# Bulletin of the American Academy of Arts & Sciences


**INDUCTION 2024**

OPENING CELEBRATION

INDUCTION CEREMONY

MEMORY IS ABOUT YOUR FUTURE: WHAT WE THINK WE BECOME


# Rebuilding Trust in Science


WINTER 2025

SELECT

# UPCOMING EVENTS

## March 9, 2025

California Science Center, Los Angeles, CA

### Los Angeles Members' Reception: Science and Creativity

Featuring: **Cynthia Friend** (Harvard University; Kavli Foundation); **Andrea Ghez** (University of California, Los Angeles); **Laurie L. Patton** (American Academy of Arts and Sciences), **Thomas Rosenbaum** (California Institute of Technology); **Kip Thorne** (California Institute of Technology); **Risa Wechsler** (Stanford University)


## March 30, 2025

Art Institute of Chicago, Chicago, IL

### Chicago Reception and Discussion: Cultural Spaces and Their Communities

Featuring: **Cynthia Chavez Lamar** (Smithsonian's National Museum of the American Indian); **Leah Dickerman** (Museum of Modern Art); **Oskar Eustis** (The Public Theater); **Laurie L. Patton** (American Academy of Arts and Sciences)

Visit amacad.org/events for more information about these and other upcoming events.

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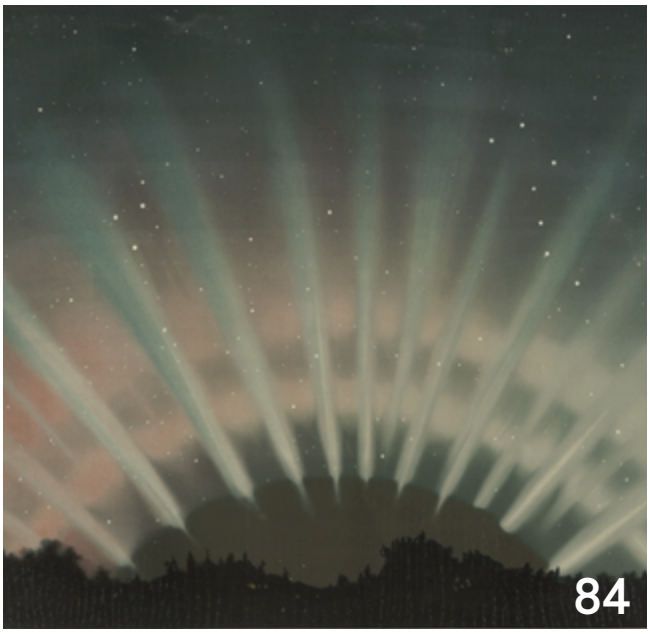
**ON THE COVER:** At the American Museum of Natural History in New York City, visitors engage with the Louis V. Gerstner, Jr. Collections Core, a multi-story facility in the Museum's Richard Gilder Center for Science, Education, and Innovation that combines working collections storage space with exhibitions that reveal the central role of scientific collections in research.



> In my first months as president of the American Academy of Arts and Sciences, I have been thinking a lot about the future – particularly "How can the Academy's mission and members strengthen democracy?"

# From the President

In my first months as president of the American Academy of Arts and Sciences, I have been thinking a lot about the future – particularly "How can the Academy's mission and members strengthen democracy?"

Every piece featured in this issue of the *Bulletin* speaks to that question: whether it is Holden Thorp, Sean Decatur, and Naomi Oreskes debating the true source of the public's trust and mistrust in science; Jhumpa Lahiri commenting on the role of writers in portraying the clash of values that is part of life in any open democratic society; or Charles Gammie reflecting on the meeting between reporters and the many physicists who produced the first image of a black hole.

I believe, as our founders also did, that the beginning of any democracy is in *the will to gather*. That is what they did in 1780, one of the most difficult years of the Revolutionary War. This is what we did during our 2024 Induction weekend, which included a conversation between Grant Hill and David Rubenstein, each an exemplar of vision, conviction, and determination. As you will read in the feature about this event, their conversation reveals what it takes to develop a group of disparate individuals from different backgrounds into a team that wins Olympic gold.

Other pieces in this *Bulletin* are about when the will to gather risks both trust and mistrust, highlights value differences that are not easily mended, and produces misunderstandings that can and will occur in open dialogues.

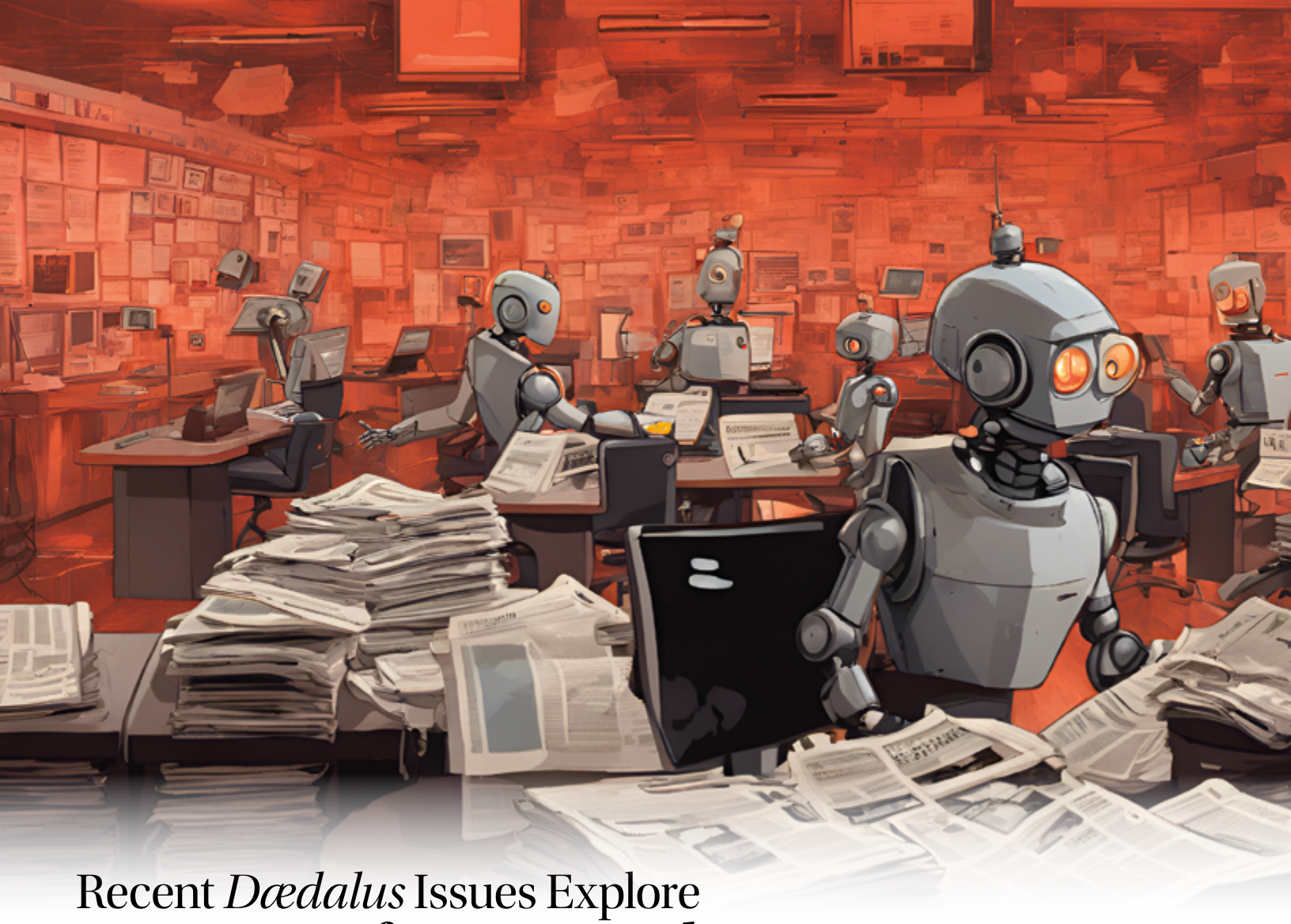
Also like our founders, I believe that the continuity of democracy lies not only in gathering, but in the *disposition to deliberate well*. In this issue, Helene Muller-Landau asks about what flaw our scientific deliberations will have when viewed through the lens of scientists a century from now. Legal scholar Daniel Ho reminds us that our most challenging problems are ones that do not fit neatly into disciplinary boxes, hence the difficulty of deliberating about them honestly. Neurobiologist André Fenton features the moment when his fellow scientists declared publicly and definitively that he had gotten it wrong and needed to change course.

These stories also show that thought leaders can be of service. Philanthropist Cecilia Conrad tells us to follow, as she did, the example of her father. Once given the opportunity to work in a less-segregated society, he proceeded to push doors open for others.

These are also the directions I would like to take the Academy with its breadth, its depth, and its roots in democracy itself. And not just conceptual directions. I also am thinking about actual directions and how we might deepen our engagement in places where we have not frequently visited, and where we might listen to leaders who have shown that it is possible to come together and build, even in the midst of real differences.

Together, we can work toward an Academy and an America that we all recognize and honor.

Yours cordially,
*Laurie L. Patton*



# Recent *Dædalus* Issues Explore the **Future of Free Speech** and the **Global Quest for Educational Equity**

By ***Dædalus*** **Editorial**

## THE FUTURE OF FREE SPEECH

Our shared principles of free speech are at risk. Changes in how we communicate with each other, the ease of manipulating audiences, and our unnerving national politics have expanded the contestation of free speech – and heightened the stakes.

But have Americans actually lost their appetite for open and constructive dialogue? Or has the First Amendment itself been cynically cast as a tool to censor and disempower citizens?

"The Future of Free Speech," edited by **Lee C. Bollinger** and **Geoffrey R. Stone** and published as the Summer 2024 issue of *Dædalus*, recognizes the complexity and challenge of the moment.

Essays by lawyers and legal scholars, philosophers, political scientists, historians, journalists, and industry leaders consider how the values of freedom of speech, freedom of the press, and freedom of inquiry play out today and in the future. The issues in this volume suggest greater conflict to come, but also remind us that it takes continued practice and determination to live in a society that embraces free and open discourse and disagreement.

**Above:** A vision of our automated media future, made using DreamStudio, July 2024.

**Page 5:** Editors and assistants in the newsroom of *The New York Times*, September 1942.

## The *Dædalus* volume on "The Future of Free Speech" features the following essays:

**Opening Dialogue**
Lee C. Bollinger & Geoffrey R. Stone

**Is John Stuart Mill's *On Liberty* Obsolete?**
Vincent Blasi

**Empowering Speech by Moderating It**
Danielle Keats Citron & Jonathon Penney

**Hostile State Disinformation in the Internet Age**
Richard A. Clarke

**The Future of Speech Online: International Cooperation for a Free & Open Internet**
Nick Clegg

**The Future of Free Speech: Curiosity Culture**
Olivia Eve Gross

**Free Speech on the Internet: The Crisis of Epistemic Authority**
Brian Leiter

**Thinking the Unthinkable about the First Amendment**
Nicholas Lemann

**The Fate of American Democracy Depends on Free Speech**
Suzanne Nossel

**The Unfortunate Consequences of a Misguided Free Speech Principle**
Robert C. Post

**Academic Freedom & the Politics of the University**
Joan Wallach Scott

**The Connected City of Ideas**
Robert Mark Simpson

**The First Amendment Meets the Virtual Public Square**
Allison Stanger

**The Free Speech Clause as a Deregulatory Tool**
Alexander Tsesis

**The Future of Government Pressure on Social Media Platforms**
Eugene Volokh

**Should We Trust the Censor?**
Keith E. Whittington

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The *Dædalus* volume on "The Future of Free Speech" is available on the Academy's website at www.amacad.org/daedalus/future-of-free-speech.

## THE GLOBAL QUEST FOR EDUCATIONAL EQUITY

The explosive growth in the number of migrant, refugee, and marginalized students globally has put great stress on the schools and teachers tasked with educating them. Too often this leaves students struggling to learn in a language they don't understand, and from a culture and curriculum that exclude them.

How can schools ensure that diverse and marginalized students can achieve at levels comparable to the dominant groups in their societies? In the Fall 2024 issue of *Dædalus* on "The Global Quest for Educational Equity," edited by **James A. Banks**, a multidisciplinary and international group of scholars share approaches and practices that have increased educational equity in primary and secondary schools.

Using a case-study approach, the authors look at what has worked and what hasn't in a variety of national, ethnic, and cultural contexts: from Australia to Lebanon, Mexico, and South Africa; and from Canada to China, India, and the United States.

This *Dædalus* issue is made possible, in part, by a generous grant from the Spencer Foundation. The views expressed are those of the authors and do not necessarily reflect the views of the Spencer Foundation.

**Above:** Heping Village Primary School, Dongxiang County, Gansu Province, China, September 6, 2005.

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"The Global Quest for Educational Equity" is available on the Academy's website at www.amacad.org/daedalus/global-quest-for-educational-equity.

## The *Dædalus* volume on "The Global Quest for Educational Equity" features the following essays:

**Introduction: The Global Quest for Educational Equity**
James A. Banks

**Globalization, Immigrant-Origin Students & the Quest for Educational Equity**
Carola Suárez-Orozco & Marcelo Suárez-Orozco

**Migrants & Minorities into Citizens: Education & Membership Regimes Since the Early Modern Period**
Leo Lucassen

**Language Equality & Schooling: Global Challenges & Unmet Promises**
Suzanne Romaine

**Refugee Education: Aligning Access, Learning & Opportunity**
Sarah Dryden-Peterson

**How Pedagogy Makes the Difference in U.S. Schools**
Gloria Ladson-Billings

**Overcoming Historical Factors that Block the Quest for Educational Equity in Canadian Schools**
Özlem Sensoy

**The Quest for Educational Equity in Schools in Multicultural Australia**
Greg Noble & Megan Watkins

**The Quest for Educational Equity in Schools in South Africa**
Crain Soudien

**The Long Struggle for Educational Equity in Britain: 1944–2023**
Audrey Osler

**Migration & the Quest for Educational Equity in Germany**
Viola B. Georgi

**The Quest for Educational Equity in Mexico**
Fernando M. Reimers

**Multicultural Education in Nigeria**
Festus E. Obiakor

**The Quest for Educational Equity in Schools in Mainland China & Hong Kong**
Jason Cong Lin

**Educational Equity in Schools in India: Perils & Possibilities**
Reva Joshee

**From Girls' Education to Gender-Transformative Education: Lessons from Different Nations**
Erin Murphy-Graham

**Disrupted Institutional Pathways for Educational Equity in Conflict-Affected Nations**
Bassel Akar

**Constructing Effective Civic Education for Noncitizen Students**
Angela M. Banks

# Bridging the Gap
# Between Science and the Public

By **Kate Carter**, *Senior Program Officer for Science, Engineering, and Technology*

Two weeks before the 2024 presidential election, Academy members convened in Cambridge for a compelling discussion about trust in science that featured **Naomi Oreskes** and **Sean Decatur** in conversation with **Holden Thorp**. The event, titled *Rebuilding Trust in Science: A Morton L. Mandel Conversation*, featured in this *Bulletin* issue on pages 60–77, took stock of the shifting terrain of science communication since the Academy's *Public Face of Science* project. The panelists tackled a landscape marked by growing acceptance of climate change, deepening skepticism of the medical community, and the relentless churn of misinformation. They explored how scientists, journalists, institutional leaders, and others can cut through division and engage the public more meaningfully. With polarization and politicization eroding public trust in science, the stakes could not be higher. The event also featured Shirley Malcom and Cristine Russell, who bookended the discussion, as well as a vibrant exchange with the audience, leaving no doubt that rebuilding trust is urgent and complex.

On the following day, twenty-two participants, spanning the fields of science, technology, journalism, museum education, and law, attended the related exploratory meeting, *Bridging the Gap Between Science and the Public*, cochaired by Thorp and Russell. The meeting opened with participants facing an uncomfortable truth: Trust in science is not a universal concept. It depends on who you ask, what you are asking about, and where you are asking. The room buzzed with a shared understanding that the science engagement landscape had shifted – traditional media, once the gatekeeper of scientific knowledge, had given way to a cacophony

of influencers, content creators, and conspiracy theorists. The challenge was not just about reaching people but cutting through the noise and making them care.

The conclusion was blunt: Transparency is nonnegotiable. "If science is going to regain trust, we need to show people how the sausage gets made," Thorp argued, underscoring the importance of explaining how scientific conclusions evolve. But the participants also acknowledged the underlying paradox. While admitting uncertainty can build credibility, it is also a gamble – one misstep and the critics pounce, branding scientists as indecisive or, worse, deceitful.

## COVID-19, AI, AND CLIMATE CHANGE: EXPLORING CHANGES TO THE ENGAGEMENT LANDSCAPE

The meeting cochairs and Science, Engineering, and Technology project staff selected three topics to explore how public trust in science and communication strategies have evolved since 2019: COVID-19, artificial intelligence (AI), and climate change. These areas were chosen for their global impact, their unique challenges to scientific messaging, and their role in shaping public perceptions of expertise. Together, they provide a lens to examine shifts in trust, the rise of misinformation, and the opportunities for constructive engagement.

When discussing COVID-19, the participants agreed on one point: trust, once broken, is hard to repair. The attacks on Dr. Anthony Fauci – symbolic of broader distrust in public health institutions – offered a cautionary tale. His transformation from trusted expert to political lightning rod illustrated how quickly credibility can erode when science becomes entangled with politics. Although the war metaphor "fighting misinformation" came up repeatedly, some participants pushed back. Wars are won with strategy and attacks, they argued, not just defense. The science community needs to think beyond debunking myths and anticipate the next wave of misinformation before it hits.

This need is amplified by AI's ease of generating false or misleading information. One participant recounted a startling moment when they asked an AI chatbot for scientific advice. The response was polished, authoritative, and completely wrong. It is this veneer of credibility that makes AI so tricky – it does not just spread misinformation; it does so with unsettling confidence.

The participants wrestled with the implications of AI and emerging technologies. AI's "black box" nature – its inability to explain how it arrives at conclusions – undermines a core tenet of science: reproducibility. While Europe has begun regulating these opaque models, the United States lags, raising questions about accountability and ethics. "How can we expect the public to trust AI when we do not fully understand it ourselves?" one attendee mused.

Unlike growing distrust of AI and COVID-19, climate change has, in most ways, changed for the better, with more people expressing belief in its realities. However, when the stakes are so existential, the participants agreed that action needs to be more robust. For years, scientists have been winning the battle of belief – more people accept the reality of climate change than ever before. But belief, as one participant put it, "does not put solar panels on roofs."

They suggested that the problem is trust – or the lack of it. Government funding for climate initiatives often fails to reach the communities that need it most. "If people do not see the benefits of our work in their daily lives, why would they trust us?" one participant asked, voicing a sentiment that resonated throughout the meeting.

The solutions proposed were both pragmatic and ambitious. Universities could lead by example, adopting climate action plans that model accountability. Local organizations could harness social norms to

**Holden Thorp** (left, American Association for the Advancement of Science) moderates a conversation with **Sean Decatur** (center, American Museum of Natural History) and **Naomi Oreskes** (right, Harvard University)

inspire action – if your neighbor installs solar panels, you might feel compelled to follow suit. But beyond strategies and statistics, the group emphasized something less tangible: empathy. As one attendee stressed, "We need to stop talking at people and start listening to them."

## WORKING TOWARD SOLUTIONS

The discussions returned repeatedly to a fundamental challenge: meeting people where they are. Building trust is not just about sharing facts; it is about understanding the fears, values, and experiences that shape how those facts are received.

Representation emerged as a key theme. When scientists look like the communities they are trying to reach, barriers to trust are lifted. However, the group acknowledged that representation alone is not enough. Trust requires consistency. Too often, scientific outreach feels episodic – a one-off lecture or a fleeting campaign. They argued that sustained engagement is needed, the kind that builds relationships over months and years, not weeks.

Social media, for all its flaws, presents an opportunity. TikTok can reach younger audiences, and active participation from scientists can combat the platform's steady stream of misinformation. The trick is tailoring the message without diluting its meaning. It is a delicate balance – simplifying without oversimplifying, engaging without pandering.

By the end of the meeting, there was no grand consensus – after all, how could such a complex issue lend itself to simple solutions? There was a shared conviction that the way forward requires more than better communication. It requires better listening, greater empathy, and a renewed willingness to adapt. The work ahead is not just about restoring trust in science but reimagining what that trust looks like in a fractured, fast-changing world. Social media and fragmented media ecosystems demand innovative approaches, not just updated messages. Institutions should invest in systems that support scientists, helping them engage more effectively without overburdening their already demanding roles.

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To continue this work, in early 2025 the Academy is planning to host a series of roundtables with members to explore actionable steps the Academy can take to address these challenges. These discussions will provide a platform to deepen our understanding, gather diverse perspectives, and chart a path forward. Members interested in contributing to this critical dialogue are encouraged to reach out to Program Associate **Jen Smith** (jsmith@amacad.org) and participate in shaping the Academy's role in this vital work.

Participants at the Academy's exploratory meeting on Bridging the Gap Between Science and the Public.

# From Matriculation to Completion:

# How College Students Move Between Majors

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

A new study by the Academy's Humanities Indicators (HI) staff reveals significant changes in students' majors from the time they begin their baccalaureate studies to when they complete a degree (if they do). To arrive at these findings, the HI staff commissioned data from the National Student Clearinghouse, which provides the most comprehensive information available on students' educational pathways through higher education. The data focused on the cohort of students who began their studies in fall 2017 and their status as of June 2024.

The results offer useful insights into the underlying patterns of movement after matriculation, most notably:

1. After seven years, around 30 percent of the students who started work toward a bachelor's degree in every major field had ended their studies without a degree, and another 1 percent were still working toward a degree.
2. A significant number of students who completed a degree had switched to a different subject area from the one they initially started in.
3. Only two fields – the behavioral and social sciences and the humanities – gained more students than they lost to either attrition or students switching to other fields. All other subject areas experienced a net loss.
4. Most students who completed a second major earned it in the same field as their first major.

Prior to this research, most information about college majors came from annual degree completion data reported by colleges and universities to the U.S. Department of Education. These data provide invaluable information about the number of students completing degrees in particular fields and the students' demographics. However, the data set offers no insights about how the fields compare in completion rates,

how many students change majors in the course of their studies, or the relationships between double majors at completion. This new study aims to address some of those gaps, though it focuses on only one cohort of students.

## WHO ENTERS A HUMANITIES MAJOR?

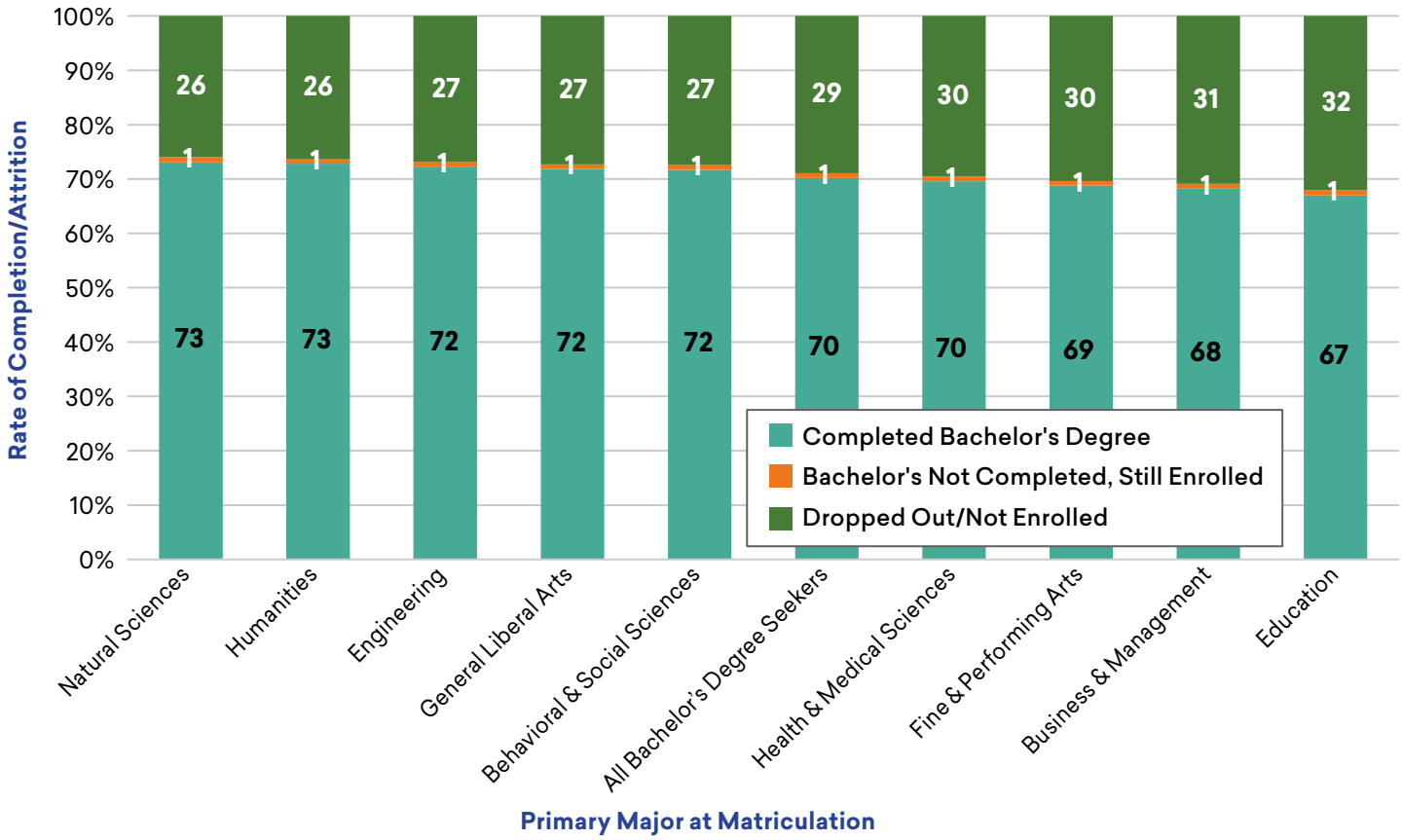
According to the Clearinghouse, almost two million students started working toward a bachelor's degree in fall 2017. Seven years later, 70 percent had completed a degree, with only modest variations between the fields of study (Figure 1).

Students who began with majors in the natural sciences and the humanities had the highest degree completion rates within the study's seven-year window, with 73 percent finishing their degree by summer 2024. But that was only one percentage point higher than the completion rates for students who started in three other fields. And three fields had completion rates below 70 percent (the fine and performing arts, business and management, and education), with the lowest completion rates, just 66 percent, found among students in smaller – typically vocational – subjects that the HI aggregates into an "Other" category (not shown).

This study also examined the subpopulation of students who had completed an associate's degree before matriculation into baccalaureate studies. These students accounted for 10 percent of the entering cohort. Unsurprisingly, given their head start in coursework toward the degree, these students were more likely to complete the degree within seven years of matriculation (with a completion rate of 77 percent).

Students with an associate's degree were significantly more likely than the typical college student to start with a major in one of the

**Figure 1:** Completion and Attrition Among Students Starting a Bachelor's Degree Program in Fall 2017 (Status as of Summer 2024), by Primary Major Declared in 2017




**Source:** Custom data runs from the National Student Clearinghouse for the Humanities Indicators.

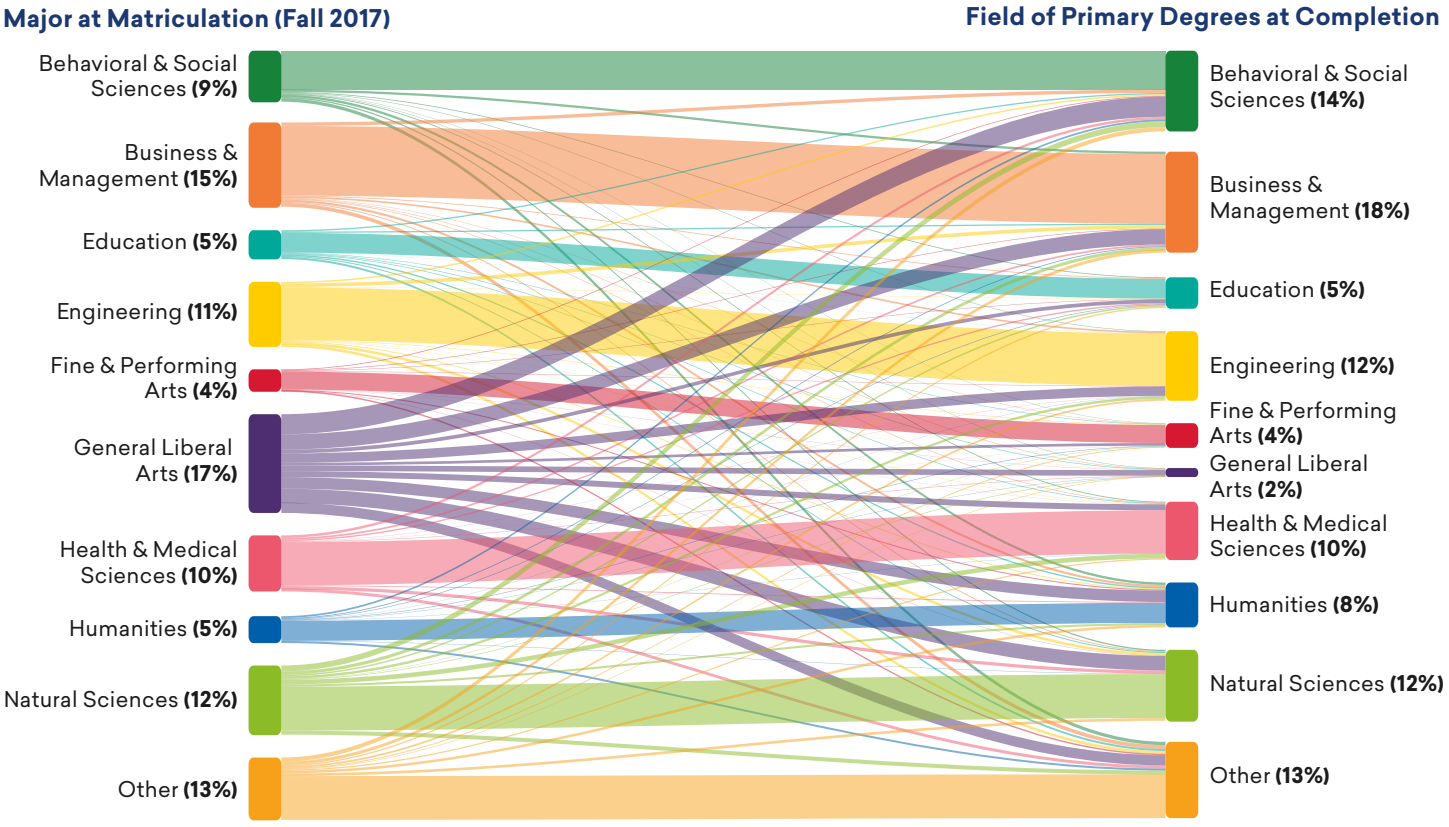
academic fields. While 17 percent of the students matriculating in 2017 began their studies in the general liberal arts category, less than 6 percent of those entering baccalaureate studies with an associate's degree chose that subject area. Compared to their peers without associates degrees, these students were more likely to start with a major in the health and medical sciences, business and management, or the behavioral and social sciences. This suggests the importance of the early years of study – when students are taking general education requirements – as a period of sorting and reassessment of initial majors. However, further research is needed as this study did not examine *when* students switched majors.

## HOW MUCH MOVEMENT IS THERE BETWEEN MAJORS?

One of the primary goals of this study was to determine how much migration between majors occurred from matriculation to completion. Figure 2 shows the movement between majors among students who had completed a degree. Of the nearly 1.4 million students from the fall 2017 matriculating cohort who completed a degree by the summer of 2024, 47 percent had changed their primary major somewhere along the way. For most fields, more than three-quarters of the students who started in a field and completed a degree remained in the same field from beginning to end.

Business and management majors and engineering majors were the most likely to stick with their majors (at 83 percent and 80 percent, respectively). Students were least likely to remain in a general liberal arts major, with only 6 percent completing a major in the subject after starting there. As a result, while general liberal arts majors accounted for 17 percent of entering students, this field represented just 2 percent of the cohort who completed degrees (suggesting that this category is now the functional equivalent of an undeclared major in the past). Education and the natural sciences were the only other fields with retention rates below 70 percent among students starting in their fields (at 69 percent and 64 percent, respectively).

**Figure 2:** Noncompletion and Change of Major Among Bachelor's Degree Seekers, from Matriculation (in Fall 2017) to Summer 2024, by Primary Major Declared at Matriculation



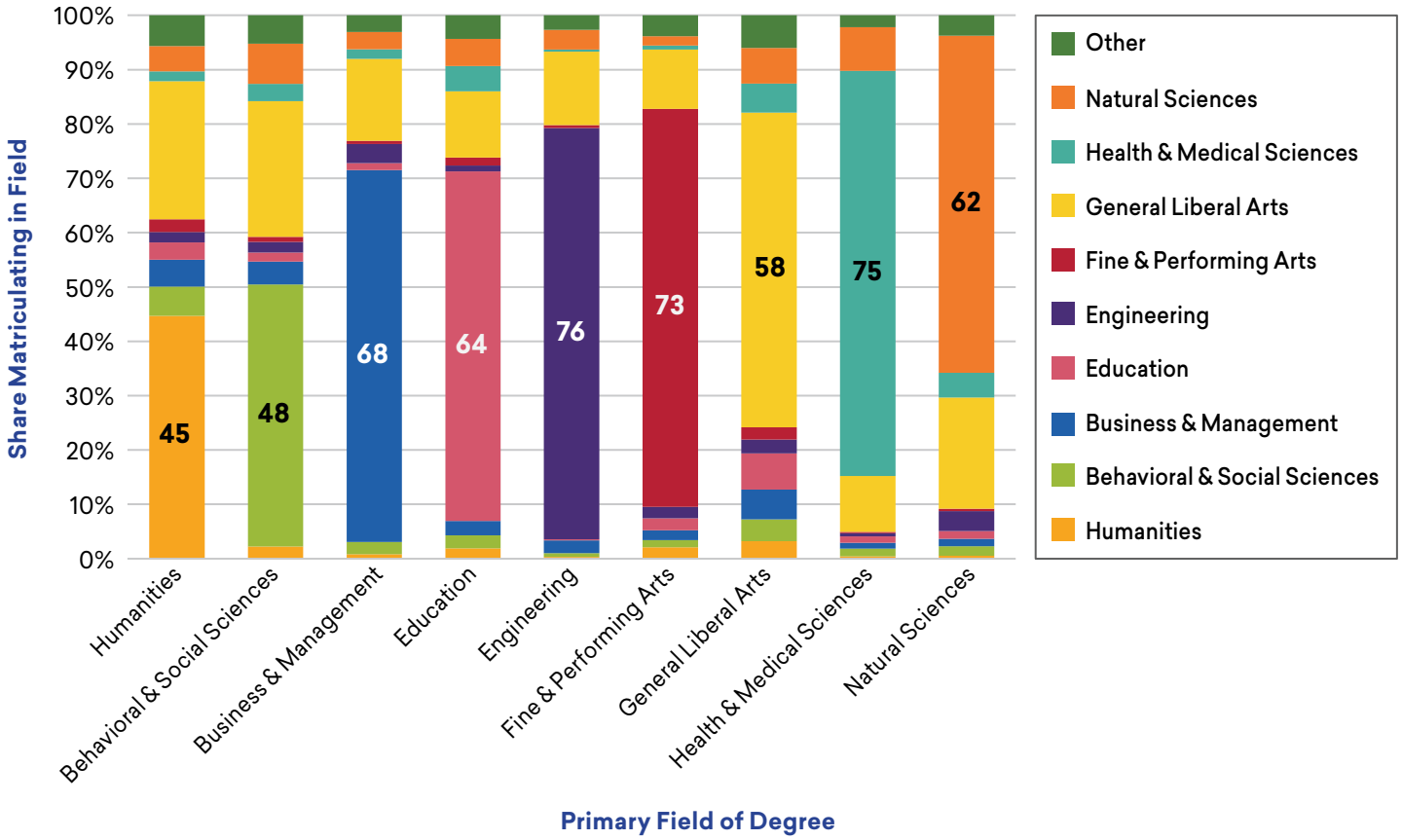

**Source:** Custom data runs from the National Student Clearinghouse for the Humanities Indicators.

Conversely, only two fields gained more students from other fields than they lost to dropouts or changes in major. Approximately 20,000 more students finished with degrees in both the behavioral and social sciences and the humanities than had matriculated into those fields in 2017. In the behavioral and social sciences, for instance, of the 175,650 students who started their studies in the field, 49,775 did not complete a degree, and 29,895 switched to another field before finishing their degree. As a result, only 95,980 students from the original cohort started and completed a degree in the same field. However, 103,159 students switched into the behavioral and social sciences from other areas, making up the majority of the nearly 200,000 graduates in the cohort who earned a degree in this field. Consequently, 52 percent of the students who earned a degree in the behavioral and social sciences had entered college planning to major in another field.

One in five students who started in general liberal studies had switched to the behavioral and social sciences by graduation, as did 9 percent of students who began in the natural sciences and 7 percent of students who started in the humanities. (The humanities saw a similar influx of students from other fields. For more details, see the Research Brief at the HI website.[1])

Compared to the humanities and behavioral and social sciences, the natural sciences have both a lower retention rate among students starting in the field and relatively little in-migration from other fields. In fall 2017, the natural sciences started with 233,413 students, lost almost 125,000 students to attrition or other fields, and gained only 33,306 students from other fields. This resulted in a net loss of more than 91,000 students from the natural sciences.

**Figure 3:** Primary Field of Major Declared at Matriculation, by Primary Field of Degree (Fall 2017 Cohort, Status as of Summer 2024)




**Source:** Custom data runs from the National Student Clearinghouse for the Humanities Indicators.

Figure 3 shows the movement between fields from the perspective of the students in the fall 2017 cohort who completed a degree in each field. For example, only 45 percent of the students completing degrees in the humanities had started their studies with a major in one of the humanities disciplines, the smallest share of any field. In contrast, 76 percent of the students completing a degree in engineering and 75 percent of the students completing degrees in the health and medical sciences had started in those fields. This study was not designed to explore the reasons for these differences, but rather to highlight the variability in patterns of movement between fields.

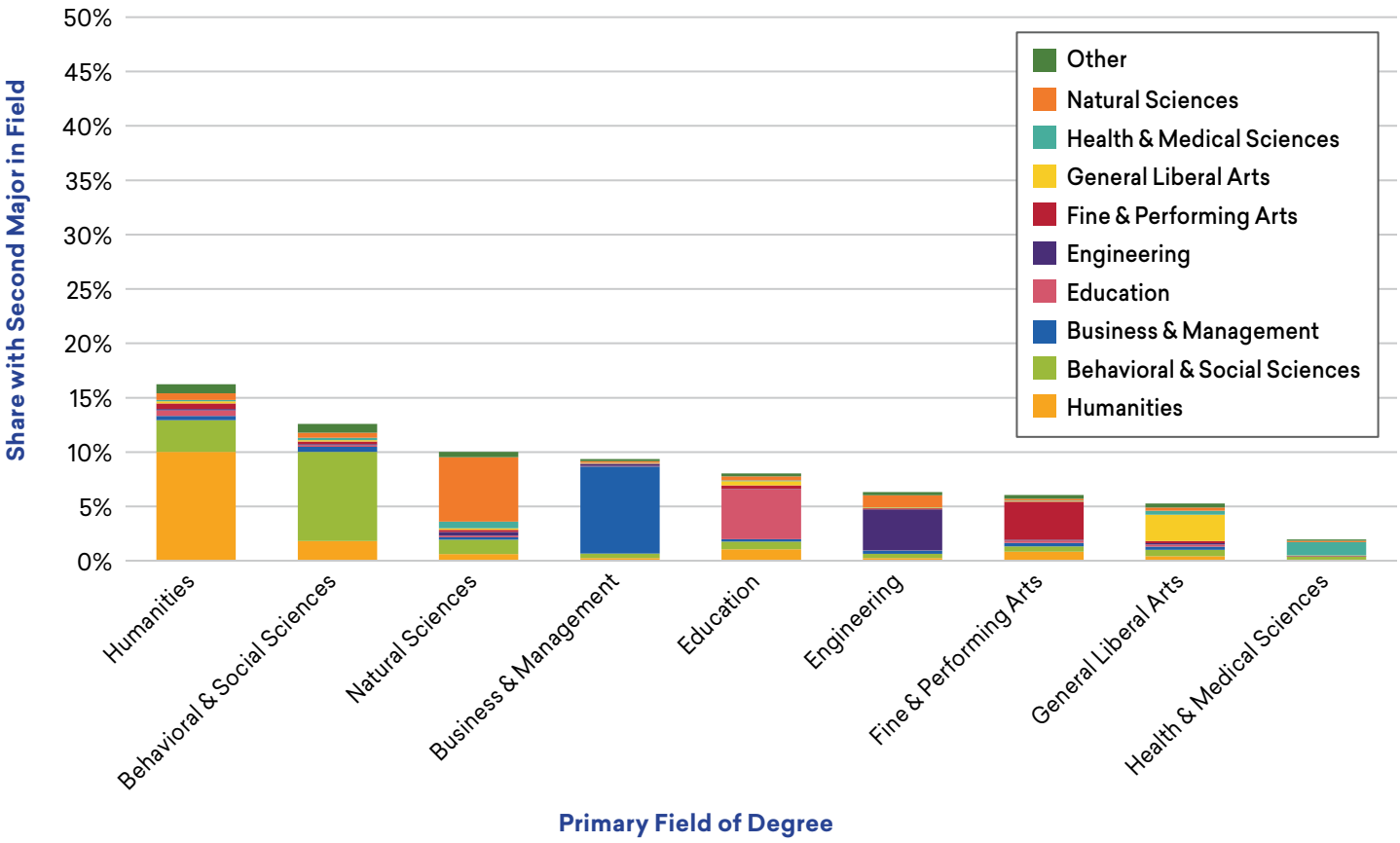
## WHAT IS THE RELATIONSHIP BETWEEN FIRST AND SECOND MAJORS?

This study also examined the relationship between first and second majors. As shown in Figure 4, only a small percentage of college graduates completed a second major. Among students who started their bachelor's degree in fall 2017 and graduated by the 2023 – 2024 academic year, 9 percent finished with a second major.

Students earning degrees in the humanities were more likely to complete a second major than their peers, with 16 percent of humanities graduates finishing a second major. This was more than three percentage points higher than the next closest field – the behavioral and social sciences (13 percent). In all other fields, 10 percent or less of the graduates finished with a second degree.

Notably, in every field most students who finished a second major chose the same subject area for their first and second majors. About two-thirds of the students earning a second degree in one of the major academic fields received both degrees in the same field. Business and management majors stood out in this respect, with 85 percent earning their second degrees in the same field as the first, which was significantly higher than the next closest field, the behavioral and social sciences, at 65 percent. Numerically, the behavioral and social sciences awarded the most second degrees

**Figure 4:** "Second" Major at Graduation, by Primary/"First" Major (Fall 2017 Cohort, Status as of Summer 2024)




**Source:** Custom data runs from the National Student Clearinghouse for the Humanities Indicators.

(25,046), followed by business and management (23,563). In all other fields except general liberal arts, the percentage of second degrees awarded was greater than 55 percent, with each field awarding fewer than 19,000 second degrees.

## HOW DO DOCTORAL COMPLETION RATES COMPARE?

As a final part of the research with the Clearinghouse, the Humanities Indicators looked at students who entered doctoral studies in fall 2015 to compare completion rates across fields. The study found completion rates above 50 percent for every field except general liberal arts (which was just below that threshold, at 49 percent). Among all students who began doctoral studies in fall 2015, 65 percent had completed a doctorate by fall 2024, while 35 percent had dropped out (or were no longer enrolled in a program), and 1 percent were still enrolled toward their degree.

Students who entered the natural sciences had the highest completion rates, with 78 percent completing their degree within nine years, followed by engineering and the fine and performing arts, each at 75 percent. Most other fields had completion rates between 62 percent and 66 percent, with one-third or more of their students no longer enrolled or working toward the degree.

These studies on baccalaureate and doctoral students are intended to enhance our understanding of how students move through their programs and how many complete their intended degree. While the studies were not designed to explain when or why students chose to end their studies or change the trajectory of their studies, the HI will continue to explore these issues in the coming months.

## ENDNOTE

1. Humanities Indicators, Research Brief, *From Matriculation to Completion: How College Students Move Between Majors* (American Academy of Arts and Sciences, 2025), https://www.amacad.org/publication/matriculation-completion-how-college-students-move-between-majors.

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

# Our Common Purpose **Champions Convening**

Our Common Purpose cochairs **Danielle Allen** (Harvard University), **Stephen Heintz** (Rockefeller Brothers Fund), and **Eric Liu** (Citizen University) in discussion with **Goodwin Liu**, Chair of the Academy's Board of Directors, at the opening session of the convening.

By **Kelsey Ensign**, *Louis W. Cabot Humanities Policy Fellow*

In 1780, the founders of the American Academy of Arts and Sciences were facing a critical moment during the beginning years of the American democratic project. At the height of the American Revolutionary War, the scholar-patriots who would establish the Academy gathered to create an institution that could help make a nascent republic function and thrive.

More than two hundred years later, this tradition of convening for the sake of American democracy continues at the Academy. In December 2024, the Academy hosted a two-day convening at another pivotal moment for our constitutional democracy. The convening brought together practitioners and leaders from across the democracy renovation space to reconnect, reflect on the 2024 U.S. presidential election results, and find new ways to collaborate ahead of America's 250th anniversary in 2026.

The attendees largely came from the Academy's Our Common Purpose (OCP) Champions network. Champions organizations are committed to advancing one or more of the recommendations in the *Our Common Purpose: Reinvigorating American Democracy for the 21st Century* report. They represent communities from across the country and have a range of perspectives. Each Champion is doing work to strengthen our civil society, to bolster our civic culture, and to make our democratic institutions more responsive to the public.

OCP Champions have made important contributions to all facets of American constitutional democracy and have been vital to the work of the Our Common Purpose project. While the Academy has brought this group together virtually since the release of the *OCP* report in 2020, the December OCP Champions Convening was the first time the network met in person. As the OCP project heads into its final two years, this convening offered an opportunity to recenter and reconnect with the Champions.

The two-day meeting featured a mix of panel discussions and small-group breakout sessions. **Goodwin Liu**, Chair of the Academy's Board of Directors, opened the convening and moderated a discussion with the Our Common Purpose cochairs: **Danielle Allen** (Harvard University), **Stephen Heintz** (Rockefeller

Brothers Fund), and **Eric Liu** (Citizen University). They reflected on the progress that has been made since the release of the *OCP* report, shared their thoughts on the challenges that remain, and expressed their optimism about the movement and network that have been built around democracy in recent years.

After these opening comments, attendees joined breakout discussions and a plenary session that gave them an opportunity to reflect together on the 2024 presidential election and what the results might mean for their work. Throughout the next two days, the plenary and breakout sessions focused on forward-looking topics, including planning for the country's 250th anniversary in 2026, setting and working toward generational democracy goals, engaging policymakers at all levels of government, and working with philanthropic funders on democracy initiatives. **Laurie L. Patton**, who at the time was about to start her tenure as the Academy's president, addressed the attendees and shared her vision for the Academy and how it will remain committed to cultivating thought leadership in service of American democracy.

Throughout the convening, several themes emerged that will help guide the Academy's OCP work through the project's conclusion in 2026. These themes include the power of the local and place-based democracy work, the need to pursue both cultural and structural democratic innovations, and the importance of considering how economic inequities impact American democracy. During the final two years of the Our Common Purpose initiative, the Academy will work in partnership with the OCP Champions network to advance these ideas.

We are approaching a major national milestone: 250 years since the beginning of the American democratic experiment in 1776. As we near this important moment for the country, the Academy is committed to remaining a key place for people to gather, share ideas, and reflect on ways to strengthen American democracy in the twenty-first century.

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**For more information about the OCP project and its work, please visit www.amacad.org/ourcommonpurpose.**

Attendees listening during the breakout discussions.

INDUCTION 2024

# Opening Celebration

*Annual David M. Rubenstein Conversation*

2126th Stated Meeting | September 20, 2024

Induction Weekend 2024 began with an Opening Celebration that featured the first Legacy Recognition Honorees and a performance led by new member bassist **Rodney Whitaker**. The program also included a conversation between **David M. Rubenstein**, Co-Founder and Co-Chairman of The Carlyle Group, and **Grant Hill**, a new member, basketball hall-of-famer, and philanthropist. An edited version of their conversation follows.

## David M. Rubenstein

David M. Rubenstein is Co-Founder and Co-Chairman of The Carlyle Group. He was elected to the American Academy of Arts and Sciences in 2013 and is a member of the Academy's Board of Directors and a member of the Academy's Trust.

## Grant Hill

Grant Hill is a Basketball Hall of Fame inductee, Olympic gold medalist, sports commentator, and basketball executive as well as an investor, philanthropist, and art collector. At Duke University, he was a three-time All-American and led the Blue Devils to win two NCAA championships. He had a successful nineteen-year NBA career, largely with the Detroit Pistons. He was elected to the American Academy of Arts and Sciences in 2024.

**DAVID M. RUBENSTEIN:** Grant, thank you for joining us this evening. When you were notified that you had been elected to the American Academy of Arts and Sciences, did you know anything about the American Academy?

**GRANT HILL:** It's my pleasure to be here this evening. I must confess that I was not familiar with the Academy. But as I learned about the Academy and read about all the distinguished members who have been elected, I was struck by the thought that I'm now part of this institution that includes you and many other remarkable individuals. It was certainly a big thrill to learn about my election. But I did not know about the Academy at that time.

**RUBENSTEIN:** Knowing about the Academy is not a requirement. There are many qualities that we want members to have, but prior knowledge of the Academy is not necessarily one of them. Let's shift to something that happened recently. You are the chair of USA Basketball.

**HILL:** Yes.

**RUBENSTEIN:** And USA Basketball is in charge of developing the teams that represent this country overseas, including at the Olympics that just concluded.

**HILL:** Correct.

**RUBENSTEIN:** When you were asked to be the chair of USA Basketball with all of the responsibility that goes along with that, why did you accept? If you win a gold medal, you're not going to get extra credit. And if you lose, you're going to get blamed. People will certainly complain to you. Did you consider that when making your decision?

**HILL:** It seems as if you're saying that I have bad judgment for accepting this role! I fell in love with basketball by watching the 1984 Summer Olympics in Los Angeles, and dreaming and hoping one day to be a participant. And I had the opportunity in 1996 in Atlanta to play, and then years later to be in a leadership role, picking the team and selecting the coaches. Yes, I obviously felt the pressure. When we were in Paris and during some of those close games, I was thinking if we don't win, I will be banished from coming back to the United States. Thankfully, there were some great theatrics at the end and we did win. There's an expectation that we'll always win, and so we felt that pressure. We lived with it for two weeks. I didn't sleep the entire time, but certainly it was worthwhile.

**RUBENSTEIN:** There was a game when we were behind by double digits against Serbia. You may remember this. Were you thinking that you may have picked the wrong players? What was going through your mind during that game?

**HILL:** You know, it's interesting. Sports condition you to always believe you have a chance. That's part of competition, and that's why upsets occur and great moments happen in sports. I've lived it my entire life. My father was a professional athlete in the NFL. During that game with Serbia I kept thinking, okay, if we can just chip away at this lead, if we can get some stops defensively and some momentum then we have a chance. Call me delusional, but I did believe that, and thankfully we took care of business and won that game.

> "Sports condition you to always believe you have a chance. That's part of competition, and that's why upsets occur and great moments happen in sports.

**RUBENSTEIN:** In the final game against France, we weren't doing so well at one point. You have a player that you put on the team, Steph Curry, and he takes these easy shots that he makes look hard. These are the three pointers that anybody could do – and he had four right at the end. Were you thinking how glad you were to have picked him, or what?

**HILL:** In that moment, yes. I think everyone knows who Stephen Curry is and we are all aware of his tremendous success as a basketball player. He's revolutionized the game with his easy shots that he makes look difficult, as you described. But he really struggled up until then. He had not had a signature game or a great Olympic run. But he worked every day on his shot and you just knew in time he would have a moment. In the second half of that

game, we had fifteen turnovers, and I kept asking myself why are we turning the ball over? We're giftwrapping the game to France. We can win the game by ten points. At the end, Stephen Curry was remarkable and had a signature moment in a gold medal game.

RUBENSTEIN: Some people have said that you opted for players who were a little older, like LeBron James, who I think is thirty-eight or thirty-nine.

HILL: Yes.

Let me share what a coach once told me. He said in order to have a piano recital you need a piano mover, a piano tuner, and a piano player. You can't have all piano players. You need people to understand their roles. So we tried to balance it out. We wanted players who complemented each other.

RUBENSTEIN: Was it a conscious decision that you needed to pick the most famous basketball players as opposed to the younger ones who are up and coming? How did you decide it's okay to have a thirty-nine-year-old basketball player on the team?

HILL: I'm impressed with how aware you are of the basketball scene. Are you with *The Boston Globe*? LeBron James will be forty in December. Kevin Durant is another player who is seasoned like Stephen Curry. These three guys have been the face of the NBA, the face of USA basketball, and globally the face of the game. And so if they wanted to play, they earned the right to be on that roster. But we needed some balance. We needed guys who were in their prime and guys a little younger who hadn't yet entered their prime. As you said, David, you don't want all old guys on the team.

RUBENSTEIN: At the American Academy, thirty-nine would not be old.

HILL: Exactly. Let me share a story about LeBron James. I really didn't know LeBron that well. It is the first day of camp and we are in Las Vegas. He's thirty-nine years old and in the best shape and running around like he's nineteen. He's going full speed. I think he had twenty-five dunks during that practice. The next day at breakfast I went up to LeBron and I said, "You know, when I played in the NBA and I was thirty-nine, I had twenty-five good dunks for the entire season, and you had twenty-five just yesterday. Slow down." And he said to me, "Hey, if you don't use it, you lose it." So every day he was in the best condition, he was the most consistent, and he brought energy to the game. He was impressive, and we needed that to win.

RUBENSTEIN: Not everybody here this evening is from Boston. But since we are in the Boston area, there's a player from Boston who played at Duke, Jayson Tatum, but he didn't get much playing time in the 2024 Olympics. Why didn't he get to play very much?

HILL: Is Jayson here or did he call you? It's not easy. You have all these superstars, and Jayson is certainly one of them. He won a championship this year with the Celtics. He's been a first team all-NBA player for the last three years. Let me share what a coach once told me. He said in order to have a piano recital you need a piano mover, a piano tuner, and a piano player. You can't have all piano players. You need people to understand their roles. So we tried to balance it out. We wanted players who complemented each other. There were two games in which Jayson didn't play because of the matchups and it became a story and something much greater than we had anticipated. But to his credit, Jayson handled it well. He went to a fantastic school, he was coached by the incredible Coach K, and it didn't become a distraction for the team in the locker room. And we're thankful for that. This is Jayson's second gold medal. He'll have other opportunities in the future.

RUBENSTEIN: Are you going to stay as the head of USA Basketball and be there for the LA Olympics?

HILL: Well, after you described the experience, I'm questioning now whether it makes sense to continue in that role.

RUBENSTEIN: You did a pretty good job. You won the gold medal.

HILL: I think I will stay on. It is an incredible honor and privilege to have that responsibility, and though there's pressure, it's worth it.

**RUBENSTEIN:** Next time could you pick at least one Jewish basketball player? I know you want to win, but just consider it. For those who don't know Grant's background I've known Grant for a long time. I'm good friends with his parents. Grant grew up in northern Virginia. His father was an all-pro football player with the Dallas Cowboys and was all-American at Yale. His mother was one of the few African American students at Wellesley, where her suitemate was Hillary Rodham. Sadly, your mother Janet, who served on several boards with me, passed away about two years ago from a brain tumor. As I remember, she was known in your family as the General because she was the disciplinarian. Is that right?

**HILL:** Yes, she was the disciplinarian and I was often in trouble. During the Carter administration she worked in the Pentagon. She was a special assistant to the Secretary of the Army, Clifford Alexander. I called her Colonel at first and she said, "No, I'm far better than a Colonel," so she gave herself the nickname General.

**RUBENSTEIN:** You are an only child of two successful parents: your father is an all-American football player and your mother was a very prominent person in Washington, D.C. Did you feel any pressure to be a great athlete and a great scholar? What was it like being an only child with two parents who were super talented?

**HILL:** I'm an only child of two only children so yes, you can feel sorry for me. But truthfully, my parents were and are incredible people in their own right. I didn't look at it as pressure. I saw it as inspiration. My friends looked up to Dr. J or to other public figures. My heroes were my mom and dad. I learned so much from them.

**RUBENSTEIN:** Your mother once told me that she forced you to take piano lessons. Is that true?

**HILL:** Yes, it is.

**RUBENSTEIN:** Do you still play the piano?

**HILL:** So my mother was a pianist. She was classically trained. When I was young, she shipped the piano that she grew up playing in New Orleans to our home in northern Virginia. And she convinced me to take piano lessons when I was nine years old. At the beginning I was into it, but then it becomes much more difficult. You have to practice and put the time in. At times I could be rebellious. About three or four years in I had a piano recital and I was horribly unprepared, and I might have embarrassed the family name. After that, my mom withdrew me from piano lessons. Clearly their financial investment in these lessons was not paying off. But I picked the piano up later when I was in college. You may not believe this, but a teammate of mine that you know, Christian Laettner, taught me a song on the piano when I was a freshman and so now I play the piano. I enjoy the relaxation, the creativity, the chance to learn songs that I admire, and so I do thank my mom for forcing me to take lessons.

"During the Carter administration my mom worked in the Pentagon. She was a special assistant to the Secretary of the Army, Clifford Alexander. I called her Colonel at first and she said, "No, I'm far better than a Colonel," so she gave herself the nickname General.

**RUBENSTEIN:** When did you realize that you were unusually gifted and maybe one of the best basketball players in the country?

**HILL:** I think it was when I was thirteen. I played in a national tournament, and our team won. I had a chance to measure myself against other thirteen-year-olds from all over the country. And at that point I realized that I have a chance here. It didn't mean I would be destined for the NBA, but it was eye-opening for me. Up until then my main sport had been soccer. I loved soccer, but I thought I was better than I actually was. I guess I realized then that I had a better chance to be Dr. J than Pelé.

**RUBENSTEIN:** The University of North Carolina heavily recruited you.

**HILL:** Yes.

Going to Duke gave me an opportunity to get to know Coach K. I think many of us are aware of his remarkable legacy and career. But if you go back to the late 1980s, there was some concern whether he could win the championship. He had gotten to the final four a number of times and come up short. He won me over during the recruiting process and as a result I got introduced to Duke University.

RUBENSTEIN: Many people thought you were going to go there, and I'm sure you thought you were going to go there. How did you wind up at Duke University, the much better school? (laughter) Any regrets about going to Duke or not going to UNC?

HILL: No regrets at all. I was a North Carolina fan, but going to Duke gave me an opportunity to get to know Coach K. I think many of us are aware of his remarkable legacy and career. But if you go back to the late 1980s, there was some concern whether he could win the championship. He had gotten to the final four a number of times and come up short. He won me over during the recruiting process and as a result I got introduced to Duke University. I had four fantastic years and a relationship with Coach K that I really enjoyed, that I benefited from, and hopefully contributed to. So through basketball, through Coach K, I was introduced to Duke. I have children and it's remarkable to think that when I was sixteen I made such an important and meaningful decision that helped shape and chart the rest of my career and life.

RUBENSTEIN: You are one of the few NBA players who earned a college degree. Many go to college for only one year before entering the NBA draft. You majored in history and political science.

HILL: Yes.

RUBENSTEIN: Did you ever think of leaving Duke early to go play basketball? What would your parents have said?

HILL: My parents would have said no. And I had no desire to leave early. I remember at the end of my junior year one of my roommates was a senior on the basketball team. His name was Thomas Hill, no relation, and he was preparing for the NBA draft. And at that moment, as he was flying off to work out with various teams in anticipation of the draft it dawned on me that I'll be doing this next year. Things are different now in college sports but there was a real innocence back in the 1990s. There was a sense of fulfillment being a student athlete, being a part of the community, being a part of the school. I don't know how you can really understand and get to know a school if you're there for just one year.

RUBENSTEIN: Do you have any regrets that when you were at Duke, you got a scholarship and that was basically it? Today the best players at Duke are getting paid several million dollars a year by the university, and other schools are doing the same thing. It's allowed by the NCAA. Do you think you got shortchanged by not getting paid by Duke?

HILL: No. I understand that intercollegiate athletics is going through a transformation right now and there's a lot of uncertainty. And as a result, student athletes, and especially athletes from high-profile programs, are making a considerable amount of money, and I think that's fine. Name, image, and likeness are a good thing in theory, as long as there are guardrails and rules in place. But no, I wouldn't trade my experience at all. There's something about being a student and learning how to stretch $20 over the course of a week that builds character and resolve. I couldn't imagine having $1 million at the age of eighteen. I couldn't imagine having $1,000 at the age of eighteen.

RUBENSTEIN: So Coach K successfully recruited you, and he's telling you how great you are and your parents are listening to how he's going to take care of you. Then you go to practice and he's yelling and screaming at you. What's that like?

HILL: It is not fun. During the recruiting process Coach K writes you handwritten letters, he calls you during the windows when he's permitted to, he does everything to woo you, to recruit you, to bring you in. And then we had our first meeting as a team and Coach K is swearing and cursing. He's intense. And I'm thinking, who is this guy? This isn't the person who recruited me. Did I make the

right decision? But it's part of the process. As I always say, there are twelve inches between a pat on the back and pat on the butt, and as a metaphor you've got to do both as a parent, but also as a coach. Coach K pushed you; he challenged you; he coached you hard; but he also empowered you.

**RUBENSTEIN:** For people who aren't college basketball fans, two of the most famous games were played by Duke. Duke won the national championship in 1991 and was trying to repeat that win in 1992. You were behind by one point in the game against your archrival Kentucky with two seconds to go. The coach calls a timeout and says, "We have to get two points. We're one point behind. We've got two seconds to go." What did Coach K say to you in the huddle and what did you then do that got so many people excited to say that it was one of the greatest basketball games ever?

**HILL:** It was really an incredible moment. We were number one all season. The pressure, the weight of that, was exhausting. We were in the regional finals, playing against Kentucky, a team that we felt we were better than, but they played well. And here we are, two seconds left. We have to go the whole length of the court. When the gentleman from Kentucky hit the shot to go up one point I was walking to the bench and thinking instead of being at the final four next weekend I guess I'll be at Beach Week with the rest of the school. In that moment I didn't think we were going to win. But Coach K's brilliance was on display at a moment when there was a lot of commotion, a lot of stress, a lot riding on that timeout. As we were making our way to the bench, he came on the court, met us, looked in our eyes, and said, "We're going to win." So right away he establishes the vision. Now, I don't know if he believed that we were going to win, but as a leader he said that and your leader gives you confidence in these moments. At the bench, instead of telling us what to do, instead of saying, "Grant, you make the pass the length of the court; Christian, you stand here and you catch it and you score," he asked me, "Grant, can you make the pass the full length of the court?" And I said yes. And that's an empowering thing. I'm saying it in front of a group and when you're asked to do something, something that is really difficult to do, you take ownership, and in that moment I did that. And the coach asked Christian, who was at the time everybody's all-American, he was the player of the year, he didn't miss a shot, "Can you make the shot?" And Christian answered, "If Grant makes the pass, I'll make the shot." So now I'm a little nervous. Coach K took control of that moment by injecting and exuding confidence in us and then asking us if we can execute. And we say we can. I actually walked onto the court thinking we're going to win, that we can overcome and do the unthinkable.

**RUBENSTEIN:** You threw the pass seventy-five feet, he caught it and got the two points, and you won. And then you went on to win the national championship. Another incredible play that some people here may know if they're basketball fans is in a championship game against Kansas. You got an alley-oop kind of pass and it was a little bit high so rather than catch it and go down, you caught it with one hand and swooped down and did a dunk. I've never been able to do that myself. Is a one-handed kind of dunk something that you practiced before?

**HILL:** So Bobby Hurley, my teammate, one of the great point guards ever in college basketball, has the all-time assist record in the NCAA. Early in that game against Kansas, Bobby threw a bad pass and really made me work to catch it. And somehow, some way, I was able to catch the pass and make a nice play. And you know, the beauty of it is that every year they replay that play and they replay the Kentucky play. The downside of that though is that I had a really bad haircut on that dunk. Talk about poor judgment. It just shows that you shouldn't be too trendy when you're young.

**RUBENSTEIN:** You graduated from Duke, you got a degree, you played in the NBA for nineteen years.

**HILL:** Correct.

**RUBENSTEIN:** You played with four different teams and had lots of success. You set some incredible records, but you were injured for a lot of it. You had terrible ankle problems. I think Wilt Chamberlain and you are the only people who led their teams three years in a row in scoring, assists, and rebounds. For Detroit, you led in all three of those categories. What were your other teammates doing?

HILL: That's why we struggled in Detroit. The team was not the same quality as the team at Duke, so I was called upon to do a great deal and that may have contributed to my ankle eventually giving me issues.

RUBENSTEIN: Who was the greatest basketball player you ever played against?

HILL: The greatest basketball player I ever played against was Michael Jordan.

RUBENSTEIN: If you went one-on-one with him, could you beat him?

HILL: Yes. He's not here, right?

There are so many values that you can take from sports and apply in all facets of life. We talked about Duke and the superior education I received there, but I also learned a great deal from Coach K. I learned a lot from being in team sports. I learned from all of the ups and downs that came with that.

RUBENSTEIN: Sometimes professional athletes after their professional careers are over don't live up to their potential in non-athletic areas. You have done incredible things since you retired. I will mention just a few: Grant is a member of the Board of Trustees of Duke University and is also on the Executive Committee of Duke University. He is a committed philanthropist. He has one of the largest and most impressive African American art collections in the United States. He is also a sports team owner, an owner of the Baltimore Orioles with me. An owner also of the Atlanta Hawks and an owner of the professional men and women soccer teams in Orlando. In addition to that he is a broadcaster for the NCAA Final Four and a broadcaster for the NBA. He is also on some corporate boards, including Campbell's Soup.

HILL: We just changed our name to Campbell's. Same brand.

RUBENSTEIN: Yes. And you have two daughters who are very successful in their own right, and your wife is a professional singer. Do you ever fail at anything? Is there something that you just didn't do well at so you can make the rest of us feel not so inadequate by your being so successful at everything?

HILL: If my wife were here, she would tell you I fail in a lot of things. It's been interesting since I retired. I think sometimes athletes struggle with putting so much into reaching the top that it consumes you in the sense of what you need to do to stay there. And whether you play for ten, fifteen, or twenty years, it defines who you are. Then when you're done and you retire – I retired at forty, which is old in my respective sport – it can be scary and overwhelming for athletes to figure out what to do next. I think first of all having a father who went through that same thing and learning from his experiences and the experiences of his contemporaries was helpful. I tend to look at sports as if they are a microcosm of life. There are so many values that you can take from sports and apply in all facets of life. We talked about Duke and the superior education I received there, but I also learned a great deal from Coach K. I learned a lot from being in team sports. I learned from all of the ups and downs that came with that. And the same thing throughout the NBA. Being on top of the world, being one of the top five players in the 1990s, and then all of a sudden having a devastating injury that really changed the trajectory of my career. And now being back when I'm older and in a different role. The totality of all of those experiences really helped prepare me for what I'm doing now. And those are values that you learn in real time, that you learn on a public stage. I've had some successes and a couple of failures here and there, but for the most part I'm fulfilled. I'm doing things that I like, I'm healthy, and I'm here.

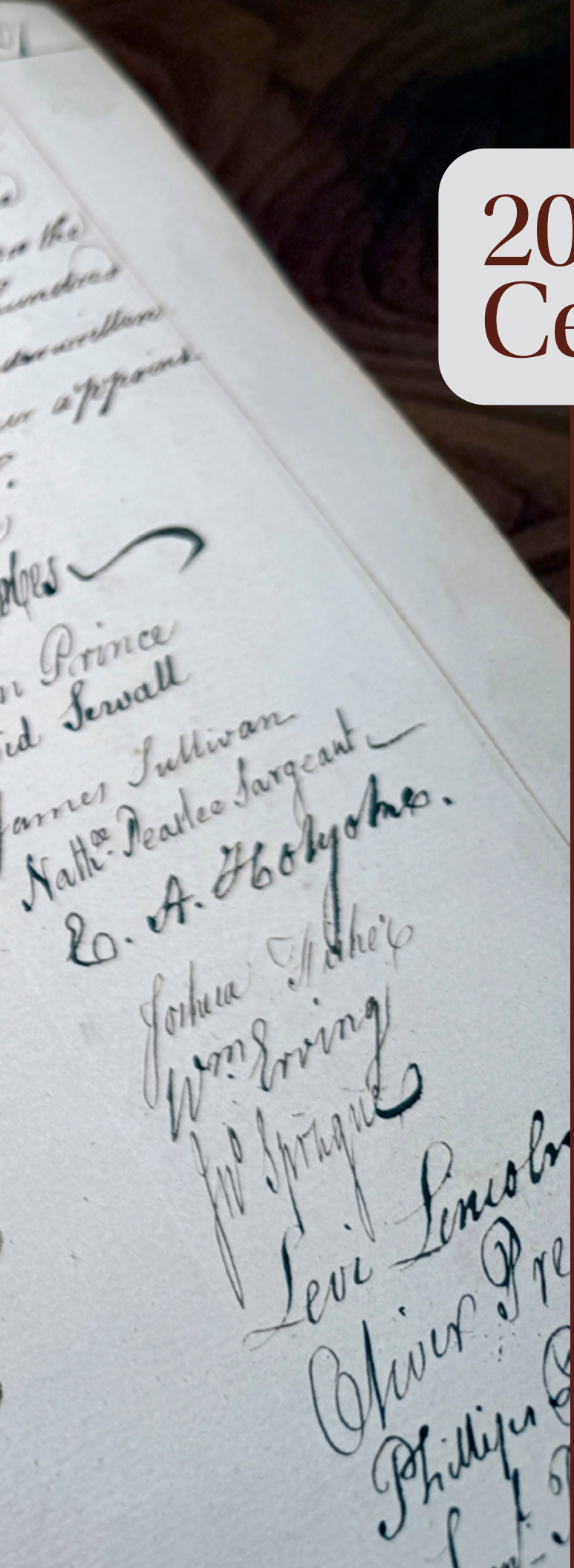
RUBENSTEIN: You're a great role model. I want to thank you for your service to Duke University and to the country and for the great job you have done for the Olympics and what you're going to do next time for the Olympics when you pick some younger players and maybe a Jewish player. Thank you for being with us this evening and welcome to the Academy.

HILL: Thank you.



To view or listen to the presentation, visit www.amacad.org/events/grant-hill-david-rubenstein-interview-2024-induction.


For the removal of all doubts, who are
members of the American Academy of
Arts and Sciences, incorporated by the
General Court of this Commonwealth
third day of May one thousand seven
and eighty; We, whose names are
do hereby declare our acceptance of
ment of Election as Members thereof
James Bowdoin
Cotton Tufts
Thos. Dawes
John Lowell
Elisha Story
Richard Cranch
Samuel Baldwin
Eliphalet Pearson



# 2024 Induction Ceremony

2127th Stated Meeting | September 21, 2024 | Sanders Theatre, Harvard University

On September 21, 2024, the Academy inducted over two hundred of the new members elected in 2024. As part of the ceremony, the new members signed the Academy's Book of Members, a tradition that dates to 1785. The signatures in the photo on the left are from some of the Academy's earliest members.

The class speakers at the Induction Ceremony explored several themes, including the value of curiosity and the unexpected; strategies to prevent scientific failures with harmful consequences; the role of the social sciences in addressing the urgent challenges of today; the processes of transformation and translation; and how openness fosters innovative and sustainable problem-solving. The ceremony featured presentations from theoretical astrophysicist **Charles F. Gammie**, research ecologist **Helene Muller-Landau**, lawyer and legal scholar **Daniel E. Ho**, writer and translator **Jhumpa Lahiri**, and economist and nonprofit leader **Cecilia A. Conrad**. An edited version of their presentations follows.

## Charles F. Gammie

Charles F. Gammie is the Stanley O. Ikenberry Endowed Chair in Astronomy and in Physics at the University of Illinois at Urbana-Champaign. He was elected to the American Academy of Arts and Sciences in 2024.


It is a joy and an honor to be here today, to be inducted into the American Academy of Arts and Sciences, and to speak on behalf of Class I, the Mathematical and Physical Sciences. This weekend has instilled a sense of wonder and accomplishment at joining such a remarkable fellowship. Being admitted to the company of Euler, Gauss, Einstein, and so many others who created the intellectual landscape we inhabit today is deeply moving for me, and perhaps for you as well.

It is this sense of wonder that I'd like to talk about today. My main point is about the importance of curiosity, surprise, and the unexpected – in my life, in my discipline, and in the work represented in the Academy more generally.

I began college expecting to study math and go on to law school, maybe because I had a keen interest in history. Curiosity led me astray, however, and I found a course on Einstein's theory of gravity so attractive that I was drawn toward the study of physics. To my great surprise, when I finished college I was headed for graduate school in astrophysics rather than law school, and my keen interest in history had been surpassed by a keen interest in a historian, who I was later fortunate to marry!

I have continued to follow my curiosity in the intervening years, and it has led me on many unexpected adventures. I still have vivid memories of the smell of metal and machine oil inside the twenty-foot horn antenna at Bell Labs, where the cosmic microwave background, the relic of the Big

We now know that our galaxy, the Milky Way, contains not just a hundred billion stars but also *at least* a hundred billion planets. Do any of these planets harbor life? I hope that within my lifetime curiosity-driven research can bring us an answer to this question and, along the way, bring us unexpected answers that can change lives for the better.

Bang, was discovered; seeing snow fall through headlight beams atop Mauna Kea on the Big Island of Hawaii, where telescopes study distant galaxies, planets, and black holes; and speaking with reporters at the National Press Club in Washington, D.C., where the Event Horizon Telescope collaboration unveiled the first image of a black hole.

That black hole image was seen by billions of people and, in what was perhaps our collaboration's greatest achievement, inspired Krispy Kreme to offer free orange donuts for a day!

The black hole image was more than a treat for donut eaters. It demonstrated beyond a shadow of a doubt that the massive dark objects found at the centers of galaxies, including our own Milky Way galaxy, are black holes containing the mass of millions to billions of suns. The image also set us on the road to measuring the one number *other* than mass that describes a black hole: its rotation rate or spin. To do this we will need to make sharper images of a black hole from a satellite in orbit around the Earth, and also make a movie of a black hole.

My colleagues and I have had great fun thinking about black holes. People around the world have had fun reading about it and looking at our images. And soon, we hope, people will have fun viewing the first movie of a black hole. But does all this have a more serious purpose?

As my Scottish grandmother once asked when I told her that I was going to study astronomy, "are there any commercial possibilities?"

This returns us to the theme of the importance of the unexpected, of surprise, and especially of curiosity-driven research. It seems to me that curiosity-driven research will continue to be important, even in a world beset by climate change, war, and the disruptive advent of intelligent machines. I will offer just a couple of reasons for the pursuit of curiosity-driven research, using astronomy as an example.

The first reason is that astronomy inspires. Astronomy inspires children, students, adults, and researchers to widen their perspective, to think about our place in the universe, and to learn to solve problems. It is an educational strategy that works. You will find former physics and astronomy students from my own University of Illinois working in almost every field of human endeavor: in agriculture, education, online commerce, public policy, finance, insurance, and energy. You will even find one of them working as a statistical expert in major league baseball. For the Houston Astros, of course.

The second reason is that curiosity-driven research is an efficient strategy for advancing human knowledge. This is a familiar argument, and there are many examples that you have probably heard before. But one connected to black holes may be new. Einstein's theory of gravity, general relativity, developed through curiosity-driven research more than a century ago, predicted the existence of black holes. It was, much later, used to predict the characteristic donut of light seen in Event Horizon Telescope images of black holes. This same theory is also fundamentally embedded in the design of the global positioning system, or GPS, which your phone uses to determine your position, anywhere on Earth, to within a few meters.

To end on a hopeful note, I want to emphasize that the space above our heads is full of opportunity. We now know that our galaxy, the Milky Way, contains not just a hundred billion stars but also *at least* a hundred billion planets. Do any of these planets harbor life? I hope that within my lifetime curiosity-driven research can bring us an answer to this question and, along the way, bring us unexpected answers that can change lives for the better.

## Helene Muller-Landau

Helene Muller-Landau is a Senior Scientist at the Smithsonian Tropical Research Institute based in Panama and Lead Scientist of the ForestGEO Global Carbon Program. She was elected to the American Academy of Arts and Sciences in 2024.

Thank you to the Academy for this honor. I'm humbled to be here in such august company. I thank the many people who have shaped my path here – family, teachers, mentors, colleagues, and students.

I'm not going to talk today about any of the many wonderful scientific accomplishments. Instead I'm going to talk about scientific failures, cases where scientific "experts" and indeed the scientific community as a whole came to incorrect conclusions that led to real harms. And I ask what we as a scientific community can do to avoid such tragedies.

It's easy to come up with many past instances when scientists got things very wrong, with grave consequences. Only a century ago, leading scientists of the day argued that top predators like wolves and hawks are vermin and should be eliminated, that schizophrenia is caused by poor mothering, that forcibly removing Native American children from their homes and communities to be raised in boarding schools would do them good.

We can look back on these errors and shake our heads at how scientists at the time got it so wrong, how much damage this caused, speculate on how they let their prejudices distort their science, congratulate ourselves on how we know so much better today, how we are better people, better scientists than they were.

But we are not without our own biases and blind spots.

So I ask, when future generations, say one hundred years hence, look back on the science of today, what errors will they see that we are blind to?

**How did we end up with scientific recommendations that actually reversed prior practices and made things worse?**

How will they judge us? And when I talk about errors, I do not mean just the individual scientists who were wrong. Obviously, scientists are not gods. We make mistakes. Individual studies can be misleading. But science is supposed to be self-correcting and robust to such mistakes.

Yet within our lifetimes, not only individual scientists but the scientific community as a whole have made major mistakes with grave consequences. Forest scientists practiced complete fire suppression; the biomedical community promoted low-fat, high-carbohydrate diets; educators de-emphasized phonics in reading instruction. Think about your own fields, your own experience and knowledge of policy-relevant science, and I'm sure you can all come up with many more examples.

Much has been written about the declining trust in science, especially in the United States. Blame is often placed on political polarization, on disinformation and misinformation, on bad actors. Efforts to combat this, including some by this Academy, focus on helping scientists communicate their science better, educating the public about how science works, countering misinformation. And the basic message is: the problem isn't us scientists; it's them, the public. And the way the press reports on science. And the bad self-interested actors like Big Tobacco and Big Oil.

Now surely these factors all play a role in the declining trust in science, and a lot of good work has been and is being done to address them. But I think we are letting ourselves – the scientific community – off the hook too easily.

Consider the life experience of a hypothetical American who has been "listening to the science" all his life.

- He switched to a low-fat diet after the surgeon general's report came out, and for decades struggled with his weight and associated metabolic disorders. And then the scientific advice changed. He switched to a low-carb diet and lost weight.
- The Forest Service practiced complete fire suppression for decades in the national forest near his home. The fuel built up, and eventually there was a catastrophic fire that burned down his house.
- He had two kids, and when the first one was a baby, doctors said to avoid feeding babies peanuts or other potentially allergenic foods to reduce the chance of peanut allergies. So he followed that advice, *even though his parents told him they had fed him and his sister peanuts early on and neither he nor his sister developed allergies*. His first child, a son, developed a severe peanut allergy. By the time he had his second child, a daughter, the scientific guidance had changed to recommend early introduction of allergenic foods. He followed that advice, and his daughter never developed allergies.
- His son's elementary school teachers followed a reading program in vogue at the time that de-emphasized phonics, and the boy struggled with reading for years. By the time his daughter reached kindergarten, the school had switched to a phonics-centered program, and his daughter had no trouble with reading.

Looking back, the latest scientific advice had major detrimental effects on his health, his home, his son's health, and his son's educational trajectory. Is it any wonder some Americans don't trust science or scientific advice?

Obviously, hindsight is 20/20, and we can't blame people for not knowing then everything that we know today. But how did we end up with scientific recommendations that actually reversed prior practices and made things worse? Why did self-correction take so long, with such high casualties in the meantime? What went wrong? And where is the mea culpa from scientists? Where is the post-mortem of how this happened? The only post-mortems I know of are from the popular press. Where is the self-reflection of the scientific community on what went wrong and how we can do better in the future? Where are the lessons learned?

I think we are missing a major opportunity to do better: to improve science, to improve scientifically based policy recommendations, to improve human well-being.

We, the scientific community, have a successful model for post-mortems that we could build on. In 1999, the Institute of Medicine released a report

"To Err is Human: Building a Safer Health System" that revealed that 98,000 patients were dying in U.S. hospitals every year of preventable medical errors. At the time, these errors were seen either as inevitable and accepted with resignation, or as the result of a few bad apples that needed to be weeded out. Any investigation tended to focus on assigning "shame and blame."

But that report ultimately led to a major shift in how medical errors were viewed, to the recognition of systemic problems contributing to errors, and to shifts in practice that have greatly reduced these preventable errors and deaths.

I think we owe the public, and we owe ourselves, thorough post-mortems on major failures of past scientific recommendations. What went wrong? And how can we, both individually and as a community, do better in the future? Because, if we don't learn from our mistakes, we are doomed to repeat them. And not only will this result in a continued decline in trust in science and the influence of scientists, but more importantly, it will do actual harm.

I don't know what we would find if we did such a post-mortem. But I have some ideas on what we might do, collectively and individually, that might help.

1. Remember that the road to hell is paved with good intentions. In all these cases, including the horrific older ones, the scientists involved thought they were advancing the public good.
   - Good intentions don't make us right.
2. Don't allow a heckler's veto and, more generally, don't allow a "bad actor's" veto. Reviewer comments such as "This study will be misused by evil people (Big Food, Big Oil, opposition politicians) to stymie urgently needed action on an important problem or to unjustly attack good people" should not be allowed to affect publication decisions or scientific conclusions or recommendations.
   - Everything can be misused or twisted to bad ends. We need to get the science right or we risk doing more harm.
3. When developing policy recommendations, seek out opposing viewpoints, and carefully consider them.
   - Seek broad input from the scientific community, not just from those most inclined to speak up.
   - Develop mechanisms for anonymous expert input, especially on controversial or politically hot topics. Any differences between anonymous and non-anonymous experts are a red flag.
4. Look to other times and places, and if practices and recommendations differ, consider why.
   - We can't look to the future, unfortunately, but we can look to the past, and to other countries.
5. Don't overstate certainty.
6. Don't rush to a false and premature consensus.
7. Don't suppress dissent out of fear that a known lack of consensus among scientists might be misused by opponents of the policy recommendations (that would be a bad actor's veto).

"I think we owe the public, and we owe ourselves, thorough post-mortems on major failures of past scientific recommendations. What went wrong? And how can we, both individually and as a community, do better in the future?

Those are things we might do as a community. As to what we can do as individual scientists:

1. Don't be overconfident. Be humble. There is so much we still do not know.
2. Don't tie up your ego with being right.
3. Don't personally attack people who disagree with your position.
4. Don't invoke the bad actor's veto to try to suppress views you disagree with.
5. Don't remain silent when you thoughtfully disagree with the prevailing viewpoint, or when you see problems with the process, like suppression of dissent. Don't self-censor. Be brave.
6. Finally, be less concerned about the judgment of your peers and the public today. Think instead of the judgment of future generations. How will future scientists, future people, judge us?

## Daniel E. Ho

Daniel E. Ho is the William Benjamin Scott and Luna M. Scott Professor of Law, Professor of Political Science, Professor of Computer Science (by courtesy), Senior Fellow at Stanford's Institute for Human-Centered Artificial Intelligence, and Senior Fellow at the Stanford Institute for Economic Policy Research at Stanford University. He was elected to the American Academy of Arts and Sciences in 2024.

It is such an honor to be here. Being inducted into this venerable institution and filmed here today indeed fulfills the dream of a lifetime: to star in a film associated with the name George Clooney! In all seriousness, it is hard for me to convey how grateful and honored I am to be at these festivities today.

I grew up in a small town in Germany. By virtue of a generation displaced by the Chinese Civil War and World War II, my parents found themselves in a strange country in their twenties. I saw a generation of Germans question the choices of their parents. And I remember as a young boy seeing firecrackers on the streets when the Berlin Wall came tumbling down.

That childhood left me with an indelible impression: our social institutions are fragile. And I've spent much of my adult life trying to wrestle with that fact. Trust, and public trust, is earned in drops and lost in buckets.

Those indelible impressions are what drew me to law and the social sciences. Some see a sharp juxtaposition between the two. Law is about advocacy and how things should be. The social sciences are about observation and how things are.

But the world's most wicked problems are social problems, which don't come packaged neatly in disciplinary trappings. Despite the fact that the American Academy of Arts and Sciences might classify us neatly into different Classes and Sections by discipline, there is deep value and urgency in engaging across these boundaries, just as we are today.

So much can go wrong if we don't. I'm reminded of a faculty lunch between two colleagues: one an international human rights lawyer and the other an intellectual property scholar. They spent

several minutes engaged in a vigorous debate about pirates. But only five minutes into this debate did they realize that one colleague was talking about *Somali* pirates and the other one was talking about *software* pirates. I think they came to more agreement after clearing that up.

Let me offer three examples of how our institutions – and the urgency to strengthen democratic institutions – need that broader form of engagement across boundaries and with the social sciences.

*Example One*. The county I live in, Santa Clara County, was the first in the country to see the trajectory of the pandemic and issue a shelter-in-place order, which was informed by the emerging infectious disease science. But within a matter of weeks, the social dimensions of COVID-19 hit with a vengeance. Although Latinx individuals make up about 25 percent of the county's population, they accounted for more than 50 percent of the COVID-19 cases. In order to tackle dramatic racial disparities, the classic public health toolkit had to grapple with social disparities. To allocate scarce testing resources, a conventional strategy favored by infectious disease experts was to go after household members of people who tested positive. But the precise worry was about blind spots in testing coverage. We showed in one intervention that the *social* knowledge of community-based health workers (promotoras de salud) and simple insights from machine learning doubled or tripled the effectiveness of the conventional strategy. Public health could not afford to turn a blind eye to the social disparities of disease.

*Example Two*. One of the fiercest debates of our time is around the governance of artificial intelligence, how to harness its potential for good while addressing its potential for bias, privacy violations, worker displacement, disinformation, and the like. Conventionally, AI has been evaluated via technical performance benchmarks. But as AI moves into the real world, those computer science benchmarks are proving woefully insufficient. The fear is not about the technical property alone; it is about the human-machine interaction, which requires the science of human decision-making. The funny thing about humans is that they can ignore, overrule, or overrely on algorithmic tools. Humans love automated music recommendations, but hate medical ones. Some judges rely too much on criminal risk assessment scores and others find them a waste of time. In recognition of the need to treat the governance of AI as a sociotechnical challenge, the Stanford Institute for Human-Centered AI and Stanford RegLab bring together a wider range of disciplinary perspectives and communities to ensure that the future of AI centers human values and social impact.

“To address wicked problems requires engagement across boundaries. Working to help solve society's toughest problems leads us to a more engaged social science, one that moves from dispassionate observation to engagement, collaboration, and, yes, intervention.

*Example Three*. What is the future of government in light of existential challenges to democracy? Public trust is at an all-time low. And part of the blame is that government programs often don't work very well. It is in the basic citizen-state interactions – the payment of an unemployment check and filing of a tax refund – where public trust is earned or lost. For decades, the Supreme Court has emphasized the need for accuracy in these interactions: in benefits decisions for veterans, immigrants, and the disabled. Emerging technology may help increase accuracy in government decision-making. But over the course of the twentieth century, the Supreme Court came to neglect equally important values, like dignity and equality, in favor of accuracy as the lynchpin of procedural due process. A program with perfect accuracy may still fail its most basic democratic goal. The wrong move would be to use technology to wholesale skip hearings in the name of accuracy and efficiency. As one veteran noted to a judge, “Judge, I know I'm going to lose, but I just want to be heard.” We can treat government programs like an engineering challenge, but as the social sciences teach us, process – and dignity – matters.

Each of these simple examples teaches the same basic lesson: to address wicked problems requires engagement across boundaries. Working to help solve society's toughest problems leads us to a more engaged social science, one that moves from dispassionate observation to engagement, collaboration, and, yes, intervention.

Science is social, and we cannot tackle the most urgent challenges of the day without the social sciences.

## Jhumpa Lahiri

Jhumpa Lahiri, a bilingual writer and translator, is the Millicent C. McIntosh Professor of English and Director of Creative Writing at Barnard College, Columbia University. She was elected to the American Academy of Arts and Sciences in 2024.

As this year's Class IV speaker, I represent the Humanties and Arts: I am part of this group, and our group forms a part of the Academy as a whole. Thanks to this ceremony, my fellow inductees and I will begin to take part in the Academy's activities. Being a part, taking part: these are synonyms for being a member, participating, contributing to a greater good.

In recent years I have been pondering the significance of parts and wholes in relation to one of my current projects: an English translation of *The Metamorphoses*, Ovid's opus magnum, composed in Latin between about 2 and 8 CE. I am undertaking this translation with a former colleague at Princeton, classicist Yelena Baraz. Given its collaborative nature, our translation is partly hers, partly mine.

It was in a college Latin class that I first encountered Ovid's *Metamorphoses*, a deeply variegated text describing approximately 250 accounts of human transformation. When Ovidian transformation occurs, the new state of being, whether animate or inanimate, tends to retain certain aspects of the previous self. Thus the Myrmydons, in Book 7, are ant-born soldiers who retain their frugal nature and ability to toil. Ovid reminds us that we all contain the seeds of change – sometimes radical change – within us.

Why did this work speak to me in my twenties? Why does it guide me still? Perhaps because I recognize my own hybrid identity in its weave. From childhood I lived partly in one language, partly in another. My upbringing had two landscapes, two idioms, two traditions, a juxtaposition of values. I wrote to explore different parts of me. Over the years, my creative and intellectual life has broken down into further parts: there is the writer in me, the academic, the translator, the part that writes in English, the part that writes in Italian. This double register correlates to how I was raised, by parents partly in the here and now, partly attuned to a reality unfolding on the other side of the world.

Borders, partitions, limits: these are terms in English to signify that which separates and divides. Italo Calvino, in his introduction to an Italian edition of the *Metamorphoses*, observes that Ovid is always problematizing borders and frontiers.[1] But Ovidian borders, Calvino notes, are porous, serving to both demarcate and merge separate identities. Indeed, though the poem is segmented structurally and narratively, its essence is fluid, rich with slippage and ambiguity.

At the start of the poem, Ovid describes Creation, a state of affairs in which there are no parts. Here is our translation-in-progress:

> Before sea and lands, and sky that covers all
> nature showed one face across the whole globe,
> called chaos: a rough, unprocessed mass,
> merely an inert clump heaped together in
> one spot:
> discordant seeds of disparate matter.[2]

The word "all" (*omnia* in Latin) appears in the first line of this passage, while the final line contains "disparate" (in the Latin, *non bene iunctarum*, meaning not well-joined). The original universe, lacking limits, lacking places, is called chaos, a word and concept that come from ancient Greek, meaning void, which comes to mean disorder.

My gravitation toward reading stories, which led me to writing them, was an attempt to organize the incoherence of life. Books were a parenthesis; stories, a refuge from my not well-joined self. The more I thought about literature, the more I realized that it was an open-ended, partial conversation. Artists and writers don't strive to find solutions or arrive at incontrovertible truths. In questioning and confronting facets of the human condition, they may modify our perspective. Someone – Picasso – exaggerates the partial nature of the human face, altering the way we see each other and ourselves. Literature, too, thrives on detail. I have never forgotten the description of poor Narcissus' chest in Book 3 of the *Metamorphoses* after he beats himself, as the image of his beloved, another part of himself, dissolves into water:

> much like those apples that are partly white,
> partly red as well, or the way grapes in
> multi-hued clusters, still unripe, acquire a
> purple shade.

**"Translation accompanies the text across its natural limits, altering language so that readers can comprehend written words from other cultures, and recognize the other in themselves.**

Like some apples and grapes, much of nature is hybrid in aspect. And yet, being composed of different parts, being biracial or bicultural or bilingual, being someone who has chosen or been forced to cross borders, has never been easy. In Greek mythology, hybrid creatures were tantamount to monsters. Those of us who house more than one self in our souls may feel like imposters every time a boundary is drawn, every time our commingled origins are called into question. We cannot claim a mother tongue or pinpoint where we are from; we fear that our various parts don't amount to an authentic whole. A piecemeal identity, something Ovid spotlights in antiquity, something Primo Levi reiterates when he calls man as a centaur, "a tangle of flesh and mind," threatens a world preoccupied by borders, populist movements, paradigms of normativity, and ideologies of the nation-state.

1. See Italo Calvino, "Gli indistinti confini," introduction to *Le metamorfosi*, ed. Piero Bernardini Marzolla (Einaudi, 1979).

2. This translation and the rest that follow are the work of Jhumpa Lahiri and Yelena Baraz. All of the translations are in progress.

**Much of nature is hybrid in aspect. And yet, being composed of different parts, being biracial or bicultural or bilingual, being someone who has chosen or been forced to cross borders, has never been easy. In Greek mythology, hybrid creatures were tantamount to monsters. Those of us who house more than one self in our souls may feel like imposters every time a boundary is drawn, every time our commingled origins are called into question. We cannot claim a mother tongue or pinpoint where we are from; we fear that our various parts don't amount to an authentic whole.**

You don't need me to tell you that the humanities are in peril, that people read less, that foreign language departments are disappearing. These changes trouble me and some members of my group; like climate change, they will have grave consequences for our world. The poet Patrizia Cavalli wrote a book called *My poems can't change the world*. She's right, they can't; but they might change a reader, and each reader is part of the world. That is why some of us continue to make poetry, teach it, keep it relevant. Art and poetry can reframe the world by centering the peripheral, lingering over what goes unnoticed. But a poem, written in any given language, only reaches part of its potential readers. Translation accompanies the text across its natural limits, altering language so that readers can comprehend written words from other cultures, and recognize the other in themselves. Translation, the most humanistic of endeavors, is one in which artificial intelligence can never play a relevant part.

*Ma phaleshou kadachana*. My father taught me these three Sanskrit words from the Bhagavad Gita when I was young. They mean: Do your work, but don't expect the fruits of your actions. I work with words, reading and forming and transforming them, with no other purpose or mission. My father began the American part of his life's journey here in Cambridge, working as a librarian at MIT; here sprang the American strand of my identity. We lived behind Inman Square, my mother walked with me up Mass Avenue to play in Harvard yard, and when we moved to Rhode Island, she brought me back to Sanders Theatre to appreciate classical Indian music concerts played upon this stage.

In poetry, there is a rhetorical device called synecdoche that refers to the play between parts and wholes. In ancient Greek, synecdoche means to understand more than one thing at once. Ovid uses synecdoche to describe the sea according to its green-blue shade, or a wing by virtue of its feathers. I recall my Cambridge origins because they form part of my metamorphic beginnings. They link a previous part of me to the here and now, and contribute to the emotion of standing before you today.

# Cecilia A. Conrad

Cecilia A. Conrad is a Senior Advisor at the John D. and Catherine T. MacArthur Foundation and CEO of Lever for Change, a nonprofit that helps donors find high-impact philanthropic opportunities. She was elected to the American Academy of Arts and Sciences in 2024.

My dad was born in Baton Rouge, Louisiana, where he started college at Southern University, an HBCU, at the age of sixteen. In his junior year he was drafted for World War II, but then something extraordinary happened, especially in 1940s Jim Crow Louisiana. My dad took a special science and math exam, and based on his performance on that test the Army sent him to Stanford instead of to combat, and then paid for his first year of medical school at Meharry. Southern University clearly provided a solid education, but my father described his arrival in Palo Alto as life-changing. He talked about the thrill of sitting on the first floor of a movie house in seats with arm rests instead of in a segregated balcony. He expressed gratitude to his white roommate who invited him to spend Thanksgiving with his Los Angeles family. Doors that had been closed were now open.

He spent the rest of his life pushing doors open for others. He was a surgeon, but also a public servant. As the first Black man elected to the Dallas School Board, he created a free breakfast program, pushed for bilingual education, demanded equal pay for Black and white teachers, kept pregnant teens in classrooms – and the list goes on. Clearly that open door, that opportunity, benefited not only my dad but society writ large.

I am my father's daughter. Like him, I benefited from formerly closed doors that were opened by the concerted efforts of his generation. An early affirmative action initiative created as part of a historic settlement of the *EEOC v. AT&T* case funded a college internship at Bell Labs and my graduate education. And like my dad, a central goal in my career has been to open doors. As a professor and academic leader, I've pushed for access and inclusion

Openness requires both an open door and a receptiveness to new perspectives, to reasoned opinions not your own. It requires humility and acknowledgment that no matter the wealth one has accumulated, or the accolades and validation one might receive, including election to this Academy, others might have better ideas.

across disciplines, but most especially in my own discipline of economics.

When I came to philanthropy eleven years ago, I was surprised that there were so many closed doors. An overwhelming percentage of foundations, over 70 percent, do not accept unsolicited requests for funding. Grant opportunities are mostly by invitation only, a likely contributor to the big disparities in revenue and assets between white-led and Black-led early-stage nonprofits. I was also surprised at how little focus there was on solving problems as compared to mitigating the symptoms of problems. With average grants of under $50,000 and a duration of eighteen months, we're unlikely to make significant headway on critical problems. So when then–MacArthur President Julia Stasch asked, "What if we opened things up?" I leapt at the chance to create a new model for philanthropic giving.

Our first experiment was 100&Change, an open call grant competition that asked problem-solvers around the world, "How would you use $100 million to make significant headway in solving a problem?" The first grantee of 100&Change is an early childhood intervention in the Syrian refugee region of Jordan, Lebanon, Iraq, and Syria, led by Sesame Workshop and the International Rescue Committee. At year five, this intervention has improved children's learning and their caregivers' well-being by delivering customized educational content, including a new local version of Sesame Street that reaches 240 million children.

Our model is open – not only because any organization can apply, but also because we welcome diverse ideas and perspectives. We are open to listening to independent voices and relying on their advice to guide donor decisions about what to fund. We crowdsource multiple forms of expertise to help donors find where their dollars might have the greatest impact. And by facilitating large multiyear grants, we empower nonprofits and social entrepreneurs most proximate to the issues to identify the critical problems to be solved and implement the solutions that work.

Since that first experiment, Lever for Change has designed and managed over a dozen open calls on behalf of individual donors and foundations and facilitated over $2 billion in gifts. We have learned that openness finds organizations not on the radar of most foundations and major donors, leads to greater equity in grantmaking, uncovers unexpected collaborations like Sesame Street and the International Rescue Committee, and inspires creative, sustainable, and feasible approaches to solving problems. These lessons apply beyond philanthropy. Openness requires both an open door and a receptiveness to new perspectives, to reasoned opinions not your own. It requires humility and acknowledgment that no matter the wealth one has accumulated, or the accolades and validation one might receive, including election to this Academy, others might have better ideas.

I am struggling with the humility part this afternoon. I've heard a lot of humility among my fellow inductees, but I will admit I'm feeling pretty good right now. But whenever I get a little out of line, I have a voice in the back of my head that belongs to my mother-in-law. My mother-in-law, a brilliant Bajan woman, helped make it possible for me to be here today because she took care of my son when he was young. We didn't always see eye to eye. One day in a fit of peeve she said to me, "You may have a PhD, but you don't know everything." So it is with deep humility and Edith's voice in my ear that I look forward to signing this book and joining this historic organization.



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To view or listen to the presentations, visit www.amacad.org/events/class-speakers-2024-induction.

# Memory Is About Your Future:

## What We Think We Become

2128th Stated Meeting | September 22, 2024

The closing program of the Academy's 2024 Induction weekend featured a presentation by new member **André Fenton** about the science and stimuli of memory, followed by a conversation with incoming Academy President **Laurie L. Patton**. An edited transcript of the presentation and conversation follows.

## Laurie L. Patton

Laurie L. Patton began her term as President of the American Academy of Arts and Sciences in January 2025. She previously served as the 17th President of Middlebury–the first woman to lead the institution in its 224-year history. She was elected to the American Academy of Arts and Sciences in 2018.

It's wonderful to see everyone this morning. I hope you're rested and refreshed. Our program today is not the Induction Ceremony all over again, but something else entirely. We hope the program is fun and an informal conversation between friends. By now, at this moment in the weekend, I'm hoping you are over your imposter syndrome and just happy to be in the company of people who like to talk about ideas.

It's my pleasure to introduce our speaker. I think André Fenton was chosen because of the almost universal fascination with the question of mind and memory. Let me share a little bit about his background. He knows how to work with humanists, scientists, social scientists, and artists because he's a deeply interdisciplinary person.

André Fenton grew up in Guyana and Toronto and was educated at McGill University. His undergrad thesis was on the neurobiology of crickets. And his first job after college was at the Czech Academy of Sciences in the research group of Jan Bureš, studying the hippocampus. He earned his doctorate from the State University of New York, where he looked at how cues affect the hippocampus. His research broadly involves how brains create, store, and experience memories using electrophysiological experimental techniques, some of which he has pioneered himself, combined with theoretical analysis. He has also studied how the hippocampus is involved with information processing and the formation and recollection of memories across different timescales. Who isn't interested in that? Welcome, André.

## André Fenton

André Fenton is Professor of Neural Science at New York University. He was elected to the American Academy of Arts and Sciences in 2024.

Good morning. This is quite an honor, and it's also very humbling. I could never imagine giving a talk like this to an audience like this. It's really breathtaking that I'm here at the Academy and also a new member of the Academy. Thank you for giving me this opportunity.

We all have an intuition about what our memories are. And the ordinary intuition is that it's something about the past. It's how we store our past, and how we retrieve our past. For most of my career, I've been a memory scientist. Some might say I'm a world expert in memory, but that is a mistaken understanding. I would like to share with you my more recent understanding, which is stated in the title of my presentation: Memory Is About Your Future: What We Think We Become. Our memories are really about our futures. I'm going to make the case not just from opinion, but from the evidence that you can measure with electrodes and proteins and the anatomy of the brain. And so if that's true, then our experiences, which are predicated in the brain, are designed in many ways by our past and inform our future and what we think we can become. So that's the thesis of today's argument.

Let's start at the beginning. Slide 1 (S1) shows me when I was six years old, standing in front of my grandmother's house in Guyana, where I was born. I used to be really embarrassed about this picture and so to get over that, I now show it everywhere! In preparing for this presentation, I

wondered, what was I thinking about in this picture? And to be honest, I have no idea. And I'm a memory expert. Anything that I imagined that I was thinking is probably confabulated and made up. But what I'm really sure about is that I was not thinking about opportunity, impact, commitment, or the Academy. What I understand today is that I had an incredible opportunity because I left Guyana, went to Toronto, spent some time in the Czech Republic, and now I reside in New York. And that opportunity really came from my mother, who's here today. I can't figure out how to thank her for taking me out of Guyana and giving me those opportunities. And I've been trying to think how to give her the honor and the recognition for that. Today happens to be her 80th birthday. So, happy birthday, mom. This presentation is devoted to her!

This image in slide 2 (S2) is a word cloud, which I created using a lecture that I had given that you can find on the internet. What is interesting is that the lecture is not actually about memory. But these are the concepts that occupy my mind. To give you some insight into why I use these words so often, I would like to start with my daughter Zora. In slide 3 (S3), Zora is approximately the same age as I was in the photo of me that I just showed you. Next to the photo of Zora is a painting that I would show her when she was three, four, and so on. What's interesting about this painting is that when Zora looked at this before she was six, she would only see dolphins. Does anyone see the dolphins here? Okay, there's an innocent there! Most people see


the couple in an intimate embrace. Zora started to see the couple in an intimate embrace, which was worrisome, when she was about seven or so. But before that, she only saw the dolphins. And for those of you who are too shy to say you don't see the dolphins, this is actually a painting of nine dolphins. We could spend most of the lecture time so that you could all see the dolphins. But trust me, there are dolphins there. What's really important about this is that it demonstrates the thesis of what I want to show you. Zora's experience and your experience with human intimacy change how you perceive this painting. For many of us, it's hard to see the dolphins because from our experience we see the couple. So why is it that your experience changes your mind such that going forward you don't see the dolphins, or it's effortful to see the dolphins?

Zora Fenton


Sandro del Prete

S3

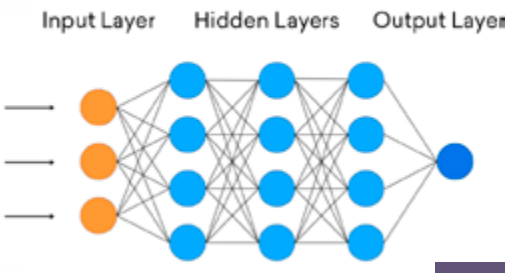
I have the good fortune to work in a laboratory that I founded: the Neurobiology of Cognition Laboratory. I'm going to talk about why we don't see the dolphins from the point of view of the work we do in this laboratory. By the end, I hope to work through the different concepts of memory that have been traditionally used when people talk about memory, using the technology of their time. Plato imagined memory to be a wax tablet that you would inscribe (S4), and there would be a trace of experience in that tablet. Many people think of memory as being filed away in a filing cabinet or a bunch of photographs that you would put somehow in some order so you could retrieve them. And the last concept is a deep neural net, like ChatGPT.

So where is memory? Is memory in the individual, in a society, in the brain, in a neural network, in a neuron, in the synapses that connect those neurons? Is it in the proteins, in the channels of those neurons, or in the DNA? The crazy thing is memory is everywhere. It is operating at all of these levels. It's a process and not a thing. In our laboratory, we use mice because we can make manipulations at these different levels of biology.

How to think about memory?

GustavoG | Flickr

McCarony




Calin Cretu

S4

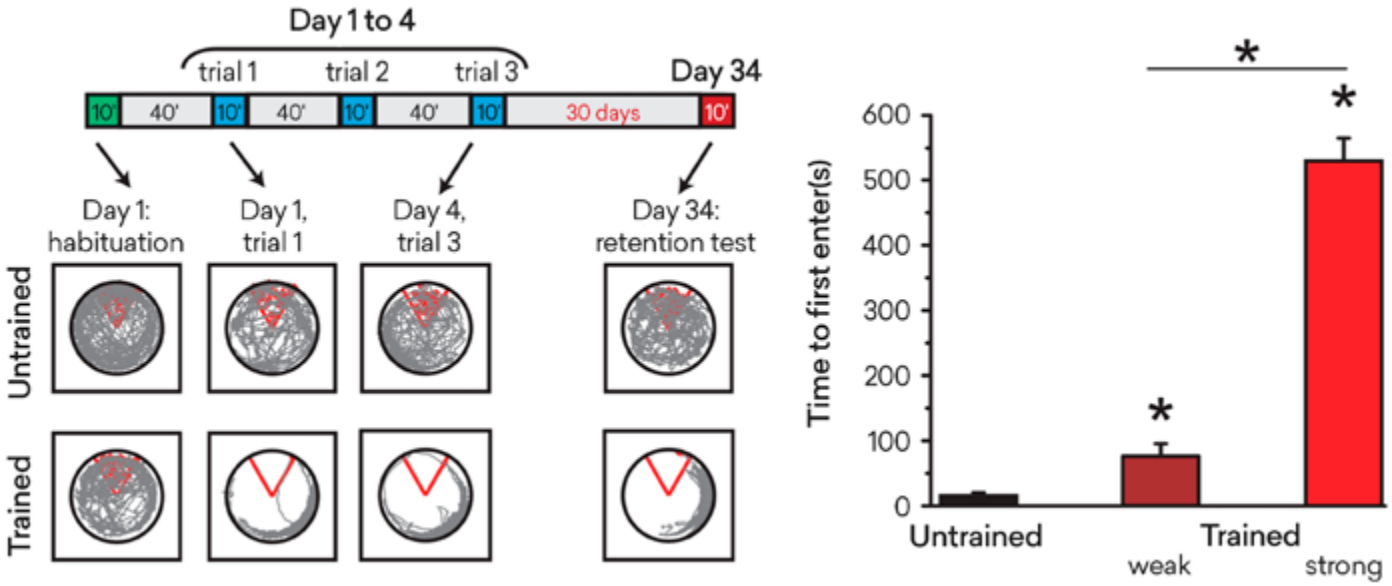
We use mathematics, machine learning tools, and some complicated things that aren't really so complicated. I will show you some of those tools in order to make the connections across these levels.

We focus most of our studies on a part of the brain called the hippocampus. One of the things we can do is ask the mouse to learn something in a way that it can demonstrate that it learned that thing. For example, in one of our studies, we put a mouse on a rotating arena, with the computer tracking the position of the mouse. When the mouse is detected in a particular zone, the computer can electrify the floor just a little bit, so it's unpleasant for the mouse to be in that area, and it turns off the shock when the mouse leaves. Mice don't like to have their feet shocked, so the mouse will stay away from that area. After the mouse has learned something, we reward it by killing it humanely, slicing through its hippocampus, and then probing electrophysiologically the strength of the synaptic connections between the neurons. We can measure the synaptic response to a stimulation of neurons in the tissue.

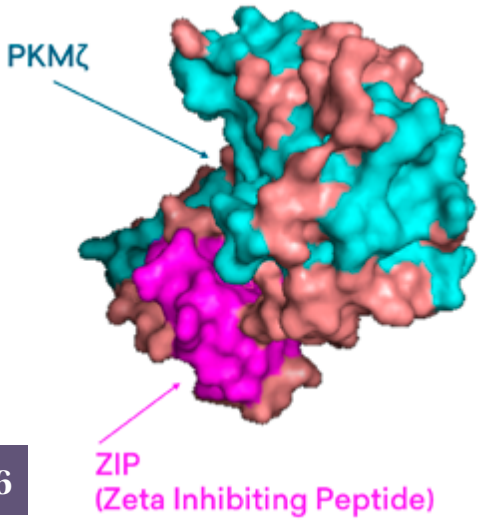
In our study, we have a control mouse that doesn't get the training and a mouse that is trained (S5). What can we see a month after the memory has been acquired? Some mice don't remember very well, while other mice are the good students, and they remember very well. They take ten minutes before they enter the shock zone a month later. If we look in the brains of those mice, we see a couple of things. We are measuring the strength of those synapses, that connection between one part of the hippocampus and another part. The connection is strengthened in the mice that remember, but not in the mice that don't remember. This part of the hippocampal circuitry is changed for at least a month. Mice only live in the wild for several months. In our laboratories, they live about two years maximum. So a month for them is a very long time.

One of my favorite proteins is protein kinase Mzeta (PKMzeta) (S6). This is a model of what it looks like. The area in magenta is not part of the protein. We engineered it, and did so because it fits into that protein in a particular place to render the function of the protein inactive. It is Zeta Inhibiting Peptide. We know that PKMzeta is crucial not only for strengthening these synapses, but for the synapses persisting in their strengthened stage. We were interested in seeing where the brain makes the PKMzeta a month after acquiring the memory. But we didn't want to look just anywhere in the brain. We wanted to look in the neurons that were

Memory training causes persistent synaptic strengthening




S5 Pavlowsky et al., 2017, Learn & Mem.
Chung et al., 2021, Nature



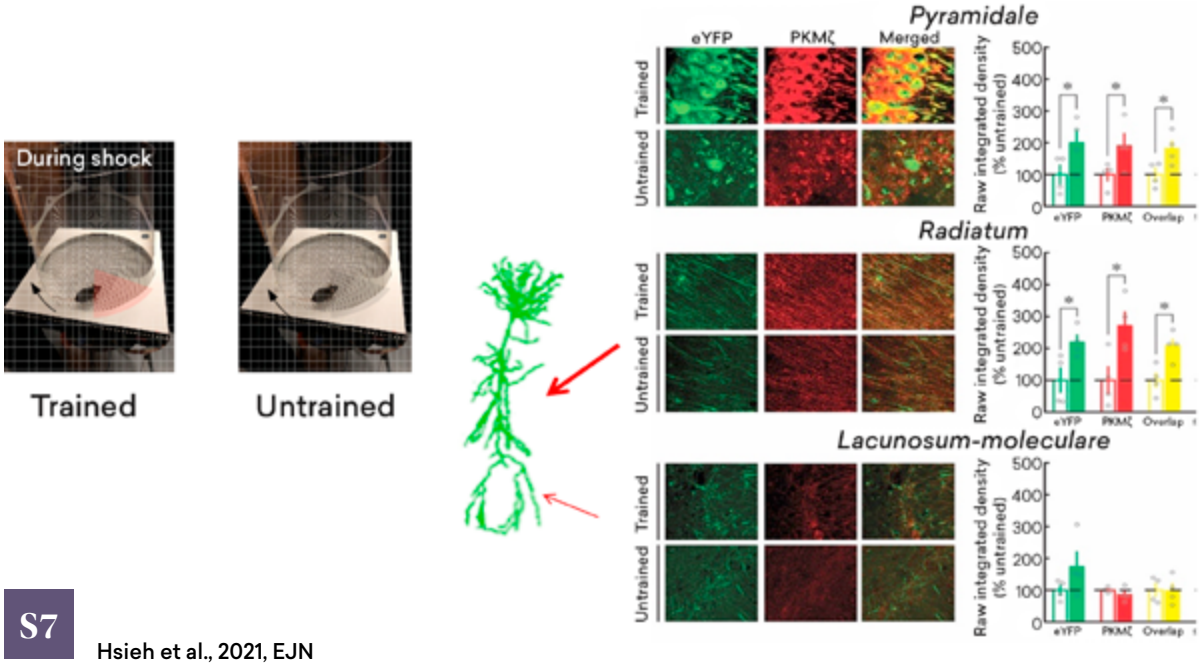

S6

crucial for memory. We can engineer a mouse so that when we remove the hippocampus, the neurons that were active when the mouse was forming the memory will be green. What we can do is mark those neurons and then wait thirty days. In our experiment, we first showed that those neurons are crucial for memory.

We engineered the neurons to not just glow green, but to be responsive to light. Your brain is not ordinarily responsive to light, but these neurons are because we engineered them that way. It's what we call optogenetics. We can tag the neurons that were active when the animal was expressing memory by avoiding a particular area, and in a control mouse we can tag neurons that were active when the mouse was exploring a neutral environment with no shock. Weeks later we can put the mice in a new lab where the mice have never been and stimulate the neurons with pulses of light. You can see that only the avoidance memory-tagged mouse has chosen a place to avoid because we are reactivating those neurons. The mouse has nothing better to do than to interpret that light stimulation as the experience of the room with shock. And so it's avoiding a certain location that it has chosen. These stimulated neurons are essential for the expression of this avoidance memory. We can look in those neurons for the PKMzeta. And what's crazy and cool is the PKMzeta is in particular parts but not throughout the neurons. We can measure how many neurons are green in the trained animals compared to the untrained animals. We can determine how much PKMzeta there is in those memory-trained neurons.

One month later, the synapse is strengthened, and there's more PKMzeta in these neurons that are crucial for that memory (S7). There's also a circuit change here if you look through the whole hippocampus. The green neurons are the memory-activated neurons, and the red compartments are the places the PKMzeta is elevated a month after training (S8). What this shows is that the brain as a neural circuit has been transformed. It's persistently different. The information flow across

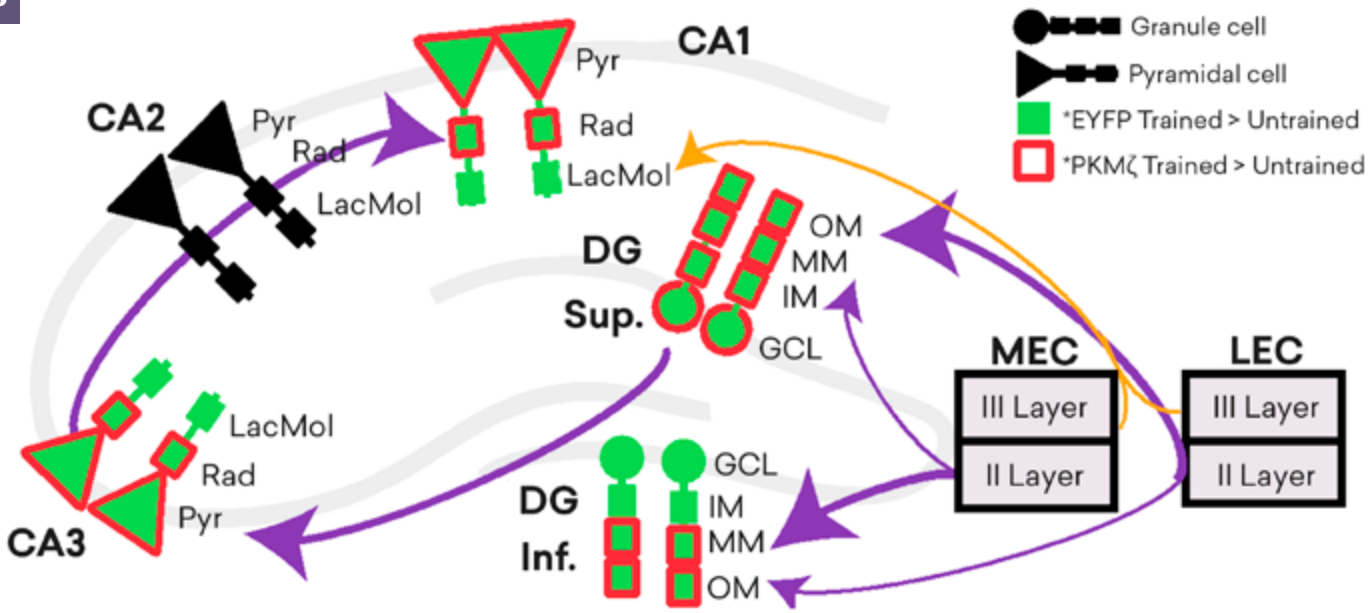
Memory training persistently increases input-specific PKMζ expression in memory-tagged cells




S7

Hsieh et al., 2021, EJN

S8

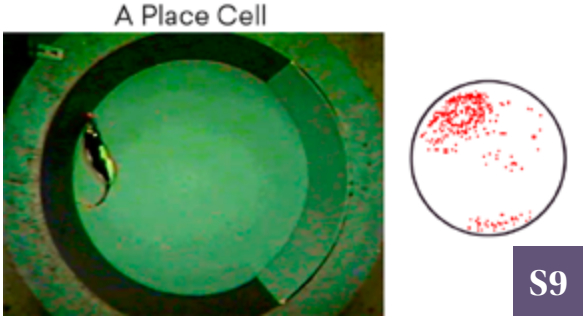



these different parts is going to be different a month later because of an hour and a half experience that the animal had a month earlier.

So what does that mean? A month after the learning experience PKMzeta has changed, and how much one neuron activates another is different. Well, John O'Keefe won the Nobel Prize in Physiology or Medicine in 2014 for describing the cells that I studied as a student (S9). This neuron in the hippocampus is discharging as the animal walks around that space. We can record many of those neurons and decode where the animal is thinking it is, where it remembers it is. And this shows that we can do that decoding if we collect enough data. We use Bayesian inference in order to predict where the animal thinks it is when it is walking around that space. We can record from a few tens to a few hundreds of these cells. What's remarkable is if we use the ZIP peptide that blocks the activity of PKMzeta, we can erase all of the information about the places from those neurons (S10). That shows that these synapses are important. PKMzeta is storing that information and we can remove that information, but not destroy the hippocampus. We can wipe the slate clean, if you will, of that particular type of information.

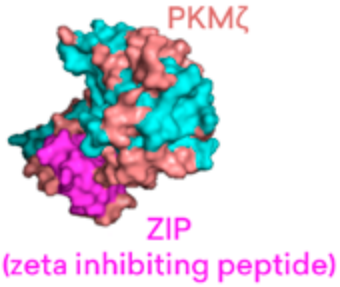
So maybe you don't care about place cells. Not that many people do. So let's look at memory. Eva Pastalkova did this truly heroic experiment (S11), in which we made sure the animals had this strong memory because we gave them training over two weeks, then we waited another thirty days. When we injected the PKMzeta inhibitor into their brains, they no longer remembered. We erased the memory. This discovery put me on the front page of *The New York Times* in 2009 (S12). That's a pretty cool thing. And let me point out, it's above the fold! What's also interesting is it coincided with a photo of Barack Obama giving a speech in the Czech Republic. What a coincidence and honor to share the front page with President Obama. I was feeling pretty good. Then some papers published in *Nature* in 2012 claimed that everything I just said is wrong, and really wrong. Those papers reported on experiments in which they genetically deleted PKMzeta and observed that memory was fine. One of the authors is Richard Huganir, a member of the Academy, and at the time the president of the Society for Neuroscience – that itself

Electrical activity in the brain

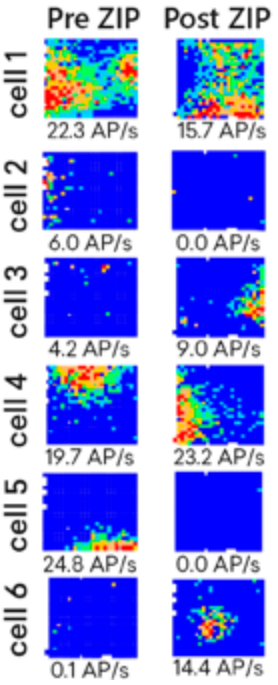


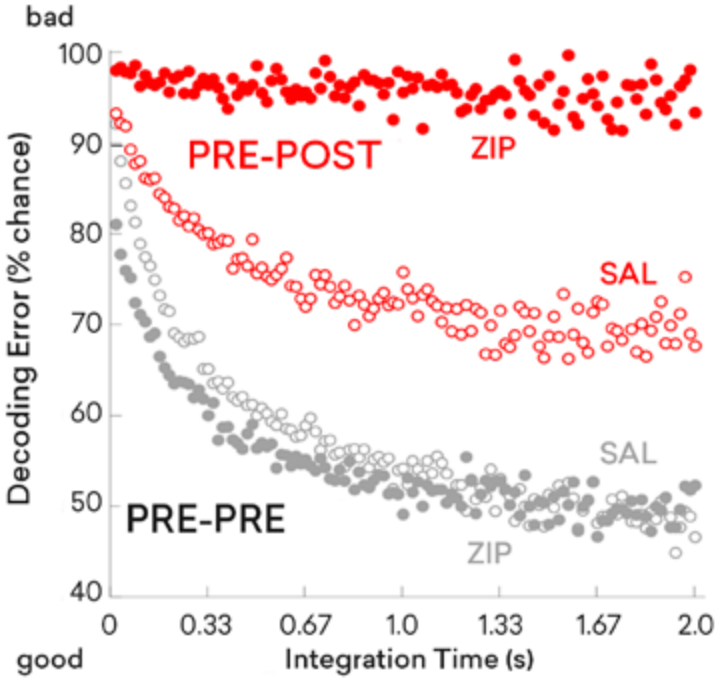

S9

Inhibiting PKMζ erases place information in hippocampal place cell firing



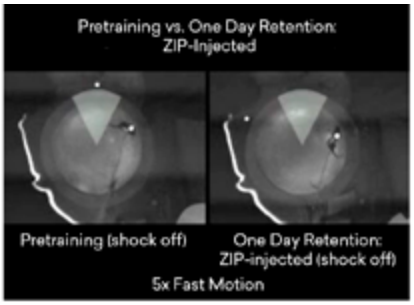

**S10** Barry et al., 2012, J. Nsci

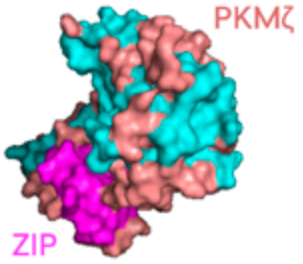


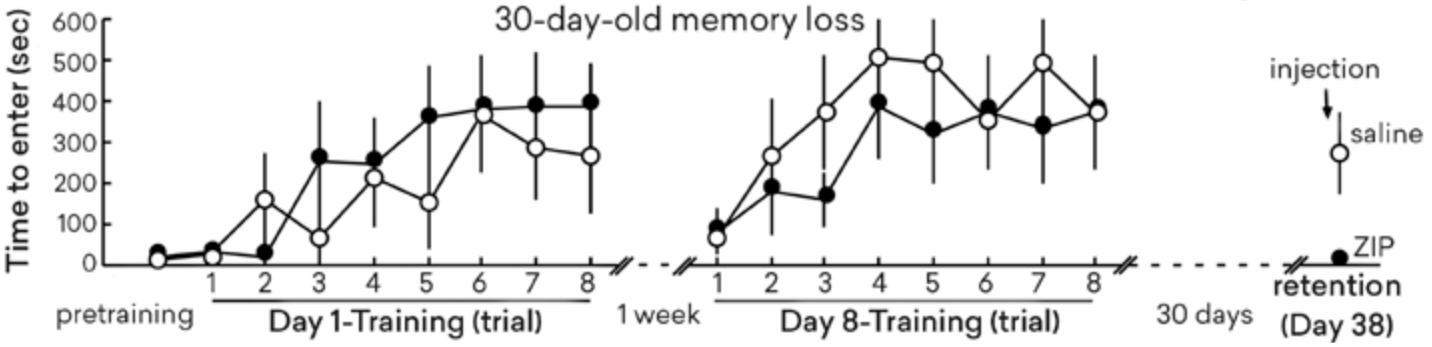




ZIP erases long-term memory

**S11** Pastalkova et al., 2006, Science




made us nervous. But this is how science works. It turns out that we weren't wrong, but rather something really interesting happened to create this controversy in the observations, and it took us about three years to work it out. What happened is that another protein compensated for the loss of PKMzeta; it took the place of the genetically deleted PKMzeta.

In S13, the PKMzeta is shown in red, and PKCiota/lambda, this other compensating molecule, is in green. It's a structurally similar molecule to PKMzeta but it's not expressed much where the memory-associated synaptic changes happened. This mouse is engineered so we can give it the drug Tamoxifen to genetically delete the PKMzeta gene. After we delete the PKMzeta

S12


The New York Times

Brain Researchers Open Door To Editing Unwanted Memory

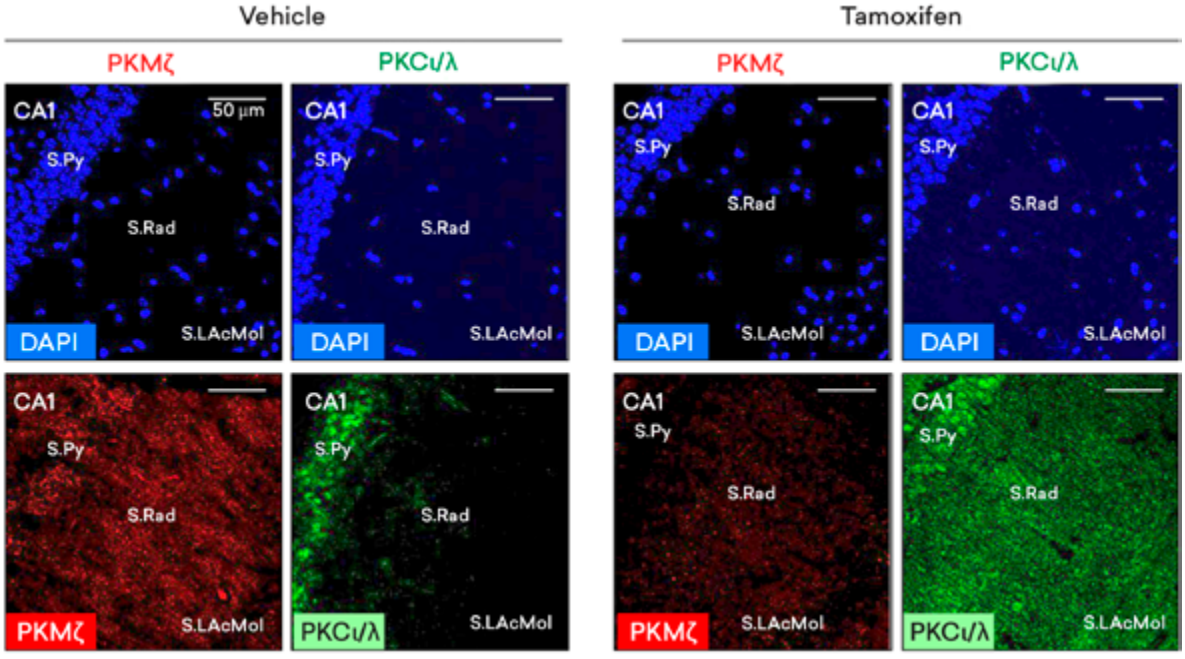
Brain Researchers Open Door That Could Allow Editing of Unwanted Memory

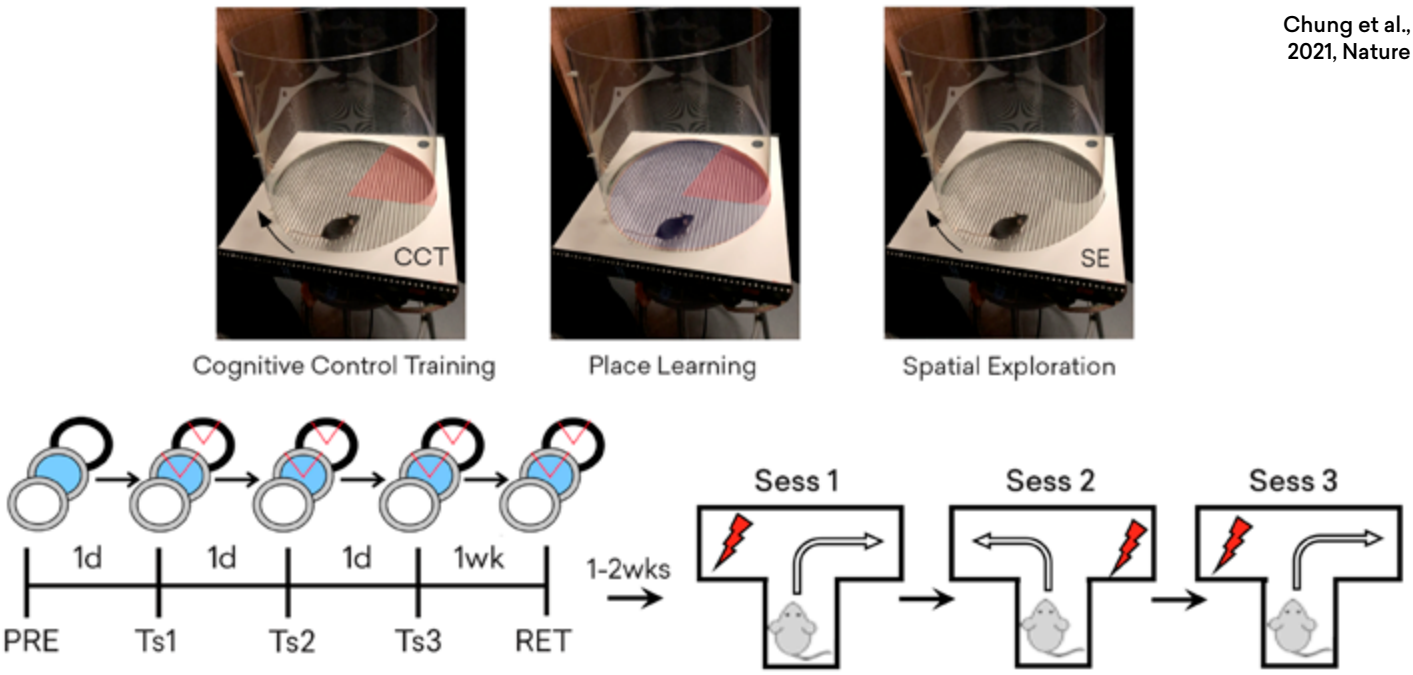
protein we observe there's suddenly a lot of this PKCiota/lambda protein where there previously wasn't. So the PKCiota/lambda replaces, if you will, the PKMzeta. And that's the important lesson here. There's not one important molecule. There are interactions of molecules, and they compete for particular functions. We have to be careful about using drugs or various kinds of chemistry to manipulate these molecules in the brain because they get replaced. And there are very good biological reasons for the replacement because PKCiota/lambda is actually very similar to the PKMzeta in its structure.

What the PKMzeta – iota/lambda labeling showed us is that they were in conflict in some way, and the conflict was resolved because there's another molecule, KIBRA, that targets where the PKMzeta activity should be operating. When the PKMzeta is not present, then a weaker chemical interaction with PKCiota/lambda is allowed to happen. We've designed new kinds of drugs that interfere with these interactions without modifying the proteins themselves. So what I've shown you so far is that you can erase memories. But we are not simply scrambling the file cabinet or scrubbing over the wax tablet. We are affecting the function of this network. The easiest way to explain this is to describe a complicated experiment by

S13

*Prkcz* deletion is compensated by *Prkci*



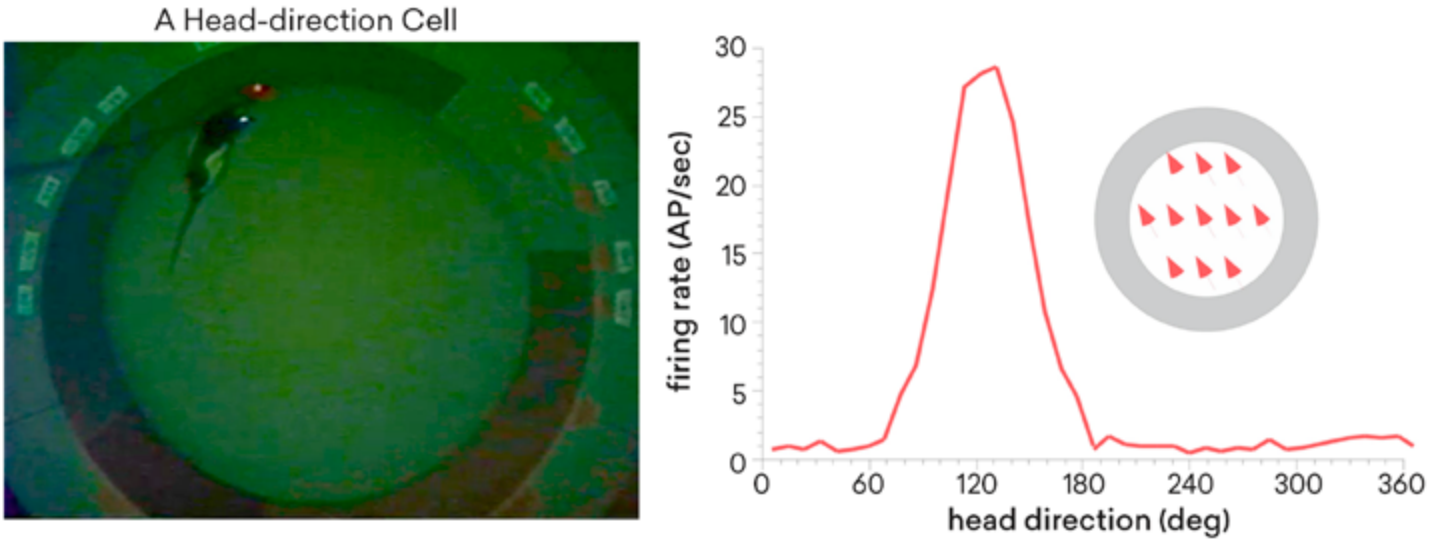



Ain Chung (S14). She trained animals in one of three variants of a place-avoidance task using the identical rotating arena. In one variant, the cognitive control training, a mild foot shock is turned on if the mouse enters a stationary region called the shock zone. By using what they can see of the room when they are shocked, the mice quickly learn to avoid the shock zone. Note that learning to avoid the shock also requires the mouse to ignore the distracting cues like smells that rotate with the floor and define where the mouse is on the floor when there is shock. Everything is the same in the second variant, place learning, except there's water on the arena surface. The water hides the distracting olfactory cues so the mouse has less distractions to ignore. In the third variant, spatial exploration, the arena is identical to the first variant but shock is never turned on. Because the shock duration is only half a second and the mice learn to avoid well, less than 1 percent of their experience is with the shock on and 99 percent of the time the conditions are identical between the variants. Now if you wait a couple of weeks after this training, and you put the animals in different tasks – if you put them in a maze where they have to learn to go to the right to avoid getting shocked and then switch it so they learn to go to the left to avoid getting shocked – what we observe is that there's no difference among these three groups initially. But when you ask the animal to do something that contradicts what it had originally learned, they improve if they had this training in distraction. The training changes synaptic function and it is persistent for a month. It also changes what the animal is able to do in the future when exposed to something that has no relationship at all to what it was trained in. The circuit becomes efficient. It dampens down the small signals and boosts the strong signals. And this is one of those changes that this hour and a half of experience has permanently, or at least for a long time, maintained in the hippocampus.

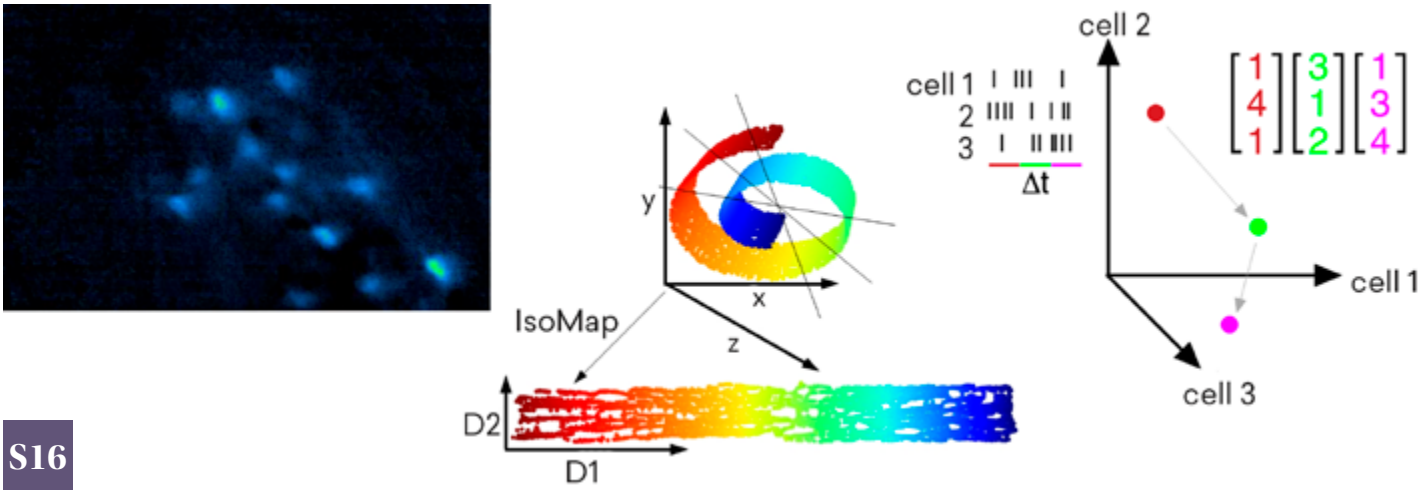
Let me give you a hint of what the activity in the brain looks like. I am going to rely on a head-direction cell because it is easier to study than a place cell. The neuron in the video fires when the animal's head is pointing in a particular direction, let's say about 11 o'clock or so (S15). Immensely more informative than recording one neuron, we can use novel technologies to record the activities of hundreds. The data from a population of neurons are analogous to hundreds of voices from a subset of the individuals that make up a crowd. We can describe the population activity during each short moment of time as a code by listing what each voice said in the moment. For the neurons, we call that an activity vector (S16). Each activity vector describes all the activity details of the entire population at that moment, which is a single point in the so-called state space, where the number of neurons is the

**S15**

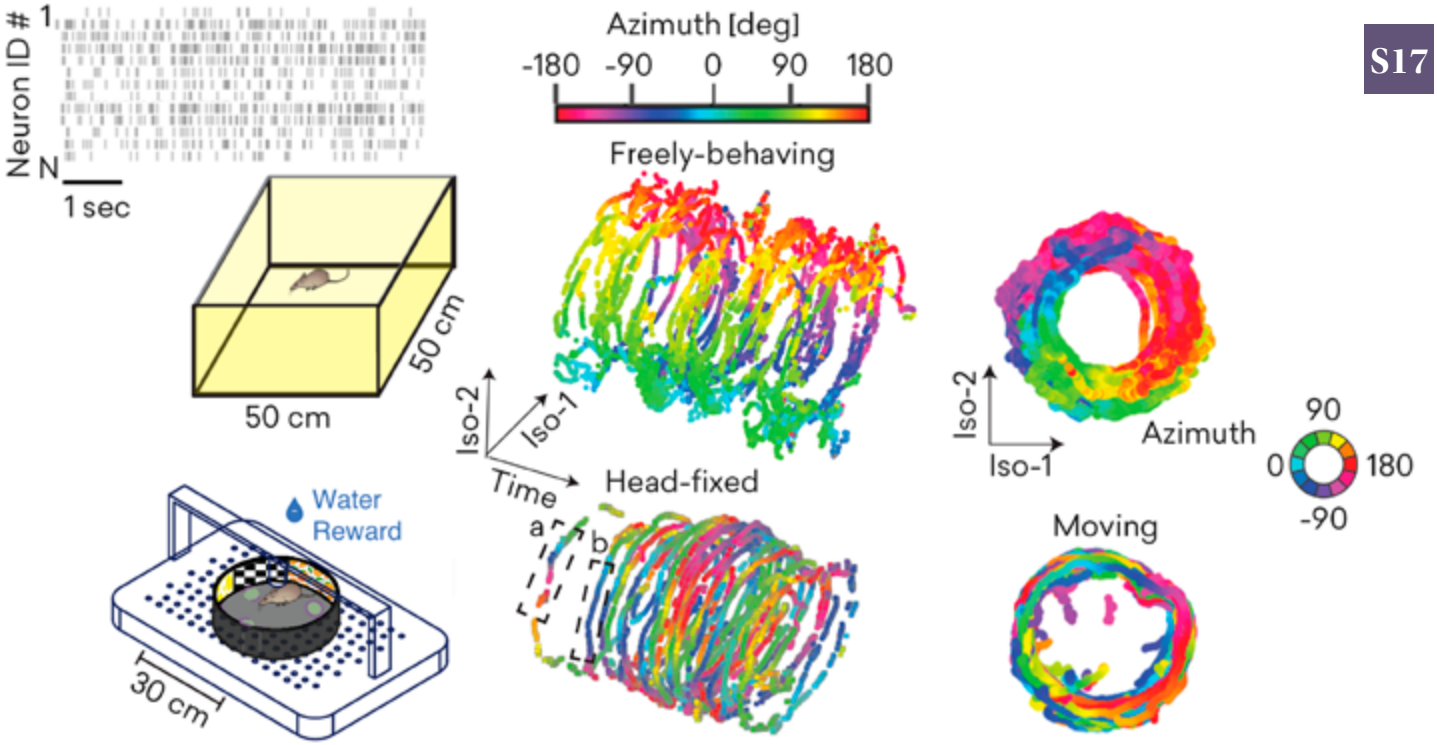
Electrical activity in the brain




number of dimensions of the space – I've depicted a 3-D space as an example. The population activity at any possible moment is a point in that state space and if the activity of each individual is independent of every other individual, the set of activity vectors will form an unorganized cloud of points. But like the example of the swiss roll shown here, we don't observe an unorganized cloud when we examine the activity from a population of head-direction cells. Like people in a crowd engaged in multiple conversations, within the population, the subset of neurons that are active when the head is pointing to 11:00 tend to fire with the neurons that are active when the head points at 10:55 and 11:05, and none of them fire when the head is pointing toward 5:00. Because the population activity is not characterized by independence it can have a geometry within the state space, analogous to how points of a 3-D swiss roll organize on a lower dimensional 2-D sheet. If we use some math we can discover the topology of the neuronal population activity. If we record a population of head-direction cells, we observe that the population activity organizes as a ring (S17). The population activity of neurons recorded from other parts of the brain has a different topology like a plane or a torus, or higher-dimensional objects. With a little more math we can investigate the topological shape of the neuronal population activity to gain insight into how the organization develops, maintains, and changes in this abstract space to represent information about the real world (like direction).




**S16**




We build maps, beliefs, and understandings of the world, and using head-direction cells I've given you an example for the direction sense. These representations are changed by our experience, and we use that to project our beliefs and our histories onto the world that we experience. That is the kind of inference you can come to from the work I've described. These are fundamental neurons that define the space in which you have your experience, and in my work, the space in which these mice have their experience. And if the fundamental space in which the theater for experience is subjective in this way, it's not surprising why our perceptions of the world are also subjective. They have to be and can't be otherwise.

What I hope you go away with from my presentation today is recognizing that we are here at the Academy because we're interested in the life of the mind. Our minds are very powerful. They generate ideas. But those ideas are *our* ideas. They're subjective. And how we manage to get people to have shared and collective ideas, so that we can work together on those ideas rather than separately, is deeply challenging. What I hope I've given you evidence of – biochemical, physiological, and functional evidence – is that this neuronal synaptic function, the stuff that our experience is built on, crucially determines our experience. We should be using this type of knowledge and this kind of insight to figure out how to make the world better.

## Conversation

LAURIE L. PATTON: That was an incredible talk. Now you realize you're about to be interviewed by a scholar of religion and literature, right?

ANDRÉ FENTON: Yes!

PATTON: A little bit later I want to get to your personal experience in making some of the discoveries that you just shared with us. And I have a question about language, and how we might think about, talk about, and express what it is when we have a memory. But first, I want to focus on your childhood. That photo of you as a child was such a great picture. André, you had an interest in literature when you were in college and maybe even in high school. And then you took the accidental biology class that created a whole world for you. I would love to hear whether and how that interest in literature still remains for you, and whether you see any connections in the work that you do now to the idea of reading a novel. When I was at Duke, we had a faculty member who was doing a neural mapping of people reading. There's interesting work being done there. But let's go back even further. Do you think there's something about your philosophical interest in the role of the imagination that got you started? And is that still there for you in some way?

FENTON: I have always been curious, at least from the time I can remember, which is when I was thirteen or so, about how I know what's real. That has both bothered me and fascinated me. I think one of the reasons literature was attractive to me was because I could recognize that through stories, people could explore what's real. And what was really fascinating to me is that stories are completely made up, or at least most of them are. They're not about me, but you follow them as if they're real. You cry, you exalt, you feel depressed, and you get invested in these things. And frankly, that seemed crazy to me. Why would that be? So, that was my initial interest. I also wanted to try to understand it through philosophy. I had English teachers who made the English classes seem like philosophy classes. And so when I went to college, I started to study philosophy, which I found, no offense to the philosophers here, very opaque. But it taught me to reason and to argue. What I've never forgotten is that the reason the stories are compelling is because they are stories. They have a trajectory through time. The character starts somewhere and develops. For that reason, Joyce is terrible for a casual read because you jump around too much. But for the most part, there's a thread that tells the story. And the reason that's appealing is because that's how our brains work.

We work on the basis of those stories. We fill in the facts. If you want to have fun at a dinner party, say that something interesting happened to you at the Academy and let people guess what that is. And then answer them randomly. The party guests will construct a story. They will find a story in the nothingness that you offer them, because that's what we do.

PATTON: I am going to add a little footnote about Joyce because I can't resist. There's a very devoted, some might even say religious, group who read *Ulysses* on an annual basis in celebration of Joyce. They often use it as a kind of neural map in itself. So I think there is a way in which the challenge of overcoming the basic neural construct of a story, as you were saying, could actually be in itself an activity of the brain to be studied by you.

FENTON: Absolutely. In fact, the experiment I showed you in which the control animals didn't learn to learn, didn't have the neural changes, is very interesting to think about. The one difference between that control and the animals that did form the changes is that the controls didn't have to ignore the distracting cues. There's something about having to use the effort to quell or quiet in order to focus attention. It didn't take long but that training itself was the key to making the persistent changes that we could find. It's not that there weren't persistent changes; they were just much harder to find.

PATTON: Let's stay with this for a second. If you studied the brain of someone reading Joyce and studied the brain of someone reading "Cinderella," would you see different activities?

FENTON: I would predict you would see different activities. And in fact, Joyce is really satisfying when you learn to read Joyce.

PATTON: He's the rotating arena.

FENTON: Yes, that's right. He's the rotating arena that when you learn to embrace the jumps, you recognize their connections.

PATTON: Let's talk a little bit more about the rotating arena. I'm interested in it for a couple of reasons, especially because in higher ed administration, you sometimes feel like you're a gerbil on a wheel. But I actually love the rotating arena much better. I'm just not sure many people will understand mice in a rotating arena without my having to explain your research. But someday it might be a universal image.

FENTON: I hope not!

PATTON: Let's skip to something that I was planning to ask you at the end of our conversation, but you featured it in your talk so I'll ask now. You have invented several devices, and the rotating arena is one of them. If I understand your biography correctly, the rotating arena was something you worked on right after undergrad, and then perfected it in different ways. You clearly work at the theoretical level but you also work at the pragmatic one. You've created a low-cost micro EEG device, which you could take to people who can't have an EEG in a hospital. I would love to hear your stories of how you invented those things, and why it matters to you to work in that pragmatic space in addition to the theoretical space of neurobiology.

FENTON: I am interested in solving problems, and doing that gives me joy. The way it works for me is I ask myself, how would I solve this problem? What would be a really useful tool to solve the problem? And it turns out that for most problems that you want to solve that are hard, the tool doesn't exist. So you have to step back and say, well, I wish I could have an X. And when you do that, most people who have been trained slightly differently than me say, "Well, I can't do that because there's no X." My training was really fortunate. I was trained in pretty impoverished conditions. When I went to Prague, they made everything, and they knew how to make everything. They made their amplifiers, their PC cards – literally everything. And over five years or so I was taught engineering informally every evening for about an hour and a half by focusing on how to solve problems. The engineer who taught me was a Russian elderly person who didn't speak English very well. He would say, "I'm no engineer; I'm a designer." And so he taught me how to design things, and I've used that training ever since. When I look at a problem, I ask, how do I design a solution for that? Sometimes you can make a thing for that, and I enjoy making those things because I've been trained to find a solution by making a thing rather than buying a thing. And that's how we proceed. So, give me a problem, and I naturally think, what are the ways to solve that? How would I design that thing? And then you do it.

PATTON: There's a Sanskrit word for what you are saying: *yukta* can mean sensible, suitable, fit. It is related to the word *yoga*. And in contemporary India, you'll hear people use the word *jugād*, "a fitting, often frugal innovation." These are words related to the earlier Sanskrit. It literally means "making it as you go, figuring it out." On an Indian street you will see a luxury car store next to a small bicycle stand, a rickshaw, and an oxcart that's carrying computers. You have all of it. And it's really important to know that that is the genius of that word *jugād*. For every single moment in that street scene you are making it up as you go. And in a way, you had a scientific version of that.

FENTON: Yes, I was trained to make it up as I go, but cautioned not to pretend that this is special. Make it up as you go so that other people can do it. That was the impetus. I remember very clearly being really proud as a graduate student that no one could understand my rig. It was so complicated. Wires went everywhere. And I was told, "That means you don't understand this." When you make it simple so that anyone can walk in and say, "Oh, wow, look at this, it makes sense," it means you've thought about it, you've designed it properly so that it's easy and other people can use it. My thesis mentor would impress upon me the principle of making things as simple as you can to get the job done and then be proud that it was simple so other people could use it.

PATTON: I'm impressed by the way that you're talking about your different scientific experiences, and also describing them as social experiences. You're from Guyana; you studied in Canada; you worked at the Czech Academy. You are currently teaching and doing research in New York City. Has the fact that you've had many homes affected your science or the way you think about the mind?

FENTON: Oh, absolutely. If you get on an airplane from New York and you arrive in Guyana and you get on that same airplane and leave, it's almost like everybody literally has different beliefs. People in Guyana are interested in whether you're Black or Indian when you're in Guyana. And because of colonialism, it's like they can't get along. But if you get on the airplane to leave, then everyone's Guyanese and united in being Guyanese to deal with the people in the country that the plane will land in. And I saw the same thing in the Czech Republic. I was one of the only Black people in town. I was both invited and rejected at the same time over the same things. That experience taught me that how I react and how other people react to me is in my mind and is in their minds. I decide how I will interpret what's happening. And as you can see, that's what my research demonstrates with evidence.

PATTON: In the middle of your presentation, you talked about the critique of your work and how that compelled you to think about the interaction between proteins. You realized that there was not a single answer. You actually ended up with a more complex model. Even though you're working toward simplicity in certain ways with instruments, with ways of thinking that might be a kind of Occam's razor in certain ways, and yet the science as you've developed it is actually more complex.

FENTON: Actually, I don't think of it as more complex. We figured out the rules that make it simple. Think of a murmuration of starlings. If you want to understand those birds, you could count all the birds and track everything about each individual

of the flock. But there are actually three simple rules that describe them: 1) Keep flying; whatever velocity you have, maintain it. 2) Don't bump into anything. And 3) Do what the seven or eight nearest neighbors are doing. Those three simple rules describe what looks complex. From my point of view, we're actually looking for something simple, something elegant, but the answer happens to be abstract.

PATTON: And it's also a dynamic interaction.

FENTON: Yes, you have a ΔT in there.

PATTON: My last question before we turn to questions from our audience. I thought about this as I was listening to your presentation. I want to describe an experience I had with my brother. My brother and I were moving objects from my mother's home. We just moved her into a nursing home. And it was hard. There were memories everywhere. My brain was flooded with these memories. A neighbor came by to give us tea, and when I introduced my brother to the visitor, I got his job wrong. Now I am hyper about getting everyone's biography right, about honoring people in everyday interactions. And then I got my brother's job wrong. But what I didn't say at that point, partly because I had been thinking about your work, was "Oh, that was horrible and I disrespected you, and what's going on with my brain. I must be losing it." Instead I said, "My hippocampus is just not working today." And I felt better because that biological fact made it okay at a certain level. But I don't know whether it made my brother feel better. I'm thinking about our everyday use of language, and what would it look like if twenty years from now we don't say, "I forgot that," but instead we say, "My PKMzeta wasn't present today." I'm interested in that because there are other ways in which we have biologized our somatic experience because of new scientific discoveries in language.

FENTON: Absolutely.

PATTON: What do you think about that?

FENTON: In fact, I think that's the goal. We're interested in ourselves and how we engage with other people. And we have psychological concepts for that. Psychologists are brilliant. They can infer all of these functions without actually knowing how they were implemented. But now we don't know if some of those concepts are actually correct. We don't know if they're precise. And that has caused many problems in societies and cultures. Think of something like race as an example. There is no such thing as race. It's not in the DNA. It's actually not a physical concept, but we're stuck with it. It'll take hundreds of years for us as humans to shed ourselves of those concepts. So the goal for me is to find the physical instantiations of our concepts and replace them with that kind of understanding, because our memories are often inaccurate, and we have conviction about them being correct. There's no reason to have a war or a divorce over bad memories when it's just in the nature of our minds. And if we all understood that I think we would be a lot more tolerant of different beliefs, ideas, and presentations. Just like you felt better, hopefully your brother would feel better if he shared the same concepts.

PATTON: That's right. You're sounding so Buddhist, so now we're in the same world. Let's turn now to a few questions from our audience.

AUDIENCE MEMBER: When I think about organisms and memory, I'm thinking about how variable natural environments are. And, of course, there's a problem with memory, which is if the world is changing constantly, what you remember may not be of use. And so I'm curious about the adaptive value of forgetting. With your mice, is forgetting simply a random decay of memory, or is there actually an adaptive action in which at some point it is forgotten because it may no longer be useful in the world?

FENTON: I think forgetting is actually part of the process. Let's not talk about biological memory for a moment, but instead let's talk about those deep neural nets. Anyone trying to build one of those networks to learn something realizes that they can overlearn things. They learn all the details, and the details are not actually useful. In fact, those generative networks don't recall anything. They've just learned the likelihoods of things. They've learned an abstraction, if you will. And so memories are mostly forgotten. Most experience is forgotten. But the statistics of those experiences remain in the network. The recollection of was there

food or what type of food depends very strongly on the will, life history, and circumstances of that organism on that day. I think the insight here is not so much about the specifics unless they're very important. We build a model of the world that's actually adaptive and useful going forward.

AUDIENCE MEMBER: I want to ask you about learning and memory. Is the PKM family involved in learning if it's based on a tone or a smell, and not associated with a position? And what is PKM phosphorylating?

FENTON: So, we don't know everything about what PKMzeta phosphorylates. But there is a protein called NSF that traffics AMPA receptors into the postsynaptic density. Another is Numb, an endocytic protein that plays a role in a number of cellular processes. PKMzeta seems to operate in this biological capacity in many systems: in the spinal cord, in the various parts of the cortex, in motor learning, in tone, in fear conditioning. In one of our early papers, we cataloged a bunch of classic memories. And what was interesting is you can learn without PKMzeta. Even without the compensation, memories can form. We don't know how they'll form, but I'll give you an insight into that in a moment. There are PKMzeta independent forms of memory, but those memories tend to be general. They're like learning the context of something rather than its specifics. Driven by the KIBRA interactions there, our working hypothesis is that all memories are formed with a set of biological rules. It might be the NMDA receptor in the system; it might be the KIBRA, for example. And it's targeting the kinase activity; you need a kinase to keep proteins activated. Consider this: Let's say we live to one hundred years, but we know that the proteins that are essential and that maintain that only last a week. So, how do you maintain something across decades with the elements that only last a week? It's a dynamic ongoing process, which can be solved using these manifold ideas that I've described without using the word manifold.

AUDIENCE MEMBER: Do you choose to study shock memories because these pain memories tend to be stronger and they're easier to study?

FENTON: So the answer is no. In fact, the shock is quite mild. And we've checked that the shock doesn't make the animals any more stressed out than just walking around. And we've done that very deliberately, because we didn't want to study stress and painful things. The reason we chose shock is because it's convenient. The animals learn it very quickly. We can dissect the time course of the proteins. We can look five minutes later or a month later. I'm a pragmatist. I'm building a model of a question that I want to be able to address in a very deliberate and intentional way. It's not meant to study something that's global and universal. We hope that what we learn is global and universal, but we target the problem.

AUDIENCE MEMBER: For humans, what kinds of memories tend to stick the most for the strongest among us?

FENTON: For me, it's the emotional memories. The ones that seem really important to the trajectory of my life. Those are the memories that I think I remember very clearly and very well. If you do the research, it is often the case that we incorrectly remember those memories. We remember that they happened and we remember the circumstances of them happening, but possibly because we replay them. All of this is a dynamic and subjective process. We might change the actual contents of those memories. That's what the research suggests. The eyewitness accounts are fraught.

PATTON: From the sociology of labs to James Joyce to the neurobiology of memories, André Fenton, thank you. This was so fun and a wonderful conversation. My KIBRA activity and kinase presence about this conversation are going to last for a long time!

I hope that the topic of this morning's conversation will be a memory for all of you, and an interpretive framework for many years to come of how you think about the world, and how you think about your own work and its relationship to the world. I hope your time here has been rejuvenating, helping you think with new energy about the work ahead, both in your own scholarship, in your own leadership, in your own business worlds. I also hope that it gives you inspiration to renew our democracy in all the ways that we know we can. Welcome again. We are so proud that you are members of the American Academy of Arts and Sciences.



To view or listen to the presentation, visit www.amacad.org/events/andre-fenton-interview-2024-induction.

A visitor is standing outside of the horns and antlers array in the Louis V. Gerstner Jr. Collections Core, in the American Museum of Natural History's Richard Gilder Center for Science, Education, and Innovation.

# Rebuilding Trust in Science

*A Morton L. Mandel Conversation*

2129th Stated Meeting | October 16, 2024 | House of the Academy, Cambridge, MA, and Virtual

On October 16, 2024, the Academy hosted a discussion on the importance of science communication and strategies to bridge the gap between science and the public. The event featured **Sean Decatur** (American Museum of Natural History) and **Naomi Oreskes** (Harvard University) in conversation with **Holden Thorp** (American Association for the Advancement of Science). **Shirley Malcom** (American Association for the Advancement of Science) offered opening remarks and **Cristine Russell** (formerly, Harvard Kennedy School) provided some final comments.

The panelists discussed how scientists, scholars, journalists, institutional leaders, and others who shape public opinion and trust can engage with a divided public in constructive ways and rebuild the public's trust in science. An edited transcript of the program follows.

The Academy is deeply invested in the issue of trust in science and effective science communication. The Public Face of Science project produced three reports touching upon the complex and evolving relationship between scientists and the public.

## Shirley Malcom

Shirley Malcom is Senior Advisor to the CEO and Director of the SEA Change initiative at the American Association for the Advancement of Science. She was elected to the American Academy of Arts and Sciences in 1995 and serves as the Academy's International Secretary.

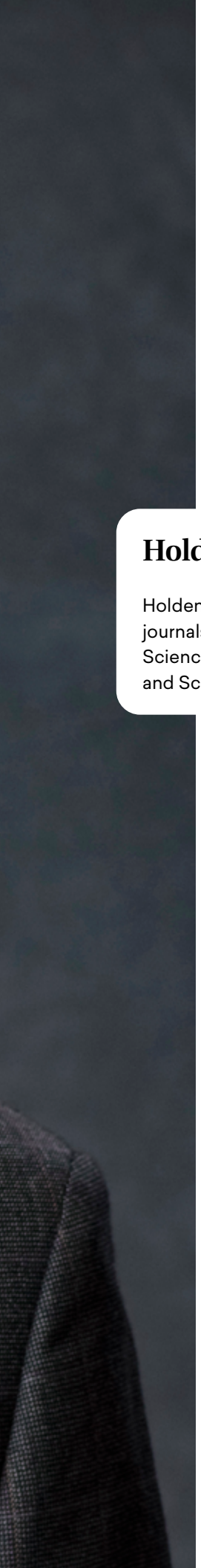
Good evening. I'm Shirley Malcom. I am Senior Advisor to the CEO and Director of SEA Change at the American Association for the Advancement of Science. As a member of the Academy's Council and as the International Secretary of the Academy, it is my pleasure to formally call to order the 2129th Stated Meeting of the American Academy of Arts and Sciences.

Our conversation on rebuilding, or perhaps building, trust in science is being held as a Morton L. Mandel Conversation. Morton Mandel was a dedicated member of the Academy who believed in the power of connecting across disciplines, professions, and geography in service to the common good. In the spirit of his vision and generous gift, we have designed today's event as a discussion both among our distinguished panelists and between them and our audience, whether you are here in person or joining virtually. We welcome you and we welcome your contributions.

The Academy is deeply invested in the issue of trust in science and effective science communication. The Public Face of Science project produced three reports touching upon the complex and evolving relationship between scientists and the public. You can find those reports and related materials on the Academy's website. I'm pleased that several members of the Public Face of Science project are here with us this evening. The project's reports inspired robust discussion and arrived at a crucial time for those who care about successful science communication. They were finalized on the eve of the COVID-19 pandemic, a crisis that underscored how essential it is to have a healthy relationship between science and society and how fragile and fraught that relationship truly is.

Today, as circumstances continue to evolve politically and culturally, the Academy remains committed to advancing public trust in science in the United States. Tomorrow we are convening a small group here in Cambridge to revisit the work of the Public Face of Science project and consider some updated recommendations. In the spirit of the Academy's interdisciplinarity, those conversations really will begin this evening with all of you. Though there is so much uncertainty around this issue, what we know for sure is that scientists cannot solve this problem alone. It is wonderful to convene members representing so many different fields and perspectives as we turn our attention to the question of how scientists, scholars, journalists, institutional leaders, and others who shape public opinion and trust can engage with the divided public in constructive ways. The expertise and ideas you share this evening will inform our conversations tomorrow. We know that rebuilding trust in science will take time and can only be done successfully if we work together.

It is now my pleasure to turn things over to my friend and colleague, Holden Thorp, Editor-in-Chief of the *Science* family of journals at the American Association for the Advancement of Science, who will moderate our panel discussion.



> Where are we with trust in science and trust in institutions in the United States generally? Is there a way for science to decouple from other institutions so that if trust in all the other institutions is declining then science doesn't have to necessarily go down with them?

## Holden Thorp

Holden Thorp is Editor-in-Chief of the *Science* family of journals at the American Association for the Advancement of Science. He was elected to the American Academy of Arts and Sciences in 2021.

I'm delighted to be here this evening and for the next few days to talk about rebuilding trust in science. We have a large audience watching online, showing the deep interest that so many have about this important topic. I'm very excited to hear from our two panelists. Naomi Oreskes is a trained geoscientist and historian who has consulted various government offices about global warming. Her book, *The Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*, which was coauthored with Erik Conway, is an absolute classic in the genre, the Rosetta Stone by which all books in this area are written. She won the much coveted Watson Davis Prize from the History of Science Society in 2011 for this book, as well as many other honors, including having the editor of *Science* teach a class at George Washington University that's based largely on her book. I have studied it in great detail with my students. In the first half of our class we discuss Naomi's book, and in the second half of the class we look at what has happened since the book was published, which unfolded more or less as Naomi predicted.

Our second speaker, Sean Decatur, is President of the American Museum of Natural History. He joined the museum in April 2023, and has presided over the opening of the Richard Gilder Center for Science, Education, and Innovation. If you haven't been to the Gilder Center yet, I encourage you to go as soon as possible to see that magnificent facility. It is the embodiment of a lot of the things that we're here to talk about this evening. Sean's plans for the Center are both inspirational and instructive. I got my start in administration running the science museum on the UNC campus, which is about five orders of magnitude less impactful than the American Museum of Natural History, but I have some appreciation for informal science education.

My first question for both of you is, where are we with trust in science and trust in institutions in the United States generally? We see in the Pew data that trust in institutions in this country is declining. A new set of Pew data will be released next month, and many of us are eager to see what that data show. What do you think is going on with trust in science in America? Is it really declining? Or not? Is there a way for science to decouple from other institutions so that if trust in all the other institutions is declining then science doesn't have to necessarily go down with them? To me that seems to be the challenge more than almost anything else. Naomi, we'll start with you and then turn to Sean.

If you're familiar with the Pew data, you know that trust in science has declined less than trust in other institutions. So most of these scary headlines about a crisis of trust in science are not actually supported by the data.

## Naomi Oreskes

Naomi Oreskes is Henry Charles Lea Professor of the History of Science and Affiliated Professor of Earth and Planetary Sciences at Harvard University. She was elected to the American Academy of Arts and Sciences in 2017.

Thank you for inviting me to be here tonight. I appreciate the way you have framed the question because we actually have a lot of data about trust in science. But what we know isn't always reflected in the way the data are presented. Many of us have seen the raging headlines in some journals about the crisis in science and the crisis of public trust, and those kinds of headlines get a lot of attention. But I think they do a disservice to what we're facing. As you suggested, if we look at the data, particularly if we go back to the 1970s, we see a couple of important trends. One is that trust in institutions broadly, like government, banking, and journalism, has been declining for a long time. That's a big cultural trend. Science is part of society, so we're not immune from the larger trends that affect society as a whole. If we want to think about the overall position of science, then we have to think more broadly about why trust in institutions has declined.

That said, there is some good news in this story. If you're familiar with the Pew data, you know that trust in science has declined less than trust in other institutions. Now it's not something to jump up and down and say, "We're not as bad as the rest of them." In fact, trust in science overall is second only to trust in the military in the United States. It's a little different in other countries. Trust in science remained relatively unchanged from the 1970s until quite recently. So most of these scary headlines about a crisis of trust in science are not actually supported by the data.

However, there are two things that we need to pay attention to. One concerns what has happened in the last few years and, as you said, we're eagerly awaiting the new Pew data because we do know that things have changed post-pandemic, and there is evidence that trust in science took a hit during the pandemic. What we don't know yet is how bad was the hit? This year's data will give us at least some indication of that, and depending on what we see I think it will affect what we need to do.[1] And the other factor is something I've written about in the journal of this august institution. I had a piece in *Dædalus* recently explaining that the crisis of trust in science in America, to the extent that there is one, is a crisis of *conservative* trust.[2]

If you unpack the data what you see is that, broadly, most Americans do trust science. Democrats and Independents trust science a lot and Republicans and people who lean conservative don't. And the gap is very large. We're not talking about two or three percentage points. We're talking about ten, twenty, or thirty percentage points. This enormous gap is historically significant. If we go back to the 1970s, Republicans in general tended

1. Note: trust in science has somewhat rebounded in 2024.

2. Naomi Oreskes and Erik M. Conway, "From Anti-Government to Anti-Science: Why Conservatives Have Turned Against Science," *Dædalus* 151 (4) (Fall 2022): 98–123, https://www.amacad.org/publication/daedalus/anti-government-anti-science-why-conservatives-have-turned-against-science.

to trust science more than Democrats, but that flips and we see the curves crossing in the 1990s. This tells us that a major social change happened about thirty years ago. It's not about anything that we did this week, this month, or this year. It's not really even about the pandemic, although the pandemic may have altered or exacerbated those trends. There's something bigger and deeper here, which has to do with the broader pattern of political polarization in this country.

How do we as scientists deal with that? How do we regain trust among conservatives? Given what we know about what's caused the problem, it is not going to be easy. How do we decouple ourselves from some of these other broader changes? I think that's going to be especially difficult, because one of the reasons conservative trust in science has fallen so much in the last thirty years or so has to do with conservative attitudes toward government and the relationship between American science and the American government. This is where I think we are facing something that is quite sticky and without a simple solution.

A tremendous amount of support for science in this country comes from the U.S. federal government, with additional support from state governments. Many of us in this room have fought hard to maintain, sustain, and expand federal government support for science, because we know that support is absolutely crucial to the strength of the scientific enterprise. Yet, the linkage between science and the federal government is a major part of the reason why many American conservatives, who generally distrust the federal government – who generally have a worldview of being suspicious of "big government" – distrust science. The coupling of science to government in the minds of conservatives, not just ideologically but practically, has created a problem in terms of gaining and sustaining the trust of American conservatives.

So that's a diagnosis, and not a solution, because first you have to diagnose the problem.

THORP: That's an excellent analysis, as always. Sean, you see the public coming by the millions into your building. For most of us who teach at a college or university, our view of the public is the undergraduate who has elected to come to our institution, which is not very representative. You have a different perspective. Where do we stand in terms of what you see?

> I think we sometimes use science and trust in science to refer to three different things. There's science as an institution. There's science as a body of knowledge. And then there's science as a process.

## Sean Decatur

Sean Decatur is President of the American Museum of Natural History. He was elected to the American Academy of Arts and Sciences in 2019.

Let me start by separating science and scientific institutions. When we talk about trust in scientific institutions and trust in an institutional voice of science or an authoritative presence of science, I agree with Naomi completely that there's been a conflation between scientific institutions and a broader set of institutions that people have had declining trust and confidence in for some time. When we think about the linkage of science with government, I would add private industry into the mix. If we think of science associated with the tech industry, which is one of the more distrusted entities for most people, those are all connections of science with voices that are not particularly trusted at this moment.

I think we sometimes use science and trust in science to refer to three different things. There's science as an institution. There's science as a body of knowledge, or at least it's presented as a body of knowledge – that is, a collection of facts and information. And then there's science as a process, like the epistemological view of science. I think there's an issue with trust in science as an institution, but that's coupled with trust in institutions generally.

For science as a body of knowledge or a collection of information, there are moments of suspicion because knowledge changes over time. And that uncertainty can be jarring to some: that what is a fact one moment may actually not be considered a fact at another moment. Scientists, but also the media and others, present a confusing picture of what we mean by a scientific fact, creating a

sense of uneasiness when we say that something is scientific knowledge.

The third category, science as a process, may be the thing that people have the most trust and confidence in. There was a National Science Foundation study a little while ago that showed that if you ask questions about science – for instance, what is a hypothesis? – there's a correlation between people who understand how the scientific process works, who understand the connection between evidence and conclusion, and who say that they trust science. People who understand science are more comfortable with science, and so they trust it.

There's something about the process of knowledge generation that allows people to trust and have confidence in science. We need to shift the emphasis away from the idea that people should trust science as an institution and focus instead on fostering trust through investing in education about the process so that people have confidence in how the process works. That is the shift we need to make, and educational institutions and museums are doing that.

THORP: Sean, you have been very restrained about not plugging your new building, but that's precisely what your new building does. There's an election coming up in the United States. And while partisan attitudes are important to consider, so is reaching out to people who don't trust science for perfectly good reasons – like science hasn't been trustworthy to them over the years, or their religious views conflict with science. How are we going to win over these people?

DECATUR: Let me put my answer in the context of some reflections from a year and a half ago when I moved from rural Ohio to New York City, two very culturally different places. What's fascinating is when I was describing to some of my friends and neighbors in rural Ohio that I was leaving my job at Kenyon and going to New York, if I just left it that I was going to New York, it was as if I was going to be falling off the edge of the planet. Folks were worried about me. What was going to happen? Did I know what I was getting into? But if I said I was going to the American Museum of Natural History in New York, that had a fond connotation for many of them. Maybe they were thinking about dinosaurs and other exhibits. Those are things that folks can embrace. The museum has objects and evidence that you can observe about the physical world.

There's a sense in which people across a broad range of religious, ideological, and political views can embrace something about the museum, which is reflected in the fact that we get four and a half million visitors each year and that on any given day we have a fascinating cross-section of people who come into the museum. There's something that is fundamentally attractive to us as humans about wanting to understand our world that science actually speaks to. How can we get at that in terms of how we present an understanding of science? It may mean not starting with the things that are going to feel like they are ideologically heavy. We need to find common ground and then build up to things that are heavier. That approach is probably the best way to reach as many people as we can.

“There's something that is fundamentally attractive to us as humans about wanting to understand our world that science actually speaks to. How can we get at that in terms of how we present an understanding of science?

ORESKES: I agree completely. As you were speaking, it reminded me of something I learned early in my teaching career. During my first year teaching, I had a cat that had kittens. (In those days it was still socially acceptable to have an unspayed cat.) When my cat needed to move her kittens, she didn't just stand there demanding that the kittens move. My cat would go to the kittens and pick them up and put them where she needed them to be. And that became a metaphor for me in teaching. I can't tell you how many times I heard colleagues say, "Freshman should come to college with calculus. They should come to college with thermodynamics. They should, should, should, should." And I remember thinking well, yeah, okay, they should, but they don't.

We have to meet our first-year students where they are. We have to go to them and carry them along. In a sense that's what I hear you saying. That in any kind of education, whether formal or informal, we have to let go of our prior expectations of

I think sometimes in these conversations we talk about a loss of trust and confidence in scientific institutions as if the institutions are fine and it's the people that are misguided. And it's worth reflecting on that. There are a lot of good reasons why people shouldn't trust scientific institutions. There is a long history of exclusionary and problematic practices by scientific institutions.

what our audiences should know, what they should believe, what they should think, and accept what they do know and think, and work with that.

This issue of lack of trust in science didn't start with the last election cycle nor did it start with the pandemic. It's been brewing for more than thirty years. Now the scientific community is doing many of the things that we need to do, and museums are helping with that.

We have done a lot to move in the direction that we need to, but a problem that took thirty years to develop will likely take thirty years to solve. I think one of the really important things we need to do, which is hard, is to be patient and to realize that this is a long game, and it is not about what's going to happen in the next four weeks. Whatever happens in this presidential election we have to take a long view and think about how we continue to build the institutions, the programs, the approaches to teaching, in both formal and informal education, that will reach people in diverse ways.

We have already begun that. When I was in graduate school, if you wanted to do public outreach, if you wanted to take a class in writing or public speaking, if you wanted to write an opinion piece, your professors told you in no uncertain terms that you didn't have time for that. That was their polite way of convincing you that those things weren't important. I was in graduate school when Carl Sagan was famous, and I remember hearing scientists and professors say terrible things about Carl Sagan – that he was a popularizer, that he was a grandstander, that he was egotistical. Well, maybe he was. I didn't know the man personally. But so what? He did so much good work for us as a community. So many people became interested in science, liked science, saw science as something that fed their curiosity and that they could enjoy, because he made it interesting and fun.

I think we've come a long way since then. Neil deGrasse Tyson gets a much better reception than Carl Sagan ever did. We've become much better at embracing and accepting that we should be grateful for those in our midst who can do that kind of work. But we still have work to do, particularly in universities where young faculty feel that if they do public work, it will be held against them. It will be viewed as a sign that they're not really serious.

DECATUR: I think sometimes in these conversations we talk about a loss of trust and confidence in scientific institutions as if the institutions are fine and it's the people that are misguided. And it's worth reflecting on that. There are a lot of good reasons why people shouldn't trust scientific institutions. There is a long history of exclusionary and problematic practices by scientific institutions. If you look at the Pew data, in addition to the divide on political party affiliation, there are also racial divides in terms of confidence in science with African Americans and groups that have historically been excluded from full participation in the scientific enterprise, who not surprisingly have less trust in scientific institutions. These institutions can be uncomfortable places for people who bring different perspectives, different views, or different experiences. We need to think about how we want to engage people, how we relate to a broad range of audiences, and how institutions may need to change some of their practices to address inclusion in a much broader way. I think there are moments when science communicates that it somehow stands apart, and that reinforces a lack of trust and confidence that folks have.

ORESKES: I think we've been better at the first part of this problem by allowing young people to do public outreach and not denying them tenure because they did that. I think we've been not as good about embracing in a deep way what the long-term implications of our exclusionary practices have been, and part of that may be the lack of good data. One thing I've noticed is that as scientists, we're sometimes unscientific in our approach when we start looking at broader social questions and people assert things that might or might not be true. For example, on this question of trust in relation to historical practices, you'll probably remember that

when the vaccines first became available for the COVID-19 virus, newspapers were reporting that Black people weren't getting vaccines because of the legacy of Tuskegee. I remember thinking: how do you know that? Have you spoken to the community? Are you talking to people? I was skeptical that the legacy of Tuskegee was the main reason Black Americans weren't getting the COVID vaccine.

As the data came out, the studies showed two things. One was that it wasn't so much about history, but about the experiences that people of color have *today* when they go to the doctor or try to get medical care. They may not have a doctor. At one point during the pandemic, Dr. Robert Redfield, then-director of the Centers for Disease Control and Prevention, said, "If you think you're sick, call your doctor." That's a pretty clueless thing to say given that half of all Americans do not have a doctor – and they are not just people of color. There are plenty of White people in this country who don't have doctors. The second thing that came out as the data became available was that the reason why many people were not getting vaccinated was because they couldn't get a day off from work because of the practices of their employers or because they didn't have paid vacation or sick time. If they got sick *from* the vaccine, which many of us did, they wouldn't have a paid day off. It's not that Tuskegee isn't part of the story. It may well be, but there were other more immediate short-term factors that were also playing a role, and probably a larger one.

Religion is another important factor. It's an issue that is close to my heart, both in terms of my research and as a long-time board member of the National Center for Science Education. One of the things that I've written about and studied has to do with what I call *implicatory denial*: when people reject scientific evidence because they don't like its implications (or perceived implications). This comes up a lot in the domain of religion. We have studies that show that many Americans who reject evolutionary theory reject it because they believe that it implies the nonexistence of God. This is a form of implicatory denial.

But evolutionary biology does *not* disprove the existence of God. So this is a perceived implication, not a real one, which means there's an opportunity to open a conversation about what evolution implies about God, including the possibility that it implies nothing at all.

There were some wonderful studies done at Arizona State Universities, in which teachers made clear to their students that evolutionary biology does *not* disprove the existence of God. They did that in a variety of different ways. They assigned papers written by scientists who are themselves people of faith, like physicist Sir John Houghton or Brown University professor Ken Miller. They talked about Stephen Jay Gould's arguments about non-overlapping magisteria – that science and religion are complementary but not competing arenas; that science is about natural phenomenon and religion is about the supernatural. There are many different ways that you can make this point, and the studies show that when you do, it lessens the resistance of students in the classroom to engage with evolutionary theory.

> "I think a lot of scientists naively thought that when the vaccine came around it would be like 1945 when physics won the war. We would be greeted as people who saved humanity. Now the vaccine did save a lot of lives, but it wasn't universally accepted.

I'll give one more example. Many years ago when I taught at the University of California, my institution had a prize for science communication and we gave that prize to Richard Dawkins. Some of you may be fans of Richard Dawkins and I will admit that he's a great writer and a fabulous speaker, but I believe that he has done more damage to the relationship between science and people of faith than anyone alive on this planet. The fact that my institution gave him a prize without apparently understanding that the message he was promoting about the relationship of science to people of faith was deeply troubling. So it's important to consider the messages we're conveying. We may personally think that people of faith are wrong to believe in God, but if you're trying to reach diverse communities, that message is not the way to make friends and influence people.

THORP: I think a lot of scientists naively thought that when the vaccine came around it would be like

1945 when physics won the war. We would be greeted as people who saved humanity. Now the vaccine did save a lot of lives, but it wasn't universally accepted in the way science was in 1945 when the approval rate of science was probably 95 percent and it led to the launch of the funded science enterprise in America. Were you surprised at what happened during the pandemic? I'm guessing no. But what would you say to the folks who were surprised? My answer would be to read some of your books.

ORESKES: But not just my book. Any books on the history of medicine would be a good resource.

THORP: So what do we do about vaccine hesitancy and resistance?

ORESKES: I wasn't surprised. I and virtually every historian of medicine I know saw this coming. There's a long history of vaccine resistance. There was a lot of resistance to the Salk vaccine, which we've now forgotten about and wiped away because we see that as a great success of modern science. It's not my intention to insult anyone personally from the CDC who may be here with us, but I think the CDC was negligent in not taking seriously what the social part of vaccine delivery needed to look like. This is an area where I think the scientific community still has a lot of work to do. You cannot develop a medical treatment without addressing the social dimensions of health care delivery and expect things to go well.

DECATUR: If we look back, we see that we have had a golden era in which scientific discoveries were universally embraced. And it's natural to have some skepticism about who owns and controls the scientific innovation, given the power and authority of institutions. People who have reason to question the broader systems of authority and power naturally question the technology and the science that goes along with it. They are connected.

I think museums are well positioned to do two things. One is to work to democratize science as much as possible, to open up ways in which folks from the broader public can engage in conversations about the process of science. And the second is to show how science actually works: that new observations can change a set of ideas. The more transparent we are about how science works and the more open we are to invite people into the conversation, the better we can dispel the notion that science is exclusive to elites connected to power or institutional authority. It is a risky position to put ourselves in, because we are inviting people in to engage in dialogue and ask questions about what we do. But I come back to the idea of going to where people are and a sense of humility that we can't expect everyone to come to us. We may have to change our language and how we talk about religion in order to bring people into a conversation. And humility in the way we act and engage is important.

THORP: Let's now take some questions from the audience.

AUDIENCE MEMBER: What do we mean by mistrust of science? Everybody in this room expects that when I flick the switch, the lights will come on. When I put my key in the car and it turns on, that's trust in things that were made through scientific, engineering, and technological inquiry and innovation. I want to argue that we should try to be a little more specific about the locus of distrust. This program is being watched on Zoom. Ten years ago, we could never imagine being able to watch such a program live while being in another city or even another country. But that possibility now is a product of science. But there's a distrust that comes in the door when science and society meet. There's mistrust right now about things concerning our bodies, about disease, and about the control of epidemics. There are people who are actively manipulating facts that we know are facts. So how do we counter all of this if we don't get specific about what we mean about the aspects of the scientific enterprise that are now front and center being distrusted by our publics?

THORP: Let me add one thing before I ask Sean and Naomi to comment. The journal *Science* is very deliberately crafted so that our audience is other scientists. Occasionally we have a news story that millions of people look at and we always love that because that's good for our metrics, but our number one goal is to write for other scientists.

DECATUR: I think it is important to be specific about what's being mistrusted. And it might be broader than health and the body. For example, the mistrust concerning the environment and other aspects of the natural world often focuses on food production, which we know is connected to our health. Let me also add that there's a difference between trusting your doctor and trusting an institutional authority that may or may not have your interest aligned with the conclusions that they are making.

AUDIENCE MEMBER: The research shows that Republicans with a lot of formal education are more skeptical than Republicans with less education. Is this a failure of our educational system or a tribute to the willingness to challenge accepted wisdom that should be encouraged by education?

ORESKES: I would say it's not either one of those. The instinct of almost all of us is to think education is the solution. And yet we know, for example, that the more educated a Republican is the more likely they are to be a climate denier. That is a good example of motivated reasoning. Educated people are very good at finding the information that supports the view they want to hold. We know that many conservatives are ideologically motivated to distrust climate science or other science that implies a need for government intervention in the marketplace. So just giving those people more information doesn't solve the problem.

What does solve the problem? Well, that's a good question. We don't actually have good data on this. And there isn't a one-size-fits-all solution. Many Republicans who reject climate science are very pro-technology. Many of them are supportive of the space program. It's pointless to tell them how great technology is; they already accept that. So what is the solution? One strategy that I've sometimes used in public talks is to focus on market-based mechanisms to address climate change. For example, I'll say, "Let's talk about a climate leader, George H. W. Bush." Now he may not be a hero to many Republicans today, but he was a Republican president. Sometimes you can begin the conversation by recognizing what's at stake. These folks will not be persuaded by more information about satellite measurements of the troposphere. But if you say, "Here are some market-based solutions, and here is how they worked for acid rain, and the price of electricity didn't go up," that can be a way to create space for a conversation.

DECATUR: Now this might sound contradictory because I'm looking forward to the next round of Pew data, but I think the surveys are flawed. I'm not quite sure how to interpret many of the questions. For example, how much trust do you have in science or scientists? Or what's the net good of science? Or do you think science had a positive impact, a very positive impact, a negative impact, a very negative impact, etc.? A lot of those questions depend on how at that moment you're reading the word *science*. What happens if we swap science with technology when there's a lot of negative swirl about the technology sector and the overall impact of the technology sector is negative? But if you put it in the broader context of all the things that technology has done over the course of the past few years, you read it in a different way. I think those surveys have enough ambiguity in them and so depending on how one reads it, the data are unclear. And that relates back to the lack of specificity.

AUDIENCE MEMBER: There are scientists who are untrustworthy, corrupt, or paid to mislead human knowledge. On the other side, there is an organized assault against the idea of checking each other's facts and reasoning. And that is what science is. We check each other because we're all fallible. Well, the people who are against being fact checked, the people who want to be able to tell any lie today and no one will notice it's different from what they were saying yesterday or a week ago, they are in effect enemies of science. So what do we do? With regard to whether scientists do their work honestly, money is the source of corruption so we have to take business money out of the system. For instance, the evaluation and testing of drugs should not be funded by the drug companies. The government should tax those companies and then spend that money testing the drugs. In that way, even though the same companies may be ultimately paying for the testing, they won't have control over which scientists are doing the testing. And then there's the systematic attack on the idea of truth. Could you comment on that?

ORESKES: One of the important issues you raise is that we need to clean up our own house. I think universities have been either naive or in denial about some of the corrupting influences of funding. As you may know, I've written about Harvard and Jeffrey Epstein. Princeton recently said they would not accept funding from companies that had been involved in disinformation or corrupting the scientific process. But then last week they said they were going to take money from Exxon Mobil because it's too much of a hardship for their faculty if they don't! In effect they are saying: we'll stand on principle until it hurts and then we won't. We're asking people to trust our moral compass at

the same time that it's clear that our moral compass is being deflected by the magnetism of money.

AUDIENCE MEMBER: I want to follow up on trying to figure out which parts of science people are uncomfortable with. When you drop a ball it falls, when I turn my car on it runs – those are things that happen every time. But when you talk about vaccines and whether I will get a disease or not, or climate change, that has to do with probability, statistics, averages. Could it be that people don't understand or are uncomfortable with the science? What is the difference between saying, "This vaccine helps 80 percent of people, but I know a guy and the vaccine didn't work for him" versus the kind of science that predicts something that happens every time? What can we do to help people understand that when science gives us probabilistic or statistical results instead of certainties, that's still important information?

We need clear communication about how science actually works, and we need to be clear when we're talking about something in terms of probabilities. It is on us to communicate better. We can't just say that this is complicated, and you don't need to know about it. Just take the shot and trust us. We need to go through the process of being clear in explaining where we are and how we arrived at this point.

DECATUR: For me it comes back to being very clear in how we communicate what science is, what the process is, and what it means when we make a statement. There's a lot for us to unpack about the COVID-19 response. It was a chaotic time, and the folks in the middle of that chaotic situation were trying to communicate in the best way they could. When we express things in absolutes and then those absolutes turn out to be not so absolute, people pull back.

And so the notion that you should take a vaccine and you're going to be fine, and then everything isn't fine, or being fine doesn't mean the same thing to everyone, that leads to distrust. We need clear communication about how science actually works, and we need to be clear when we're talking about something in terms of probabilities. It is on us to communicate better. We can't just say that this is complicated, and you don't need to know about it. Just take the shot and trust us. We need to go through the process of being clear in explaining where we are and how we arrived at this point.

AUDIENCE MEMBER: Could you talk about the mistrust of federal agencies, like NASA and the Atomic Energy Commission?

ORESKES: There are a lot of different federal agencies and they behave in different ways. My former postdoc Viktoria Cologna has a set of papers that are in press right now about a study she did of trust in science in sixty-eight countries. One of the questions she posed in the survey had to do with the alignment between people's values and scientific research. She found that in many countries distrust of science is aligned with disagreement with scientific priorities. In many countries, people would like to see scientists do more work on health, medicine, and the environment, and less work on the military.

This is an elephant in the room. We all know that a huge amount of science in this country and also in Europe is linked to military applications funded by military agencies. The Department of Energy came out of the Atomic Energy Commission, which was historically linked to the atomic bomb, but we almost never talk about that. Ronald Reagan said the eleventh commandment was not to speak ill of a fellow Republican. I feel like the twelfth commandment is thou shalt not speak ill of a fellow scientist. We've been reluctant to have an honest conversation about the priorities of science as an enterprise. DOE is spending millions of dollars right now to persuade people to like nuclear energy. To me that is wrong on so many levels. Even if you thought that was a good goal, DOE is not the right agency to do that. Holden, as the editor of *Science*, you are in a good position to help us have this conversation.

THORP: I think there is a way for us to decouple ourselves from other institutions, which would include the agencies and the universities because they always circle the wagons when there's a problem but they are reluctant to stand up for things that are correct if those things are controversial. For example, we have this neutrality movement in higher education that is really not about neutrality. It's just staying out of things when it might get you into trouble. It would be so much better if they would tell the truth. For instance, if a faculty member wrote

a great paper about climate science or abortion or guns and you ask if the university has anything to say about those issues, they answer, "No, we're neutral. We don't talk about these things." But if a paper is wrong, and I write to Harvard, for example, and say we need to work on this, the research integrity officer will write back and say, "Thank you for letting me know. Research integrity is very important to Harvard University." And that's it.

Every time I write to them, they'll write back with the same response. Meanwhile people are angry that the paper hasn't been corrected. And then there are graduate students who are reading the paper and deciding whether they're going to repeat the experiment or use it in their thesis. We should tell them that we're working on the problems with the paper. But I get absolutely nothing from the institutions when it comes to this, and the agencies are the same way. We just had a news story in *Science* about misconduct that happened at the NIH. There was no comment from the NIH the whole time we were working on the story. And then right before we published the story, NIH said, "Actually, we've been investigating this and we found two instances of misconduct" – by the way, in the story we identified hundreds of cases of misconduct – "and we've dealt with them and have no further comment."

There was nothing from the NIH about how we take this seriously, that we're sorry if anybody was harmed, that these are the things we're going to do to make sure this doesn't happen again. Zip. The universities and the funding agencies are afraid. So that leaves us with saying, I'll correct the papers when they're wrong and I'll stand up for them when they're right, but it sure would be nice if I got some help from the institutions and the agencies. I think the way that science could decouple itself from the decline in trust in institutions that we're seeing is to be much more open and direct about when we screw up, and when we do something that's controversial that we're willing to stand up and acknowledge it. Because there's almost nobody else doing it with us.

ORESKES: Isn't it ironic how scientists of all people will not admit and correct their mistakes?

THORP: That would help us avoid the kind of decline seen in other institutions that are constantly focused on damage control, relying on PR firms and attorneys to stay out of trouble. But let's end on something positive. What makes you hopeful? I'll start. What makes me hopeful is that there's a culture that's slowly developing in science to hold ourselves more accountable, and I'm doing everything that I can to promote the people who are doing that. As younger scientists come into the fold, I think they're much more open and understanding about this, and I think there's a pathway for science to be a much more approachable and interactive enterprise if we all commit ourselves to that. Sean, what makes you hopeful?

DECATUR: The thing that makes me hopeful is the curiosity that I see in young people. There's something about wanting to understand the world around you, and to watch that develop gives me a sense of hope. Also institutions are evolving and becoming more transparent. The current generation of graduate students and postdocs are committed to that more open and transparent way of operation, and they may be the folks in charge of those institutions twenty years from now. So the fact that kids today are curious and invested in learning about the world and hopefully remain so when they are adults and that the folks who may be in charge of our institutions twenty years from now will have moved things forward to be more transparent – both of those things give me hope.

ORESKES: I must say I hate this question. It's become formulaic that we end programs with it. I get invitations all the time that go like this, "We want you to tell the truth. We want to know what's going on. But let's end on a happy note!" I feel like I'm being asked to be the mommy and tell the children everything is going to be okay. Everyone here is a grownup and you recognize that these are real and serious problems. I don't know if everything is going to be okay. I do think there's been a lot of positive change. Young people and graduate students are much more engaged on these issues. But we still have a lot of work to do. We need to think hard and seriously about what short-term and long-term actions could make a difference.

THORP: Your answer did make me hopeful; thank you. I would like to thank Sean and Naomi for a great discussion. And now it is my pleasure to turn things over to Cristine Russell, who's been my partner in putting this program together.

The conversation today has reinforced the importance of building trust within our communities and the country at large and the need for continued dialogue and action. We know there are new challenges ahead, but there is also unprecedented interest in making a difference in the way that science is communicated.

## Cristine Russell

Cristine Russell is a former Senior Fellow in the Environment and Natural Resources Program at the Belfer Center for Science and International Affairs at Harvard Kennedy School. She was elected to the American Academy of Arts and Sciences in 2020.

Let me start with saying that I'm a science journalist, not a scientist. I want to thank our panelists for sharing their wonderful expertise, insights, and perspectives. And many thanks to Holden for moderating this program and getting his arms around a really big subject. And let me thank all of you in the audience for your participation, thoughtful questions, and engagement.

We covered a lot of different topics today. I want to highlight one important point that Naomi made: that trust in science has declined less than trust in other institutions, with journalism, banking, and government down near the bottom. We also talked about the decline in trust in science among conservatives. But that's not new. This decline in trust has been building for thirty years. As we approach the very polarized presidential election in the coming weeks, we're hearing more about distrust of science. What I hope we can get to is some understanding about the steps that we need to take to rebuild trust in science, and our exploratory meeting tomorrow will be discussing some of those issues. The conversation today has reinforced the importance of building trust within our communities and the country at large and the need for continued dialogue and action. We know there are new challenges ahead, but there is also unprecedented interest in making a difference in the way that science is communicated. I'm excited that the Academy is facilitating expert discussions on this topic and helping to generate new ideas and a path forward. This issue is not new, but it is important that we continue to make progress by reaching out to the general public to rebuild trust in science.



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**To view or listen to the presentations, visit www.amacad.org/events/rebuilding-public-trust-science.**

# NOTEWORTHY

## Select Prizes and Awards to Members

### RECIPIENTS OF THE NATIONAL HUMANITIES MEDAL, 2022

**Joy Harjo** (Tulsa, OK)

**Ruth J. Simmons**
(Harvard University)

**Pauline Yu**
(American Council of Learned Societies)

### RECIPIENTS OF THE NATIONAL HUMANITIES MEDAL, 2023

**Roz Chast** (*The New Yorker*)

**Robin Wall Kimmerer**
(SUNY College of Environmental Science and Forestry)

**Dawn Porter** (Trilogy Films)

**Darren Walker**
(Ford Foundation)

### RECIPIENTS OF THE NATIONAL MEDAL OF ARTS, 2023

**Mark Bradford** (Art + Practice)

**Ken Burns** (Florentine Films)

**Spike Lee** (40 Acres and a Mule Filmworks)

**Steven Spielberg**
(Amblin Entertainment, Inc. & DreamWorks SKG)

### RECIPIENTS OF THE NATIONAL MEDAL OF SCIENCE, 2025

**Richard B. Alley**
(Pennsylvania State University)

**Larry Martin Bartels**
(Vanderbilt University)

**Bonnie L. Bassler**
(Princeton University)

**Angela Marie Belcher**
(Massachusetts Institute of Technology)

**Helen M. Blau**
(Stanford University)

**Emery Neal Brown**
(Harvard Medical School)

**Ingrid Daubechies**
(Duke University)

**Cynthia Dwork**
(Harvard University)

**R. Lawrence Edwards**
(University of Minnesota)

**Wendy L. Freedman**
(University of Chicago)

**Keivan G. Stassun**
(Vanderbilt University)

**G. David Tilman**
(University of Minnesota)

**Teresa Kaye Woodruff**
(Michigan State University)

### RECIPIENTS OF THE NATIONAL MEDAL OF TECHNOLOGY AND INNOVATION, 2025

**Jennifer A. Doudna**
(University of California, Berkeley)

**Paula T. Hammond**
(Massachusetts Institute of Technology)

**David R. Walt**
(Brigham and Women's Hospital)

**Feng Zhang**
(Massachusetts Institute of Technology)

### RECIPIENTS OF THE NOBEL PRIZE IN CHEMISTRY, 2024

**David Baker**
(University of Washington)

**Demis Hassabis**
(Google DeepMind)

### RECIPIENTS OF THE NOBEL PRIZE IN ECONOMIC SCIENCES, 2024

**Daron Acemoglu**
(Massachusetts Institute of Technology)

**James A. Robinson**
(University of Chicago)

### RECIPIENTS OF THE NOBEL PRIZE IN PHYSICS, 2024

**Geoffrey E. Hinton**
(University of Toronto)

**John J. Hopfield**
(Princeton University)

### RECIPIENTS OF THE NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE, 2024

**Victor Ambros**
(UMass Chan Medical School)

**Gary Ruvkun**
(Harvard Medical School)

### RECIPIENTS OF THE PRESIDENTIAL MEDAL OF FREEDOM, 2025

**Bono** (U2)

**Ashton Baldwin Carter** †
(Harvard Kennedy School)

**Hillary Rodham Clinton**
(Bill, Hillary & Chelsea Clinton Foundation)

**Jane Goodall**
(Jane Goodall Institute)

**David M. Rubenstein**
(The Carlyle Group)

**George Soros**
(Soros Fund Management)

**Denzel Washington**
(Los Angeles, CA)

† *Deceased*

## Other Prizes and Awards to Members

**Quarraisha Abdool Karim** (Columbia University; Centre for the AIDS Programme of Research in South Africa) received the 2024 Lasker~Bloomberg Public Service Award, given by the Lasker Foundation. Professor Abdool Karim shares the award with Salim S. Abdool Karim (Columbia University; Centre for the AIDS Programme of Research in South Africa).

**Floyd Abrams** (Cahill Gordon & Reindel LLP) received the National Coalition Against Censorship's inaugural Floyd Abrams Award.

**Héctor D. Abruña** (Cornell University) received the Enrico Fermi Presidential Award, bestowed by the U.S. government. Dr. Abruña shares the award with **Paul Alivisatos** (University of Chicago) and John H. Nuckolls (formerly, Lawrence Livermore National Laboratory).

**Paul Alivisatos** (University of Chicago) received the Enrico Fermi Presidential Award, bestowed by the U.S. government. Dr. Alivisatos shares the award with **Héctor D. Abruña** (Cornell University) and John H. Nuckolls (formerly, Lawrence Livermore National Laboratory).

**Richard Andersen** (California Institute of Technology) was awarded the 2024 International Prize for Translational Neurosicence by the Gertrud Reemtsma Foundation.

**Carol Anderson** (Emory University) received the Freedom Summer of '64 Award, given by Miami University.

**Kwame Anthony Appiah** (New York University) was awarded the John W. Kluge Prize for Achievement in the Study of Humanity by the Library of Congress.

**Frances Arnold** (California Institute of Technology) was awarded the 2025 Priestley Medal, given by the American Chemical Society.

**Gilda A. Barabino** (Olin College of Engineering) was awarded the 2024 Carnegie Mellon University Dickson Prize in Science.

**Richard G. Baraniuk** (Rice University) was awarded the 2025 IEEE Jack S. Kilby Signal Processing Medal.

**Regina Barzilay** (Massachusetts Institute of Technology) received the 2025 Frances E. Allen Medal from the Institute of Electrical and Electronics Engineers.

**Lee C. Bollinger** (Columbia University) received the National Coalition Against Censorship's Judy Blume Lifetime Achievement Award.

**Jericho Brown** (Emory University) was named a 2024 MacArthur Fellow.

**Emily Carter** (Princeton University) received the American Chemical Society's 2024 Marsha I. Lester Award for Exemplary Impact in Physical Chemistry.

**Cathy J. Cohen** (University of Chicago) received the 2024 Frank J. Goodnow Award from the American Political Science Association.

**Jason Cong** (University of California, Los Angeles) received the 2024 Phil Kaufman Award from the Electronic System Design Alliance and the Council on Electronic Design Automation (CEDA) of the Institute of Electrical and Electronics Engineers.

**Nicholas Donofrio** (IBM) was named a Fellow of Sigma Xi.

**Scott Emr** (Cornell University) and **Wesley Sundquist** (University of Utah) were awarded the 2024 Louisa Gross Horwitz Prize from Columbia University.

**Ronald Evans** (Salk Institute for Biological Studies) is the recipient of the 2025 Kimberly Prize in Biochemistry and Molecular Genetics from the Simpson Querrey Institute for Epigenetics.

**Percival Everett** (University of Southern California) received the 2024 National Book Award for fiction for his novel *James*.

**Rusty Gage** (Salk Institute for Biological Studies) was awarded the 2024 J. Allyn Taylor International Prize in Medicine by Western University. Professor Gage was also awarded the 2024 Ogawa-Yamanaka Stem Cell Prize by Gladstone Institutes.

**Miguel García-Garibay** (University of California, Los Angeles) received the 2025 James Flack Norris Award in Physical Organic Chemistry from the American Chemical Society.

**David D. Ginty** (Harvard Medical School) received the Perl-UNC Neuroscience Prize from the UNC School of Medicine.

**David Goeddel** (The Columm Group) received UC San Diego's 2025 Chancellor's Medal.

**Andrea Goldsmith** (Princeton University) was named to the Wireless Hall of Fame.

**Jeffrey I. Gordon** (Washington University in St. Louis) was awarded the 2024 Nierenberg Prize for Science in the Public Interest by The Scripps Institution of Oceanography.

**Fan Chung Graham** (University of California, San Diego) was awarded a 2024 Revelle Medal by the University of California, San Diego.

**Stephan Haggard** (University of California, San Diego) was awarded a 2024 Revelle Medal by the University of California, San Diego.

**Naomi J. Halas** (Rice University) was awarded the Australian Academy of Science's 2024 Geoffrey Frew Fellowship.

**Sally Haslanger** (Massachusetts Institute of Technology) was named the 2024 recipient of the Philip L. Quinn Prize from the American Philosophical Association.

**Barton F. Haynes** (Duke University School of Medicine) received the 2024 William G. Anlyan Lifetime Achievement Award, given by the Duke Medical Alumni Association.

**Matthias Hentze** (European Molecular Biology Laboratory) was awarded the Otto Warburg Medal 2025 of the Society for Biochemistry and Molecular Biology.

**Peter Hotez** (Baylor College of Medicine) received the 2024 John P. McGovern Science and Society Award from Sigma Xi, The Scientific Research Honor Society. Dr. Hotez was also awarded the Villanova University Mendel Medal.

**Richard Ivry** (University of California, Berkeley) was awarded the Andrew Carnegie Prize in Mind and Brain Sciences by Carnegie Mellon University.

**Jainendra Jain** (Pennsylvania State University) was elected as a Foreign Fellow of the Indian National Science Academy.

**Sheila Johnson** (Salamander Collection) received a People's Choice Award for Nonfiction, one of the Virginia Literary Awards given by the Library of Virginia, for her book *Walk Through Fire: A Memoir of Love, Loss, and Triumph*.

**Johan Anthony Willem Kamp** (University of Stuttgart) was awarded the Rolf Schock Prize for Logic and Philosophy by the Royal Swedish Academy of Sciences.

**Takeo Kanade** (Carnegie Mellon University) received the 2024 John Scott Award from the Board of Directors of City Trusts. Dr. Kanade shares the award with **Vijay Kumar** (University of Pennsylvania) and **Daniela Rus** (Massachusetts Institute of Technology).

**Martin Karplus** † (Harvard University) was awarded the Grand Decoration of Honor in Gold with Sash for Services to the Republic of Austria.

**Jeffrey Kelly** (Scripps Research Institute) received the 2024 Stein & Moore Award from the Protein Society.

**Pradeep K. Khosla** (University of California, San Diego) was elected as a Foreign Fellow of the Indian National Science Academy.

**Chryssa Kouveliotou** (George Washington University) received the 2024 Bodossaki Excellence Award in the field of natural sciences.

**Tony Kouzarides** (University of Cambridge) was awarded a British Knighthood for services to healthcare innovation and delivery.

**Vijay Kumar** (University of Pennsylvania) received the 2024 John Scott Award from the Board of Directors of City Trusts. Dr. Kumar shares the award with **Takeo Kanade** (Carnegie Mellon University) and **Daniela Rus** (Massachusetts Institute of Technology).

**Lynne Maquat** (University of Rochester Medical Center) received the 2024 Dr. Paul Janssen Award for Biomedical Research from Johnson & Johnson.

**Michael Marletta** (University of California, Berkeley) was named a Fellow of the American Institute for Medical and Biological Engineering.

**Margaret Martonosi** (Princeton University) received the Frances E. Allen Award for Outstanding Mentoring from the Association of Computing Machinery.

**Michael B. McElroy** (Harvard University) was awarded the 2024 William Bowie Medal by the American Geophysical Union.

**Julie Mehretu** (New York, NY) was awarded the rank of Officer of the Ordre des Arts et des Lettres by the French Ministry of Culture.

**Louis Menand** (Harvard University; *The New Yorker*) was awarded the Robert B. Silvers Prize for Literary Criticism from the Robert B. Silvers Foundation.

**Priyamvada Natarajan** (Yale University) was awarded the 2025 Dannie Heineman Prize for Astrophysics by the American Astronomical Society and the American Institute of Physics.

**William D. Nix** (Stanford University) was elected to the Royal Society of London as a Foreign Member.

**Andre Nussenzweig** (National Institutes of Health) received the Bert and Natalie Vallee Award in Biomedical Science from the American Society for Biochemistry and Molecular Biology.

**Elaine Oran** (Texas A&M University) was elected as a Fellow of the Royal Academy of Engineering.

**Julie Packard** (Monterey Bay Aquarium) was awarded the UC Presidential Medal.

**Roderic Pettigrew** (Texas A&M University) received the 2024 Research Achievement Award from the American Heart Association.

**Janet B. Pierrehumbert** (University of Oxford) was elected as a member of the Academia Europaea.

**Susan Quaggin** (Northwestern University Feinberg School of Medicine) received the 2024 John P. Peters Award, given by the American Society of Nephrology.

**Kenneth Ribet** (University of California, Berkeley) received the 2025 Leroy P. Steele Prize for Seminal Contribution to Research from the American Mathematical Society.

**Dorothy Roberts** (University of Pennsylvania) was named a 2024 MacArthur Fellow.

**Daniela Rus** (Massachusetts Institute of Technology) received the 2025 Edison Medal from the Institute of Electrical and Electronics Engineers. Dr. Rus also received the 2024 John Scott Award from the Board of Directors of City Trusts, and she shares that award with **Takeo Kanade** (Carnegie Mellon University) and **Vijay Kumar** (University of Pennsylvania).

**Eric Schickler** (University of California, Berkeley) received the 2024 Barbara Sinclair Lecture Award from the American Political Science Association.

**Joseph Schlessinger** (Yale University) received the Herbert Tabor Research Award from the American Society for Biochemistry and Molecular Biology.

**Erin Schuman** (Max Planck Institute for Brain Research) was awarded the Körber European Science Prize.

**Keivan G. Stassun** (Vanderbilt University) was named a 2024 MacArthur Fellow.

**Wesley Sundquist** (University of Utah) and **Scott Emr** (Cornell University) were awarded the 2024 Louisa Gross Horwitz Prize from Columbia University.

**Sarah Tishkoff** (University of Pennsylvania) was awarded the 2024 Vanderbilt Prize in Biomedical Science by the Vanderbilt University Medical Center.

**Peter Ungar** (University of Arkansas) received the 2024 OMNI Keeling/Hansen Climate Science Award from the Fulbright College of Arts and Sciences at the University of Arkansas.

**Carrie Mae Weems** (Syracuse, NY) is the recipient of a 2022 National Medal of Arts.

† *Deceased*

**Paul S. Weiss** (University of California, Los Angeles) received the 2024 Sigma Xi William Procter Prize for Scientific Achievement.

**Michael Whitlock** (University of British Columbia) is the recipient of the 2024 Molecular Ecology Prize, given by the journal *Molecular Ecology*.

**Omar M. Yaghi** (University of California, Berkeley) was awarded the 2024 Tang Prize in Sustainable Development.

**Chen Yi** (University of Missouri-Kansas City) was elected as an honorary member of the International Society for Contemporary Music.

**Jizhong Zhou** (University of Oklahoma) received the Distinguished Scientist Award from the Southeastern Universities Research Association.

## New Appointments

**Ann M. Arvin** (Stanford University) was appointed to the Board of Directors of Research Bridge Partners.

**Ian Baucom** (University of Virginia) was named President of Middlebury College.

**Stephen Blacklow** (Harvard Medical School) was appointed Chair of the Scientific Advisory Board of Odyssey Therapeutics, Inc.

**Anantha P. Chandrakasan** (Massachusetts Institute of Technology) was appointed to the Board of Trustees of Natcast.

**Juan de Pablo** (University of Chicago) was named Executive Dean of New York University's Tandon School of Engineering and the University's inaugural Executive Vice President for Global Science and Technology.

**Benjamin L. Ebert** (Dana-Farber Cancer Institute; Harvard Medical School) was appointed President and CEO of Dana-Farber Cancer Institute.

**Julio Frenk** (University of Miami) was appointed Chancellor of the University of California, Los Angeles.

**William G. Howell** (University of Chicago) was named Dean of the School of Government and Policy at Johns Hopkins University.

**Sun Hur** (Harvard Medical School) was appointed to the Scientific Advisory Board of Odyssey Therapeutics, Inc.

**Kathleen Hall Jamieson** (University of Pennsylvania) was named to the Communications and Public Engagement Working Group for the Centers for Disease Control and Prevention's Advisory Committee to the Director.

**William F. Lee** (WilmerHale) was elected to the Board of Directors of the John D. and Catherine T. MacArthur Foundation.

**Jeffrey Leiden** (Vertex Pharmaceuticals) was appointed as a key advisor to Enlaza Therapeutics.

**Lúcia G. Lohmann** (University of California, Berkeley) was appointed President of the Missouri Botanical Garden.

**John F. Manning** (Harvard Law School) was appointed Provost of Harvard University.

**Dwight A. McBride** (Washington University in St. Louis) was named Executive Director of the Center for the Study of Race, Ethnicity & Equity at Washington University in St. Louis.

**Ruslan Medzhitov** (Yale University School of Medicine) was appointed to the Scientific Advisory Board of Odyssey Therapeutics, Inc.

**Melissa Moore** (Moderna Therapeutics) was appointed to the Board of Directors of Chroma Medicine, Inc.

**Alondra Nelson** (Institute for Advanced Study) was elected to the Board of Directors of the John D. and Catherine T. MacArthur Foundation.

**Eric Nestler** (Icahn School of Medicine at Mount Sinai) was appointed to the Science Advisory Board of Sparian Biosciences, Inc.

**Jill Pipher** (Brown University) was named to the Board of Trustees of the Simons Foundation.

**James Rothman** (Yale University) was appointed as an Independent Director of the Board of Noscendo GmbH.

**Alexander Rudensky** (Memorial Sloan Kettering Cancer Center) was appointed to the Scientific Advisory Board of Odyssey Therapeutics, Inc.

**Michel Sadelain** (Memorial Sloan Kettering Cancer Center) was named Director of the Columbia Initiative in Cell Engineering and Therapy and Director of the Cancer Cell Therapy Initiative in the Herbert Irving Comprehensive Cancer Center at Columbia University Irving Medical Center.

**Peter Salovey** (Yale University) was elected to the Board of Trustees of Stanford University.

**Mariko Silver** (Henry Luce Foundation) was appointed President and CEO of Lincoln Center for the Performing Arts.

**Ruth Simmons** (Rice University; Harvard University) was appointed to the Board of Directors of the Federal Reserve Bank of Dallas.

**Peter L. Slavin** (Massachusetts General Hospital) was named President and CEO of both Cedars-Sinai Medical Center and Cedars-Sinai Health System.

**Natasha Trethewey** (Northwestern University) was elected to the Pulitzer Prize Board.

**Steven Wilkinson** (Yale University) was named Dean of the Faculty of Arts and Sciences at Yale University.

**Lewis T. Williams** (Ten30 Biosciences) was appointed Chairman of the Board of Directors of ReAlta Life Sciences, Inc.

**Eleanor Wilner** (Philadelphia, PA) was elected to the Academy of American Poets' Board of Chancellors.

## Select Publications

### POETRY

**Paul Muldoon** (Princeton University). *Joy in Service on Rue Tagore.* Farrar, Straus and Giroux, September 2024

**Carl Phillips** (Washington University in St. Louis). *Scattered Snows, to the North.* Farrar, Straus and Giroux, August 2024

### FICTION

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

**Pedro Almodóvar** (El Deseo Production Company). *The Last Dream.* HarperVia, September 2024

**Emma Donoghue** (Ontario, Canada). *The Paris Express.* Summit Books, March 2025

**Louise Erdrich** (Minneapolis, MN). *The Mighty Red.* Harper, October 2024

**Richard Powers** (Stanford, CA). *Playground.* W. W. Norton, September 2024

**James Stavridis** (The Carlyle Group). *The Restless Wave.* Penguin Press, October 2024

**Paul Theroux** (East Sandwich, MA). *The Vanishing Point.* Mariner Books, January 2025

**Anne Tyler** (Baltimore, MD). *Three Days in June.* Knopf, February 2025

## NONFICTION

**Amnon Aharony** (Tel Aviv University), **Ora Entin-Wohlman** (Tel Aviv University), David A. Huse (Princeton University), and Leo Radzihovsky (University of Colorado at Boulder), eds. *50 Years of the Renormalization Group: Dedicated to the Memory of Michael E. Fisher.* World Scientific Publishing Company, August 2024

**Karl Ameriks** (University of Notre Dame). *Kantian Dignity and Its Difficulties.* Oxford University Press, October 2024

**Charles R. Beitz** (Princeton University). *For the People? Democratic Representation in America.* Oxford University Press, October 2024

**Charles Bernstein** (University of Pennsylvania). *The Kinds of Poetry I Want: Essays & Comedies.* University of Chicago Press, November 2024

**Helen M. Blau** (Stanford University). *Stem Cells to the Rescue.* Cold Spring Harbor Laboratory Press, October 2024

**Noam Chomsky** (Massachusetts Institute of Technology) and Nathan J. Robinson (*Current Affairs*). *The Myth of American Idealism: How U.S. Foreign Policy Endangers the World.* Penguin Press, October 2024

**Hillary Rodham Clinton** (Chappaqua, NY). *Something Lost, Something Gained: Reflections on Life, Love, and Liberty.* Simon & Schuster, September 2024

**Francis S. Collins** (Rockville, MD). *The Road to Wisdom: On Truth, Science, Faith, and Trust.* Little, Brown and Company, September 2024

**Doris Kearns Goodwin** (Boston, MA). *The Leadership Journey: How Four Kids Became President.* Simon & Schuster, September 2024

**Hahrie Han** (Johns Hopkins University). *Undivided: The Quest for Racial Solidarity in an American Church.* Knopf, September 2024

**Robin Wall Kimmerer** (SUNY College of Environmental Science and Forestry). *The Serviceberry: Abundance and Reciprocity in the Natural World.* Scribner, November 2024

**Sandra Knapp** (Natural History Museum, London). *Flower Day: A Story of 24 Hours and 24 Floral Lives.* University of Chicago Press, April 2025

**Nicholas Lemann** (Columbia University). *Higher Admissions: The Rise, Decline, and Return of Standardized Testing.* Princeton University Press, September 2024

**David Levering Lewis** (New York University). *The Stained Glass Window: A Family History as the American Story, 1790–1958.* Penguin Press, February 2025

**Greil Marcus** (Oakland, CA). *What Nails It.* Yale University Press, August 2024

**Orhan Pamuk** (Istanbul, Turkey). *Memories of Distant Mountains: Illustrated Notebooks, 2009–2022.* Knopf, November 2024

**Daniel R. Porterfield** (Aspen Institute). *Mindset Matters: The Power of College to Activate Lifelong Growth.* Johns Hopkins University Press, June 2024

**Geoffrey Pullum** (Alexandria, VA). *The Truth About English Grammar.* Polity, September 2024

**David M. Rubenstein** (The Carlyle Group). *The Highest Calling: Conversations on the American Presidency.* Simon & Schuster, September 2024

**Daniela Rus** (Massachusetts Institute of Technology) and Gregory Mone (Martha's Vineyard, MA). *The Mind's Mirror: Risk and Reward in the Age of AI.* W. W. Norton, August 2024

**Laurence Senelick** (Tufts University). *The Final Curtain: The Art of Dying on Stage.* Anthem Press, August 2024

**Neil Shubin** (University of Chicago). *Ends of the Earth: Journeys to the Polar Regions in Search of Life, the Cosmos, and Our Future.* Dutton, February 2025

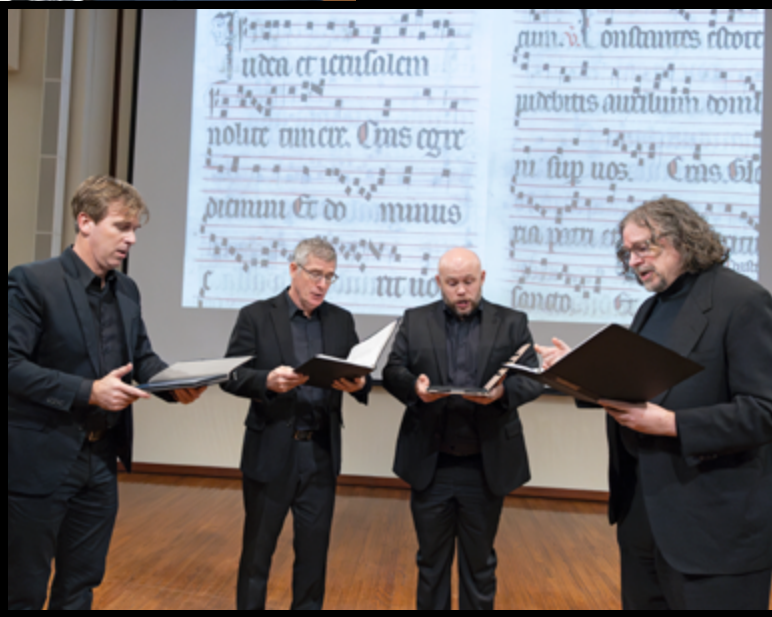
**Jean Strouse** (New York, NY). *Family Romance: John Singer Sargent and the Wertheimers.* Farrar, Straus and Giroux, November 2024

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

**Jana Clemons** (Docker), **William M. Clemons, Jr.** (California Institute of Technology), **David Drier** (Fallen Journalists Memorial Foundation), **Frances Arnold** (California Institute of Technology), and **Goodwin Liu** (Supreme Court of California) enjoy a Los Angeles members' reception and discussion on Narratives of the Economy at the University of Southern California on October 27, 2024.

Art historian **Caroline Bruzelius** (Duke University) presents at the House of the Academy on December 17, 2024, as part of "Music and Architecture at Notre-Dame in Paris." The program, which also featured musicologist **Thomas Forrest Kelly** (Harvard University) and **Anne Azéma**, artistic director of the Boston Camerata, explored the innovation and creativity of medieval Paris to celebrate the complete restoration of the famed cathedral.



Singers from the **Boston Camerata** perform medieval music originally composed for Notre-Dame cathedral in the twelfth century.

Newly elected members **Kenneth Intriligator** and **Stephan Haggard** (both, University of California, San Diego) enjoy a reception outside of the Scripps Seaside Forum in La Jolla, California. Members and guests gathered there on October 24, 2024, for an event on "Health and Our Oceans," which featured atmospheric chemist **Kimberly Prather** (University of California, San Diego) who discussed local air and water quality issues.


Étienne Trouvelot (1827–1895; elected to the Academy in 1877), "Aurora Borealis: As observed March 1, 1872, at 9h. 25m. P.M." Lithograph, ca. 1881–1882. Rare Book Division, New York Public Library.

By **Maggie Boyd**, *Archivist*

In an article published in *The Independent Ledger* in Boston on February 26, 1781, the Academy wrote that "they request the Assistance of the Ingenious in every profession. Observations in Astronomy and Geography, will be of great use. Meteorological Observations and Experiments are much wanted." By May 1781, the Academy had organized its activity into "subjects of study," instructing that the "seventh class make meteorology their special object, observe the azimuth, meridional height, vertical direction and various phenomena of the Aurora borealis. . . ."

The Academy's collection of bound communications includes one such response. In an account sent to the Academy and later published in the *Memoirs* in 1793, founding member Caleb Gannet (elected in 1780) relates the observations made by Reverend John Mellen (Academy member, elected in 1792) of a vivid aurora sighted on March 27, 1781.[1]

According to Mellen, the phenomenon began with a pale stream of light appearing above a dark vapor along the horizon. By 9:30 p.m., the display evolved to include a steady column of light, gradually growing southward and forming a faint, expanding ring across the sky.

Today, the aurora is not only an object of scientific study but also a popular subject of professional and amateur photography. In 2016, an auroral phenomenon called STEVE (Strong Thermal Emission Velocity Enhancement) was noted first among aurora photographers before becoming a subject of study among astronomers. Distinct from the aurora borealis, it can be described as a steady glowing arc of light. Due to the sun's eleven-year cycle, 2025 is expected to be one of the best years for observing the aurora; what will be observed remains to be seen.

1. "An Account of a curious & singular appearance of the Aurora Borealis, on the 27 of March, 1781," [ca. March 1781] by Caleb Gannet. Papers, Vol. 1, p. 13. RG I-C-1: General records. Communications to the Academy–Bound, 1780–1810. Archives, American Academy of Arts and Sciences.

# Bulletin
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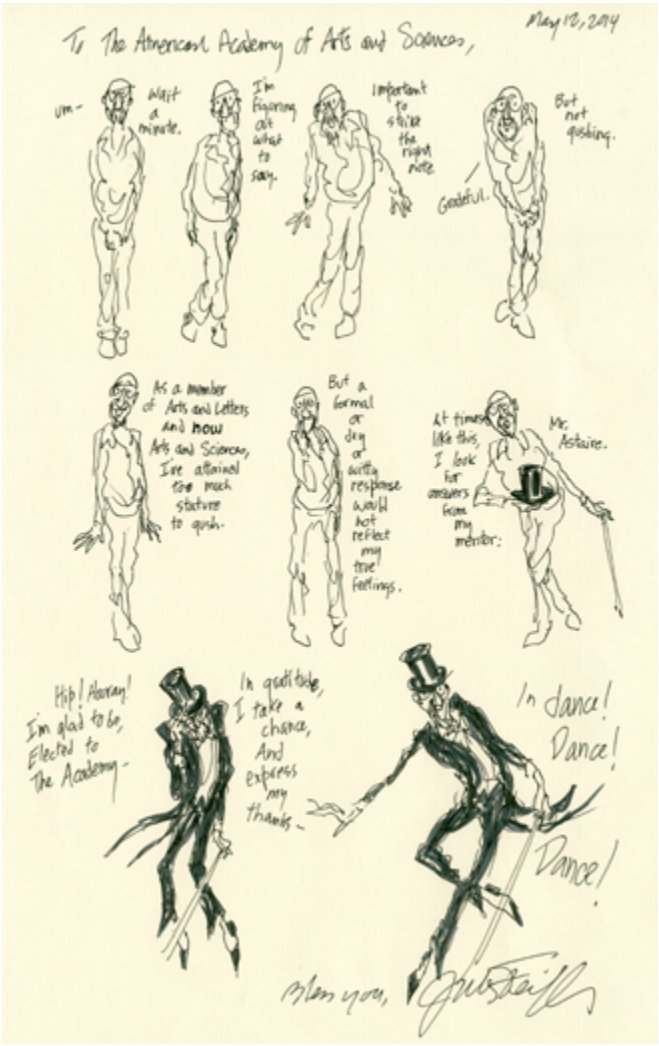
# ONLINE

The Academy marked the passing of cartoonist, author, and Academy member **Jules Feiffer** (1929–2025) by sharing his wonderful illustrated letter of acceptance that is on display at the Academy and is also available online (www.amacad.org/jules-feiffer-illustrated-letter).

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