the Obama administration is ending. We are not seeing that type of cosmopolitanism in contemporary American politics. It's also not there in Indian politics. It's not there in Nigerian politics, and it's definitely not there in Europe right now.

Anthony, you mentioned Davos so let me now turn to Mike because he's just returned from Davos. The United States has traditionally presented itself as a moral force in the world. Reagan certainly saw us that way and so did George W. Bush. We have this universalist vision. Our Declaration of Independence says that all men – not all Americans – are created equal. Mike, in many ways, you've fought one of the last big battles of pro-globalization, pro-free trade, pro-global benefits: negotiating the Trans-Pacific Partnership with Asia. Hundreds of millions of people are no longer in poverty because of globalized trade and investment. You were fighting what many of us had thought for decades was the good fight. Where did things change, and could we have prevented what happened?

Michael Froman

Michael Froman is President of the Council on Foreign Relations. He previously served as Vice Chairman and President of Strategic Growth at Mastercard.

Let's take a step back and put things in a slightly broader context. I agree with Anthony that globalization on the whole had extremely positive effects on the world, including for the United States. But both Democratic and Republican administrations failed to pair globalization with a set of domestic policies that would ensure that those who were being left behind had the tools they needed to survive and thrive in a rapidly changing economy. The economy was changing because of globalization, or because of technology, or because of immigration and that I think led to this backlash. And what's interesting is that it's not universal. Europe has a different tradition for their social compact, where labor unions have worked to make sure that their members could be retrained and continue to participate in a changing economy. They have remained much more pro-globalization. They are fully sold

on the values of liberalization and integration. The United States has pulled back more than the rest.

If we look across Africa, the continental-wide Free Trade Agreement was not a great trade agreement, but it was quite remarkable that Africa agreed to it and its implementation over several years. Asia, of course, is very committed to integration. ASEAN is a great example of that. And those efforts continue apace. I think the United States has had the most significant reaction. As we've seen in Europe, some of the polarization hasn't necessarily been translated into a fundamentally different economic policy.

If we take a step back, I think some could say that we are nostalgic for and miss the stability of the Cold War. We knew who was who in the Cold War. There was one side or the other. You knew where you stood. The tools of the trade were well known. In fact, there was a lot of interaction between the West and the East with mutual understanding of how to manage the competition and the conflict. That lasted for forty years. It was replaced by liberal democracy, which lasted for thirty years. And that's now over. We have a much more complex world today. And in my view, it's not multipolar.

SLAUGHTER: I agree. I would say it's multi-aligned.

FROMAN: I prefer the word polyamorous! Let me use India as the best example. India loves the United States for our civil nuclear cooperation and our technology. India loves Russia for its munitions. India loves Iran for its oil. India loves and hates China, depending on the topic and the time of day and this whole notion of the BRICS Plus. These are countries that do not have very much in common except for the fact that they don't want to be seen fully aligned with the United States. This is a much more complex world. And India is just one example. We could talk about other so-called middle powers.

To your question about how do we exercise moral leadership and strategic leadership, I think it would be a herculean diplomatic task for any American administration to put all of the skills of diplomacy at work to help build these coalitions of the willing around one issue or another. We're not in a world where countries are with us or against us on every issue. They're going to be with us on some issues, against us on others. And our enemies or our competitors have a third set of issues that matter to them.

Now enter Donald Trump, perhaps the most unconventional president we've had in some time, who isn't necessarily committed to that level of diplomatic engagement. This raises serious questions about what's going to be the role of the United States going forward. Are we interested in playing a leadership role? On what sorts of issues? How are we going to use the tools at our disposal to do so? If we want to engage internationally, we need to build a politically durable consensus about why we're engaged internationally, why it's in our interest to be so, how we're going to be engaged, and how we're going to manage the tradeoffs between addressing international issues and issues here at home.

SLAUGHTER: Thank you, Mike. You've given us plenty to follow up on. To quote Rana Foroohar, a columnist at the *Financial Times*, "The U.S. is not an anchor for stability, but rather a risk to be hedged against."[1] In 2022, when the German Chancellor delivered his Zeitenwende speech, he said we don't know what will happen in 2024, so we can't count on the United States to help Ukraine. The United States is certainly being seen very differently now.

I want to go back to what you said about how you prefer the word polyamorous to describe things today. I use the word multi-aligned; it is the way India describes its foreign policy. The Biden administration courted India mightily. They were "our" democracy. And then came the war in Ukraine. General Petraeus said to Indian Foreign Minister Jaishankar, "You know, Minister, you've got to choose now that Russia has invaded Ukraine. You have to be on one side or the other." And Jaishankar said, "General, we have chosen. We've chosen India." And that's the difference. They are going to have a relationship with whomever they need to have a relationship with to do what they need to do. So, we agree. It's a complex world in which many middle powers are finding new space.

Adam, you've been patient and there are lots of things you can react to. We are talking about the whole world as one entity. Thinking about America's place in the world, does that framework make sense?

1. Rana Foroohar, "An Unpredictable America Looks More and More Like an Emerging Market," *Financial Times*, October 1, 2024, https://financialpost.com/financial-times/america-looks-like-emerging-market.

Adam Tooze

Adam Tooze is the Kathryn and Shelby Cullom Davis Professor of History and Director of the European Institute at Columbia University.

It's really a privilege to be here. When I received the prompt for tonight's conversation – what are the big issues in the world right now? – I have to admit that I was quite stumped. It seemed to me at that time that the central question of our moment is the one that several people have already alluded to: What is your world? Depending on your answer, I could guess as to what your issues might be. This has a kind of

late-twentieth-century, early-twenty-first-century feel to it. Global public health would be a classic instance of this. From a historian's point of view, I'm not sure whether it's a fragile moment, but it's certainly a historical moment that has been conjured up in different ways. The cosmopolitanism of global Marxism in the 1930s was very different and remote from the world that we're in now. The cosmopolitanism of social Catholicism is another kind of globalism. After what's happened recently, especially to USAID, which more than any other organization maps the world from an American perspective that is in constant dialogue with that world, I don't know how to explain what has transpired. USAID works through this elaborate network of contractors who localize what's being done and they actually make it work. How do we describe what's happened to them? It's like some ghastly sitcom where a terrible boss charges into the office and is hurling the furniture around. In a medieval sense, it's a sacking of a complex modern institution of American power and hegemony.

The development community is in a state of shock. The sanguine stories about how last time around we managed to pull through, that the Republicans in Congress protected the USAID budget, and American development aid stayed relatively level – well that's not happening now. There's a bit of me that wants to refuse the terms of this conversation, not to tell stories that move on to how it's going to be okay. I think it's worth lingering on what this means historically for the United States. I'm shocked by how calmly senior Democratic elites in the last couple of weeks have been taking this. And why it matters is precisely Anthony's point. There's an *Economist* graphic that points out that next year, the sub-Saharan African working-age population will exceed that of the entire developed world. And one year after that, it will exceed the working-age population of China. The story of globalization that we're looking back on nostalgically has left these African people dozens of miles behind the starting line from the rest of us. East Asia, India, and even the West are in a different league, not in a different race. Hence the urgency of this moment. I'm sorry if I'm sounding alarmist, but we are feeling the foundation shaking.

SLAUGHTER: I'm going to push you all on something because you all seem to assume that the world is better off when the United States is running it or playing a major role. Let me start with a hypothetical that I think is true. U.S. foreign aid is not going away. U.S. foreign aid will now be dictated by the State Department. It will be different, but let me note that in both Britain and Australia they had a separate Department of Development and in both cases, it got rolled back into the Foreign Office. When the Department for International Development (DFID) came to see me in 2009, they were so determined to be separate from the Foreign Office that I could barely find "Her Majesty's Government" on their business card. The way things have been done is absolutely horrific, but it is not the end of U.S. foreign aid. Trump may make it deeply transactional, but many countries may not mind that. In so many countries the argument is that you, the United States, and the Europeans run this system and it's not fair. You run the IMF; you run the World Bank. I'm not saying they're jumping for joy because of Trump, but I'm not convinced it's so terrible for the world. At least, I want to hear the case for why it is.

"From a historian's point of view, I'm not sure whether it's a fragile moment, but it's certainly a historical moment that has been conjured up in different ways. The cosmopolitanism of global Marxism in the 1930s was very different and remote from the world that we're in now.

APPIAH: I was trying to make the argument that our priorities for public health haven't necessarily been the right priorities. Not in a left, right, up, or down sense. The Germans, the French, and the Norwegians have quite good ideas about public health. They're already spending a lot on this. And I think they'll take up some of the slack, which isn't a bad thing. It remains the case that without USAID, there's no battle against the Marburg virus in Tanzania, no work to find a treatment for river blindness, none of the HIV vaccine trials that we've been funding through that mechanism, no PEPFAR (President's Emergency Plan for AIDS

Moderator **Anne-Marie Slaughter** and panelists **Kwame Anthony Appiah**, **Adam Tooze**, and **Michael Froman**.

Relief) to make lenacapavir available to people at high risk of HIV infection. All of these are obviously good things.

SLAUGHTER: They will resume.

APPIAH: Yes, these things will probably be picked up by the State Department, but we benefit greatly from the work done by USAID and the WHO. If I were advising the Chinese, I would say to them that the United States is pulling out of the WHO. Thirty to forty thousand Americans could die of flu next year because the United States didn't help find the new variants that we've helped to find every year through the WHO mechanism. The Chinese wouldn't do that, because it'll cause the death of thirty thousand Europeans and that's not a decent way to behave. But my point is, the Chinese have a notion of decency. Part of our failure in the period of successful globalization was to explain what we were getting out of it. We were creating a world that was good for lots of people but it wasn't great for everybody. And it could have been better for everybody. That is not the fault of the Republican Party. It's the fault of everybody, including Europe.

What we should hope for is to maintain enough of our capacity so that when there's a new administration we can rebuild. We also need to recognize that the rest of the world is not like us in these respects. Fortunately, there are people who are working on public health in the developing world.

SLAUGHTER: Mike, would you like to respond?

FROMAN: The Council on Foreign Relations was created one hundred and four years ago to fight against isolationism and to reinforce the role of the United States in the world. I believe that U.S. leadership is a net positive thing, most of the time. I find that people around the world worry more about U.S. indifference than U.S. overreach. And they want the United States involved. The more

that China is involved in Africa, or in Southeast Asia, the more they want the United States to be there. So giving up that opportunity unilaterally creates a very negative dynamic.

I would say I'm both more alarmist and more optimistic. I'm more alarmist because of what's happening to USAID as an institution. I expect foreign aid will be cut very significantly. And I'm not sure that Congress is going to save it this time under the pressures of the president. I was on the phone today with somebody who said that they had just fired five thousand health workers in Ethiopia because their contract was not being paid. And so all of this is having a real impact on the ground beyond just who gets to dictate where the money goes.

But I'm also more optimistic. As in the case of many things that President Trump says and does, it's unconventional and it's extreme. But there's a nugget underneath that needs to be taken seriously. Foreign assistance is in dire need of reform. And that's not a controversial statement. I think anybody on the left or the right would feel that we are not necessarily getting the full bang for the buck. The impact that you would hope for after all these decades of assistance hasn't been as significant as we had expected. What does it mean to rethink foreign aid? What does it mean to address these global public good issues, such as public health or infrastructure or pandemics or climate change? I don't expect this administration will address any of that because there are lots of other issues: Greenland, Panama, Gaza. Each has a nugget of truth underneath that we need to find a way to address.

SLAUGHTER: I was just in Singapore and it's true that I heard people say that we do not want you to make us choose, but we absolutely want you to be here. I think Trump's response is going to be, "Fine, we'll be here. But we're going to require you to pay us to be here." In other words, we're not going to be there because we think it is good for the global order. We're going to be there if you pay us. Again it's a deeply transactional view. I think Congress will push back, and many of the budgets will be reallocated.

Adam, you have the last word before we turn to the audience for questions. You have written about how to think about the world differently. Europe will probably play a bigger role and to me, that's a good thing. Do you agree?

TOOZE: Another way of formulating my unease with the relatively sanguine tone of the conversation is the question of time and urgency. It makes sense in the American context to talk about a future administration in which we'll do things better. But both on the climate front and when we're running against the demographic surge in Africa, quarters lost, let alone four years lost, are disastrous. And from the point of view of global development, the real question is not why haven't we had more bang for the buck, but do we understand that the buck we're going to have to put in if we're going to be serious about this is two orders of magnitude larger than what we've done so far? We need to be in the range of a trillion dollars a year in investment. For Africa alone it is $400 billion according to estimates and we're not close to that number. All of this is going to be inefficient and rough in the way that any major investment surge is. Think about the robber barons in America in the nineteenth century; it wasn't pretty. But if you're serious about making transformational changes, China, the Soviet Union, and the United States have shown that's the kind of scale we need, and we are far from that. And that to me is what adds to the jarring disconnect between the elites and the rest of society in the United States, with the elites contemplating, "Oh well, you know the next time around . . . ." From a historian's point of view, these are the moments when we've dropped the ball, the moments our children and grandchildren will look back on and ask, "What on earth were you doing?" For me, that is what's driving this impatience.

> "Foreign assistance is in dire need of reform. And that's not a controversial statement. The impact that you would hope for after all these decades of assistance hasn't been as significant as we had expected.

SLAUGHTER: Thank you, Adam. Let me now turn to questions from our audience.

A member of the audience poses a question to the panelists.

AUDIENCE MEMBER: There's seems to be a movement afoot to take a look at the CIA, the FBI, and our domestic security establishment. To me that seems to have something to do with the role of the United States in the world. I wonder if any of the panelists have a reaction to that.

TOOZE: You might think of it as the destruction of USAID and the subversion and politicization of the FBI and the CIA. For those of us who are fascinated with macro finance, the elephant in the room is the Fed. So the question is, what happens if economic policy is subverted in a highly partisan way?

FROMAN: We've taken for granted that there would be independence or separation of powers. In some cases, I think the Fed and the market lead the way. If there's a true infringement on the independence of the Fed, one would expect there to be a market reaction. The one thing we know the president is attuned to is the market reaction, and that may have a disciplining effect. I don't expect a market reaction when it comes to merging the CIA and the FBI, or having the CIA focus on domestic surveillance. So what do we do instead of shaking our fists at the sky? Democracies have elections, elections have consequences, and we see the consequences. This president has a majority in both the House and Senate, a majority of the public vote, and every leader around the world is eager to cut a deal with him. He has the political capital right now to do what he wants. We can try and help him channel that to more productive purposes, but we're not going to put a trillion dollars to work on development. We are not going to stay at 1.5 degrees Celsius. And we're not going to prevent him from questioning some of the fundamental things that we thought were law.

AUDIENCE MEMBER: Could you comment on the feasibility and practicality of President Trump's expansionist pronouncements regarding Gaza, Greenland, and Panama?

FROMAN: I think this is an area where we need to take him seriously, but not necessarily literally. Should we be concerned about China's role in

Latin America's infrastructure, particularly its investment in ports? Yes, I think we should. I think we haven't paid enough attention to Latin America. Over the years several of my Latin American friends have complained that they are never at the top of the list of American foreign policy. And I say to them, be careful what you wish for. We have a long history of being involved in Latin America. And indeed, we are now seeing the pendulum swing to the other side. Does arctic security matter in Greenland when there's melting of the polar ice caps and new trade routes over the poles? China and Russia are working quite cooperatively in the area. Should we have more of a role to play? Should we be building icebreakers? I think we have one functional icebreaker at the moment.

TOOZE: And we can't build any new ones.

FROMAN: That's right, we can't build them, and the president just canceled a contract that we had with Finland. Some of us went to Finland and saw the types of icebreakers that the United States was going to buy. We should probably be more involved. Does that mean we need to acquire Greenland and rename it Trumpland? Probably not. Gaza to me is the most interesting case because he's laying bare the fact that there is no plan for Gaza. We don't know who's going to control it, who's going to govern it, who's going to secure it, who's going to rebuild it, and what life is going to be like for the two million Palestinians who call it home. Does moving all the Palestinians out and making Gaza into a beach resort a likely outcome? No. But he is beginning a conversation of what to do there because there is no plan for whenever the immediate conflict is over.

SLAUGHTER: I agree that the president is responding to the fact that there's no plan. If the plan involves a combined Arab force, that might be okay for the Palestinians, but the Israelis are not going to accept that without some U.S. guarantees. The United States is not going to be there as real estate developers.

TOOZE: One of the logical implications of this is the ethnic cleansing of Gaza, which seems to be very much on the table. And we can no longer dismiss that as simply the freakish discussions of extreme right-wing members of Netanyahu's government in Washington, DC. Our government is openly discussing ethnic cleansing as a just logical conclusion.

FROMAN: Gaza at the moment is uninhabitable. It is a pile of rubble.

TOOZE: It's been made uninhabitable with the full assistance of taxpayers' money.

SLAUGHTER: It wasn't a great place to live before October 7 and it is uninhabitable now. Something has to be done. It has to be rebuilt and governed appropriately in a way that Israel feels is secure, and that gives the Palestinians a degree of autonomy. The president is putting an extreme alternative on the table to get some attention and to see if others will come up with a better solution.

APPIAH: They are walking that plan back as we speak. The difficulty is that we don't know what any of these things mean because the form they take when they're first announced is almost never how they end up. We're trying to learn how to read the administration.

> "Last time around, we screamed every time Trump said anything, and it didn't work. In fact, it strengthened the base because that's what he wanted. This time the conversations that I'm in are about more strategic responses.

AUDIENCE MEMBER: What would be your reason for saying that what President Trump announced for Gaza isn't actually a plan? There are certainly people in the Israeli government for whom that is the plan. I wouldn't dare to speculate as much about Panama and Greenland, but it seems to me that we're actually going through a great deal of intellectual effort here in order to make normalized statements that say that he means what he says. And in certain cases, they may lead to the extreme results that he is suggesting.

FROMAN: They may or, as Anthony just said, they're being walked back as we speak. What we saw on the weekend was tariffs on, tariffs off.

Announcement, withdrawal. How do we read this? And by the way, almost none of his Cabinet is in place. He has a few advisors but we don't know who's actually in the room when he's making these decisions. It seems we have to take what he says seriously but not necessarily literally.

TOOZE: And we have to recognize the threshold that's crossed when these things are said. Even if they are comments like "I'm going to bully Denmark over Greenland." Denmark's claim to Greenland is problematic but that's not why Trump is raising it in the way that he is.

> We are one species. We have one planet. We have shared interests, which can be effectively pursued if we create structures through which we pursue them together.

FROMAN: There's a cost to this.

TOOZE: Yes, and liberalism can be pilloried for its hypocrisy. There is a cost to blurting out loud your wildest, most violent, most radical fantasies.

SLAUGHTER: I have a slightly different answer. Last time around, we screamed every time Trump said anything, and it didn't work. In fact, it strengthened the base because that's what he wanted. This time the conversations that I'm in are about more strategic responses. I take your point, Adam, that we should not look at the first part of what he says and dismiss the second part. But he loves to get a reaction to what he says.

AUDIENCE MEMBER: I want to move back from policy for a second and focus on the question about cosmopolitanism that Anne-Marie Slaughter began with. I wonder, Professor Appiah, do you have any ruefulness or second thoughts about cosmopolitanism? Is it not as deep-seated as you once thought?

APPIAH: I don't think it was ever deep-seated. Some people like it, and some people don't. Cosmopolitans think that the world is full of people living in different ways and how they do that is up to them within the constraints set by human rights. I continue to think that huge numbers of people, and not all of them platinum frequent flyers, are attracted to engagement with at least the cultural products of other places. Refugee camps have radios and people there listen to global music, not just the music of the place that they've escaped to. If you offered them a chance to go and visit Bhutan or New Zealand, many of them would be delighted to do so. So, I think the particular populist form of anti-cosmopolitanism is largely about exaggerating how many people have come from elsewhere and then saying you don't want them. We shouldn't turn anti-immigrant sentiment into hostility to engagement with elsewhere. Of course, a lot of the anti-immigrant sentiment is a response to the failure of our systems to deal with some of the inevitable things that happen when a significant number of people, especially poor people, from one place show up in other places. I think some places have done a better job of that than others. We are one species. We have one planet. We have shared interests, which can be effectively pursued if we create structures through which we pursue them together.

SLAUGHTER: It is clear that we could continue for many more hours. I want to leave you with one thought. I'm certainly not sanguine, and I don't think anybody right now should be sanguine about what's happening in the world. I think a lot of things are going to be broken and I want to focus on what can be built in its place if we still have a democracy.

Last time around, I kept thinking surely there's going to be this moment when something happens that is so outrageous that the American people will go to the streets. This time, I think we need to draw our line in advance. Mine is the day the president says he will not obey a Supreme Court decision – and I think that's coming. There will be a full-on constitutional crisis in which this Supreme Court tries to hold the line of the rule of law, and he will say let them try to enforce that decision. As citizens, we need to draw that line in advance and be prepared. Otherwise it's everybody looking at everybody else and wondering who's going to lead.

With that, I want to thank this wonderful panel for a really stimulating discussion and our audience for joining us.

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To view or listen to the presentation, visit www.amacad.org/events/world-in-2025.

Health and Our Oceans

2130th Stated Meeting | October 24, 2024 | University of California, San Diego

On October 24, 2024, the Academy's San Diego Committee hosted a program on "Health and Our Oceans," which featured atmospheric chemist and Academy member **Kimberly A. Prather**. Professor Prather discussed newly identified critical connections between rising pollution levels in coastal oceans and rivers and their far-reaching impacts on air quality and human health. She also described a recent study on local air and water quality issues in southern San Diego. The program included introductory remarks from **Susan Taylor**, Distinguished Professor of Pharmacology, Chemistry & Biochemistry at UC San Diego School of Medicine, and **Margaret S. Leinen**, Director of Scripps Institution of Oceanography, Vice Chancellor for Marine Sciences, and Dean of the School of Marine Sciences at UC San Diego. An edited version of Professor Prather's presentation follows.

An aerial photo of the Tijuana River

Kimberly A. Prather

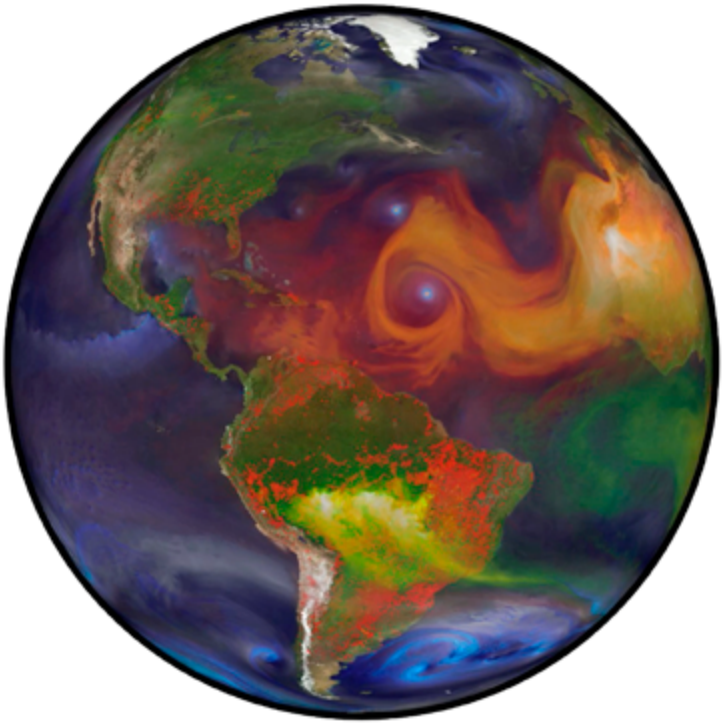
Kimberly A. Prather is Distinguished Professor at the Scripps Institution of Oceanography with a joint appointment as the Distinguished Chair in Atmospheric Chemistry in the Department of Chemistry and Biochemistry at UC San Diego. She is the founding Director of the NSF Center for Aerosol Impacts on Chemistry of the Environment and Co-Director of the Meta-Institute for Airborne Disease in a Changing Climate. She was elected to the American Academy of Arts and Sciences in 2010.

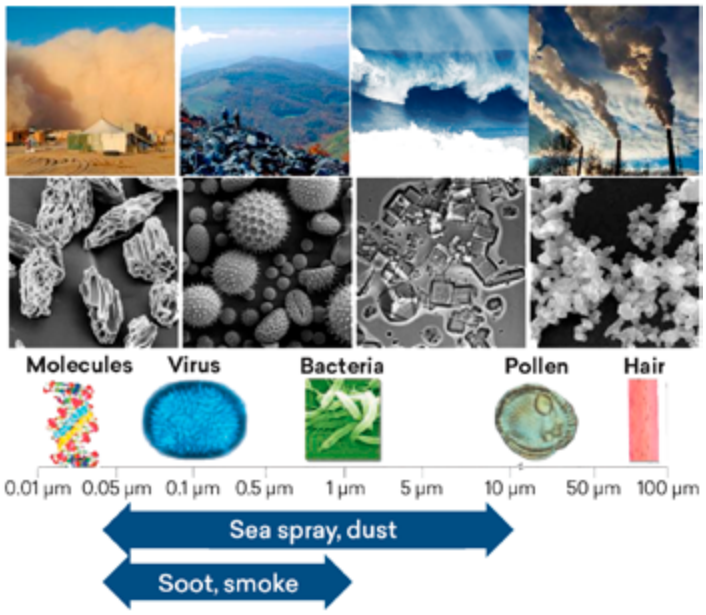
Good evening and thank you for inviting me to be a part of this program. One of my favorite topics is aerosols. But for a long time many people didn't understand what aerosols were. One outcome of the COVID-19 pandemic is that people began to recognize that aerosols are more than the stuff that comes out of a spray can. I had the honor of convincing Dr. Anthony Fauci that COVID is airborne, but not as droplets that fall to the ground, as was the understanding for about one hundred years.

Aerosols can travel all the way around the world in about two weeks (Slide 1). They seed our clouds. They have an impact on the location and amount of precipitation. The two most abundant and natural types of aerosols are dust and sea spray. We don't fully understand how they interact with clouds, and this represents the single largest uncertainty in our understanding of climate change. Which aerosols seed clouds, and how effectively do they do that? We know they can change the brightness of clouds and the amount of light that gets reflected back to space and does not warm our planet. And they can change whether the clouds produce rain or snow, and how much they produce.

When I moved to Scripps Institution of Oceanography, I ramped up my efforts on the climate

Aerosols, Microbes, Climate, Health: Globally Connected





change aspects of aerosols, and that's what I have been doing for quite a while. I directed a Center for Chemical Innovation. The center, funded by the National Science Foundation, started in 2010 and has run for fourteen years. We have an incredible team and they have taught me the importance of interdisciplinary work. The center allowed us to work with oceanographers, microbiologists, and data scientists. Since it was a chemistry-funded center, we always kept our sights on the chemistry part. We were solving a big problem and that problem was related to aerosol chemistry and the impact on climate.

We don't fully understand how aerosols interact with clouds, and this represents the single largest uncertainty in our understanding of climate change.

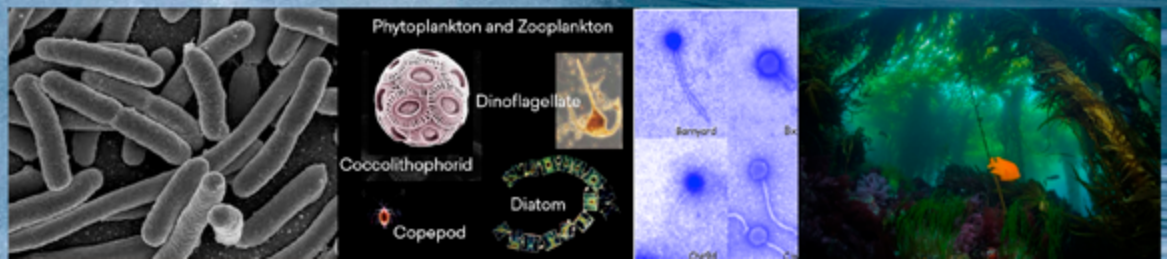
I have done studies for twenty years out in the field, and early in my career I developed an instrument that we flew through clouds. We used the instrument in ships and planes all over the world. I never felt completely satisfied at understanding what the oceans were doing to our planet, as they represent 71 percent of the earth's surface. So that's an important gap in our understanding. But oceans are hard to study because they are so vast.

So what we proposed to the National Science Foundation (NSF) was to move the ocean, atmosphere, waves, and winds into the lab, and we were fortunate to do that here at Scripps. We created the NSF Center for Aerosol Impacts on Chemistry of the Environment (CAICE) with the following mission: "To transform our ability to accurately predict the impact of aerosols on climate and our environment by bringing the full real-world chemical complexity of the ocean-atmosphere into the laboratory."

We started with one question: What is the spray that comes out of the ocean? Most people think it's sodium chloride because that's mostly what the ocean is, right? Not exactly. The ocean is composed of hundreds of millions of different compounds: phytoplankton, proteins, lipids, viruses, etc. The ocean produces over half of the air that we breathe (Slide 2). It's like a forest living underwater. So how do we move the ocean-atmosphere system into the lab, and how do we make sure that sea spray aerosols look just like they do when produced from the ocean?

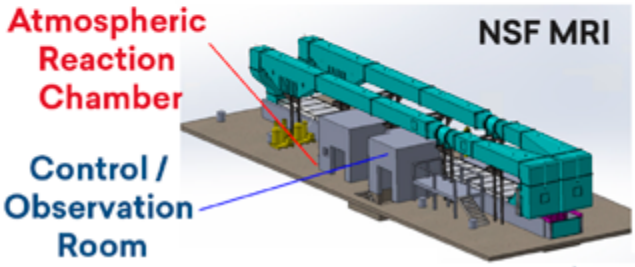
CAICE: Ocean/atmosphere studies in the laboratory

One drop of seawater
contains hundreds of millions of viruses, bacteria,
phytoplankton, proteins, lipids, even enzymes. . . .
all enriched at ocean surface in thin microlayer



S2

Now: Scripps Ocean-Atmosphere Simulator (SOARS)



Location: SIO Hydraulics Laboratory
Dimensions: **120 ft x 8 ft x 8 ft**
Air Temp: **-15 to 30° C**
Water Temp: **1 – 30° C**
Wind and waves: **Up to >100 mph (Cat 2 Hurricane)**
36,000 gallons of seawater
Sea ice for polar studies

Mesocosm: sunlight pipes + grow lights, non-toxic construction for biological studies
Sealed (clean air) headspace to study sea spray, VOCs
Environmentally controlled observation room

Integrated atmospheric reaction chamber
Simulate future (and past) climate scenarios (i.e. CO_2) with full environmental control (T, RH, wind)

S3

This type of work had not been done before. We needed people working across disciplines to make it happen. And we did exactly that at Scripps in what's called the SIO Hydraulics Laboratory. In Slide 3, you can see the long wave channel, and we pump seawater directly into it from the ocean – about 3,600 gallons of seawater. We took something that people had been using to study the ocean and we put a lid on it. Then we cleaned all the air above so that when things came out of the ocean, we could see them. They wouldn't react away, they wouldn't disappear, they wouldn't change to something else. This allowed us to explore what comes out of the ocean, how much comes out of the ocean, and what controls the quantity that comes out of the ocean. We wondered how biology was involved. What happens when you induce a phytoplankton bloom?

This was a proof of concept and the work we did in the first three years during the exploratory phase earned us ten more years of funding. Leading something of this magnitude with a magical team that came together to do this work really changed my career.

We moved from having one channel with 3,600 gallons of seawater to a massive system called SOARS – Scripps Ocean-Atmosphere Simulator – that has wind *and* waves in 36,000 gallons of seawater. We can control the air and water temperature. We can even make sea ice. Its newest feature allows us to create hurricane force winds – 105 miles/hour was the number that I heard last. In addition, the atmospheric reaction chamber is allowing us to begin to understand this synergy between the ocean and the atmosphere. We have light pipes that come in through the roof so we can induce blooms. We can study different conditions and different microbes. For decades people didn't know how much sea spray came out of the ocean with a breaking wave or with a certain wind speed or at a certain ocean temperature. But our team found those answers and they are incredibly reproducible. This work is much easier to do in SOARS than it is in the real world because in the real world your measurements are always complicated by having input of pollution from humans.

In slide 4, we see a viewing room where we can watch the waves. We can image the bubbles, the waves, and the foam. We are trying to understand the physics and the biology of what is affecting the chemistry of the things that get into the air. We have acoustics equipment so we can listen to the bubbles pop. We can measure the size of the bubbles. Bubbles are everything to spray and to aerosolization.

SOARS: One-of-a-Kind World-Class User Facility (Hydraulics Lab @ SIO)
Selective Ocean-to-Atmosphere Transfer of Waterborne Pollutants and Pathogens

Breaking waves in surf zone leads to 1,000-10,000x enrichment in air of select viruses and bacteria

S4

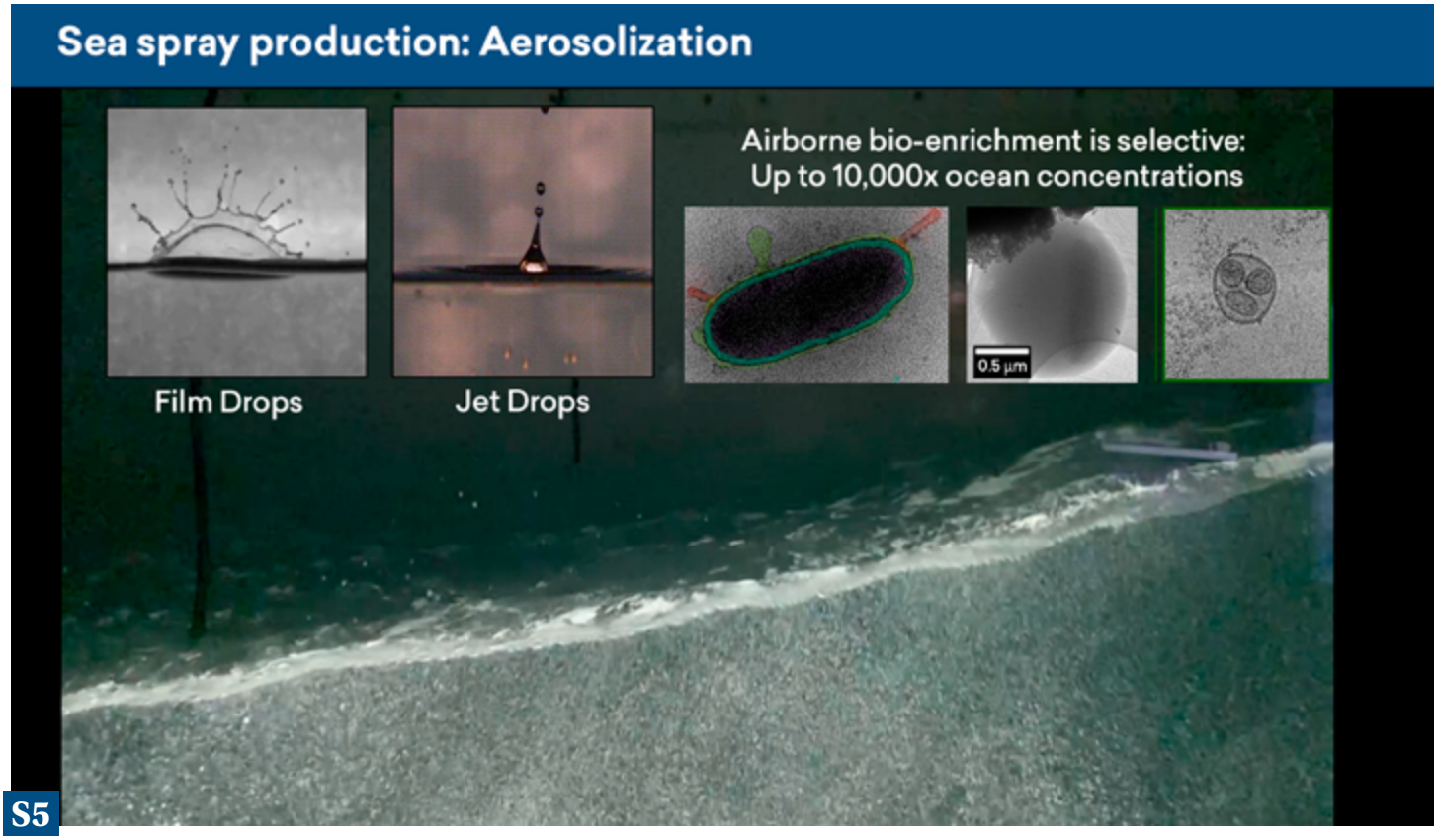
Let's talk a little bit about aerosolization. In Slide 5, we are looking at breaking waves. The white part that we see is where all the bubbles are, where all the action is. We see film drops and jet drops. Because the surface is like oil and vinegar dressing, it forms a film, and when that ruptures that's what leads to the spray. We spent three years working on this and we started to see all kinds of interesting things coming out of the ocean. We saw bacteria being invaded by phage. We saw little micelle structures that had never been seen before in the air.

Why am I so excited about aerosolization from the ocean? At first, I was interested in its ability to affect clouds and climate, but then I started thinking about the health effects, which has largely been inspired by living here. We have a very polluted ocean. In Slide 6, we see one of the members of my group with air sampling instruments. The sewage crisis in San Diego doesn't only affect you if you go in the water. Your main exposure is from the air that you are breathing. And nobody had really thought about that. Brace yourself. You may not like your Saturday morning walk on the beach as much after this talk. I apologize, but at least you'll know when not to take that walk or where not to go.

We inhale 11,000 liters of air each day, and so that is our number one exposure pathway, which has been almost completely ignored, especially the connection with what comes out of polluted water in the ocean. Counties in California have declared a local state of emergency and people are pushing to make it a federal state of emergency. As a scientist, I believe it truly is a federal state of emergency. I don't know of another place in the United States where if you had a broken sewer pipe, with 80 million gallons of sewage running through your streets, that they would allow that to continue for decades.

We have been very involved in trying to make things better in southern San Diego. And I think we're making some progress. The red dots in this map in Slide 7 represent beaches that are closed because of high bacteria levels in the water, and it is mostly the beaches in the southernmost communities that are closed.

People have been complaining for a long time about not feeling well, but those reports are escalating. We are hearing many more stories about



May 18, 2024

THREAD SEWAGE CRISIS

The San Diego Union-Tribune

Full coverage: The transborder sewage crisis in San Diego

"You inhale 11,000 liters of air a day, versus two liters of water that you drink," said UC San Diego biochemist Kim Prather, another task force member and principal investigator on the aerosols study. "So, your main exposure route is the air. Our thinking is that a lot of the exposure and a lot of the illness is coming from what people are breathing."

Pollution in Southern San Diego

Southern San Diego beaches are often closed due to high bacteria levels in the water. Many South Bay residents report strong odors and associated health impacts. Beaches were closed for >1,000 days!

Dr. Beatriz Klimeck (Prather Lab)

S7

lung and heart issues and people not being able to sleep.

How did we get started on our work studying whether polluted coastal water impacts air quality? In 2017, Scripps oceanographers Sarah Giddings and Falk Feddersen conducted an experiment in which they put pink dye in the water to determine if dilution is the solution to pollution. Does the pollution, in this case the pink dye, go out to sea or does it get trapped in the surf zone? And if it does get trapped in the surf zone, how far up and down, how many beaches, and how many people are affected?

We were involved in that research. We looked for the pink dye in the air, and we detected it all across San Diego. This was our first indirect indicator that polluted coastal water was getting trapped in the surf zone where it was aerosolized. Most of our studies have been done in what we call our rainy season, when there is massive rain and intense storms. In 2023, there were 44 billion gallons of polluted water that ran through the Tijuana River and into the ocean. That was a record. This year we think it will be closer to 40 billion gallons of polluted water. Luckily some of that polluted water is diluted by precipitation.

> “Once those pollutants get into the air they can get transferred through weather and air patterns over many miles and long distances, affecting people who are exposed through inhalation to those coastal waterborne pollutants.

We started to think about all the things in the water and what gets transferred into the air. When you go to a place that’s heavily polluted, you start to see in the water lots of things that are from humans, especially when there’s flooding from storms. Once those pollutants get into the air they can get transferred through weather and air patterns over many miles and long distances, affecting people who are exposed through inhalation to those coastal waterborne pollutants.

Many people felt that they were okay because they didn’t live here and didn’t go to a beach that had high bacteria levels in the water. But once we

started showing that polluted coastal water impacts air quality all the way to La Jolla, then people started paying more attention.

One of our studies involved putting plates outside at Imperial Beach and at Scripps to see if there's any growth from the airborne microbes in those locations (Slide 8). We didn't see much on the plates at Scripps, while the ones at Imperial Beach had a lot of growth. Matthew Pendergraft was one of my Scripps students. He showed in a paper from 2023 that up to 76 percent of the bacteria in the air at Imperial Beach could be traced back to sewage in the Tijuana River.

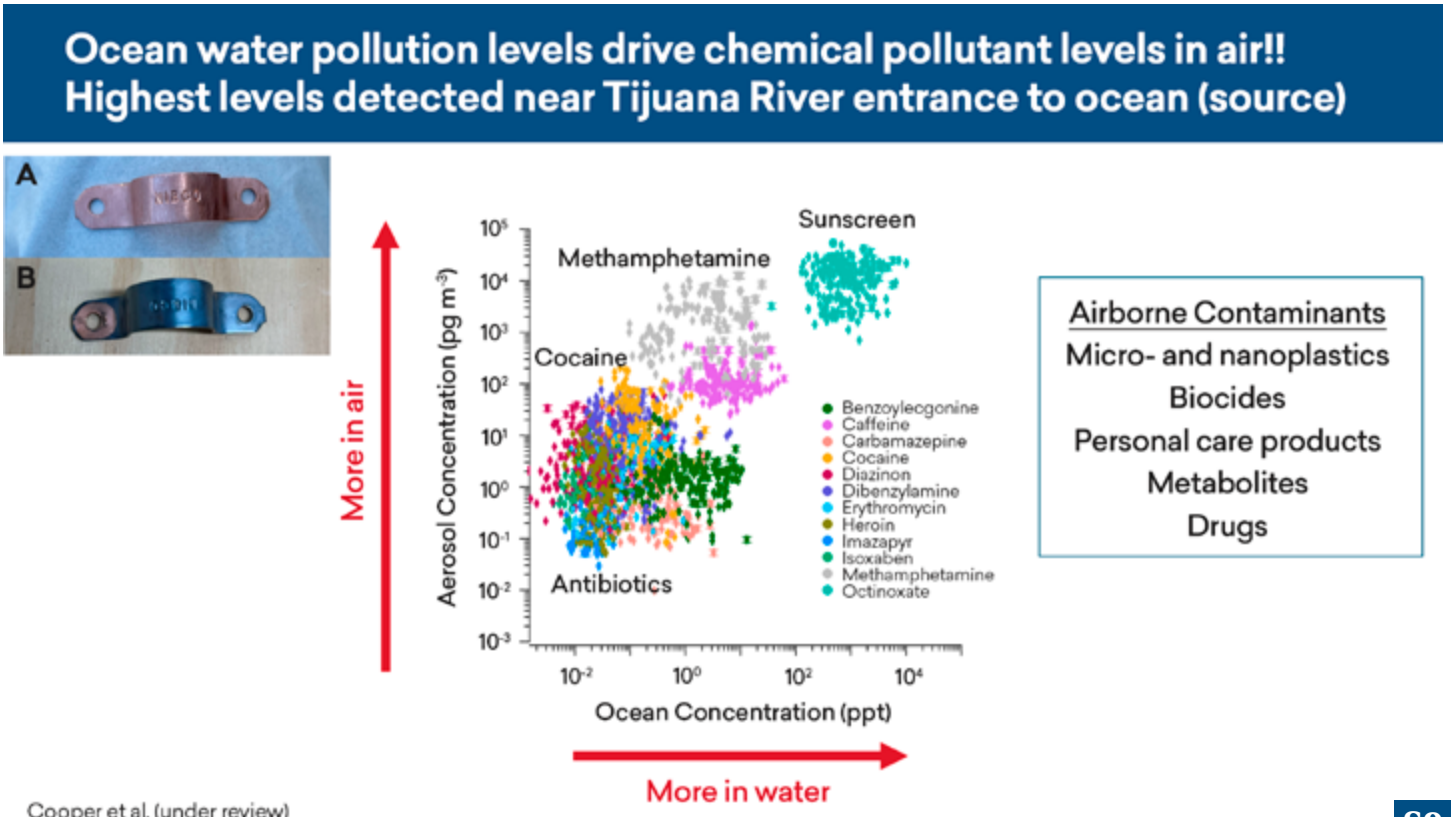
This finding was larger than any of us expected, and it led many people to start thinking about chemical pollutants. Sewage contains all kinds of industrial waste. The Tijuana River starts on the other side of the border, and the factories (Maquiladoras) there can dump things into the river that would be illegal for us to dump here (Slide 9). What we showed was that if the ocean concentration of things like antibiotics, cocaine, methamphetamine, and sunscreen, among thousands of other pollutants, is high, then the air concentration of those chemical pollutants is also high. There's a direct correlation between polluted water and polluted air. This was a significant finding.

So what have we been doing recently? Some of the students in my lab are studying air effects and others are involved in work on the biological side. I appreciate biology far more than I ever expected as I've developed a greater understanding of airborne microbes or bioaerosols. We are looking at DNA and RNA in the air. As we know from COVID, when people are sick, the virus can be detected in wastewater. But is it also in the air?

In 2023, we did a study about airborne microbes and transboundary water flow, meaning the flow in the Tijuana River that is coming across the border (Slide 10). One of the things we saw was that every time there was a rain event, we would see a spike in DNA in the air, indicated by the red circles in the chart. The data are hinting that most of the DNA that we are detecting in the air is coming from the river that's surging across the border.

If we look at RNA in the air, we see something similar: Both the DNA and the RNA in the air are amplified. The bacteria and viruses accumulate in the top sea surface microlayer. They can be enriched by a factor of up to 100,000 in the air relative to what they are in the water.

We set up different air filters at Imperial Beach. And we found phage-like particles in the samples – the first time intact airborne phage were detected in urban air samples. It is fairly common to



S9

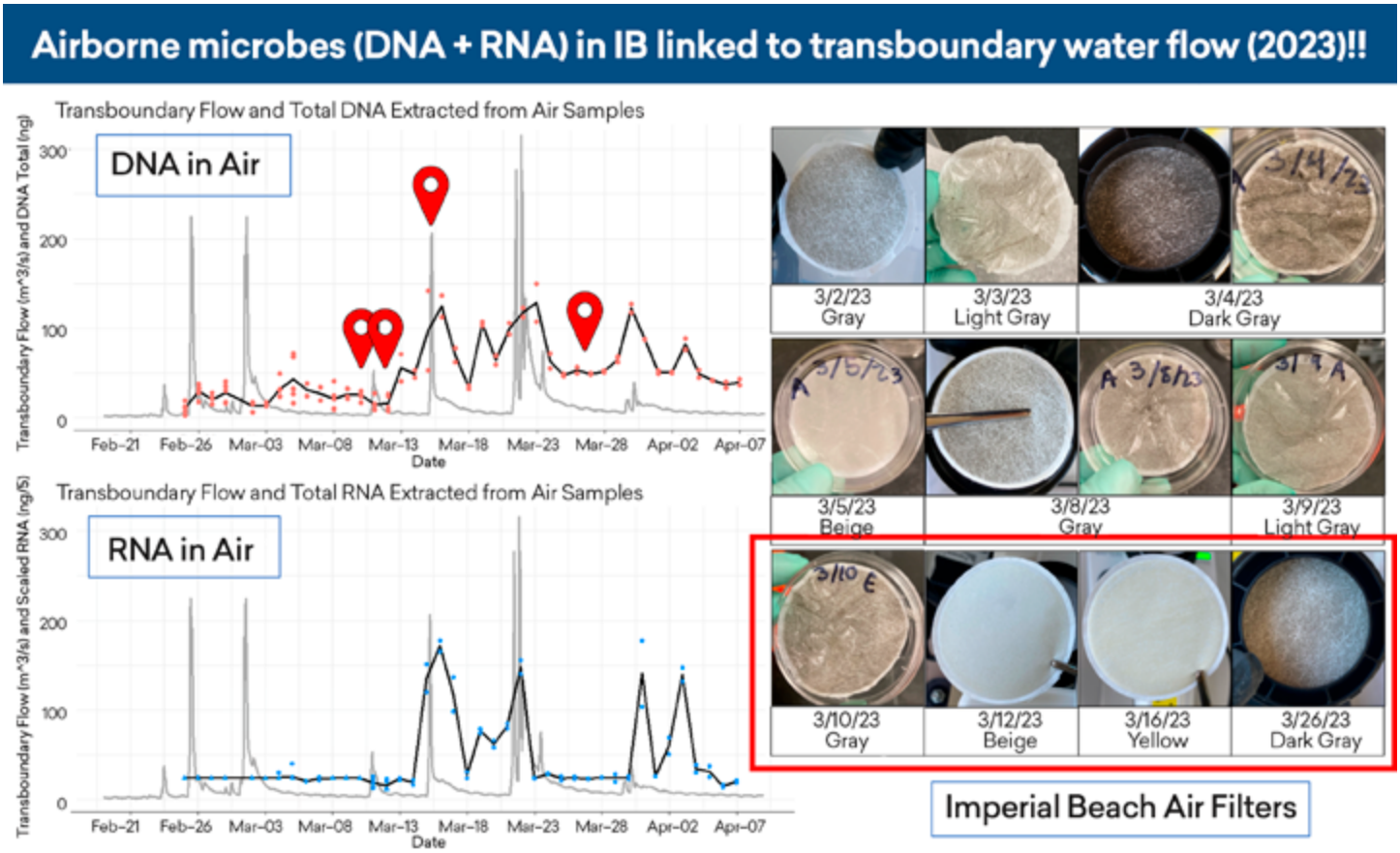
see phage at wastewater treatment plants, but no one had ever detected it in urban air, perhaps because it is challenging to sample air. From a microbial perspective, air is hard to sample because of the harsh process that we use to collect it. We worked hard to keep things intact, and I'm pleased to say that we're finally there. When you detect phage, that is one of the best indicators of a strong influence from wastewater.

We are starting to see evidence of more pollution coming across from transboundary flow, and that pollution has caused a lot of damage. Many of our studies in 2023 and 2024 were done in the wet season. But we also did a dry season study and started sampling in August 2024.

We wanted to see what was coming out of the ocean during the dry season when we expected the polluted water would be coming from Punta Bandera, which is about 10 kilometers south of the border. We expected most of the pollution in the ocean to be coming up from Mexico, but that's not what we found.

We set up air quality instruments all across the region. We started at Imperial Beach. We talked to the residents and there were record numbers of odor reports, over two hundred per day. We tested in Nestor, a small community near the river. We wanted to know what was causing the terrible smell, the headaches, the respiratory issues, and the lack of sleep for the residents. When we went out in the field, we wore full-body suits and respirators because the air was so toxic it burned if you weren't properly protected.

We set out to measure air quality, not (initially) to figure out what was causing this public health crisis. But when the community is hurting we jumped in to do what we could. The community was telling us, "It smells like a porta-potty (like rotten eggs) all the time." Smell messes with your mental status. The community felt that they were being gaslit because they knew they didn't feel well, but nobody would do anything. What's interesting is that right before our study I asked my group to buy a hydrogen sulfide monitor. Don't



S10

ask me why. We decided to measure hydrogen sulfide concentrations in Nestor where the community directed us.

Each night we found a spike in hydrogen sulfide concentrations. People were sealing the doors and windows of their houses with tape, trying to keep the toxic smell out. As awful as this situation was, the community finally felt heard. We were listening and collecting data to address the crisis.

There was a direct correlation between the community odor reports and the H_2S concentrations in Nestor.

A lot happened over a short span of time. On September 1, 2024, we started taking air measurements in Nestor. On September 2, 3, and 4, we recorded high H_2S concentrations at night. On September 5, I presented our initial results to the Imperial Beach Task Force, which includes scientists, doctors, and others from the area. We also invited people from the San Diego County Health and Human Services, and they were silent during the entire meeting. No comments, no questions. It was very odd.

Next, the mayor of Imperial Beach said we needed to have a press conference to warn the public. At this point, my San Diego State colleagues and I were dead tired, but I said okay. They started printing out our data. On September 9, we participated in a press conference at Imperial Beach and showed our early data that there were extremely high concentrations of H_2S in the air. The data validated the community's concerns. What happened next was surprising. On September 10, they diverted the Tijuana River. A San Diego State colleague and I were on a call with Congress and Senate representatives trying to explain that we do know what we're doing. We were constantly saying, "No, no, the data are correct." And they said, "Well, the river flow just stopped."

We rushed down to the river, and though there was still a trickle of water, it wasn't millions of gallons of water! On September 11 and the days following, the H_2S levels and odors had decreased. On September 22, Imperial Beach opened for the first time in over one thousand days. We are writing up our results and are almost ready to submit them for publication. The Tijuana River flow went from more than 50 million gallons per day of raw unprocessed wastewater to less than 3 million gallons flowing through the Tijuana River Valley.

There was a direct correlation between the community odor reports and the H_2S concentrations in Nestor. The residents were the canaries in the coal mine and no one was listening to them. They didn't need our expensive instruments. If they had just listened to the community, the public health crisis could have been averted.

Let me summarize what we found.

- Poor air quality impacts many more residents than just those visiting the beach. Air quality models show air pollutants traveling for miles.
- The Tijuana River remains diverted for now, though the rainy season is coming and we don't know what will happen then.
- Nightly releases of water starting at 6:00 pm and ending at 6:00 am are leading to increased flow.
- H_2S levels are lower, but remain well above acceptable standards.
- Beaches were open for the first time in over one thousand days, but they are now closed again.
- San Diego State University and the CDC have launched health surveys for residents living and working in the region.
- Efforts are underway to get air purifiers into homes near hotspots.
- The San Diego Air Pollution Control District is increasing air monitoring efforts in the region.
- Multiple requests for a state of emergency have been sent to President Biden. Those requests include our data, so that's why we need our data peer reviewed and published as soon as we can.
- At last count, three major lawsuits have been launched.
- More results are coming. We are continuing to collect and analyze groundwater, soil, and aerosol samples.
- We are doing more community health surveys, collecting indoor dust samples, and conducting indoor and outdoor air sampling.

None of this work would have been possible without Cindy Dankberg. She and her family supported our research program. I want to thank the entire Dankberg family for their support. My

presentation tonight is dedicated to Cindy's memory. I also want to thank the amazing team of researchers in my group.

Q&A SESSION

AUDIENCE MEMBER: I am curious if you have any idea how these aerosols affect biological systems. Have you tried to recapitulate them and put them on cell cultures to see if there's a change in epigenetics? Do you have longitudinal studies of these populations? Can you see any direct impacts?

PRATHER: We're trying to figure that out right now, and I'd love to hear ideas of how to get a handle on what happens when you inhale this cocktail. We're working with one of my colleagues who is exposing lung organoids to our air samples. Let's just say they don't last very long. We have so many questions, and we have a pretty steep hill to climb. One piece of good news is that UCSD Health is taking a mobile clinic to south San Diego and we should start to see data that help us connect and understand the human and health aspects. We are still doing health surveys to collect really important data. But we have a lot more work to do.

AUDIENCE MEMBER: Do the marine layer and fog have any effect? Have complaints increased or decreased during times when there is fog?

PRATHER: Temperature is a big driver. H_2S is heavier than air so temperature traps it and holds it down near the ground. Another factor are the winds that die at night. And then there's river flow and turbulence. Regarding your question about fog, many of the residents were very sick during a period when we had heavy fog, and the levels weren't that high. What we think was happening is that fog is like a sponge for acidic gases. If you have a weakened respiratory and pulmonary system and there's heavy fog, it makes things much worse.

AUDIENCE MEMBER: I have a simple question and then one that may not be so simple. First, how do you turn off a whole river?

PRATHER: You divert it.

AUDIENCE MEMBER: Who diverted it?

PRATHER: Someone in Mexico.

AUDIENCE MEMBER: My second question is, if you didn't have the personal witness of the residents, would you have eventually reached the same conclusion from the public health statistics?

PRATHER: It certainly would have been harder because the residents led us to that spot. They were our best sensors, and sadly for a long time they were dismissed. But not anymore.

AUDIENCE MEMBER: I'm fascinated about the possibilities for sampling aerosols. What is the state of the art in autonomous underwater vehicles, surface vehicles, and drones? Is sampling happening at more sites?

PRATHER: I was working with someone recently from Virginia Tech who is one of the leaders in using drones. We are using smaller samplers, and there's a debate of whether you put the samples on a filter or into liquid. I like the liquid, because it seems less harsh. But we are still working through that. The instruments are now small enough that you can fly them on drones. The drones let us swoop into places where it is not safe for people to go. The drones were able to get samples of the foam that we would not have been able to get.

Thank you everyone.

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To view or listen to the presentation, visit www.amacad.org/events/health_and_our_oceans_san_diego.

Select Prizes and Awards to Members

Dolores Albarracín (University of Pennsylvania) received the BBVA Foundation Frontiers of Knowledge Award in Social Sciences. Professor Albarracín shares this award with Icek Ajzen (University of Massachusetts Amherst), **Mahzarin Banaji** (Harvard University), **Anthony Greenwald** (University of Washington), and **Richard Petty** (Ohio State University).

Mahzarin Banaji (Harvard University) received the BBVA Foundation Frontiers of Knowledge Award in Social Sciences. Professor Banaji shares this award with Icek Ajzen (University of Massachusetts Amherst), **Dolores Albarracín** (University of Pennsylvania), **Anthony Greenwald** (University of Washington), and **Richard Petty** (Ohio State University).

Jeremy Berg (University of Pittsburgh School of Medicine) was named a Fellow of the American Society for Biochemistry and Molecular Biology.

Marsha Berger (Flatiron Institute) was awarded the 2025 John von Neumann Prize by the Society for Industrial and Applied Mathematics.

Pamela J. Björkman (California Institute of Technology) received the 2025 Wolf Prize in Medicine.

Olivier Blanchard (Paris School of Economics; MIT) received the BBVA Foundation Frontiers of Knowledge Award in Economics, Finance, and Management. Professor Blanchard shares this award with Jordi Galí (Pompeu Fabra University) and **Michael Woodford** (Columbia University).

Eduardo Brondízio (Indiana University-Bloomington) was awarded the 2025 Tyler Prize for Environmental Achievement. Professor Brondízio shares this award with **Sandra Díaz** (Universidad Nacional de Cordoba).

Marianne Bronner (California Institute of Technology) was awarded the 2025 Vilcek Prize in Biomedical Science.

Sandra Díaz (Universidad Nacional de Cordoba) was awarded the 2025 Tyler Prize for Environmental Achievement. Professor Díaz shares this award with **Eduardo Brondízio** (Indiana University-Bloomington).

Martin Gellert (National Institute of Diabetes and Digestive and Kidney Diseases) was named a Fellow of the American Society for Biochemistry and Molecular Biology.

Anthony Greenwald (University of Washington) received the BBVA Foundation Frontiers of Knowledge Award in Social Sciences. Professor Greenwald shares this award with Icek Ajzen (University of Massachusetts Amherst), **Dolores Albarracín** (University of Pennsylvania), **Mahzarin Banaji** (Harvard University), and **Richard Petty** (Ohio State University).

Naomi Halas (Rice University) was awarded the 2025 Benjamin Franklin Medal in Chemistry.

Gordon Hammes (Duke University) was named a Fellow of the American Society for Biochemistry and Molecular Biology.

John Hartwig (University of California, Berkeley) received the BBVA Foundation Frontiers of Knowledge Award in Basic Sciences. Professor Hartwig shares this award with Avelino Corma (Institute of Chemical Technology) and **Helmut Schwarz** (Technische Universität Berlin).

Stephen L. Hauser (University of California, San Francisco) is among the recipients of the 2025 Breakthrough Prize in Life Sciences.

Jainendra K. Jain (Pennsylvania State University) received the 2025 Wolf Prize in Physics.

Jonathan Jansen (Stellenbosch University) received the 2025 Division B Lifetime Achievement Award from the American Educational Research Association.

Judith Klinman (University of California, Berkeley) was named a Fellow of the American Society for Biochemistry and Molecular Biology.

Jennifer A. Lewis (Harvard University) was awarded the 2025 James Prize in Science and Technology Integration by the National Academy of Sciences.

Steven McKnight (University of Texas Southwestern Medical Center) was named a Fellow of the American Society for Biochemistry and Molecular Biology.

Sigrid Nunez (New York, NY) was awarded a 2025 Windham-Campbell Prize for fiction.

Gregory Petsko (Brigham & Women's Hospital; Harvard Medical School) was named a Fellow of the American Society for Biochemistry and Molecular Biology.

Richard Petty (Ohio State University) received the BBVA Foundation Frontiers of Knowledge Award in Social Sciences. Professor Petty shares this award with Icek Ajzen (University of Massachusetts Amherst), **Dolores Albarracín** (University of Pennsylvania), **Mahzarin Banaji** (Harvard University), and **Anthony Greenwald** (University of Washington).

Suzanne Pfeffer (Stanford University School of Medicine) was named a Fellow of the American Society for Biochemistry and Molecular Biology.

Enrico Ramirez-Ruiz (University of California, Santa Cruz) received the Research Corporation for Science Advancement's 2025 Robert Holland Jr. Award.

David M. Rubenstein (The Carlyle Group) was awarded the Dwight D. Eisenhower Medal for Leadership and Service by Eisenhower Fellowships.

Henry Samueli (Broadcom Inc.) was awarded the Institute of Electrical and Electronics Engineers' 2025 IEEE Medal of Honor.

Helmut Schwarz (Technische Universität Berlin) was awarded the 2025 Wolf Prize in Chemistry. Professor Schwarz was also elected as an Honorary Member of both the Berlin-Brandenburg Academy of Sciences and the European Academy of Sciences.

Helmut Schwarz (Technische Universität Berlin) received the BBVA Foundation Frontiers of Knowledge Award in Basic Sciences. Professor Schwarz shares this award with Avelino Corma (Institute of Chemical Technology) and **John Hartwig** (University of California, Berkeley).

Gurindar Sohi (University of Wisconsin–Madison) received the 2025 IEEE CS Computer Pioneer Award in Honor of the Women of ENIAC. Professor Sohi shares the award with **Moshe Y. Vardi** (Rice University).

Gayatri Chakravorty Spivak (Columbia University) was awarded the 2025 Holberg Prize.

Alicia Elsbeth Stallings (Athens, Greece) was awarded the Lord Byron Medal by the Society for Hellenism and Philhellenism. Professor Stallings shares this award with Victoria Hislop (Royal Society of Literature).

Chandrika Tandon (Tandon Capital Associates) won a Grammy Award for Best New Age, Ambient or Chant Album for her album *Trivendi*. Ms. Tandon shares this award with her collaborators flautist Wouter Kellerman and cellist Eru Matsumoto.

Anne M. Thompson (NASA, Goddard Space Flight Center) was elected as an Honorary Member of the American Meteorological Society.

Gerard 't Hooft (Utrecht University) was awarded the 2025 Special Breakthrough Prize in Fundamental Physics.

Moshe Y. Vardi (Rice University) received the 2025 IEEE CS Computer Pioneer Award in Honor of the Women of ENIAC. Professor Vardi shares the award with **Gurindar Sohi** (University of Wisconsin–Madison).

Jonathan Wendel (Iowa State University) is the recipient of the 2024 Cotton Genetics Research Award.

Michael Woodford (Columbia University) received the BBVA Foundation Frontiers of Knowledge Award in Economics, Finance, and Management. Professor Woodford shares this award with Jordi Galí (Pompeu Fabra University) and **Olivier Blanchard** (Paris School of Economics; MIT).

Teresa Woodruff (Michigan State University) is the recipient of the Women's Health Visionary Award from the Society for Women's Health Research.

Hao Wu (Harvard Medical School) was named a Fellow of the American Society for Biochemistry and Molecular Biology.

New Appointments

Adam F. Falk (Alfred P. Sloan Foundation) has been named President and CEO of the Wildlife Conservation Society.

JoAnn Falletta (Buffalo Philharmonic Orchestra) has been appointed Principal Guest Conductor and Artistic Advisor of the Omaha Symphony.

Andrea Goldsmith (Princeton University) has been named President of Stony Brook University.

Greg Hirth (Brown University) has been appointed Vice President for Research at Brown University.

J. Larry Jameson (University of Pennsylvania) has been appointed President of the University of Pennsylvania.

Robert J. Jones (University of Illinois Urbana-Champaign) has been named President of the University of Washington.

Richard P. Lifton (The Rockefeller University) was elected to the Harvard Corporation.

John A. List (University of Chicago) has been appointed Director of the University of Chicago's Becker Friedman Institute for Economics.

Michael A. McRobbie (Indiana University) was elected to the Board of Directors of the Council on International Educational Exchange.

Dambisa Moyo (Versaca Investments) was appointed to the National Geographic Society's Board of Trustees.

Marina Picciotto (Yale University) has been elected President of the American Association for the Advancement of Science.

Robert Rosner (University of Chicago) has been appointed Editor in Chief of the American Physical Society.

Select Publications

FICTION

Chimamanda Ngozi Adichie (Lagos, Nigeria). *Dream Count*. Knopf, March 2025

Ariel Dorfman (Duke University). *Allegro*. Other Press, March 2025

NONFICTION

Rachel Elise Barkow (New York University School of Law). *Justice Abandoned: How the Supreme Court Ignored the Constitution and Enabled Mass Incarceration*. Harvard University Press, March 2025

David Clary (University of Oxford). *Walter Kohn: From Kindertransport and Internment to DFT and the Nobel Prize*. World Scientific Publishing, January 2025

J. M. Coetzee (University of Adelaide) and Mariana Dimópulos (University of Saarland; University of Halle). *Speaking in Tongues*. Liveright, May 2025

Agustín Fuentes (Princeton University). *Sex Is a Spectrum: The Biological Limits of the Binary*. Princeton University Press, May 2025

Greg Grandin (Yale University). *America, América: A New History of the New World*. Penguin Press, April 2025

Joy Harjo (Tulsa, Oklahoma). *For a Girl Becoming*, illus. by Adriana M. Garcia (San Antonio, Texas). Norton, April 2025

Viet Thanh Nguyen (University of Southern California). *To Save and to Destroy: Writing as an Other*. Belknap Press, April 2025

Mary Beth Norton (Cornell University). *"I Humbly Beg Your Speedy Answer": Letters on Love and Marriage from the World's First Personal Advice Column*. Princeton University Press, April 2025

Elaine Pagels (Princeton University). *Miracles and Wonder: The Historical Mystery of Jesus*. Doubleday, April 2025

Neil L. Rudenstine (ARTstor). *Our Contentious Universities: A Personal History*. American Philosophical Press, March 2025

We invite all Fellows and International Honorary Members to send notices about their recent and forthcoming publications, new appointments, exhibitions and performances, films and documentaries, and honors and prizes to bulletin@amacad.org.

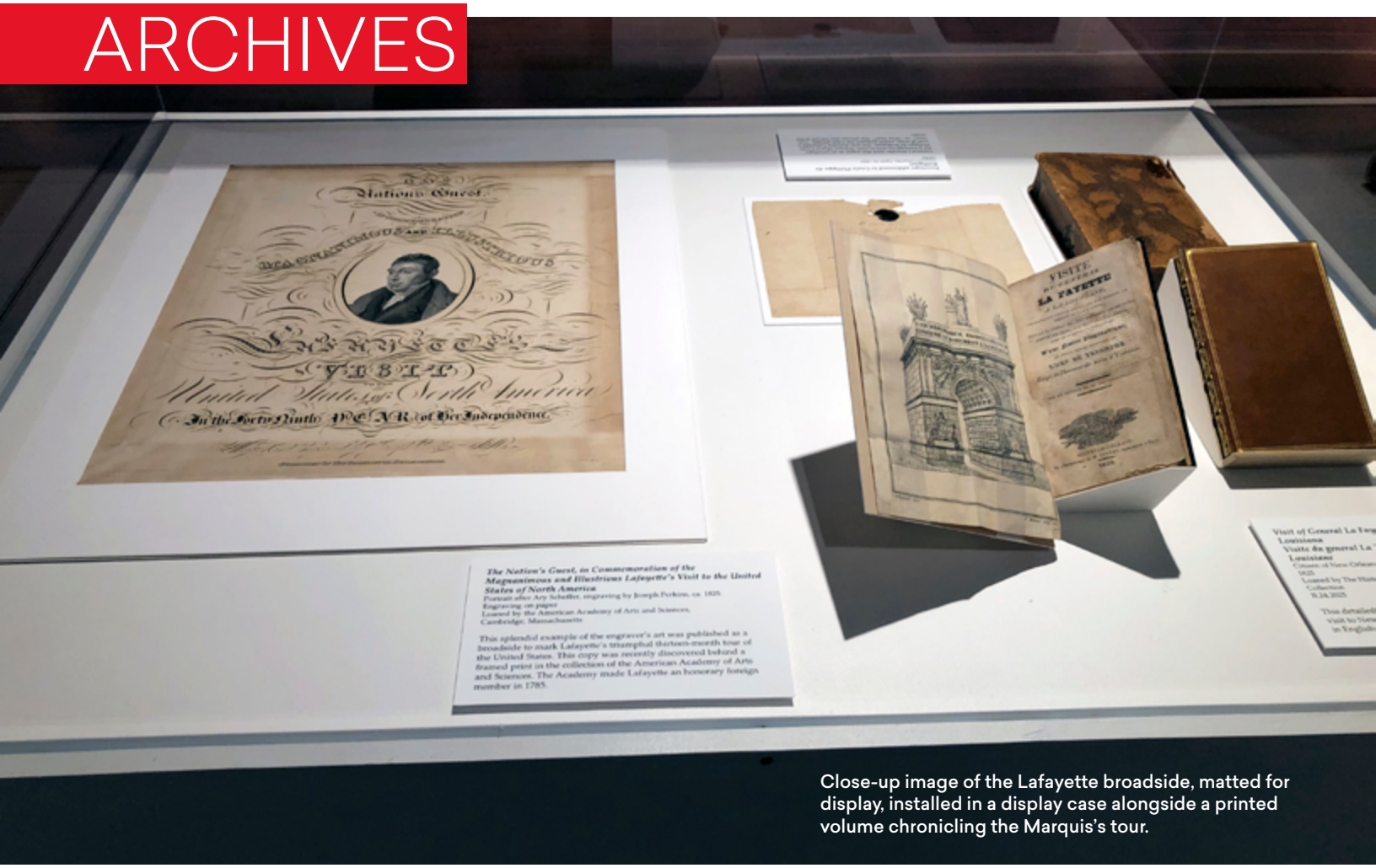
RECENT MEMBER EVENTS

Left: **A'Lelia Bundles** (Author and Journalist), **Anne Thompson** (NASA Goddard Space Flight Center), **Anita Gonzalez** (Georgetown University), and **Patricia Hill** (Entrepreneur) pose at the Washington, D.C. Members' Reception at the National Portrait Gallery on January 29, 2025. The reception included remarks from Academy President **Laurie Patton** and National Portrait Gallery Director **Kim Sajet** (Smithsonian).

Below: **David Weinstein** (Write the World), **Catherine Snow** (Harvard University), and others in the atrium of the House of the Academy on February 10, 2025, for a Cambridge Members' Reception. The event also included remarks from **Laurie Patton**, who was introduced by **Sally Kornbluth** (Massachusetts Institute of Technology).

Above: Members **Carl Holladay** (Emory University) and **Terrie Moffitt** (Duke University) enjoy a reception at the Burroughs Wellcome Fund in Research Triangle Park on January 28, 2025. The program welcomed new Academy President **Laurie Patton** and featured remarks from **Louis Joseph Muglia** (Burroughs Wellcome Fund) and a moment of artistic reflection from **Judith Ernst** (Ceramic Artist) and **Jaki Shelton Green** (Poet Laureate of North Carolina).

Right: **Goodwin Liu** (Supreme Court of California), **Laurie Patton** (American Academy of Arts and Sciences), and **Mary Susan Lozier** (Georgia Institute of Technology) at Emory University on February 26, 2025, for the Atlanta Area Members' Reception and Dinner. Following dinner, Justice Liu and President Patton discussed the future of the Academy, giving local members an opportunity to share ideas and perspectives.



Close-up image of the Lafayette broadside, matted for display, installed in a display case alongside a printed volume chronicling the Marquis's tour.

By **Michele Lavoie**, *Director of Archives*

An Archives feature published in the Winter 2022 *Bulletin* recounted the accidental discovery of a broadside advertising the Marquis de Lafayette's 1824 – 1825 U.S. tour. Previously unknown to Academy staff, the broadside had been found hidden behind another framed engraving and was accessioned into the Academy's collections in recognition of Lafayette's status as a Foreign Honorary Member, elected in 1785.

If the story had ended there, it would have been compelling on its own. But as the *Bulletin* article notes, "Discoveries are often amazing moments in archival work." Remarkably, the Lafayette broadside was discovered a second time, uncovering a whole new chapter in its history.

In October 2024, the Archives staff received a call from a curator at the Louisiana State Museum, located in the historic Cabildo in New Orleans. The museum was preparing an exhibition to commemorate the 200th anniversary of the Marquis de Lafayette's visit to Louisiana. The curator explained that they had originally arranged to borrow a copy of the broadside from another institution, but those plans had fallen through. While searching online for alternatives, he discovered the Archives article and reached out to inquire about borrowing the Academy's copy of the broadside for the exhibition.

The Academy Archives has received generous support from the Jack, Joseph and Morton Mandel Foundation to expand outreach to the public and to peer institutions like the Louisiana State Museum. With this support, the Archives arranged to loan the broadside to the museum for the duration of the exhibition. On April 10 – exactly two hundred years after the Marquis's celebrated arrival in New Orleans – the exhibition opened with the Academy's Lafayette broadside prominently displayed. Becky Mackie, Acting Director of the Louisiana State Museum, expressed the institution's gratitude and appreciation for the professional cooperation.

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For more information about *Bienvenue Lafayette*, which runs from April 2025 to January 2026, please visit https://louisianastatemuseum.org/exhibit/bienvenue-lafayette.

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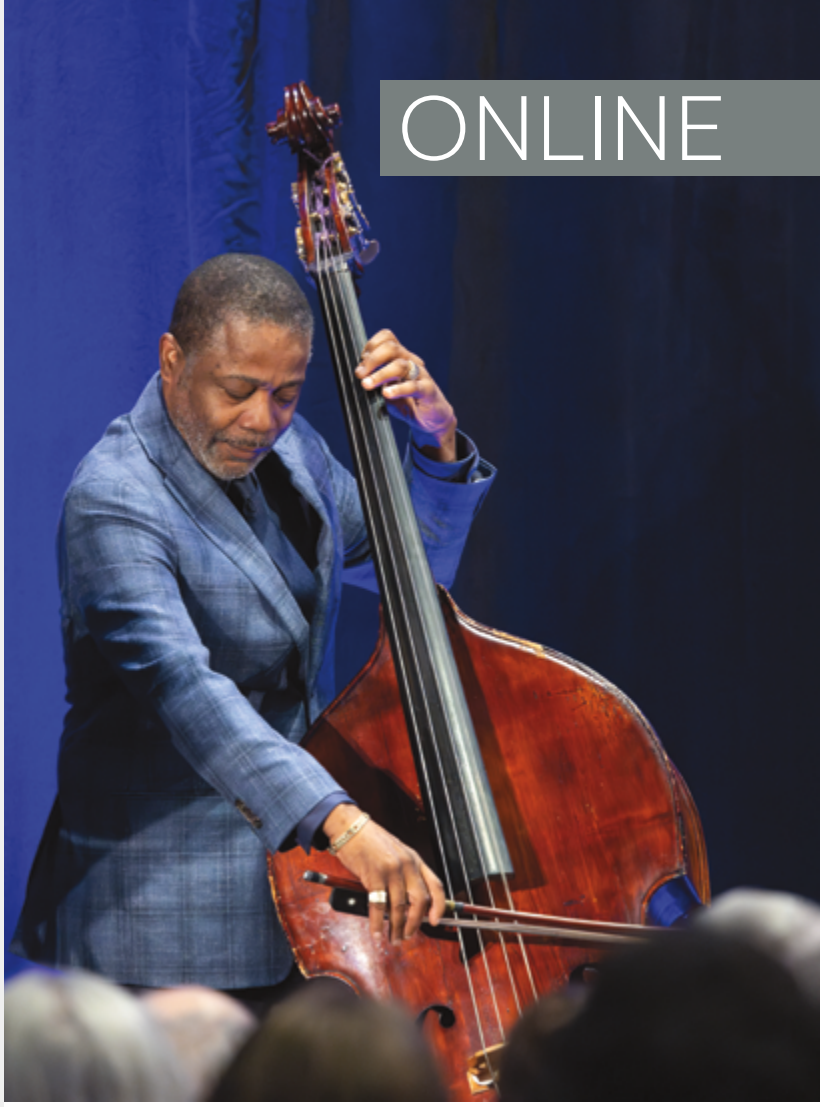

Rodney T. Whitaker, a renowned jazz bassist, recording artist, and professor of jazz double bass at Michigan State University, was elected to the Academy last year. He and his trio performed at the Opening Celebration of the Induction weekend. The performance is now available for all to enjoy (www.amacad.org/events/opening-celebration-rodney-whitaker-performance).

Follow the Academy on social media to keep current with news and events.

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