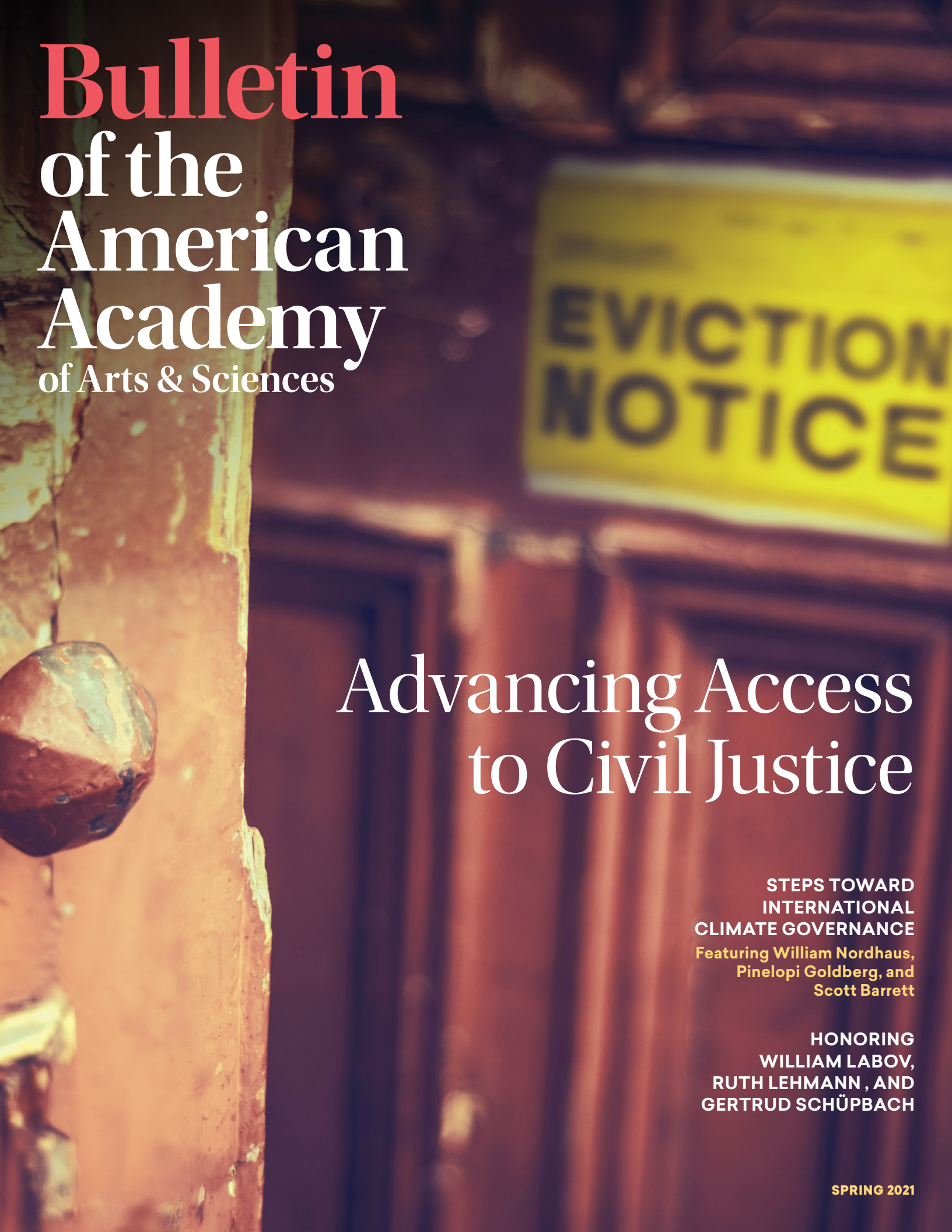
Bulletin
of the
American
Academy
of Arts & Sciences



Advancing Access to Civil Justice

STEPS TOWARD INTERNATIONAL CLIMATE GOVERNANCE

Featuring William Nordhaus, Pinelopi Goldberg, and Scott Barrett

HONORING WILLIAM LABOV, RUTH LEHMANN , AND GERTRUD SCHÜPBACH

SPRING 2021

SELECT UPCOMING VIRTUAL EVENTS

May

6 A Conversation with Architect Jeanne Gang

Featuring: **Jeanne Gang**

13 Finding a Shared Narrative

Hosted by the Library of Congress

Featuring: **Danielle Allen**, winner of the Library's 2020 Kluge Prize

Above: "Our Common Purpose" featuring the Juneteenth flag with one star. Artist: Rodrigo Corral

27 Reflections on a Full, Consequential, and Lucky Life: Science, Leadership, and Education

Featuring: **Walter E. Massey** (left) in conversation with **Don Randel** (right)

June

14 Lessons Learned from Reckoning with Organizational History

Featuring: **John J. DeGioia**, **Brent Leggs**, **Susan Goldberg**, **Claudia Rankine**, and **Ben Vinson**

For a full and up-to-date listing of upcoming events, please visit amacad.org/events.

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Flooding beside the Russian River on Westside Road in Healdsburg, Sonoma County, California; February 27, 2019.

Features

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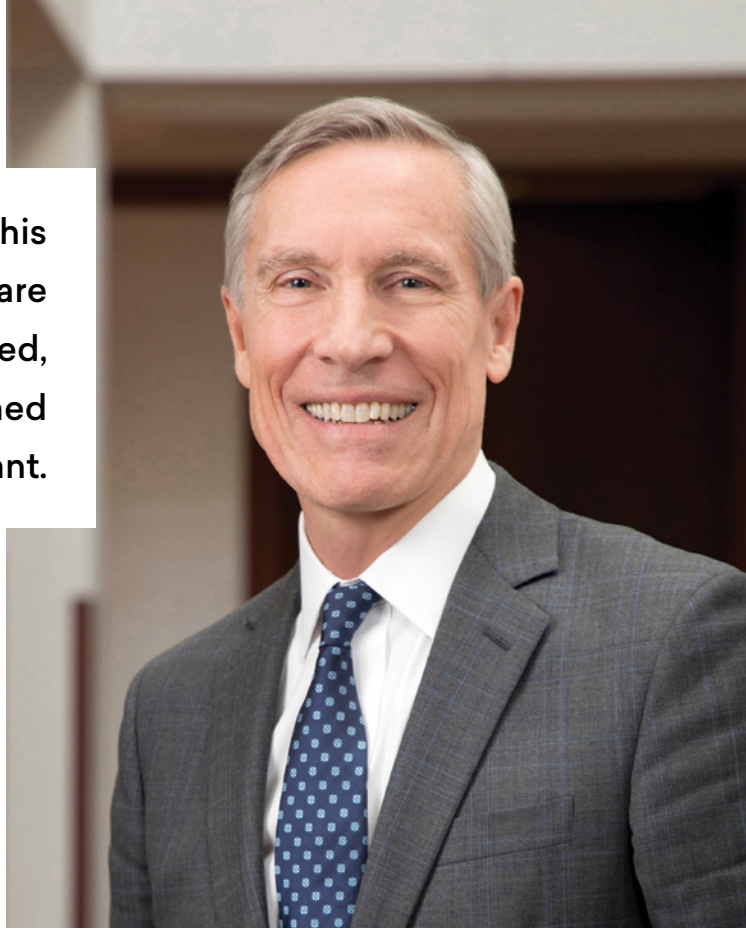
Among the contributors to the *Dædalus* issue on "Immigration, Nativism & Race" (left to right): Douglas S. Massey (guest editor), Christopher Sebastian Parker, and Cecilia Menjívar

Our Work

Members

Departments

> As the Academy emerges from this difficult year, we have good news to share as well. Despite the challenges we have faced, our Academy community has remained active and vibrant.



From the President

As I write this letter, we have just passed a somber milestone: one full year since the COVID-19 crisis fundamentally altered so many aspects of our lives. We look back in solemn reflection on a year of illness, loss, and upheaval. And yet as we emerge into this spring season, we have reason to look forward with hope. An accelerated vaccination campaign promises a gradual return to normal life in the months ahead. After a period of political upheaval culminating in the disturbing events of January 6th, there is now an opportunity to rebuild our institutions and bring our country together once again. And after a year of heartbreaking incidents of racial injustice, we see a new, broad-based movement to create a more just society.

As the Academy emerges from this difficult year, we have good news to share as well. Despite the challenges we have faced, our Academy community has remained active and vibrant. Following the Academy's rapid shift to virtual programming last spring, we have gathered for more than 50 virtual events, setting records for attendance – both in terms of unique members attending one event and in terms of total attendance, including non-members. Our virtual programming has also allowed us to reach larger and more dispersed audiences. In fiscal year 2021, members participated in virtual events from 22 countries, 36 states, and 220 different cities. And I personally had the privilege of meeting virtually with hundreds of members through one-on-one meetings, committees, and project groups.

This issue of the *Bulletin* reflects the lively pace of the Academy's virtual life during the past year. In particular, we were pleased to host virtual events bestowing two of the Academy's most revered prizes. In January, we gathered to honor pioneering linguist William Labov with the Talcott Parsons Prize for distinguished and original contributions to the social sciences. And in February, we awarded the Francis Amory Prize in Reproductive Medicine and Reproductive Physiology to scientists Ruth Lehmann and Gertrud M. Schüpbach for their significant contributions to areas including DNA repair, embryonic development, RNA regulation, and stem cell research. These virtual events allowed hundreds of participants from around the world, including friends, family, and former students, to gather to honor the prize recipients.

Our members showed up for the Academy this year not only through their participation but also through their generosity. In February, we celebrated the largest gift in the Academy's 241-year history, a $10 million donation from investor and patriotic philanthropist David Rubenstein. A portion of this gift will allow us to build a new addition to our building to house the Academy's archival collections and make them more accessible to members, students, and scholars. This gift will also support our projects in civil justice, economic inequality, and democratic and civic engagement.

The Academy also received a grant of $1 million from the Rockefeller Brothers Fund to implement the recommendations in *Our Common Purpose*, the final

report of the Commission on the Practice of Democratic Citizenship, described in more detail in this issue of the *Bulletin*. We are indebted to Academy member and Rockefeller Brothers Fund President and CEO Stephen Heintz for his energetic commitment to building a more responsive and representative democracy. We also received a gift of $1 million from the William J. and Lia G. Poorvu Foundation to spur innovation and to enable the thoughtful and inclusive planning of new projects.

As we strive in the next year to complete our $100 million Campaign for the Academy and its Future, we are honored by this overwhelming vote of confidence in our work and humbled by the commitment of our members to the Academy's future vitality.

As we reflect on the generosity of our members and their commitment to the Academy's work in service of the common good, we also honor the life of Stephen D. Bechtel, Jr., who passed away on March 15, 2021, at the age of 95. Stephen served on the Academy's membership committees and provided major philanthropic support for research projects in the areas of science, engineering, and technology as well as American institutions. Through his generous support, the auditorium that bears his name at the House of the Academy has become a beloved gathering place for our global community of members. By asking the fundamental question "What makes a good citizen?" Stephen also inspired the creation of the Commission on the Practice of Democratic Citizenship, for which The S.D. Bechtel, Jr. Foundation provided principal support. With Stephen's passing, the Academy's commitment to implementing the Commission's recommendations takes on even deeper meaning.

Thank you for all you do for the Academy, and please feel free to reach out to me personally if there are ways you would like to become involved in our work to advance knowledge in service of the nation and the world.

David W. Oxtoby

A plaque recognizing Stephen D. Bechtel, Jr., hangs in the Stephen D. Bechtel, Jr. Auditorium at the House of the Academy in Cambridge, MA. It reads:

Stephen D. Bechtel, Jr. is Chairman (retired) and a Director of Bechtel Group, Inc. He is also Chairman Emeritus and a Director of Fremont Group, LLC, separate affiliated companies that manage and operate in marketable securities, natural resources. and other selected investments. In addition, Mr. Bechtel is Chairman of the S.D. Bechtel, Jr. Foundation. His business headquarters are in San Francisco, California.

Mr. Bechtel served as the third-generation head of the worldwide engineering and construction business that began in 1898 as a small Western railroad construction firm. Today Bechtel Group, Inc. provides a broad range of technical, construction, and management services to clients in many industries around the globe. including power, petroleum and chemicals, surface transportation, aviation facilities, water supply and treatment, infrastructure development, pipelines, mining and metals, and telecommunications.

He holds a Bachelor's degree in Civil Engineering from Purdue University and a Master's degree in Business Administration from the Stanford University Graduate School of Business. He served as a Director on the boards of several major corporations, including General Motors and IBM. Presidents Johnson, Nixon, and Ford each appointed him to Presidential committees and commissions. The recipient of numerous industry, academic, and professional society awards, Mr. Bechtel served several industry and community organizations as Chairman, including The Business Council, The Conference Board, Inc., and the National Academy of Engineering. He was Vice Chairman of the California Council for Science and Technology Task Force in 2006, advising the Governor of California on increasing the state's technical talent pool by improving K–12 science and mathematics education.

Elected to the American Academy of Arts and Sciences in 1990, he has served on membership committees and provided major support for research projects in Science, Engineering, and Technology as well as capital improvement of the house. The American Academy is grateful for his continuing interest and his extraordinary support for projects and programs.

New *Dædalus* Issue Explores **Immigration, Nativism & Race**

Dysfunctional immigration policies implemented in recent decades have accelerated growth of the Latino population and racialized its members around the trope of illegality. Until 2016, the cultivation of White resentment relied on a dog-whistle politics of racially coded symbolic language, but with the election of Donald Trump, White nationalist sentiments became explicit.

The Spring 2021 issue of *Dædalus*, guest edited by **Douglas S. Massey**, confirms this political transformation. Trump's mobilization of reactionary sentiment, Zoltan Hajnal argues, was simply an extension of a long-term Republican project of fomenting White racial fears and scapegoating immigrants to increase their share of White voters. Michael Hout and Christopher Maggio's analysis of General Social Survey data found that Whites who favored restricting immigration and expressed racial resentment toward Blacks were far more likely to vote for Trump than Whites who did not hold these views. This tracks with Christopher Parker's findings that the election of Barack Obama against the backdrop of a browning America created a powerful threat to White status, fueling a bitter politics that is not just conservative, but reactionary. Ellis Monk discusses the *pigmentocracy* of skin-tone stratification that has broadened to encompass dark-skinned Hispanics and Asians as well as Blacks. The conflation of skin color with illegality, Cecilia Menjívar shows, is a distinctive feature of the racialization of Hispanics.

Trump exploited years of failed immigration and border policy to take power. César Cuauhtémoc García Hernández documents the steady criminalization of immigration – or *crimmigration* – in the United States. The devastation these policies have inflicted on immigrant families is explored by Yajaira Ceciliano-Navarro and Tanya Golash-Boza, who conducted 111 interviews with adult immigrants who had experienced the deportation or detention of a family member. And Roberto Gonzales and Stephen Ruszczyk depict life for unauthorized migrants brought to the country as children and the fraught process of "learning to be illegal," compelling them to scale back their dreams and ambitions for success in the only country they know.

Intensifying nativism since 2016 has coincided with a surge in anti-immigrant and White supremacist violence. Stephanie Canizales and Jody Agius Vallejo discuss Trump's racist and dehumanizing rhetoric and policies and report that counties hosting rallies for Trump in 2016 experienced a 226 percent surge in hate crimes and that the number of anti-Latino hate crimes rose by 21 percent in 2018 alone. And Jennifer Lee points out that while Asians are commonly seen as the "model minority," this stereotype does not protect them from racism and xenophobia, evidenced by the rise (including pre-pandemic) of anti-Asian hate crimes.

Still, there is room for optimism. Mary Waters and Philip Kasinitz note that while the lack of legal status hinders the economic integration of immigrants, it does not stop them from integrating socially. And Richard Alba concludes the volume by envisioning a future of integration, adaptation, and peaceful accommodation in which intergroup boundaries blur rather than harden. But this cannot be achieved without the full legalization of the roughly eleven million people who now peacefully live among us without legal permanent residence.

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"Immigration, Nativism & Race in the United States" is available for free on the Academy's website at www.amacad.org/daedalus. In January 2021, *Dædalus* became an open access publication.

Page 5: *Looking Backward. They Would Close to the New-Comer the Bridge That Carried Them and Their Fathers Over* (1893) by Joseph Ferdinand Keppler (1838–1894). Chromolithograph, first published in *Puck* magazine. Held at the Billy Ireland Cartoon Library and Museum at The Ohio State University.

The Spring 2021 issue of *Dædalus* on "Immigration, Nativism & Race in the United States" features the following essays:

The Bipartisan Origins of White Nationalism
Douglas S. Massey (Academy Member; Princeton University)

Immigration & the Origins of White Backlash
Zoltan Hajnal (University of California, San Diego)

Immigration, Race & Political Polarization
Michael Hout (Academy Member; New York University) & Christopher Maggio (City University of New York; London School of Economics and Political Science)

Status Threat: Moving the Right Further to the Right?
Christopher Sebastian Parker (University of Washington)

The Unceasing Significance of Colorism: Skin Tone Stratification in the United States
Ellis P. Monk, Jr. (Harvard University)

The Racialization of "Illegality"
Cecilia Menjívar (University of California, Los Angeles)

Criminalizing Migration
César Cuauhtémoc García Hernández (University of Denver)

Race, Legal Status & Social Mobility
Mary C. Waters (Academy Member; Harvard University) & Philip Kasinitz (City University of New York)

The Legal Status Divide among the Children of Immigrants
Roberto G. Gonzales (Harvard University) & Stephen P. Ruszczyk (Montclair State University)

Latinos & Racism in the Trump Era
Stephanie L. Canizales (University of California, Merced) & Jody Agius Vallejo (University of Southern California)

"Trauma Makes You Grow Up Quicker": The Financial & Emotional Burdens of Deportation & Incarceration
Yajaira Ceciliano-Navarro (University of California, Merced) & Tanya Maria Golash-Boza (University of California, Merced)

Asian Americans, Affirmative Action & the Rise in Anti-Asian Hate
Jennifer Lee (Columbia University)

The Surge of Young Americans from Minority-White Mixed Families & Its Significance for the Future
Richard Alba (Academy Member; City University of New York)

A Project to Advance

Civil Justice Access in the 21st Century

An engraving above the western entrance to the U.S. Supreme Court proclaims a bold ideal for the American judicial system: "equal justice under law." Unfortunately, the nation has not yet achieved the Court's aspiration. While many Americans experience legal issues at some point in their lives, not everyone has access to the legal assistance that they need.[1]

Over the last year, the urgency of the civil justice gap has grown more evident.[2] The avalanche of job losses prompted by the COVID-19 pandemic overloaded state unemployment offices and led to long waits for people seeking the insurance benefits to which they were entitled.[3] Although there is a current moratorium on evictions, advocates fear a housing catastrophe when that protection expires. Tenants with legal representation fare far better than those without, but a recent study of a New York City housing court found that while only 1 percent of tenants had a lawyer, 90 percent of landlords did.[4] Stay-at-home orders and closed schools placed new strains on families and made it more difficult for those experiencing domestic abuse to seek help – creating a "pandemic within a pandemic."[5]

The Academy's Making Justice Accessible project advocates for changes to improve low-income Americans' access to civil legal help. Its final report, *Civil Justice for All*, offers seven recommendations and presents several case studies of successful initiatives in family law, health, housing, and veterans' issues across the United States.

THE PROJECT'S SEVEN RECOMMENDATIONS:

1 Dedicate a consequential infusion of financial and human resources to closing the civil justice gap, and seek a significant shift in mindset – extending beyond lawyers the duty and capacity to assist those with legal need – to make genuine strides toward "justice for all"

2 Increase the number of legal services lawyers who focus on the needs of low-income Americans

3 Increase the number of lawyers providing pro bono and other volunteer assistance, to supplement the corps of legal services lawyers

4 Bring many new advocates – service providers who are not lawyers – into the effort to solve civil justice problems

5 Foster greater collaboration among legal services providers and other trusted professionals – such as doctors, nurses, and social workers

6 Expand efforts to make legal systems easier to understand and use through the simplification of language, forms, and procedures and the wider use of technology

7 Create a national team, or even a new national organization, to coordinate the efforts listed above, collect much-needed data on the state of civil justice, and help identify and publicize effective innovations that improve access.[6]

These recommendations build on the work the legal community is already doing in select states and municipalities to meet the needs of low-income Americans – work that the report uses as a model for future nationwide innovation. For instance, *Civil Justice for All* draws on successful court navigator and legal technician programs in New York City and Washington State as examples of how to simplify legal processes to allow nonlawyers to provide civil justice help to more people at a lower cost.[7] While additional funding for a variety of legal services is an important and necessary step, the report recognizes that funding alone is insufficient. National coordination, collaboration, and action are required to make "equal justice under law" real for all Americans. As the report asserts, "Access to legal services . . . should not be a matter of geography, timing, or luck. Equal justice is a right, not a privilege."[8]

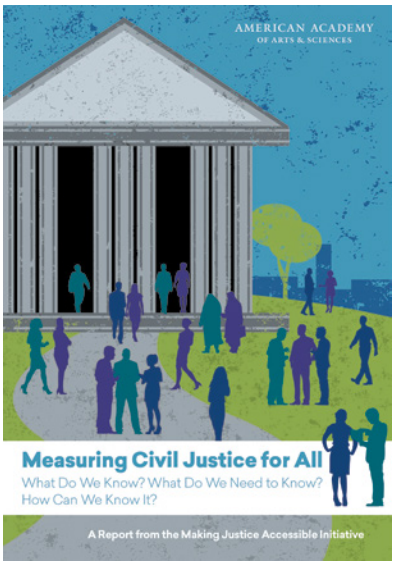
The Making Justice Accessible project also calls for raising the visibility of civil justice access outside of the legal community. Many people who experience civil justice problems do not recognize them as such or know how to seek help. Even when help is sought, the vast majority will not receive it: a recent study found that only 14 percent of the low-income Americans who reported a civil legal problem received adequate legal assistance.[9] This unmet need diminishes people's trust in institutions. It results in high public costs as people lose housing or go without preventative healthcare. And it overwhelms the capacity of legal-aid programs meant to provide a safety net. "The civil justice gap . . . exacerbates the inequalities that undermine our society. At-risk populations – by income, race, gender, and education level – cannot receive justice if they cannot access even basic legal advice. The outcomes – evictions, family separations, job loss, and other hardships – are often catastrophic."[10]

The release of the *Civil Justice for All* report in September 2020 was a culmination of conversations that began in November 2015, when the Academy convened a two-day conference on civil justice issues. Judges, lawyers, legal-aid providers, clinicians, legal scholars, government officials, and business leaders gathered at the House of the Academy to discuss the barriers low-income Americans face in seeking legal assistance, as well as what they, as stakeholders, could do to better meet those needs. The Making Justice Accessible project emerged from that meeting. Co-chairs **Kenneth C. Frazier** (Merck & Co.), **John G. Levi** (Legal Services Corporation; Sidley Austin LLP), and **Martha L. Minow** (Harvard University) have stewarded the project to understand the civil justice

gap, analyze its consequences, and design a better way forward.

Five subcommittees helped to inform the work of the project: *family* (cochaired by Tonya Brito and Lance Liebman); *health* (cochaired by John Levi and Allison Rice); *housing* (cochaired by Colleen Cotter and Diane P. Wood); and *veterans* (cochaired by Nan Heald and Martha Minow) – plus *innovation* in each area (cochaired by Elizabeth Chambliss and Andrew Perlman). In addition, legal scholar Lincoln Caplan (Yale Law School) oversaw a pro bono research team from the law firm of WilmerHale that conducted numerous interviews focusing on the priorities identified by these subcommittees.

In addition to the *Civil Justice for All* report, the project also released an issue of *Dædalus* in 2019 on "Access to Justice," guest edited by Lincoln Caplan, Lance Liebman, and Rebecca L. Sandefur, which examines the national crisis in civil legal services facing low-income Americans. And in February 2021, the project published a white paper, *Measuring Civil Justice for All: What Do We Know? What Do We Need to Know? How Can We Know It?* that includes an overview of existing information deficits in the field and provides a blueprint for gathering the data necessary to fully understand civil justice activity in the United States.



Measuring Civil Justice for All asks two fundamental questions: Is justice open to all? And is the justice system fair to all?[11]

The white paper outlines what kinds of civil justice data are currently being collected and by whom, as well as what information is nonexistent, not publicly available, or not analyzable in its current form. The paper recommends more systematic data collection by the courts, legal-aid programs, and other service providers to allow for a comprehensive understanding of who is using their services and with what results. It also recommends that questions about civil justice access be added to existing national surveys of Americans and that data be collected from Internet search engines, as many people who face civil justice issues never seek legal help.

More ambitiously, the paper advocates for the creation of a civil justice data commons, which would make it easier to meet the needs of those seeking assistance and to track their outcomes. A data commons would also allow researchers to answer important civil justice questions, such as how often people encounter multiple civil justice issues simultaneously. While it entails upfront costs and presents some regulatory and analytical challenges, a data commons would help public and private legal-aid programs become more effective and efficient.

The Academy is committed to ensuring that the Making Justice Accessible project has a lasting impact. In addition to connecting with thought leaders in the legal and business communities to build consensus around advancing the project's recommendations, the project team will explore opportunities to collaborate with other institutions committed to closing the civil justice gap. Those efforts might include developing state court pilot programs to digitize and streamline legal processes, building an information hub for sharing best practices around civil justice innovation, and expanding legal services by nonlawyers through targeted outreach to other professions and institutions that serve low-income Americans.

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To learn more about the Making Justice Accessible project, visit the Academy website (www.amacad.org/project/making-justice-accessible).

ENDNOTES

1. While the Bill of Rights gives Americans the right to an attorney when they are charged in criminal matters, no parallel right exists for civil proceedings, which include matters such as family law, healthcare, housing, employment, and veterans' issues.

2. The civil justice gap is the difference between the number of people who need civil legal assistance and those who receive help of any kind.

3. Jason Stauffer, "Still Waiting: Six Months Later, Millions Haven't Been Paid Unemployment Benefits," NextAdvisor, https://time.com/nextadvisor/in-the-news/waiting-on-unemployment-benefits/.

4. American Academy of Arts and Sciences, *Civil Justice for All* (Cambridge, Mass.: American Academy of Arts and Sciences, 2020), 7.

5. Megan L. Evans, Margo Lindauer, and Maureen E. Farrell, "A Pandemic within a Pandemic–Intimate Partner Violence during Covid-19," *New England Journal of Medicine* 383 (2020): 2302–2304.

6. American Academy of Arts and Sciences, *Civil Justice for All*, 4–5.

7. Ibid., 17.

8. Ibid., 2.

9. Legal Services Corporation, *Justice Gap Report: Measuring the Civil Legal Needs of Low-Income Americans*, prepared by NORC at the University of Chicago (Washington, D.C.: Legal Services Corporation, 2017), https://www.lsc.gov/media-center/publications/2017-justice-gap-report.

10. American Academy of Arts and Sciences, *Civil Justice for All*, 1.

11. American Academy of Arts and Sciences *Measuring Civil Justice for All: What Do We Know? What Do We Need to Know? How Can We Know It?* (Cambridge, Mass.: American Academy of Arts and Sciences, 2021), 5–9.

The civil justice gap . . . exacerbates the inequalities that undermine our society. At-risk populations – by income, race, gender, and education level – cannot receive justice if they cannot access even basic legal advice.

How Are Your Students Doing?

New Reports from the Humanities Indicators on the Earnings and Job Outcomes of College Graduates

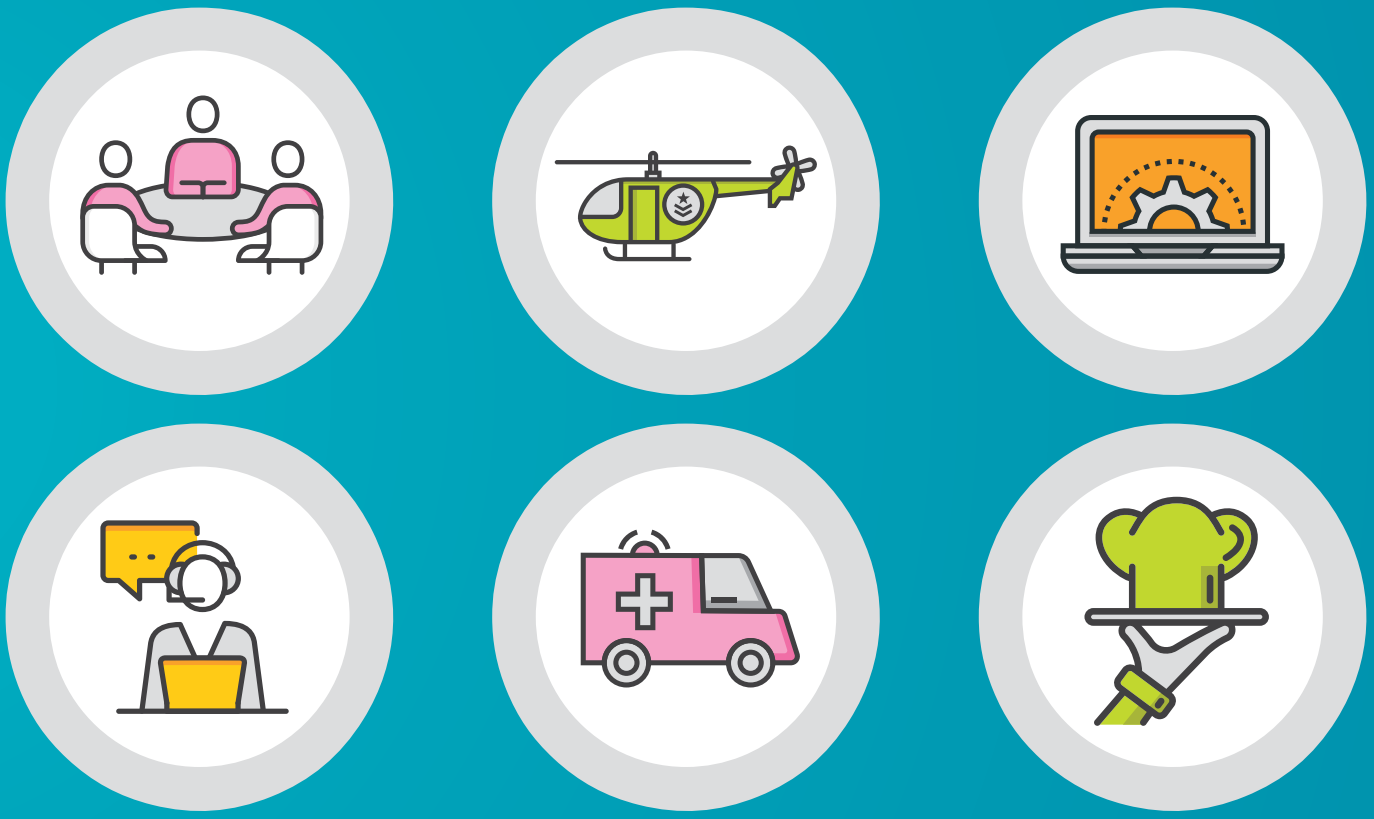
Earning a bachelor's degree, in any major, provides a substantial financial advantage over those who do not attain the degree. Recent reports from the Academy's Humanities Indicators explore the extent of that gain, as well as the occupational outcomes of college graduates, using recent data from the U.S. Census Bureau's American Community Survey (ACS).

Because employment outcomes for graduates vary substantially depending on their highest degree, the Humanities Indicators separated the data based on those who earned only a bachelor's degree from those who earned advanced degrees. While most bachelor's degree recipients do not pursue advanced degrees, there are some striking differences among the fields. As of 2018, a narrow majority of bachelor's degree recipients from the life and physical sciences had received an advanced degree (Figure 1). Among all college graduates, the average was 37 percent, with the lowest shares of advanced degrees found among arts and business majors (about 25 percent each).

OUTCOMES WITH ONLY A BACHELOR'S DEGREE

Prior to the pandemic (the most recent data are for 2018), almost everyone with a bachelor's degree who wanted a job had one. Among college graduates without an advanced degree, the unemployment rate was 2.9 percent. Even among graduates from fields that tend to have slightly higher rates of unemployment (such as the arts and the humanities), just 3.6 percent were unemployed. The lowest rates of unemployment (at 2 percent) were associated with fields aligned with specific vocational occupations (such as education and the health and medical sciences).

That difference between college graduates from vocational fields and those from the liberal arts and sciences extends to their distributions across the various occupations.



While most college graduates work in management, professional, or related occupations, graduates from disciplines with specific occupational connections tend to be clustered in the associated vocation. For example, more than 60 percent of graduates from the health and medical sciences had a job in their area of study, and almost half of education graduates were working in the education field.

In comparison, graduates from academic disciplines such as the humanities and the life, physical, and social sciences are more widely dispersed among the occupations. More than 10 percent of graduates from those disciplines were employed in management positions, around a third were working in a variety of sales, service, or other office and administrative jobs, and around 10 percent were employed in positions in K–12 education.

Having a more obvious occupational destination does not guarantee substantial earnings, however. Among college graduates with only a bachelor's degree, engineering majors had the highest median earnings ($88,139); education majors had the lowest ($45,589). In comparison, graduates from the liberal arts and sciences fell modestly below the median for all college graduates in this category (almost $63,000). For instance, graduates from the humanities and the life, behavioral, and social sciences had median earnings of between $55,000 and $59,000.

Politicians and the media often compare average earnings among college graduates from various fields, dwelling particularly on the substantial gap in earnings for engineers compared to humanities majors. It is important, however, to keep in mind that earning any college degree provides a substantial financial and employment advantage. Median earnings for workers with only a high school diploma were substantially lower (around $35,000) than those of college graduates from every field. And the unemployment rate for those who completed high school but did not attend college was 5.3 percent.

OUTCOMES WITH AN ADVANCED DEGREE

While earning an undergraduate degree provides a substantial economic improvement, earning an additional degree provides a greater financial advantage. On average, an advanced degree provided a 37 percent boost in median earnings for all college graduates. The largest earnings gains were found among graduates from the sciences. Those with an undergraduate degree in the life sciences had an 80 percent boost in median earnings, while graduates from the physical sciences enjoyed a 49 percent increase. For most of the other fields, the earnings boost, though noticeably less, was still

substantial – ranging from around 30 percent for graduates from the arts and engineering to around 35 percent for those in education and the humanities.

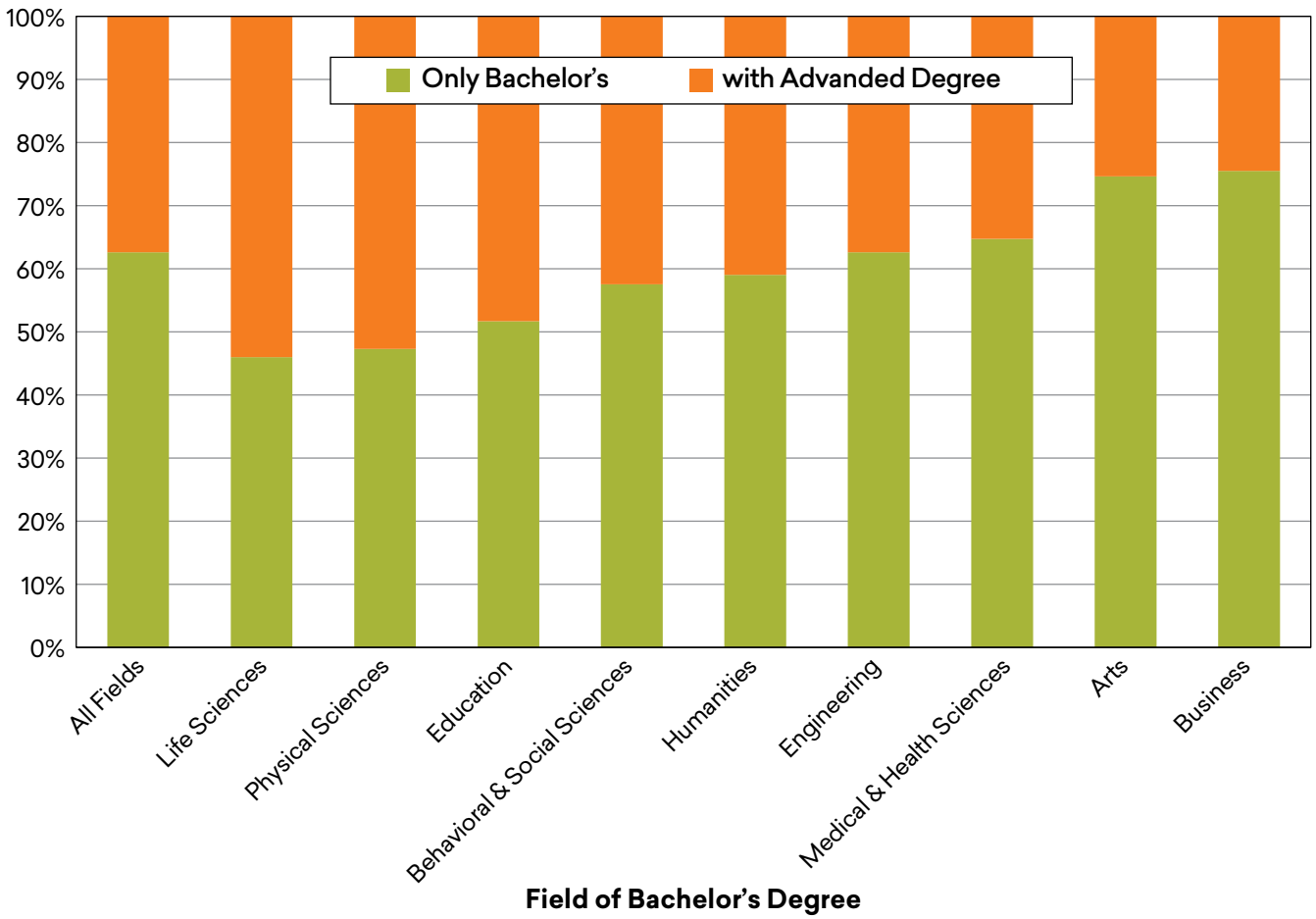
The advanced degree could be in any field (details about subsequent degrees are not requested in the ACS), but the occupational differences relative to those with only an undergraduate degree provide some significant clues. For instance, just 13 percent of those with only an undergraduate degree in the life sciences go into health and medical jobs. But among those who earn an advanced degree in the life sciences, the share rises to 47 percent. Similarly, a negligible share of graduates with just a bachelor's degree in the humanities and the behavioral and social sciences enter occupations related to law, but among those with an advanced degree, more than 12 percent do so.

THE EFFECT OF EXPERIENCE ON EARNINGS

In a separate report, the Indicators examined the effects of experience on the earnings outcomes of college graduates. Since no national survey tracks individuals through their careers, the Indicators used age as a proxy for work experience – comparing the range of earnings for those early in their careers (workers in their twenties and thirties) to the earnings of older college-educated workers (in their late-forties and fifties). While imperfect as a measure of changes at the individual level, the data help identify broad patterns.

For instance, while fields such as the humanities are often faulted for offering a limited path to financial success, the data show that substantial shares of workers with a bachelor's degree from almost every field

Figure 1. Undergraduate and Graduate Degree Attainment, by Undergraduate Major, 2018



Source: U.S. Census Bureau, *2018 American Community Survey Public-Use Microdata Sample*. Data analyzed and presented by the American Academy of Arts Sciences' Humanities Indicators.

have significant earnings later in life (Figure 2). Among older adults with just an undergraduate degree, more than one in four had annual earnings above $100,000 in 2018, attesting to the fact that every field offers a path to financial success (for those who consider that a priority). The notable exception was among education majors, in which only the top quarter of the older graduates earned above $73,000.

Among those with advanced degrees in most fields, the upper earnings are even higher (with more than one in four across most fields making more than $140,000 per year). The top earnings for graduates from the life and physical sciences are particularly notable, with more than a quarter of those who have gone on to earn an advanced degree making more than $200,000 – placing them above engineering majors.

One purpose of the study was to test a popular argument among humanities advocates that the earnings of humanities majors "catch up" to those of graduates from business, engineering, and science programs. Unfortunately, the data do not support that claim. Older humanities graduates earned less than their younger counterparts relative to degree holders in the life and physical sciences, and even though the gaps narrowed relative to engineering and business majors, they still lingered.

The Indicators staff are working on additional studies about the employment outcomes of college graduates, including relative job satisfaction, and the earnings and occupations of graduates with masters and doctoral degrees from various fields (using a separate federal survey of college graduates). Those findings will be released in the fall.

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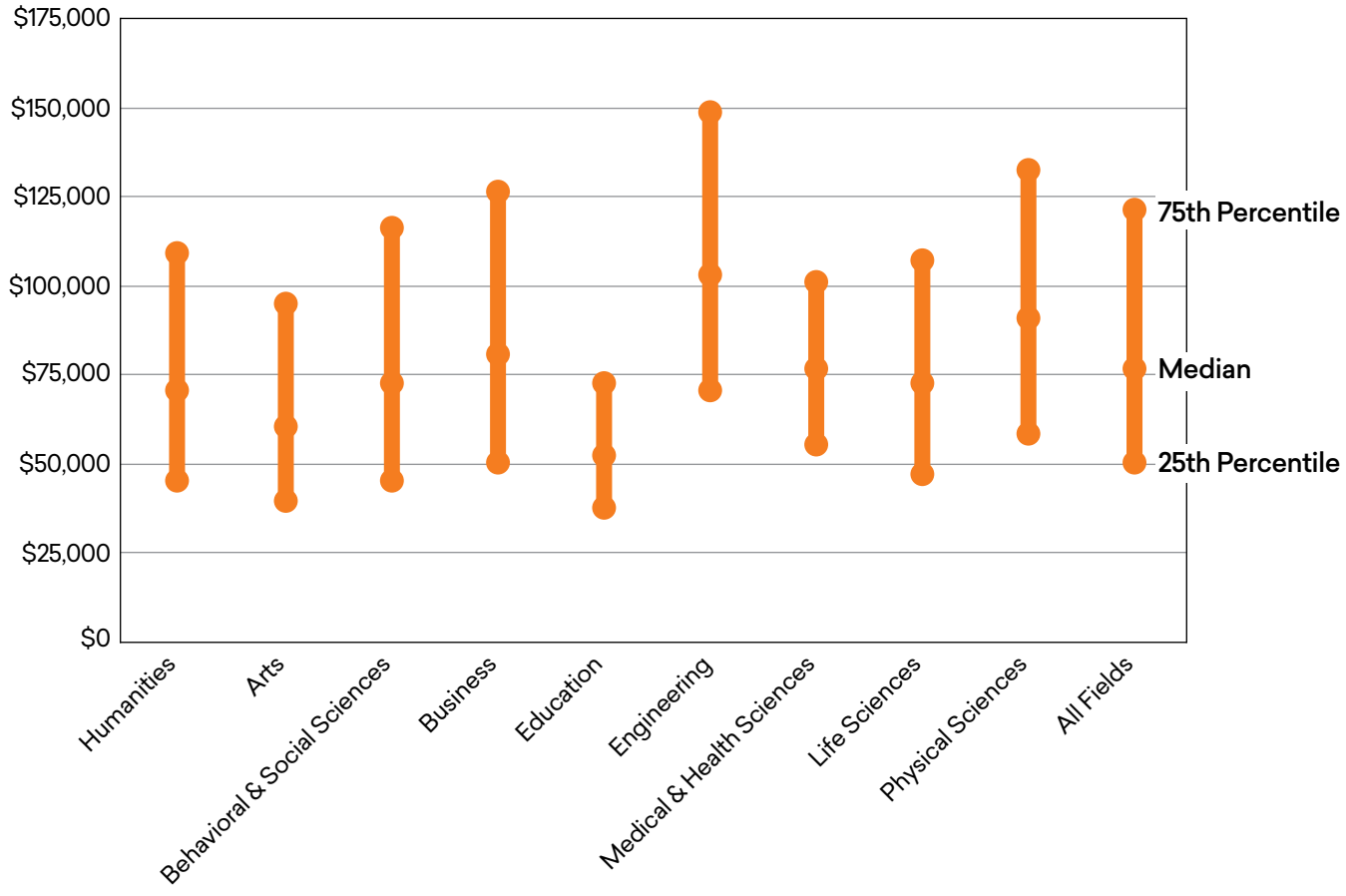
For questions about these reports, suggestions for other lines of inquiry, or general queries about the data, please contact Robert Townsend, codirector of the Humanities Indicators, at rtownsend@amacad.org.

Figure 2. Median Annual Earnings of Full-Time Workers with a Terminal Bachelor's Degree, Ages 48–59, by Field of Degree, 2018



Source: U.S. Census Bureau, *2018 American Community Survey Public-Use Microdata Sample*. Data analyzed and presented by the American Academy of Arts Sciences' Humanities Indicators.

Our Common Purpose
in Communities Across the Country

Since the release in June 2020 of *Our Common Purpose: Reinventing American Democracy for the 21st Century*, the final report of the Academy's Commission on the Practice of Democratic Citizenship, there have been a number of surprising and inspiring stories about the impact the report has had. From giving the report away as Valentine's Day presents to ordering a copy for everyone in the city government of Boise, Idaho, *Our Common Purpose* has been shared, read, downloaded, viewed, and discussed around the country. As the Academy continues to work with champion organizations to advance the report's recommendations, below are a few stories of how individuals are taking it upon themselves to put the report to work.

> *"The report is such a breath of hope and fresh air to counter the pessimism and divisiveness of this challenging period."*
> **—Andrea Martonffy, La Grange, IL**

Andrea Martonffy first heard about *Our Common Purpose* at the Humanities Open House held at the University of Chicago in July 2020. An alumna of the university, she was thrilled to learn about *Our Common Purpose* and knew the report would be an ideal document to share with the La Grange Area Branch of the League of Women Voters. Using the Commission's informational video, Andrea created a presentation for the board of her chapter of the League of Women Voters. They are now discussing how they want to implement the report's recommendations, and Andrea is excited to share the report with other chapters in the area.

> *"I greatly admire the* Common Purpose *Project."*
> **—Bob Groves, Philadelphia, PA**

Bob Groves is a faculty member at Temple University's Osher Lifelong Learning Institute in Philadelphia. This past February, he taught an online course on "What Does It Mean to be an American: Two New Perspectives." He devoted two of the course's four Zoom sessions to *Our Common Purpose*. The course attracted a hundred students, all over the age of fifty. Focusing on the

scope of the recommendations, the virtuous and vicious cycles of democracy, and the meaning of citizenship, Bob reported that his students enthusiastically supported many of the report's recommendations. He especially appreciated how the report lent itself to discussions of current initiatives, noting that it was easy to relate *Our Common Purpose* to various national and local organizations that work to repair America's divides.

> *"I think it is one of the finest and most accessible meta-analys[es] of the academic work done on how to fix our democracy that I have seen."*
>
> **—John Lesko, Parsonsfield, ME**

John Lesko has been advocating for the Commission's work since he read the report. A social economist and a retired professor of organizational behavior and public policy at Bentley University's School of Management, John wrote an unpublished commentary on *Our Common Purpose* as part of his effort to get others involved. In his article, he advocates for every town hall in the country to stock a copy of *Our Common Purpose* and urges individuals to use the report to enhance their understanding of civic activity. He has been distributing the report and his commentary to his friends, family, and network, sharing the recommendations, and hoping to generate more civic engagement.

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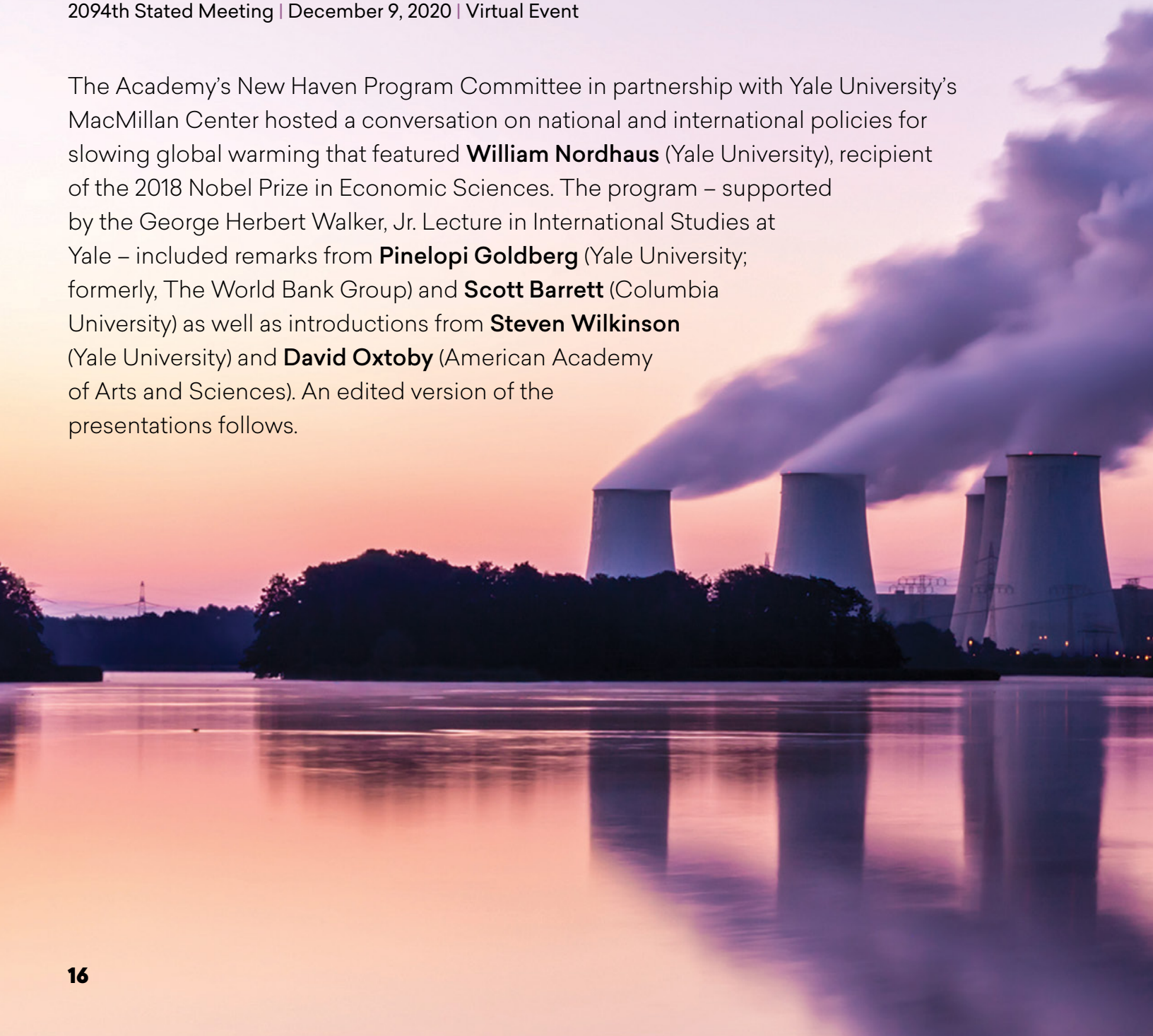
Have you used *Our Common Purpose* in your own community? We would love to hear about it. Reach out to ourcommonpurpose@amacad.org to let us know!

The ongoing work of the Commission on the Practice of Democratic Citizenship and efforts to advance the recommendations in *Our Common Purpose: Reinventing American Democracy for the 21st Century*, the Commission's final report, are made possible by the generous support of S.D. Bechtel, Jr. Foundation; Rockefeller Brothers Fund; Alan Dachs and Lauren Dachs; David M. Rubenstein; The William and Flora Hewlett Foundation; The John S. and James L. Knight Foundation; and Thomas and Susan Clary.

Steps Toward International Climate Governance

2094th Stated Meeting | December 9, 2020 | Virtual Event

The Academy's New Haven Program Committee in partnership with Yale University's MacMillan Center hosted a conversation on national and international policies for slowing global warming that featured **William Nordhaus** (Yale University), recipient of the 2018 Nobel Prize in Economic Sciences. The program – supported by the George Herbert Walker, Jr. Lecture in International Studies at Yale – included remarks from **Pinelopi Goldberg** (Yale University; formerly, The World Bank Group) and **Scott Barrett** (Columbia University) as well as introductions from **Steven Wilkinson** (Yale University) and **David Oxtoby** (American Academy of Arts and Sciences). An edited version of the presentations follows.



William Nordhaus

William Nordhaus is Sterling Professor of Economics at Yale University. In 2018, he was awarded the Nobel Prize in Economic Sciences for "integrating climate change into long-running macroeconomic analysis." He was elected a Fellow of the American Academy of Arts and Sciences in 1984.

It is clear that we are nowhere near meeting the goal of zero net emissions by the middle of the century.

I would like to discuss four key issues concerning international aspects of climate change: 1) there has been very little progress in slowing emissions; 2) the challenge of incentives for low-carbon technologies; 3) the important role of carbon pricing; and 4) the need to combat international free riding with a climate compact.

Let's begin with some facts about global CO_2 emissions.

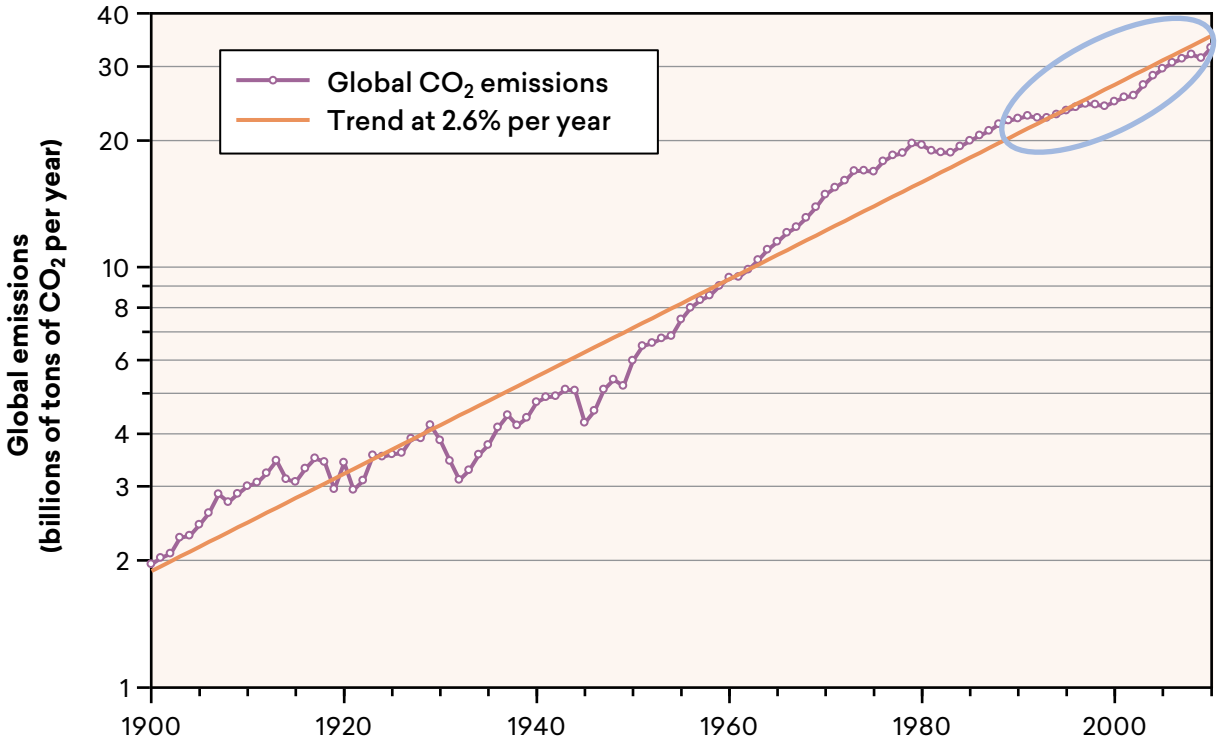
Over the last century, global CO_2 emissions have risen at about 2.6 percent per year (Figure 1). If we look at the most recent period, we don't see any major drop in emissions. In terms of decarbonization, we have seen a decline of about 2 percent a year over the period from 1990 to 2019.

One of the surprising but slightly depressing results of the Paris Accord is that its ambitions are very low and that it will do relatively little to improve the global carbon output ratio at normal economic growth. It is clear that we are nowhere near meeting the goal of zero net emissions by the middle of the century (Figure 2).

A question that I am often asked is whether it is true that the pandemic and the slowdown in economic growth have dramatically cut emissions. My answer is yes. And then the usual follow-up question that I am asked: is cutting emissions a useful way to slow economic growth? That is a very interesting question. We do not know what exactly has happened to emissions in 2020. We think they are down sharply, but we need to know what has happened to CO_2 accumulations. What the data show is that even though there has been a sharp drop in emissions, there has been no similar sharp drop in CO_2 concentrations. This reminds us of the great inertia in the climate and earth system. A sharp drop in output and a sharp drop in emissions will only make a small dent on concentrations and on temperature, partly because there is so much inertia in the earth system. This is a good reminder that this problem is a long-term one that cannot be solved overnight.

In terms of the role of economics in climate policy, I would like to focus on three things: 1) the

Figure 1. Global CO_2 Emissions



Source: International Monetary Fund and World Bank.

inadequate investment in low-carbon technologies; 2) carbon pricing; and 3) the landscape.

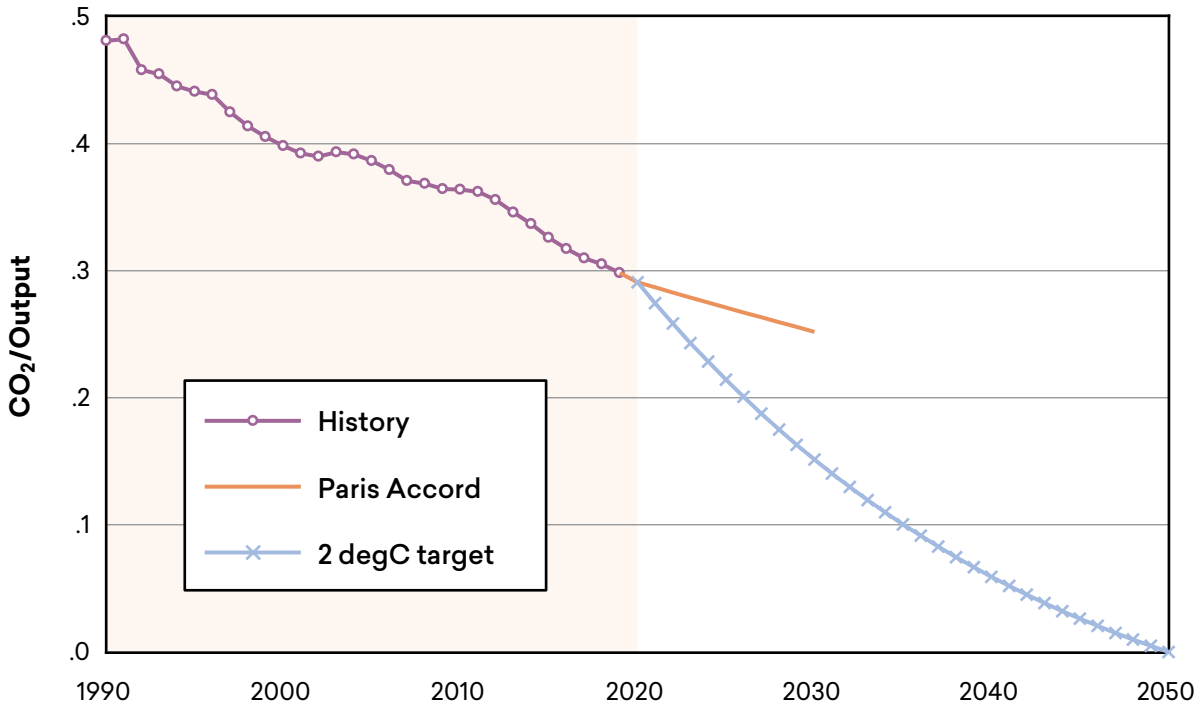
One of the issues that does not get much attention is the inadequate investment in low-carbon technologies. It's clear that we do not have low-carbon technologies that are sufficient to turn the world around. About 80 percent of our energy system is based on carbon and fossil fuels. There are at present very few solutions that are economical and adequate substitutes for existing technologies. This relates to the economics of innovation and invention, which is twofold. First, and the most important, is that the private returns on innovation are far below the public returns. So even though Bob Dylan just received $300 million for all of his songs, I am sure that the public benefit of that is far larger.

But for the environment and for climate change, things are worse because there is a double externality for low-carbon innovations. Not only is there the innovation externality because inventors cannot bottle and capture the full returns of their inventions, but there is also a climate impacts externality. For example, a green invention is doubly cursed because of the innovation externality and because the returns of lower emissions are not captured in the marketplace. So policies for low-carbon technologies require both fixing the climate externality and having special incentives for research and development on low-carbon technologies.

“One of the issues that does not get much attention is the inadequate investment in low-carbon technologies. It's clear that we do not have low-carbon technologies that are sufficient to turn the world around.

The way that economists have focused on fixing the climate externality is largely through carbon pricing. My second key economic insight is the importance of harmonized carbon prices across sectors and countries. A high price on CO_2 emissions is the key to sharp emissions reductions because emissions are not caused by a single entity, a

Figure 2. Decarbonization: History and Future



Source: William Nordhaus.

Figure 3. The Carbon Price Landscape, 2019

Region	Percent of region covered by price	Carbon price ($/tCO$_2$)	Effective price ($/tCO$_2$)	% of global emissions
Sweden	40	127	50.8	<1
Norway	60	59	35.4	<1
Switzerland	33	96	31.7	<1
British Columbia	70	26	18.2	<1
France	33	50	16.5	1
California	85	16	13.6	2
ETS	43	25	10.8	8
Japan	70	3	2.1	5
Argentina	20	6	1.2	<1
Chinese cities	40	3	1.2	1
Northeast U.S.	18	5	0.9	1
Mexico	45	1	0.5	1.5
Uncovered	100	0	0.0	80
Global average			**1.7**	

Source: World Bank.

single government, or a single corporation but are the responsibility of billions of people in millions of firms, in thousands of governments, in hundreds of countries. You cannot hope to affect all of them without giving the appropriate market signals, but it requires more than that. To meet carbon targets in an effective way, the level of the carbon price should be harmonized so that the incentives across countries and across sectors over time are similar for similar groups. You cannot have vastly different prices for power plants versus automobiles, homes versus businesses, some countries versus other countries, some industries versus other industries. We would allow for different paths for poor countries, but we cannot make exceptions the rule.

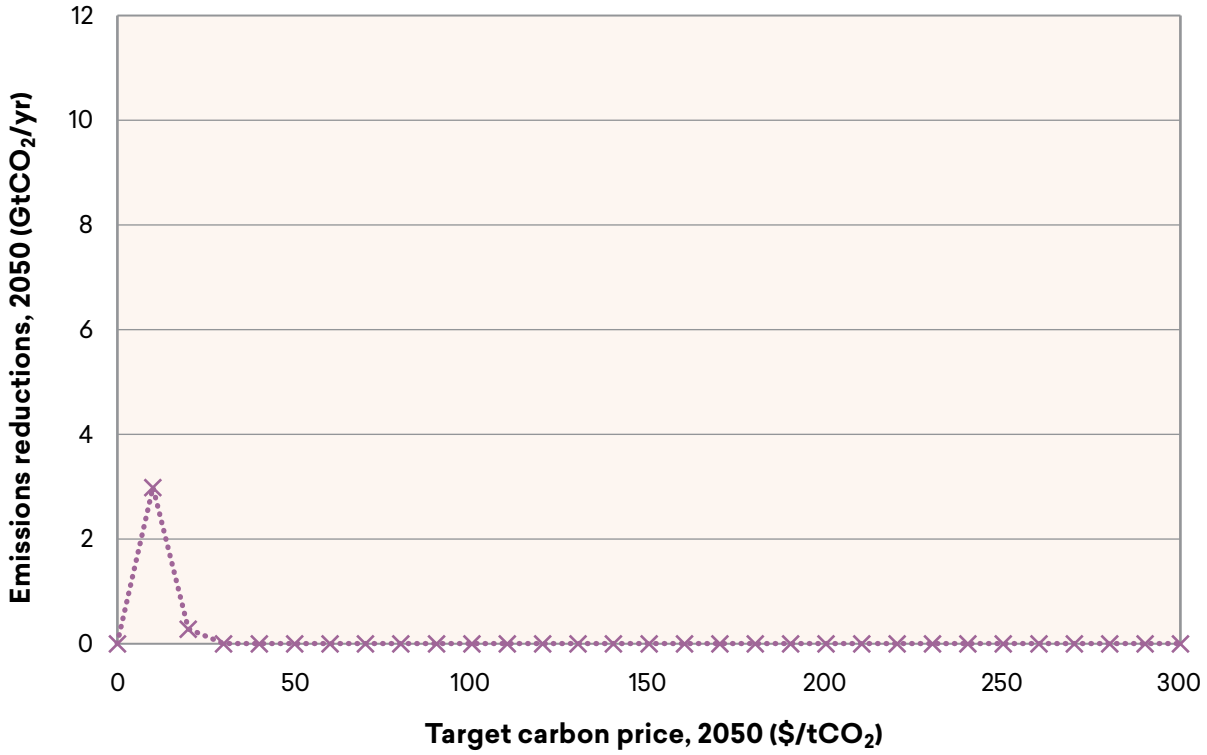
Though all of this is idealized, I think it is useful to keep the ideal in mind. In reality, carbon prices are fragmented and very low. Figure 3 shows the carbon price landscape in 2019. We see countries ranked by their effective carbon price, from Sweden to the uncovered countries of the world. It should not come as a big surprise that the countries with the highest effective carbon price are European countries: Sweden, Norway, Switzerland, and France. There are a few others: British Columbia and California have reasonably high carbon prices. But as we see in the figure, 80 percent of the global emissions are from uncovered countries that have a zero-carbon price. If you take the weighted average of carbon prices across countries, it is a little under $2 a ton.

I think it is fair to say that looking at the carbon landscape, we were doing virtually nothing as of 2019 to control CO_2 emissions.

The third key economic insight is what I call the global free-rider problem. After thirty years of international climate policies, though we have accomplished much in terms of measurement and reporting, international policy is at a dead end. Climate change policy is hampered by what is known as the free-rider problem: the agreements are voluntary, there are no penalties for non-participation, and countries talk loudly but carry no stick. It is like riding on a trolley for free because there is no penalty for not paying. You can hop on at any point since no one is checking for tickets. But the problem is that no one then pays for the trolley system and there is underinvestment in areas where free-riderism prevails.

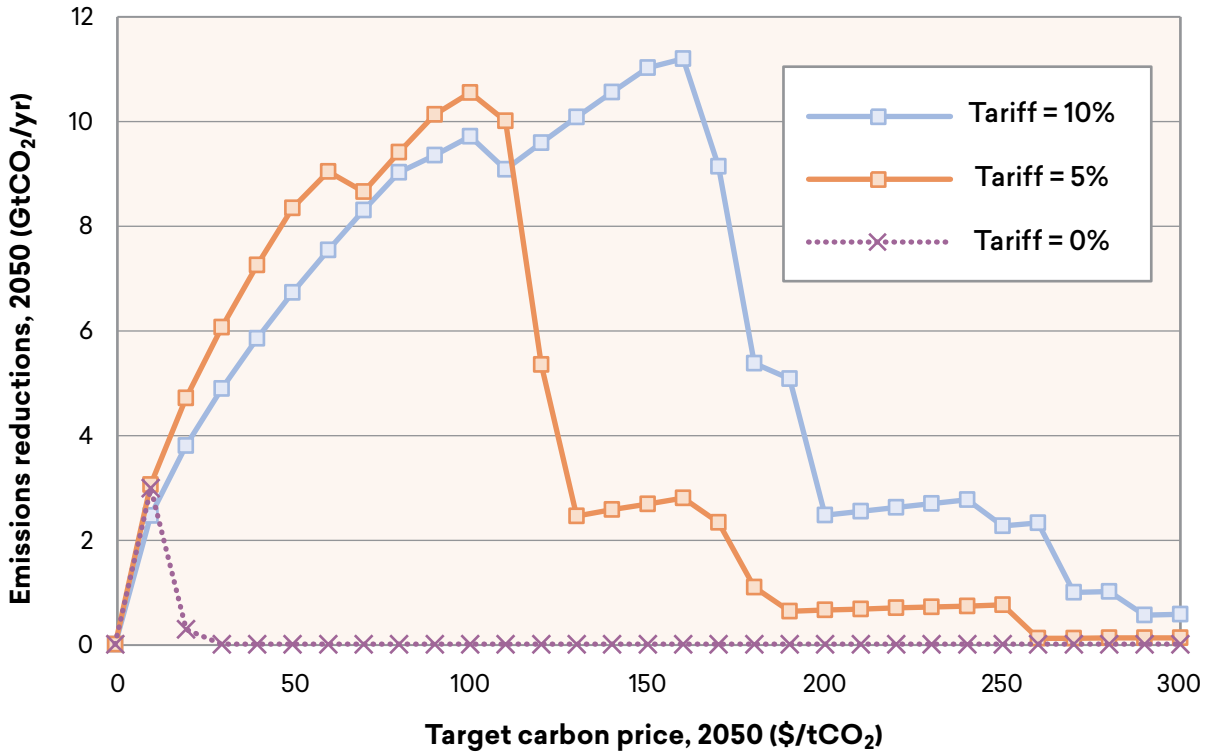
What is the reason for this rather pessimistic, or maybe realistic, assessment? It is based on both actual carbon prices, which are today low, and the minimal level of emissions reductions that we see in the data. So where do we go from here? A suggestion that I and others have made is what is

Figure 4. Carbon Prices Supportable in a Voluntary Regime



Source: William Nordhaus.

Figure 5. Carbon Prices Supportable under Different Tariffs



Source: William Nordhaus.

The world will need rapid development of low-carbon technologies to make the transition less expensive and make a carbon compact more effective.

sometimes called a climate compact to overcome free riding. The analytical approach behind this is the well-developed theory of clubs, which says that voluntary groups that have incentives for people to join are stable and effective. The EU is an example of a group that is most effective as a multinational club.

For climate change, a compact would include two features: One is an abatement requirement, such as a target carbon price, perhaps $50 per ton of CO_2. The second is a penalty tariff for non-participants, say a 3 percent penalty tariff on all imports. We have done some modeling at Yale that suggests this could be an effective way to combat free riding. Figures 4 and 5 show supportable carbon prices for different tariff structures.

If we take the Paris regime or the Kyoto regime, what kind of reductions would be possible and at what carbon prices? Well, there would be some reductions possible, something like three billion tons of CO_2 per year in the year 2050.

You can also look at different tariffs and see what kinds of tariff rates and reductions would be supported. What we see is that if the price gets too high, it is too costly to participate and countries drop out. If the price is too low, nothing happens. So somewhere depending on the tariff between $100 and $200 per ton of CO_2 is the range at which you can support this system. But this by itself is probably not going to be sufficient to meet our goals, and the world will need rapid development of low-carbon technologies to make the transition less expensive and make a carbon compact more effective.

I will end by summarizing four key takeaways. First, the current climate architecture is ineffective. It has not solved the problem of high harmonized carbon prices and of reducing emissions. Second, low-carbon technologies are plagued by a double externality: the externality of invention itself and another externality because of the underpricing of carbon. Third, a key policy objective is to have high and harmonized carbon prices across countries, industries, and sectors. And fourth, strong incentive-compatible agreements can be supported with a climate compact: namely, mandatory carbon price policies plus tariff penalties for non-participants.

Pinelopi Goldberg

Pinelopi Goldberg is Elihu Professor of Economics at Yale University and former Chief Economist of The World Bank Group. She was elected a Fellow of the American Academy of Arts and Sciences in 2014.

If you look at where the emissions come from, it is essentially five countries: China, the United States, Germany, Russia, and India. If we want to move the needle on climate change, we need to start with these five countries. Taxing imports from the small players, from small developing countries, is not going to make a big difference.

In contrast to my co-panelists, I do not specialize in climate change, but I do specialize in trade. As we have learned from Bill's presentation, climate change involves cross-country externalities. There is a lot to learn from how trade policy has managed similar cross-border externalities over the years and what trade agreements have achieved. To start, let me give a very brief overview of the three basic points that I wish to make. First, while I share the assessment that so far the international climate architecture has been ineffective, I am slightly more optimistic about the future. I think there are reasons to believe that in the future international cooperation could play out better, and I will explain why. Second, I will be specific about how I envision international climate governance and what concrete steps we can take in the near future to make progress. And third, I will refer specifically to carbon pricing and to the proposal on climate clubs and tariffs.

Why am I more optimistic about the future? I believe that today we are in a very different place compared to thirty years ago, when many people did not believe in climate change (though some people still do not believe in it). Partly because of the weight of the scientific evidence and partly because of events that people have experienced, such as natural disasters, tsunamis, flooding, and so on, there is more acceptance of the fact that we are facing climate change, that it is not a low-chance event that isolated scientists emphasize, and that the risks are real.

Moreover, we are at a point where at least in advanced economies people are willing to trade off growth in pursuit of other objectives. Two years ago, if you were to tell us that the United Kingdom, Germany, most of Europe, and the United States would go into lockdown and take a huge economic loss in order to achieve some other objective (in this case, to save lives in the midst of the coronavirus pandemic), most of us would have considered that impossible. What this shows is that attitudes change.

Finally, one of the main problems with policy in the past was that many perceived a tradeoff between growth and addressing climate change. However, we are now at a point where policy-makers in certain parts of the world (mainly Europe) believe that addressing the challenges of climate change is not only compatible with growth, but can serve as the basis of a (green) growth strategy. It is therefore not surprising that Europeans seem more willing to embrace measures that address climate change. The policy in the United States is a different story, and I will come to that next.

What are the ways in which we can foster international cooperation? Here I am a bit pessimistic about the prospects of a truly multilateral solution to address the externalities involved in climate change, partly because multilateralism is all but dead now. The World Trade Organization is nearly defunct because of the actions of the United States, and many advanced economies are turning inward. To the extent that there is international cooperation these days, it takes the form of bilateral or regional agreements. And for climate change, this is insufficient because the problem is global in nature. A pragmatic approach needs to take into account who the big polluters are. If you look at where the emissions come from, it is essentially five countries: China, the United States, Germany, Russia, and India. If we want to move the needle on climate change, we need to start with these five countries. Taxing imports from the small players, from small developing countries, is not going to make a big difference.

Here, there are reasons for optimism and pessimism. As I mentioned, Europe is already on board and that is important. On the other hand, the United States, which is the second biggest polluter in the world, has been rolling back its environmental regulations. It is very hard to think about any form of international cooperation or any international solution that does not involve the United States. There is hope that with the new administration we can make progress. At the same time, there are big political economy issues that the United States faces no matter what the federal government does. For example, Texas relies on oil as do states such as

Oklahoma, North Dakota, or Alaska. So, achieving consensus in the United States regarding the approach to climate change is challenging. This is a problem distinct from the issue of cross-border externalities.

As you may know, China is the biggest polluter in terms of total emissions. However, its *per capita* emissions are not among the highest in the world. Importantly, as the per capita income in China increases, people have started to prioritize the quality of life over growth. Many Chinese policy-makers now emphasize the so-called ecological civilization, which is one way to frame climate change. An optimistic vision going forward is that climate change is an area in which the United States and China could find common ground and cooperate. These two countries could pursue a joint agenda to reduce emissions, leaving aside geopolitical differences and the toxic rhetoric of the last few years. This would move the needle in climate change.

I do not think there is much hope that Russia will join these efforts given its heavy reliance on oil. India, with its very low per capita income, is prioritizing growth over climate change. Nevertheless, it is important to keep in mind that many developing countries face some of the worst consequences of climate change: air and water pollution, flooding, low agricultural yields, and desertification. It is important to bring them on board in the long run. But in the short run, one needs to take into account the many other challenges they face. In sum, I think a constructive approach forward would be to focus on the five major polluters (starting with the United States, China, and Europe) and try to foster an agreement among them.

What went wrong with the World Trade Organization (WTO)? There are quite a few lessons we can draw from its history that are relevant to climate change. The first is that the WTO was very effective in its initial stages because it included a number of like-minded countries that had similar objectives, that were at a similar stage of economic development, and that could agree on a common strategy. Eventually, trade agreements broadened their scope to include developing countries and many other areas that went beyond trade. At some point, the WTO became the victim of its own success. It became too broad and too heterogenous, with too many members pursuing different agendas and objectives. The WTO used to follow an all-or-nothing approach: all parties had to agree on all issues, which was paralyzing and debilitating. Recent reforms embraced a plurilateral system, in which a group of countries agree on a set of issues. These countries are generally like-minded. Other countries can join later if they want. They don't face any penalties if they don't join immediately, and they always have the option of joining later. This type of agreement allowed the World Trade Organization to make progress in some areas, for example, in trade facilitation and agriculture.

This approach could be applied to the area of climate change. To a certain extent, it is similar to what Bill proposed with climate clubs, but there is a crucial difference. There would be no penalties. But I know that in Bill's proposal, it is crucial that the incentives be aligned and that there are tariffs that are used as penalties. This brings me to the third part of my comments on carbon pricing.

“An optimistic vision going forward is that climate change is an area in which the United States and China could find common ground and cooperate. These two countries could pursue a joint agenda to reduce emissions.

I agree with Bill that carbon pricing is the way to go. Naturally, economists embrace prices as the mechanism to efficiently allocate resources. The question is, why has this mechanism failed so far? One of the reasons is the political economy of carbon pricing. I mentioned the heterogeneity of preferences across U.S. states earlier. But also, if we think about the domestic context, the most common form of a carbon tax is a tax on gasoline. Raising the gasoline tax has not been feasible politically given the regressivity of the tax. Approximately two years ago, President Macron tried to raise the fuel price tax in France, and this is when the yellow vest riots erupted. It didn't help that he tried to increase the tax at the same time when the wealth tax was abolished in France. What this shows is that framing, implementation, and bundling of carbon taxes with additional policies, potentially taxes or subsidies to

> Partly because of the weight of the scientific evidence and partly because of events that people have experienced, such as natural disasters, tsunamis, flooding, and so on, there is more acceptance of the fact that we are facing climate change, that it is not a low-chance event that isolated scientists emphasize, and that the risks are real.

make sure the tax is not as regressive as it usually is, is important and so far we have failed to deliver on that front.

My concerns about imposing tariffs on countries, some of which are too small to affect worldwide emissions and climate change, are twofold. First, tariffs have often been used for geopolitical reasons, as we have seen with the recent tariff war with China. Separating politics from science may prove hard. Second, in addition to China, there are other countries – for example, India, Bangladesh, Egypt, Pakistan – that are going to be disproportionately affected by tariffs. Some of these countries are not polluters; others are, like India. And as they grow, they will become even bigger polluters. So, while I am in principle in favor of carbon pricing, both domestically and internationally, I would like to conclude with two appeals.

First, carbon taxes should be implemented in a way that makes sure that those who are disproportionately affected or those who cannot afford to pay them, such as lower-income households and small businesses, are compensated. Second, we need to make accommodations for lower-income countries that are not at present in a position to take the steps necessary to reduce emissions.

Scott Barrett

Scott Barrett is Lenfest-Earth Institute Professor of Natural Resource Economics and Vice Dean of the School of International and Public Affairs at Columbia University.

In Paris in December 2015, (all) the world's countries came together and agreed that climate change is a serious problem that requires them to act collectively to ensure that temperature change remains below 2 degrees Celsius relative to the pre-industrial level. Countries promised to make their own individual pledges for how they would help to contribute to meet this collective goal. If you look at the pledges that were made, they state that emissions are going to continue to rise, and there is no way to stabilize temperature change at 2 degrees Celsius or indeed at any level, as long as emissions keep increasing.

Why would countries go to all the trouble of meeting, agreeing on a collective goal, and making pledges, when those pledges guarantee that they will not meet their goal? We saw something similar with an earlier effort to address climate change multilaterally: namely, the Kyoto Protocol. Here too the world agreed on what to do. But the United States did not ratify the agreement. Canada did ratify the agreement, but it never passed legislation to meet it. When it went wildly off course and was sure to be in violation of compliance, Canada pulled out of the agreement, which under international law it is allowed to do; it is only obligated to fulfill the requirements of the treaty if it belongs to the treaty. Ultimately the agreement collapsed.

The behavior on display in Kyoto and Paris is consistent with the free-rider problem. What the Paris Agreement is doing is asking countries to make voluntary contributions. If people get to decide how much they are going to contribute, they will tend to contribute very little, and that is the situation we are in now.

But if you look at the history of international cooperation more broadly, the world has succeeded in some cases, and what is common about those

In Paris in December 2015, (all) the world's countries came together and agreed that climate change is a serious problem that requires them to act collectively to ensure that temperature change remains below 2 degrees Celsius relative to the pre-industrial level.

cases is that countries are able to sustain cooperation when they choose to negotiate over something that gives rise to a phenomenon I am going to call "tipping." With tipping, states are willing to play their part provided they have assurance that others are going to play their part, too. Once you get past a critical threshold of countries that will play their part, others will want to join in. You can think of this critical threshold as the tipping point for an international treaty. The problem with Kyoto and Paris is that neither agreement provides this assurance.

One possible way to do this is to link cooperation on trade to cooperation on climate change. This has been proposed before. President Macron of France, when he gave his address to the UN General Assembly in September 2019, said, "Let's sign no more trade agreements with powers that don't respect the Paris Agreement for climate change." He was linking trade to participation in a climate treaty. Joe Biden is another example. Biden's presidential campaign website says that Biden will condition future trade agreements on partners' commitments to meet their enhanced Paris climate targets. The idea is already out there that we can link cooperation on trade to cooperation on climate. However, with linkage, we can expect that countries that were the target of these tariffs would want to retaliate. The whole trade system is built on reciprocity and so retaliation is expected. So, linkage could be risky.

Recent work that I have done with Astrid Dannenberg of the University of Kassell finds that linkage can work for a problem like climate change if a critical condition holds. And that condition is that the gain that a country gets from free riding has to be small relative to the gains it gets from avoiding a trade war. When that condition holds, linkage gives rise to a tipping phenomenon: there has to be a critical mass of countries that are in the agreement and that have promised to impose tariffs against nonparties. If that critical mass condition is met, then all countries are going to want to be inside that agreement to avoid the trade measures. What regimes give rise to this? There are two obvious ones: unilateralism and multilateralism. For unilateralism, it may be that just one, two, or three countries decide they want to do it. This may not achieve the required critical mass, causing the whole thing to collapse.

Under multilateralism, by contrast, participation must exceed some critical level in order for the agreement to enter into force. If this condition is satisfied, all countries will want to join. That is the ideal outcome: full cooperation on climate and no trade war.

Another way to look at this would be to focus on individual sectors. We can look at the linkages that have been tried in the past. One example is the Waxman-Markey Bill, otherwise known as the American Clean Energy and Security Act of 2009. There are provisions in that bill for trade measures to be used for trade sensitive sectors. Unfortunately, Waxman-Markey was never adopted; the Senate never voted on it so we do not know how it would have worked.

Another example is the European Union's aviation directive, which focuses on one sector: international aviation. This legislation did enter into force, but immediately upon doing so the United States, China, India, and other countries threated retaliation. In response, Europe suspended its implementation of the directive.

There has been one multilateral attempt so far to link climate and trade, and that is an amendment to a treaty called the Montreal Protocol, the treaty that has protected the stratospheric ozone layer. The amendment to the treaty limits the emissions of hydrofluorocarbons (HFCs), a greenhouse gas that the Kyoto Protocol tried to limit but failed. Unlike Kyoto, however, the Montreal Protocol embodies a trade measure. And for this reason, there is a good chance that this amendment to the Montreal Protocol will succeed in limiting HFCs.

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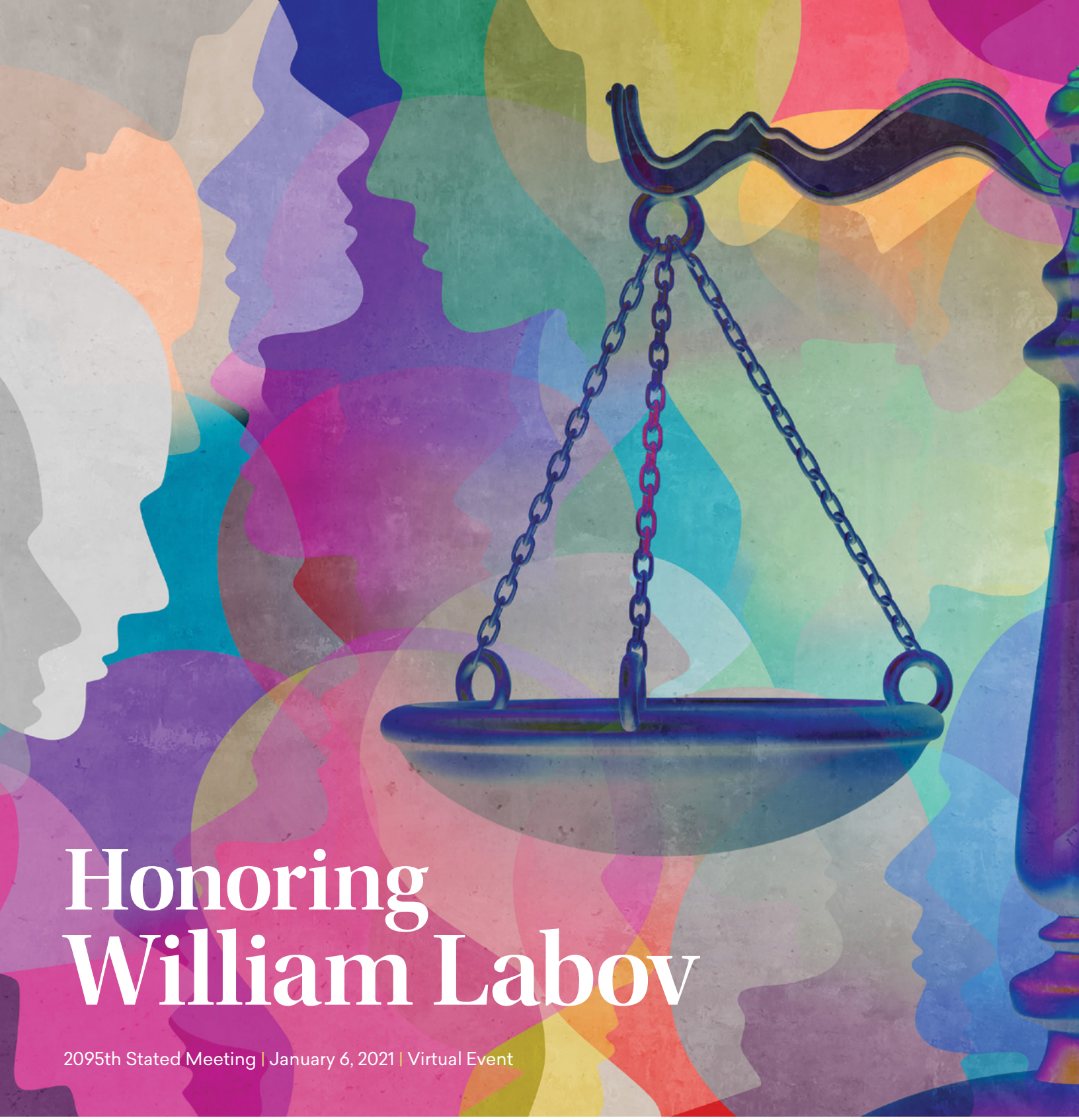
To view or listen to the presentation, visit www.amacad.org/events/international-climate-gov.

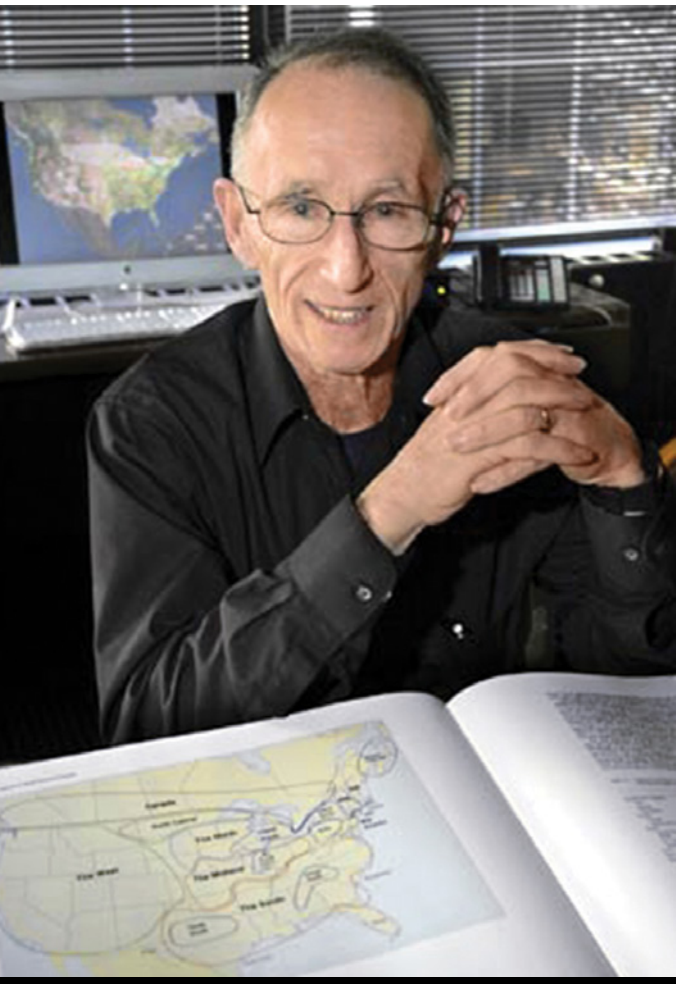


Honoring William Labov

2095th Stated Meeting | January 6, 2021 | Virtual Event

William Labov is regarded as the founder of variationist sociolinguistics, a discipline dedicated to understanding and researching language in relation to social factors that include region, class, and gender. Dr. Labov has worked to promote literacy for speakers of nonstandard dialects and to develop reading and teaching materials for these populations.

At a virtual program that included remarks from Academy President **David Oxtoby**, University of Pennsylvania Provost **Wendell Pritchett**, and Stanford University linguist **Penelope Eckert**, the Academy presented the Talcott Parsons Prize to William Labov for his distinguished and original contributions to the social sciences. An edited version of Dr. Labov's acceptance remarks follows.



William Labov

William Labov is Professor of Linguistics at the University of Pennsylvania. He was elected a Fellow of the American Academy of Arts and Sciences in 1976.

I very much appreciate this meeting, and I am honored to receive the Talcott Parsons Prize in recognition of the contributions that I have made to linguistics since I entered the field in the 1960s. I would like to acknowledge the help of my colleague Gillian Sankoff at every stage of the preparation of these remarks.

ENTERING THE UNIVERSITY

I entered the field of linguistics at the age of thirty-three. I had worked previously for ten years as an industrial chemist, and so I brought with me the habits of numerical recording, testing, and experimentation. I left behind my friends in the factory and a decade of trade secrets and entered into the open pursuit of the universal properties of human language at Columbia University. There I found that linguists had a very different mode of gathering data: they would ask, "Can you say this?" or else would rely on introspection.

It occurred to me that the field could profit by the adoption of a new invention, the tape recorder, that preserved what people actually *did* say. It was fortunate that I brought my numerical habits with me, because I found that the variation in the way people said the very same words could be measured, and that variation was subject to a number of social parameters.

NUMBERS IN NEW YORK

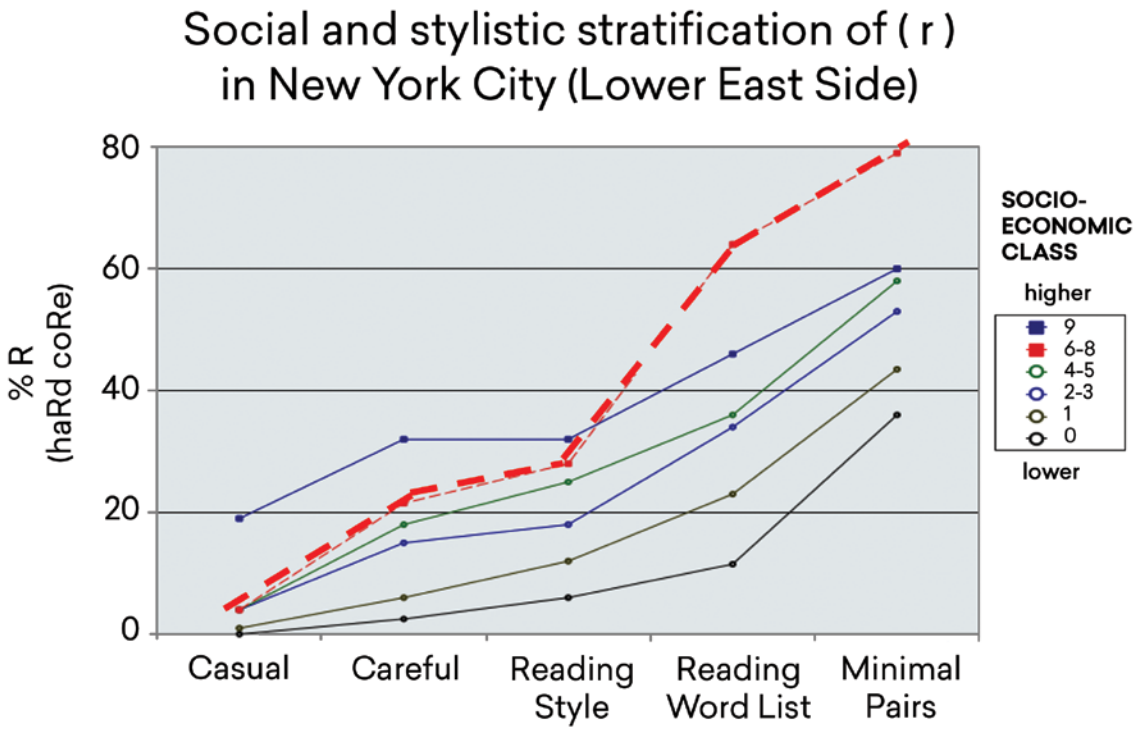
In my first efforts to record linguistic variation, I introduced the concept of the *linguistic variable*: a closed set of possible options with a single underlying value. But linguistics was not yet ready for that idea. A senior colleague told me that the only numbers in linguistics were the numbers on the pages.

I expected decades of stiff resistance to the quantitative study of change and variation. But I was surprised. My first report on "The Social Motivation of a Sound Change" on Martha's Vineyard was greeted with a wave of approval at the national meeting of the Linguistic Society of America. I later took a course on Survey Methodology at Columbia's Bureau of Applied Social Research, and carried out a survey of New York's Lower East Side using a piggy-back design, a subset of the survey of *Delinquency and Opportunity* by Richard Cloward and Lloyd Ohlin. The graph in Figure 1 is typical of the results. It builds from the observation that New Yorkers sometimes pronounce the (r) in words like *hard core* and sometimes do not.

The graph is based on the speech of the eighty-one adults whom I interviewed on New York's Lower East Side, grouped into six social classes. The percent pronunciation of consonantal (r), shown in the vertical axis, is very low in casual conversation: less than 20 percent by most speakers, as we see at the lower left. It increases to over 50 percent in the more formal styles on the right-hand side of the figure.

The data clearly show that (r) pronunciation was conditioned by speech style and by the speaker's social status, but there was a third conditioning factor:

Figure 1. New York City (r) in 1964



the speaker's age. The younger the speaker, the greater their use of consonantal (r), and this reflected an ongoing change in the speech of New Yorkers.

Sociolinguistics, based on the quantitative analysis of language variation and change, became a burgeoning field. In 1988, I was the founding co-editor of *Language Variation and Change*, which is now in its thirty-third year of publication. Since then, several other journals in variationist sociolinguistics – such as *Asia-Pacific Language Variation*, *Journal of Sociolinguistics*, and *Journal of Historical Sociolinguistics* – have appeared. Most of the papers in these journals are based on automatic assessment of data by mixed-level, maximum-likelihood regression analysis, data that now take an hour to analyze that previously would take a month. Let me add that the 49th annual NWAV conference (New Ways of Analyzing Variation) will be held in Austin, Texas, in October 2021.

SEARCHING FOR LINGUISTIC JUSTICE

At several points in the citation of my Talcott Parsons Prize, there is mention of my concern for social justice. The quantitative analysis of the pronunciation of (r) did not automatically lead to a concern with such matters, but there were social issues involved with the speech of young Black people in New York. The Office of Education funded a study of mine of what was then recognized as "nonstandard Negro English" (now generally referred to as African American Vernacular English, or AAVE).

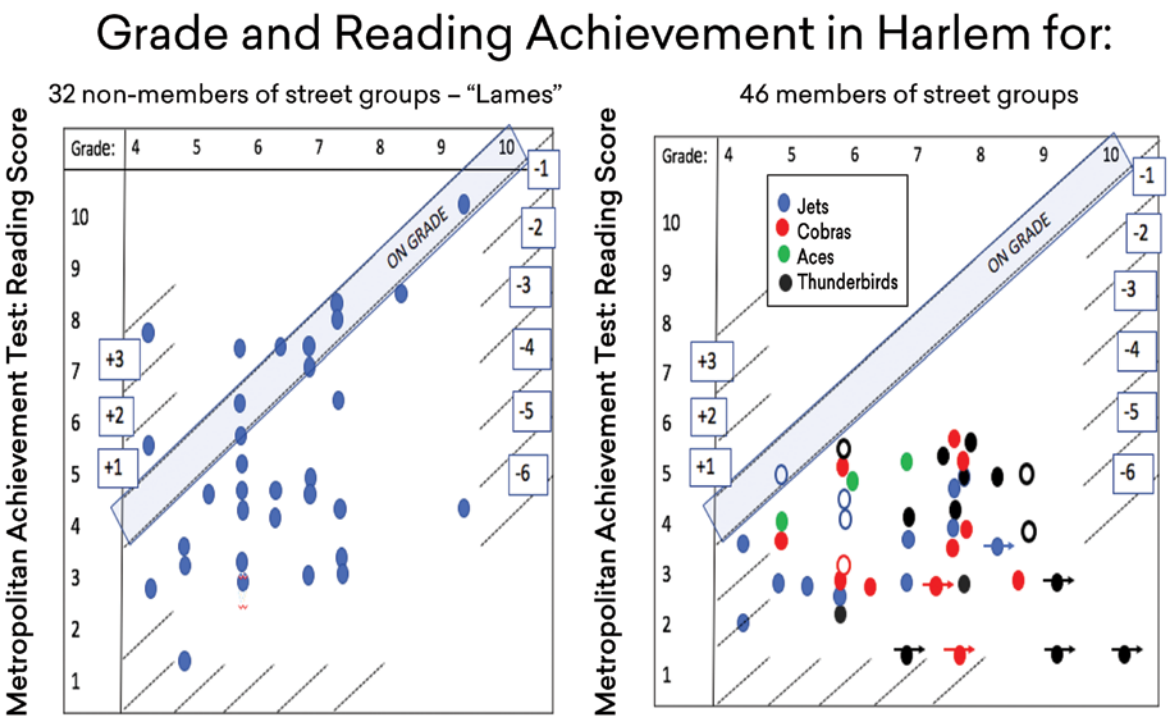
The goal of the research was to find out the connection, if any, between that speech pattern and the high rate of reading failure in Harlem schools. I enlisted two young Black men to interview members of local street clubs at a club house that I rented on 112th Street. One result of that work appeared in the *Teachers College Record* (see Figure 2).[1] It showed an overwhelming difference in reading progress between the forty-six members of the local groups – the Cobras, the Jets, the T-Birds – and the thirty-two non-members of the street groups. We found correlated differences in their use of language: the street club members spoke AAVE in its most consistent form.

Many of the thirty-two non-members had reading problems, but there was a general upward movement: a good number read at grade level, and a few were even above it. But only *one* of the forty-six members of the street groups read at grade level. Many of those in the higher grades read far below grade level.

Many educational psychologists attributed this failure to "verbal deprivation," arguing that Black

1. William Labov and Clarence Robins, "A Note on the Relation of Reading Failure to Peer-Group Status in Urban Ghettos," *Teachers College Record* 70 (1969): 395–405.

Figure 2. Reading scores of street club members and others



children lacked any logical structure, that they come to school unable "to make statements of any kind."[2]

A paper that I wrote on "The Logic of Non-Standard English" disagreed with that view.[3] I gave voice to the most eloquent of the group members. The most often reprinted passage is a discussion between the interviewer (KC) and Larry Hawthorne (LH), a fifteen-year-old member of the Jets. KC asks a question: "Just say that there is a god. What color is he? White or Black?"

LH: He be White, man!

KC: Why?

LH: Why? I'll tell you why. 'Cause it – the average whitey out here got everything, you dig it? An' then we ain't got shit, you know? So, for that to happen, you know it ain't no Black god that's doin' that bullshit!

This exchange was greeted with a peal of laughter from KC and others present, which registers the fact that Larry had won the logical argument using AAVE.

A special target of proponents of the "verbal deprivation" position was the absence of the copula (the verb *to be*). Our analysis showed that this absence is actually a form of contraction and can occur only in certain grammatical constructions. The absence of *is* and *are* in AAVE is a variable: it can be deleted only where Standard English can *contract* them.

In Larry's discussion of the existence of heaven and hell, the copula has been deleted when he says: *you __ good* and *you __ goin'*. And: *When they be sayin' if you good, you goin' to heaven*.

In both of these cases, Standard English speakers could contract a copula to *you're good* and *you're going*. In contrast, we find Larry using the copula *is* later in this discussion when he says *this is hell*, as represented in bold type:

LH: And when they be sayin' if you good you goin' to heaven, that's bullshit.

KC: Is that so?

LH: You ain't goin' to no heaven. 'Cause it ain't no heaven for you to go to.

2. Carl Bereiter and Siegfried Engelmann, *Teaching Disadvantaged Children in the Pre-School* (Englewood Cliffs, N.J.: Prentice-Hall, 1966).

3. William Labov, "The Logic of Non-Standard English," in James Alatis, ed., *Georgetown Monographs on Languages and Linguistics* 22 (1969): 1–44; reprinted in William Labov, *Language in the Inner City* (Philadelphia: University of Pennsylvania Press, 1972), 201–240.

Figure 3. The hero inexplicably refuses to take off his coat.

KC: Well if there's no heaven, how can there be a hell?

LH: I mean, yeah. . . hm. . . well let me tell you, it[4] ain't no hell, 'cause **this is hell** right here, you know?

KC: So **this is hell**?

LH: Yeah. This is hell right here.

How do we explain Larry's use of the full form "this is hell"? It is consistent with the fact that Standard English does not contract this structure to "this's hell." In other words, AAVE and Standard English are not foreign languages; they are cousins.

The quantitative analysis, published as "Contraction, Deletion, and Inherent Variability of the English Copula,"[5] introduced the first linguistic use of multiple regression in the form of the Varbrul program, an ancestor of today's mixed-level regression analysis programs.

THE ANN ARBOR TRIAL

The weight of sociolinguistic information on AAVE accumulated until it was brought to bear in a cry for social justice through legal channels. This happened when Black citizens of Ann Arbor, Michigan, sued the city for failing to teach their children to read.

Linguist Geneva Smitherman (Director of the African American Language and Literacy Program at Michigan State University) assembled the witnesses (including myself), who testified and convinced Judge Charles Joiner to find for the plaintiffs.

Judge Joiner delivered his opinion on July 12, 1979, and directed the Ann Arbor School Board to submit to him within thirty days a plan defining the exact steps that would be taken to help teachers to identify children speaking AAVE, and to use that knowledge in teaching such students how to read Standard English.

In the years that followed, very little progress was made in following Judge Joiner's orders. Programs that build on contrastive analysis of AAVE and Standard English have been met with violent objections from parents, teachers, and the general public, who have not absorbed the linguists' view of AAVE.

THE READING ROAD

In 1970, I left Columbia and came to Penn. I found that the low reading scores of Black children in Philadelphia, as in New York, had remained a barrier to their progress. Conferring with Ira Harkavy and Cory Bowman at Penn's Netter Center for Community Partnerships, I converted my course on AAVE to an Academically Based Service-Learning course. Over twelve years, I developed *The Reading Road*, a tutoring program for the lower grades that used our knowledge of the alphabet and its relation to AAVE. *The Reading Road* is used by Penn undergraduate volunteers in the Penn Reading Initiative, tutoring second and third graders in local schools.

The stories I wrote for *The Reading Road* were produced as graphic novels. They give voice to young people with a long history of being blamed for things they didn't do. Figure 3 is a crucial moment from *Take Off Your Coat*, a chapter that focuses on words with final consonant clusters, as in *cold*. The hero is sent to detention because he has refused the teacher's command to take off his coat. The reader knows (but the teacher does not) that it is because he has ripped a hole in his pants by getting a neighbor's cat down from a tree on the way to school.

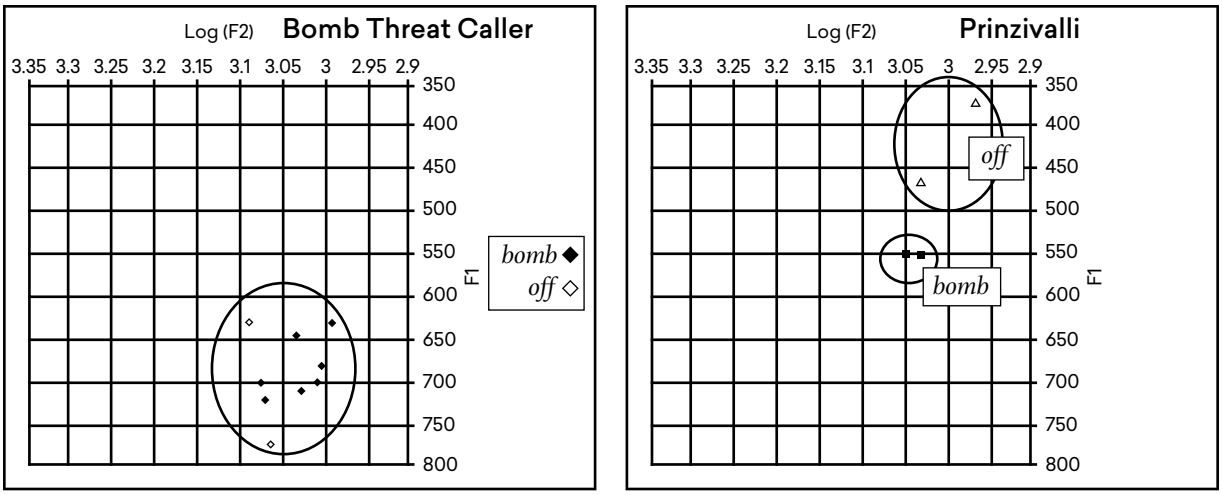
And it actually happened that way. This incident was in the school records of Larry Hawthorne, who we heard from earlier on the color of God.

Sociolinguists often take the side of the speakers they study. John Baugh, president-elect of the Linguistic Society of America (LSA), was the first to demonstrate the effect that prejudice against AAVE has on racial profiling in housing. His book, *Linguistics in Pursuit of Justice*, published by Cambridge

4. Note that AAVE uses *it* in existential sentences, where Standard English uses *there*, which in this case would be expressed as *there is no hell*.

5. William Labov, "Contraction, Deletion, and Inherent Variability of the English Copula," *Language* 45 (1969): 715–762; revised in Labov, *Language in the Inner City*, chap. 9.

Figure 4. Acoustic Measurements for *bomb* and *off* for the Bomb Threat Caller and Prinzivalli



University Press in 2018, had a national impact in identifying racial bias to speech. We also see this in the publications by the three linguists who nominated me for the Talcott Parsons Prize, all former presidents of the LSA. For example, in her 2019 presidential address to the Linguistic Society,[6] Penelope Eckert showed that the use of double negatives was a clear symbol of resistance to school norms on the part of the young women in the high school she studied, characterizing it as "a claim to autonomy, rebelliousness, or toughness." In a paper jointly authored with Sharese King, John Rickford called attention to the ways in which the voices of minority witnesses are obscured in the courtroom.[7] And Walt Wolfram defended the use of AAVE in the Ebonics controversy.[8]

THE ATLAS OF NORTH AMERICAN ENGLISH AND PERSONAL IDENTITY

One large-scale numerical project that emerged from the Penn Sociolinguistics Laboratory was *The Atlas of North American English*.[9] *The Atlas* mapped the vowel systems of the United States and Canada through telephone interviews of residents in cities with a population of more than 50,000. The prevalence of active sound changes across the continent assures that native speakers of English can often be differentiated by their vowel systems in a way that persists throughout life. It also provides a dramatic example of how large-scale quantitative research can decide matters of social justice.

THE PRINZIVALLI CASE

Paul Prinzivalli was a cargo handler from New York City, who was working for Pan American Airways in Los Angeles. The airline received a series of bomb threats by telephone:

> "There's gonna be a shootout tonight up there and a bomb going off."

The executives of the airline and the police thought that the caller sounded like Prinzivalli, who was known to be a "disgruntled" employee. Prinzivalli was arrested. Prosecutors offered him a plea bargain: time served and five years' probation for a guilty plea. Prinzivalli refused, although he knew he faced possibly six to eight years in prison if found guilty.

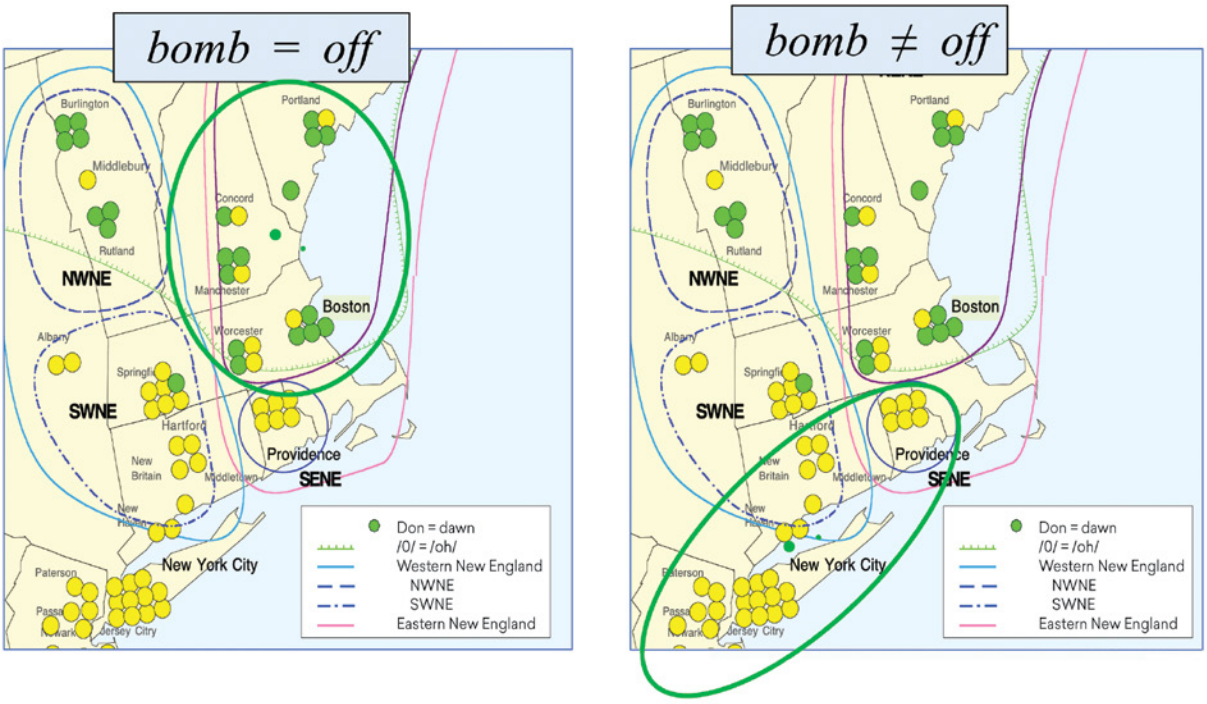
6. Penelope Eckert, "The Limits of Meaning: Social Indexicality, Variation, and the Cline of Interiority," *Language* 95 (2019): 752–776.

7. John Rickford and Sharese King, "Language and Linguistics on Trial: Hearing Rachel Jeantel (and Other Vernacular Speakers) in the Courtroom and Beyond," *Language* 92 (2016): 948–988.

8. Walt Wolfram, "Language Ideology and Dialect: Understanding the Oakland Ebonics Controversy," *Journal of English Linguistics* 26 (1998): 108–121.

9. William Labov, Sharon Ash, and Charles Boberg, *The Atlas of North American English: Phonetics, Phonology and Sound Change* (Berlin and New York: Mouton de Gruyter, 2006).

Figure 5. Pronunciations of *bomb* and *off* in New York and Eastern New England



Since the case involved voice identification, and because Prinzivalli was from New York City, Sandra Disner of the Phonetics Laboratory at UCLA sent me a copy of the tapes. As soon as I heard the recordings, I knew that Prinzivalli was innocent. The bomb threats were made by someone with an Eastern New England phonology, in which *bomb* has the same vowel sound as *off*. For Prinzivalli, a New Yorker, these vowel sounds are very different. The question then was how to convey this to Californians, for whom New Yorkers and New Englanders sound the same?

I was told that expert witnesses had to limit their testimony to giving *opinions* of the evidence. But I looked for a way to establish that Prinzivalli's innocence was a fact. I showed Judge Gordon Ringer the acoustic measurements of vowels in the bomb threat caller's statement and of Prinzivalli's repetitions of *bomb* and *off*. The analyses demonstrated that the bomb threat caller had the *same vowel* in *bomb* and *off*, and Prinzivalli had different vowels, as shown in Figure 4.

The evidence of *The Atlas* in Figure 5 shows that geographic distributions of these two systems do not overlap.

The trial adjourned on Friday afternoon. On Monday morning, Judge Ringer asked the attorneys if they had any further evidence to present. They did not. The judge then asked Prinzivalli to stand and to recite the Pledge of Allegiance. Prinzivalli said: "I pledge allegiance to the flag of the United States of America." The judge then said to me, "What can you tell me about *that*?" I said, "It shows he's a New Yorker, because it's the only dialect in the Eastern United States where *flag* has the same vowel as the word *yeah*."

The judge found the defendant not guilty on the basis of the linguistic evidence, which he described as "objective" and "powerful." He later told *The Los Angeles Times* that "it was the 'ah's' and the 'oh's' that did it." The prosecutor had to agree with this assessment.

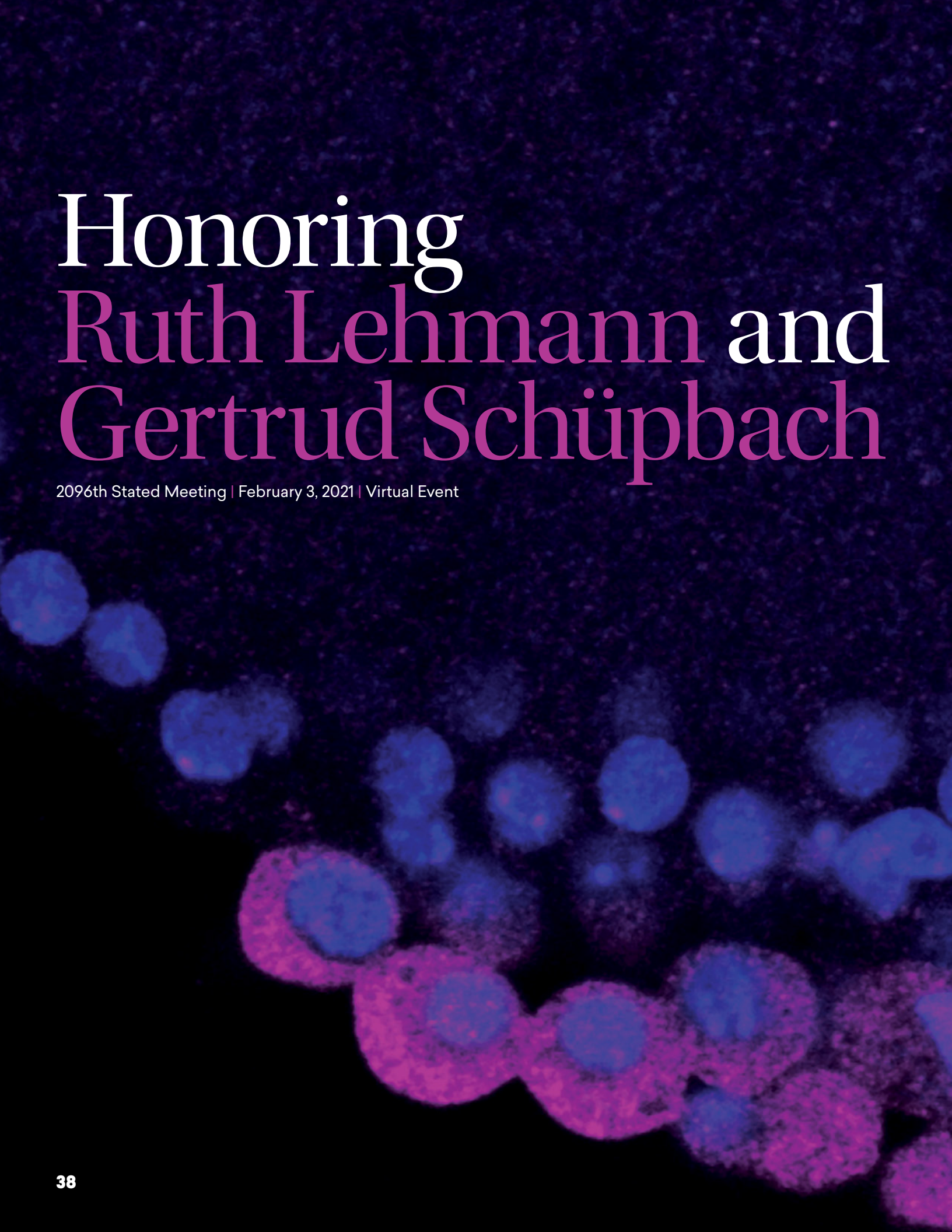
Prinzivalli later sent me a thank you card that said that he had spent fifteen months in jail waiting for someone to demonstrate the truth of the matter as I had done. I have had many scientific results in which the convergence of evidence was so strong that I felt that I had laid my hands on the reality behind the surface, but nothing could be more satisfactory for any scientific career than to separate fact from fiction, as in this case. By means of linguistic evidence, one man could be freed from the corporate enemies who had assailed him, and another could sleep soundly on the conviction that he had made a just decision.

&

To view or listen to the presentation, visit www.amacad.org/events/honoring-labov.

Honoring Ruth Lehmann and Gertrud Schüpbach

2096th Stated Meeting | February 3, 2021 | Virtual Event



The Academy's Francis Amory Prize recognizes major contributions to the field of reproductive biology and was first awarded in 1940. Over the years, the prize recipients have reflected the increasing complexity and remarkable scientific progress in the field of reproductive biology.

The Academy awarded the 2020 Francis Amory Prize in Reproductive Medicine and Reproductive Physiology to Ruth Lehmann and Gertrud M. Schüpbach in recognition of their extraordinary research that has advanced the areas of DNA repair, embryonic development, RNA regulation, and stem cell research.

The virtual program featured presentations by **Gertrud Schüpbach** and **Ruth Lehmann**, and included remarks by Academy President **David Oxtoby**, an introduction by Princeton University President Emerita **Shirley Tilghman**, and a reading of the Francis Amory Prize citations by Chair of the Academy's Board **Nancy C. Andrews**. The introduction and an edited version of the presentations follow.

Early *Drosophila* embryo. Blue: nuclei stained with DAPI and Magenta: Vasa antibody staining of budding primordial germ cells.

Shirley Tilghman

Shirley Tilghman is President Emerita and Professor of Molecular Biology and Public Affairs at Princeton University. She was elected a Fellow of the American Academy of Arts and Sciences in 1990 and serves as a member of the Academy's Board of Directors.

This year's recipients of the Francis Amory Prize have each made seminal contributions to our understanding of one of the most fundamental questions in developmental biology: how does an early embryo assign identities to its cells so that they learn their future fates?

INTRODUCTION

It is my great pleasure to introduce this year's recipients of the Francis Amory Prize: Gertrud Schüpbach, who is known to all as Trudi, and Ruth Lehmann. They have each made seminal contributions to our understanding of one of the most fundamental questions in developmental biology: how does an early embryo assign identities to its cells so that they learn their future fates? For their organism of choice, *Drosophila melanogaster*, the earliest of those decisions are determined by the mother, prior to fertilization, while the egg is developing in the mother's ovary. The egg is prepackaged with information that specifies anterior versus posterior, dorsal versus ventral – setting up in other words which end is up and which is down, which side is back and which is front. In organisms like *Drosophila*, in which survival requires development to proceed as rapidly as possible, a strategy that prepackages as much information as possible in the egg makes perfect evolutionary sense.

As a young scientist at Princeton University, Trudi made one of her most important and lasting contributions to science. With her husband and collaborator Eric Wieschaus, she conducted a large genetic screen in *Drosophila* to identify the genes that act in the ovary of the mother to pattern the developing oocyte. These genes, called maternal effect genes because they act in the mother and not the embryo, were given colorful names such as *torpedo*, *gurken*, *torso*, *trunk*, *vasa*, *staufen*, and *tudor* – names that described the aberrant appearance of embryos born from mutant mothers.

By pointing to the importance of these genes, Trudi and Eric created a bonanza for the developmental biology community, whose members eagerly jumped on individual genes to study them in detail and uncover their specific roles in patterning the embryo. Trudi's genetic screens are beautiful examples of a scientific achievement that catalyzed a whole new direction for a field.

Trudi chose to study the genes that act earliest in the patterning of the oocyte by focusing on those that affect the appearance of the eggshell as well as the resulting embryo. The developing egg begins as a single cell, which divides four times to produce sixteen cells, one of which will be designated as the future oocyte, while the rest become nurse cells that cater to the oocyte as it develops. These cells are surrounded by follicle cells that were not thought to be particularly relevant in the development of the egg until Trudi's lab showed that they in fact play an essential role in both anterior-posterior and dorsal-ventral polarity through cell-to-cell communication with the developing oocyte.

Using elegant genetic and molecular approaches, Trudi's lab showed that the follicle cells communicate through a protein encoded by a maternal effect gene called *torpedo* that receives a signal produced in the oocyte, the product of the maternal effect *gurken* gene. When either is mutated in the mother, her embryos are unable to develop dorsal structures. When *torpedo* and *gurken* were cloned, it was revealed that they belonged to an important family of signaling proteins that we now know play many roles throughout eukaryotic biology, and they have been implicated in cancer when they are mutated or mis-expressed.

But the story does not end there. How does the signaling produce dorsal-ventral asymmetry? During early oogenesis, Trudi demonstrated that the messenger RNA for *gurken* becomes localized to the future dorsal side of the oocyte, tightly associated with the oocyte nucleus. She then showed that the localized *gurken* RNA produces a high concentration of Gurken protein exclusively on one side of the egg, sending the signal that this will be the future dorsal side of the embryo. But timing is everything in biology, so localization alone is not sufficient to send the Gurken signal at precisely the right time. Trudi has now shown that the *gurken* RNA is not just localized, but its translation into Gurken protein is tightly regulated as well. Thus, with a remarkable combination of genetic and biochemical insights, Trudi brought the story of the initiation of dorsal patterning full circle.

After a dazzling career, Trudi has recently retired as the Henry Fairfield Osborn Professor of Molecular Biology at Princeton University. At

Princeton, she is a highly regarded and beloved teacher of genetics to both undergraduate and graduate students, and she has mentored many students and fellows in her lab who have gone on to have successful careers in science. A former Howard Hughes Medical Institute Investigator and member of both the National Academy of Sciences and the American Academy of Arts and Sciences, Trudi received the Edwin F. Conklin Medal from the Society of Developmental Biology in 2006 and an honorary Ph.D. from the University of Zurich in 2011. She served the scientific community in many ways, including as the president of the Genetics Society of America in 2008 and as the president of the Drosophila Board in 2000. I cannot think of anyone more deserving of this award.

The second Amory Award recipient is Ruth Lehmann. Ruth's interests lie both upstream and downstream of Trudi's, as she is interested in how germ cells, those cells set aside in early embryogenesis that are destined to become the future sperm or eggs, are specified and how they migrate to the gonad and assume their ultimate identities. Beginning with her training with Christiane Nüsslein-Volhard in Germany, Ruth became fascinated by the most posterior region of the early *Drosophila* embryo, where the germ cells are the first cells to be specified. The cells form around membraneless structures called polar granules, a dense mixture of proteins and RNAs that are both necessary and sufficient for germ cell development. By targeting for study the maternal effect genes that are required for germ cell development, Ruth generated a beautifully coherent account of how the critical gene products of *oskar, vasa, nanos*, and *tudor* work in concert to generate polar granules. In the course of these studies, she discovered the importance of conserved RNA regulators that control the translation of mRNAs in the germline and are required to maintain germ cell identity in animals as distant from *Drosophila* as worms and mammals.

Once germ cells are specified in *Drosophila*, they must successfully migrate to the future gonad, where they will learn their ultimate fate: sperm or oocyte. By identifying genes that affect migration, Ruth's lab painstakingly dissected the migratory pathway from beginning to end, showing that a G-protein coupled receptor in the germ cells is required to start the migration, and that lipid signals guide their journey to the gonad. When germ cells reach the gonad, Ruth showed that cell-cell communication between the germ cells and the resident somatic gonadal cells is necessary to finally signal that it is time to stop. Thus, like the little bunny who follows her nose, Ruth followed the development of germ cells wherever they led her, adopting new approaches and new technologies along the way, and making unexpected discoveries about *Drosophila* that were shown to be universal in the animal kingdom.

> By choosing to honor these two brilliant and much admired scientists with the Amory Prize, the Academy is signaling its commitment to recognizing the highest standard of scholarship in life sciences.

Like the germ cells she studies, Ruth Lehmann has migrated multiple times in her career. Following her training in Germany and the United Kingdom, Ruth began her independent career at the Whitehead Institute at MIT, where she became an Investigator of the Howard Hughes Medical Institute. In 1996, she moved to New York University as the Laura and Isaac Perlmutter Professor of Cell Biology and ultimately assumed the roles of the Director of the Skirball Institute of Biomolecular Medicine and Chair of the Department of Cell Biology. Just this year in the middle of a pandemic no less, she returned to MIT as the Director of the Whitehead Institute. Her list of honors is a long one, including the Edwin F. Conklin Award from the Society of Developmental Biology and the Keith Porter Award from the American Society of Cell Biology, professional societies for which she has served as president, and a lifetime achievement award from the German Society for Developmental Biology. Ruth is a member of the American Academy of Arts and Sciences and the National Academy of Sciences.

By choosing to honor these two brilliant and much admired scientists with the Amory Prize, the Academy is signaling its commitment to recognizing the highest standard of scholarship in life sciences. It is truly an honor to introduce them and to call them my friends.

Gertrud Schüpbach

Gertrud Schüpbach is Emeritus Professor of Molecular Biology at Princeton University. She was elected a Fellow of the American Academy of Arts and Sciences in 1999.

I would like to thank President Oxtoby, the prize committee, and the Academy for awarding us this prize. I am excited to be here and to share this honor with my longtime friend and colleague, Ruth Lehmann.

In my presentation, I want to give some insight into the research that has led to this moment. But before I get into the research, let me say something about my background. I was born and raised in Zurich, Switzerland. I attended the University of Zurich, where I was first introduced to questions of developmental biology. My Ph.D. thesis focused on the reproductive system and on sex determination in the fruitfly, *Drosophila melanogaster*. I was fascinated by the beautiful ovary of *Drosophila*, in which, as Shirley pointed out, eggs develop from stem cells in successive stages. And they do that in close proximity to somatic support cells.

Together with my partner, now husband, Eric Wieschaus, we moved to Princeton in the early 1980s, where we conducted a large-scale screen for mutations that would affect the egg or the embryo. Several overarching questions have guided my research, such as: How does an egg develop during oogenesis that then can support the development and patterning of an embryo? What factors are put into the egg by the mother during oogenesis that allow an embryo and eventually an adult to develop with a head at one end and a tail at the opposite end, and a dorsal and a ventral side? How much of the embryonic pattern is already programmed in the egg, and how does this happen?

Eggs are built during oogenesis, and they are surrounded by somatic support cells. This is true for all ovaries of higher organisms. In Figure 2, we see an egg chamber of *Drosophila*, and the follicle cells are surrounding the growing oocyte. These follicle cells will produce yolk and later will produce the eggshell. Oocytes are also connected to another type of helper cells, the nurse cells, which are synthetically very active and transport proteins and RNA into the oocyte. We can therefore predict at that early stage in the development of the egg chamber the anterior end of the egg and embryo by the position of these nerve cells, which connect to the anterior end of the oocyte. The future dorsal side of the egg and embryo is also already predictable because the oocyte nucleus is very asymmetrically positioned within the oocyte, and whichever side it is closest to will become the future dorsal side of the egg and embryo. This pattern is reflected in the eggshell. The two dorsal appendages that protrude from the egg indicate the region where the embryo will form its head because they indicate a dorsal anterior position within the egg.

In order to find what factors were involved in generating these patterns, I conducted a screen for mutants that would show pattern alterations.

Figure 3 shows some examples. At the top is the wild type egg with two dorsal appendages. Below that is a ventralized egg and its dorsal appendages are lost. Follicle cells have formed ventral structures. At the bottom is a dorsalized egg, in which the dorsal structures are expanded at the cost of ventral structures. We found, and very excitedly so, that the embryos that develop inside such eggs are ventralized or dorsalized. This told us that we had made mutations in genes that are required for

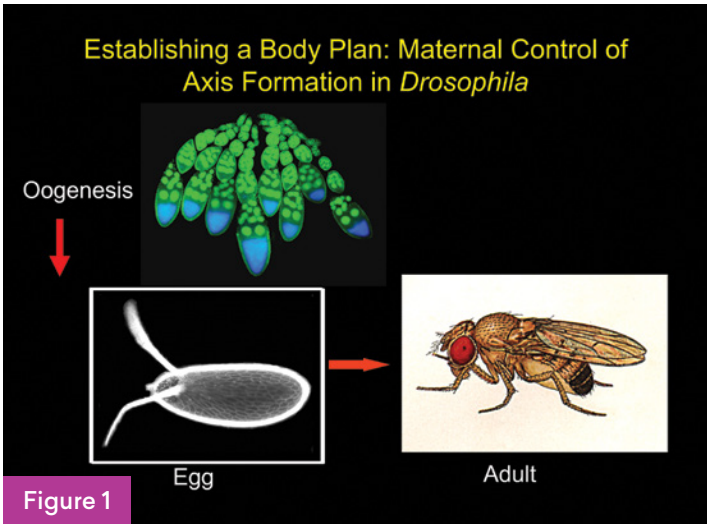


Figure 1

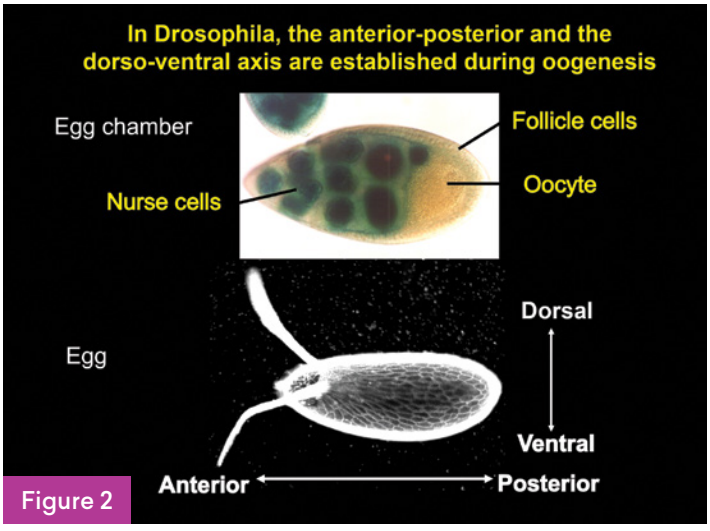


Figure 2

Several overarching questions have guided my research, such as: How does an egg develop during oogenesis that then can support the development and patterning of an embryo?

steps in pattern formation that have consequences both for the follicle cells as well as for the oocyte itself. This strongly suggests that there should be some sort of coordination between the oocyte and the follicle cells with respect to these patterns. Very talented postdoctoral fellows and graduate students who had joined my lab were able molecularly to clone the genes that had been mutated in these cases. And we found, to our excitement, that we had isolated mutations in a receptor and signaling pair. We also found very quickly that these genes had mammalian, and therefore human, homologs because the gene that we had called *torpedo* corresponded to the *Drosophila* EGF receptor, and the gene we had called *gurken* encoded a TGF-alpha like factor. These proteins are known from research in human cancer; the EGF receptor and its family members are involved in several different types of human cancers. Just as in humans, the *Drosophila* EGF receptor has several ligands that can bind to and activate the receptor. The one specific for oogenesis, Gurken, resembles the Transforming Growth Factor-alpha.

The molecular identification of these genes allowed us to ask where in the egg chamber these proteins are found. As we see in Figure 4, the EGF receptor outlined in white is present in all the follicle cells, presumably initially in an inactive form. In contrast, the ligand Gurken, which will activate the receptor on the adjacent follicle cells, is only found in this very restricted space above the oocyte nucleus. This allowed us to understand an aspect of pattern formation. Gurken will bind to and activate the EGF receptor in the adjacent follicle cells, and this induces them to assume a dorsal cell fate, in which they will express a certain set of genes. In contrast, the follicle cells on the ventral side see little if any Gurken and therefore the EGF receptor remains inactive and the cells enter a ventral cell fate, where they express a different genetic program.

In science one result always raises many more questions. Why is the Gurken protein only found in this restricted area of the oocyte? We saw very soon that the process involved localizing the RNA that encodes *gurken* to this place. The RNA is transcribed in the nurse cells that are transported into the oocyte, and then anchored in the region around the oocyte nucleus.

The importance of the RNA localization became clear when we looked at mutants in which the *gurken* RNA wasn't properly localized. In the mutant, the RNA is found all around the circumference of the oocyte (see Figure 5). This gives rise to mislocalization of Gurken protein and activation of the EGF receptor in all of the follicle cells. This results in an egg, in which all the follicle cells were activated to be dorsal, and therefore a whole ring of follicle cells produced this mass of dorsal appendage material.

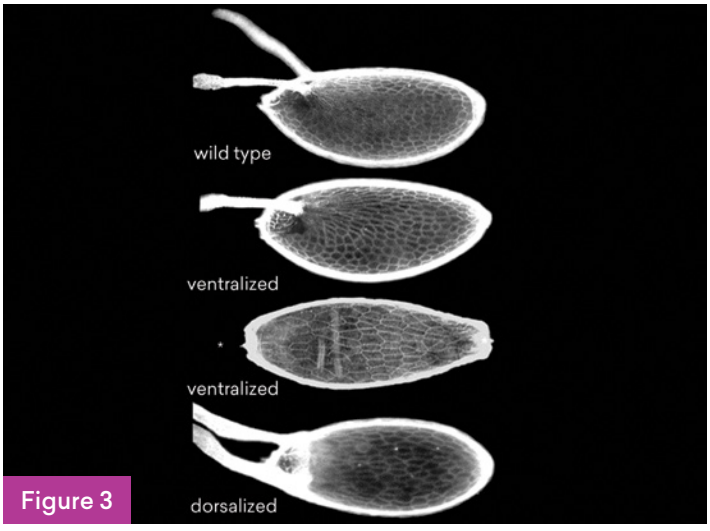


Figure 3

Figure 4

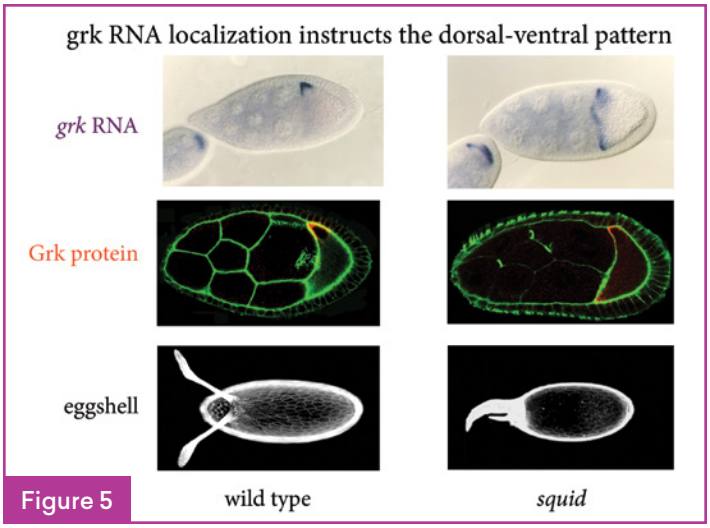


Figure 5

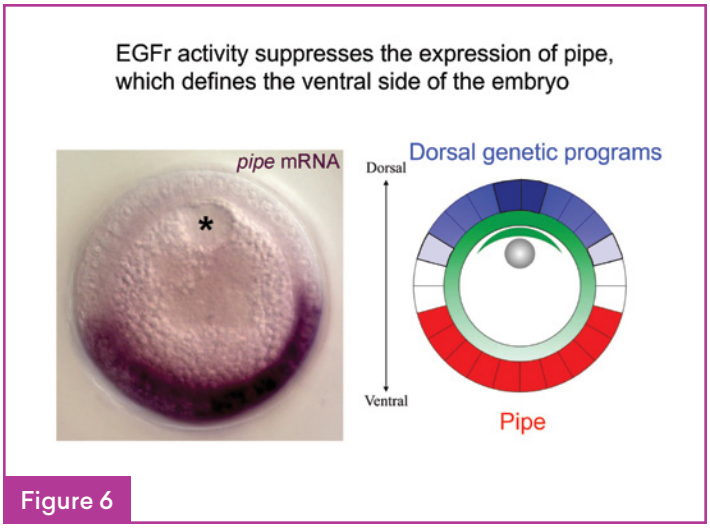


Figure 6

Over time, we were able to define a pathway, where we found that there are several genes involved in the localization of the *gurken* RNA, some in the translation of the RNA into protein at just the right level at the right time. After the EGF receptor is activated in the adjacent follicle cells, the dorsal follicle cell program is initiated. In addition, this activity of the EGF receptor also represses a secondary signal that comes back from the follicle cells to the egg at a later stage, and which becomes important for the establishment of the embryonic pattern.

We see this illustrated in Figure 6, where we are looking at a cross section through an oocyte. The oocyte nucleus is at the dorsal side, and while not shown here, we know that the Gurken protein is activating the EGF receptor in the overlying follicle cells and eliciting these dorsal follicle cell fates in a gradient around the dorsal side. This activity represses the expression of this key factor, Pipe, which will later initiate a new signal that will induce ventral cell fates in the embryo that will be developing inside the egg.

A little later, we discovered that the Gurken–EGF receptor signal was already operating at an earlier stage in oogenesis. In Figure 7, we have a young egg chamber. The oocyte is still very small, but Gurken protein is already visible within the oocyte (shown in green). Gurken activates the EGF receptor in the follicle cells and induces those follicle cells at the posterior to activate a specific genetic program that is different from the later dorsal or ventral program. These posterior follicle cells then signal back to the oocyte, and this results in the repolarization of the cytoskeleton inside the oocyte, which will become important for the anterior-posterior pattern of the embryo. The signal also causes the movement of the oocyte nucleus from an initially symmetric position to an asymmetric position. The *gurken* RNA and protein follow this movement and activate the EGF receptor in the cells on the lateral side and induce a dorsal cell fate.

> We know that there is only a limited number of signaling pathways that are active during development, and yet organisms have to establish hundreds of different cell types. How is this possible with this restricted number of signaling pathways?

This raises another question: how can the same ligand and receptor pair result in two different cell fates? This touches on a larger question in developmental biology. We know that there is only a limited number of signaling pathways that are active during development, and yet organisms have to establish hundreds of different cell types. How is this possible with this restricted number of signaling pathways?

To help us understand this posterior signaling process, we conducted more screens. And without going into the details here, we found that the

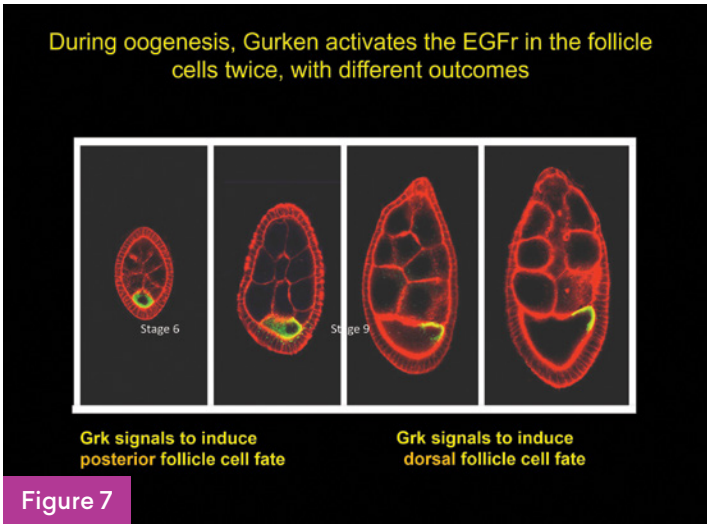


Figure 7

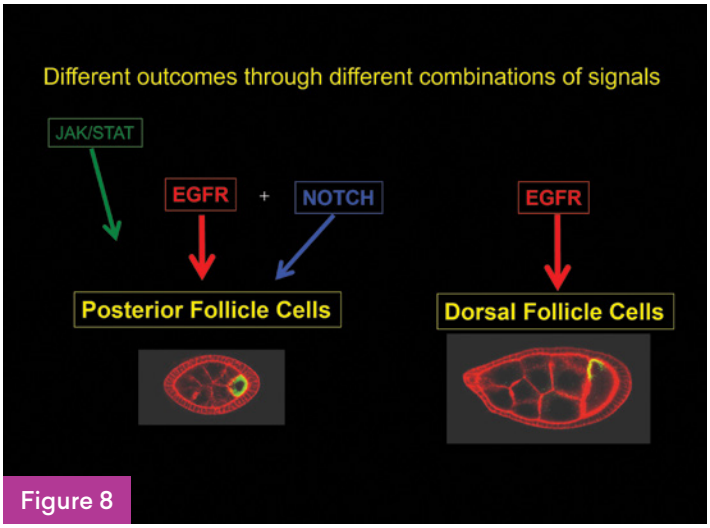


Figure 8

The award ceremony for the Amory Prize featured remarks and presentations from Ruth Lehmann, Academy President David Oxtoby, Gertrud Schüpbach, Chair of the Academy's Board Nancy Andrews, and Shirley Tilghman.

posterior cell fate was affected not only by mutations in the EGF receptor pathway, but also by mutations in the Notch pathway (see Figure 8). Notch is another receptor that acts in many developmental programs. Putting a lot of data together, we found that at the early stage, there are, in fact, three different signaling pathways that are active in these posterior follicle cells. At the later stage, it is only the EGF receptor that sends a signal to the follicle cells and this single input then dictates dorsal follicle cell fate. Over time this analysis has shown us a beautiful picture of how in development a relatively simple organ, such as the egg chamber or the ovary, develops.

So what general lessons about signaling in development can we take away from the analysis with respect to the wide variety of cell types that make up an organism? First, we have learned that different cell fates can be achieved by combinations of different signaling pathways that are active at any one time. Second, we have seen that different cell fates can result from different levels of activation, for example, gradients of signaling molecules like Gurken determine a variety of different dorsal follicle cell fates. And third, I have not shown you this but we also learned that different cell types can be induced by modulating the duration of the signaling, and this is often regulated by feedback mechanisms.

In conclusion, I would like to thank all the people – postdoctoral fellows and students – who have worked in my lab and have contributed to this analysis over the years. I know that many of them have joined us today. I want to thank all of you again and say that it has been my great privilege and pleasure to work with all of you over the years. I also want to thank my longtime friends and collaborators, Eric Wieschaus and Stas Shvartsman. And finally, I thank the funding agencies that have supported my research over all these years.

Ruth Lehmann

Ruth Lehmann is Professor of Biology at the Massachusetts Institute of Technology and Director of the Whitehead Institute. She was elected a Fellow of the American Academy of Arts and Sciences in 1998.

Germ cells are the cells that make sperm and egg, and thereby allow this immortality. Germ cells are destined to give rise to the next generation. Their naivety and their ability to rejuvenate within the organism are absolutely essential for the continuity of our species, but they themselves are dispensable for the development and function of the body.

I want to thank David Oxtoby and Shirley Tilghman for a spectacular review of our research. And I am grateful to Nancy Andrews for an overly generous recognition of our work. As we all know, you do not win these prizes from nowhere. There are always colleagues who have supported you along the way. I want to give a big shout-out and thank you to Hugo Bellen and Mitzi Kuroda. This was very unexpected, and I am incredibly honored.

I would like to share an overview of the germline. Let's start with immortality. Obviously, we are mortal, but we have offspring and that offspring gives rise to new offspring and so on, and that is what I am referring to as immortality. The offspring is not identical to us. Rather, they are a combination of the paternal and maternal genomes. Germ cells are the cells that make sperm and egg, and thereby allow this immortality. Germ cells are destined to give rise to the next generation. Their naivety and their ability to rejuvenate within the organism are absolutely essential for the continuity of our species, but they themselves are dispensable for the development and function of the body.

Germ cells do all kinds of things. First, they have to be specified and set aside from all other cells in the body. Then they have to migrate to the somatic gonad, where they have to be protected not to develop into any other cell types or cell fates. And, finally, they have to be selected to be successful gametes, which means sperm or egg. I will touch on all these points because our work, to some extent more and to some extent less, has focused on the various phases of germ cell development.

We are studying – and this should not surprise you – germ cells in flies. Flies are a powerful model organism for genetic studies. My story starts with a genetic screen that you heard about from Trudi Schüpbach. Genetic screens were carried out for maternal effect mutations that affected the development, polarity, and segmentation of the embryo. The screen I was part of was carried out in Tübingen, Germany, in Christiane Nüsslein-Volhard's lab. I was a starting graduate student in the lab with Hans Georg Frohnhöfer, another graduate student, and two postdocs, Kathryn Anderson and Gerd Jürgens. At the same time, Trudi Schüpbach and Eric Wieschaus were carrying out similar screens. There was a lot of back and forth because Eric and Trudi focused on mutations on the second chromosome and we were looking at the third chromosome.

One of the important findings from this screen was that the mother provided information through the egg to the embryo about its segmentation pattern: such as where to develop the head and tail and that the patterning information for the abdomen was linked to the origin of germ cells. This is illustrated in Figure 1, where we see an image of an embryo that was laid by a mother mutant for the *oskar* gene. The *oskar* gene defines the posterior group pathway. In *oskar* mutants as well as other genes of the same pathway, when the mother is mutant, the embryo will not have normal abdominal patterning, and it is also lacking the primordial (or early) germ cells at the posterior pole. After an analysis of the genetic pathway of the posterior group genes in Janni Nüsslein-Volhard's lab, I started my own lab at the Whitehead Institute, where we identified the molecular nature of several posterior group genes, including the *oskar* gene. Anne Ephrussi, a postdoc in the lab, conducted a critical experiment: She had found that *oskar* RNA is localized to the posterior pole, but when she swapped the localization to the anterior pole, *oskar* alone was able to initiate the posterior pathway, and this pathway leads to the organization of the germ plasm. We now know that *oskar* is the key component that nucleates germ plasm.

So what is germ plasm? In *Drosophila*, germ plasm is formed at the posterior pole of the egg during oogenesis (Figure 2). It is a site where RNAs are localized. And these RNAs are localized within granules, which are composed of proteins in which Oskar is the starting point. These granules are membraneless and contain RNA, which is structured within the granules. The RNAs, which are localized to these granules, are important for

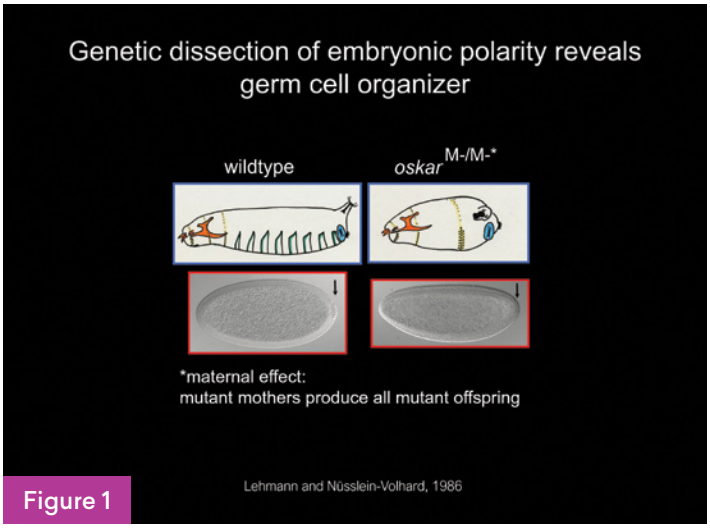


Figure 1

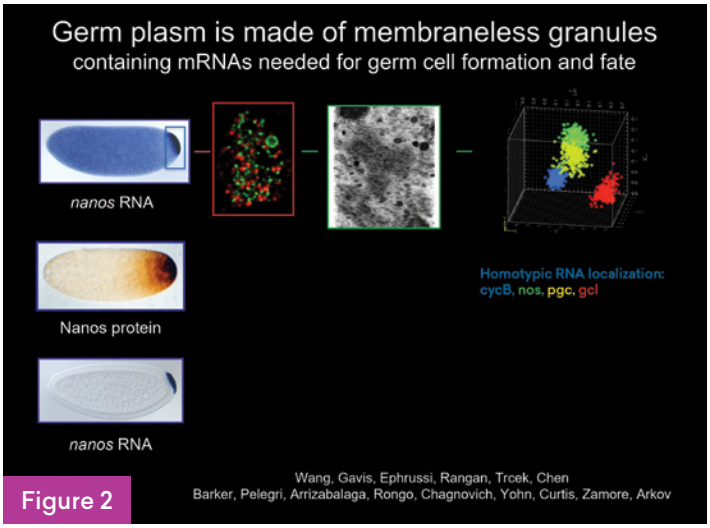


Figure 2

many aspects of germ cell development. They are important for germ cell specification, like the *nanos* RNA, for their migration, and for their ability to escape the lethal differentiation into soma. These RNAs are specifically translated when they are localized. And they are protected in germ cells while they are degraded in the rest of the embryo that goes on to make soma.

What we noticed was that with the germ plasm, RNAs segregate very specifically into germ cells as they form, and germ cells form earlier than any other cell in the body. Indeed, germ cells form by a completely different mechanism than all the other cells that will give rise to the soma (body) of the organism. Thus in the fly, the distinction between soma and germline occurs early and is very pronounced.

As part of this dichotomy, germ cells form at the fringe of the embryo, which is quite general for germ cell formation also in other species. At this time in development, the developing soma is actively transcribing and signaling, and you can see in Figure 3 a readout of this activity, with MAP kinase signaling at the termini promoting the development of head and tail structures. Germ cells, in contrast, remain naive by employing different molecular mechanisms to silence all somatic transcription and any transcription at all, and to degrade the particular signaling molecules, which could induce somatic differentiation. Thus, the first step in germ cell differentiation is to prevent being soma. Once germ cells have formed, they are not going to be able to make sperm and egg on their own. They first have to undergo a migration. They start directed migration as individual cells. On their way, they encounter various interactions with other cells, including repellents, and eventually they stop at the side of the somatic gonad where their differentiation into egg or sperm begins (Figure 4).

“Germ cells . . . remain naive by employing different molecular mechanisms to silence all somatic transcription . . . and to degrade the particular signaling molecules, which could induce somatic differentiation.

To give you a little bit of the flavor of this migration, this is quite common in many developmental models – germ cells form in a clutch – but most organisms have two gonads, so germ cells have to split into two on their migration and that is both mediated by repellent and attractive cues. Then germ cells have to find their way to the gonad, and that is associated, as we found recently, with a local hormonal signal from the gonad. Once the germ cells have made it to the gonad, they interact very closely with somatic cells. At this stage, germ cell sex is being determined, which will decide whether they are going to develop as an oocyte or a sperm, and interactions between the germ cells and the soma control how many germ cells there are. For example, if there are too few germ cells in the early embryo, they will catch up in number during the larval stages. During the larval stages,

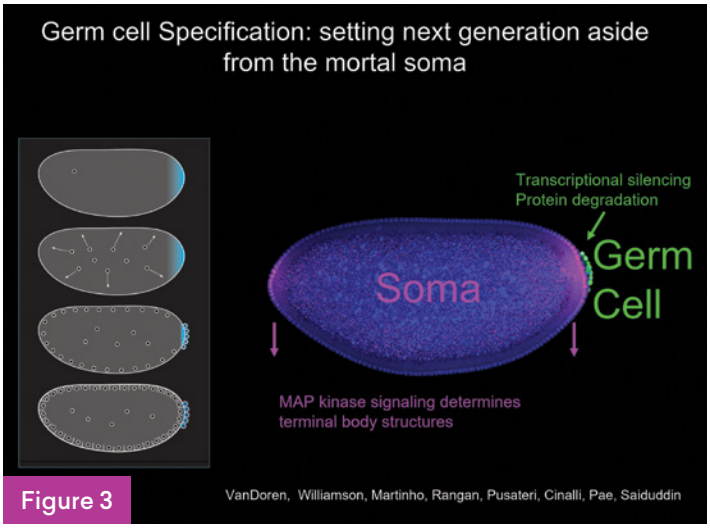


Figure 3

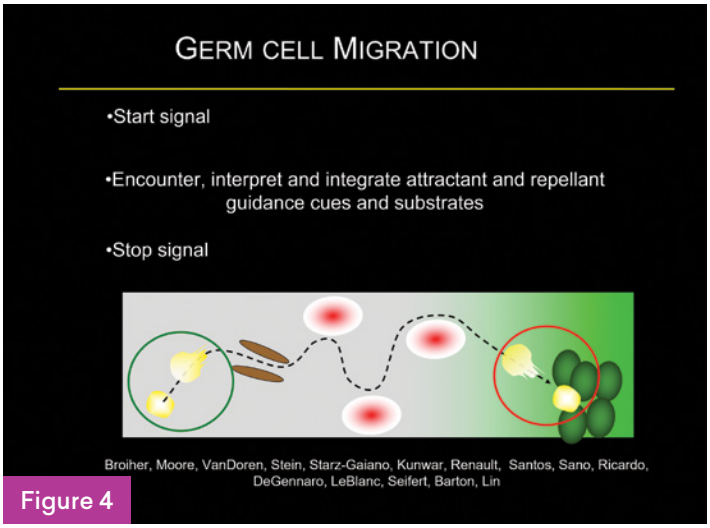


Figure 4

the ovary morphs from a ball of germ cells mixed with somatic cells into a highly sophisticated organ, the full-fledged ovary. Within the ovary, there are specific stem cell niches where stem cells are set aside, and in the adult female these stem cells will continue to generate egg chambers, which Trudi beautifully described (Figure 5).

What are the hallmarks of germ cells? Germ cells lack a master transcriptional regulatory program that determines their fate; instead RNA regulation is a fundamental and conserved principle underlying germ cell fate.

Within the stem cell niche, there are two types of stem cells. There are germline stem cells, which will give rise to the egg. But there are also somatic stem cells, which give rise to all those follicle cells that are needed for the oocyte to grow but are also necessary for the prepattern of the oocyte to prepare for embryogenesis.

Both Trudi and I study the development of the egg, and as you already heard there is so much more to the egg than just the genetic information contained in the nucleus. For example, mitochondria are only transmitted through the egg and thus through the female germline. Mitochondria have their own genome. And that genome is very vulnerable as the mutation rate is high and it is not able to undergo recombination. So, variability between mitochondrial DNA molecules creates a heterogeneity that can cause mitochondrial diseases.

Almost one hundred years ago, in the 1930s, Muller proposed that without recombination there had to be some other mechanism of selection in organisms without sexual recombination, otherwise accumulation of mutations would lead to the death of the species. This concept is very relevant for mitochondria, because without selection mitochondria would accumulate mutations, leading to nonfunctional mitochondria unable to support the survival of the organism. What we found was that mitochondria are enriched in the region of the egg where the germ cells will form. These germ cells are endowed with a larger pool of mitochondria. The segregation of some mitochondria from the vast number of mitochondria in the oocyte to the germ cells is referred to as a bottleneck. The mitochondria that are sequestered in the germ cells will be the mitochondria of the next generation. We also identified when and how mitochondria are selected. We were able to point to the developing germline cysts, which are derived from the germline stem cells, as the stage where selection occurs. We analyzed the stage and mechanisms of selection by developing an RNA *in situ* hybridization protocol, which allowed us to distinguish between functional and nonfunctional mitochondrial genomes (Figure 6).

I will close by returning to an earlier question: what are the hallmarks of germ cells? Germ cells lack a master transcriptional regulatory program that determines their fate; instead RNA regulation is a fundamental and conserved principle underlying

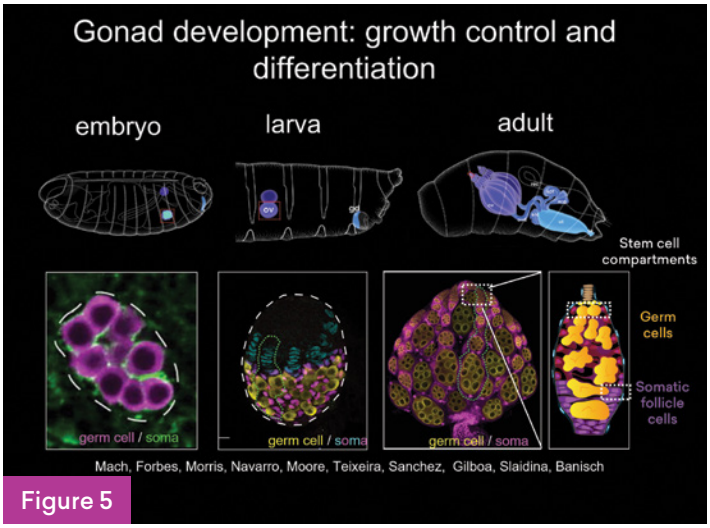


Figure 5

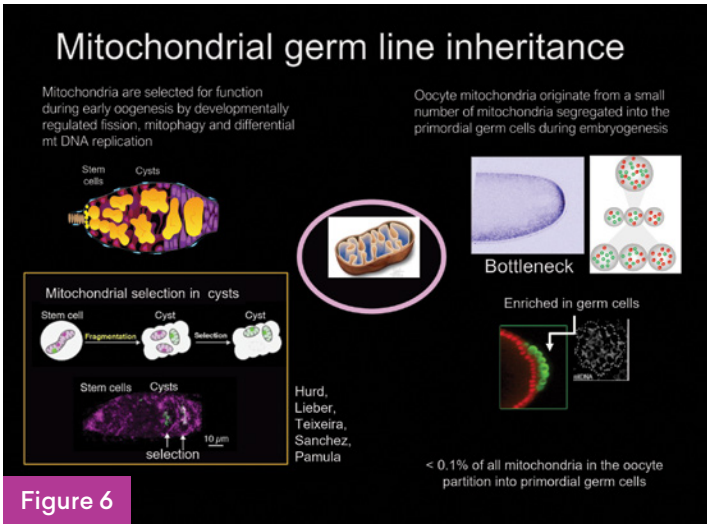


Figure 6

germ cell fate. Let me share two conclusions about the fundamental mechanisms that need to exist in germ cells to fulfill their unique function. One, there has to be genomic resilience so the genome can be passed from one generation to the next. As Trudi showed so beautifully, the successful completion of DNA recombination is read by the egg in order to determine whether it can form its normal pattern. So, if the recombination machinery is not working correctly at meiosis, patterning defects occur similar to those in *gurken* mutants. Part of the genomic resilience also requires that transposable elements, which can be active in the germline and may accelerate evolution, have to be controlled and if they cannot, this can be harmful for reproduction.

The second fundamental aspect of germ cell biology is that the egg is more than a nucleus; it provides the cytoplasm, including essential organelles such as mitochondria, for the next generation. In addition to mitochondria, there are symbionts like the bacterium Wolbachia in insects, which are carried through the female germline and can play important roles in reproduction but also as a defense against viruses. In summary, a combination of mechanisms that control genomic resilience and cytoplasmic maternal inheritance assure the continuity of the species.

The "we" that I have been referring to in my remarks are the many people who have worked in my lab. Over the years, they have contributed so much; they are incredibly smart, energetic, and resourceful. We had a reunion a few years ago, and that was very special for me. At one of our last gatherings, we were confined to sitting six feet apart in Washington Square Park. We hope to be together again in person soon.

> The egg is more than a nucleus; it provides the cytoplasm, including all essential organelles such as mitochondria, for the next generation.

I recently moved from the Skirball Institute at NYU Langone to the Whitehead Institute at MIT. I want to thank both institutions for supporting me so generously. I also want to thank my former and present funders. Finally, none of this would be possible without family, some of whom are watching from Germany, and my partner for many years, Steve Burden, and our dog Luke. And with that, I thank you again for this award. And my congratulations to Trudi.

To view or listen to the presentation, visit www.amacad.org/events/award-lehmann-schupbach.

In Memoriam: Louis W. Cabot (1921–2021)

Louis W. Cabot, Chair Emeritus and an active member of the Academy for 63 years, passed away on January 29, 2021, at age 99. He served as Chair of the Board (2010–2013), Chair and founding member of the Academy Trust (2002–2013), and Vice President (2001–2010), as well as a member of numerous governance committees, including the Finance, Development, Investment, and Audit Committees. He is remembered by all who worked with him for his wisdom, boundless energy, skill in running meetings, generosity, optimism, and hearty good cheer.

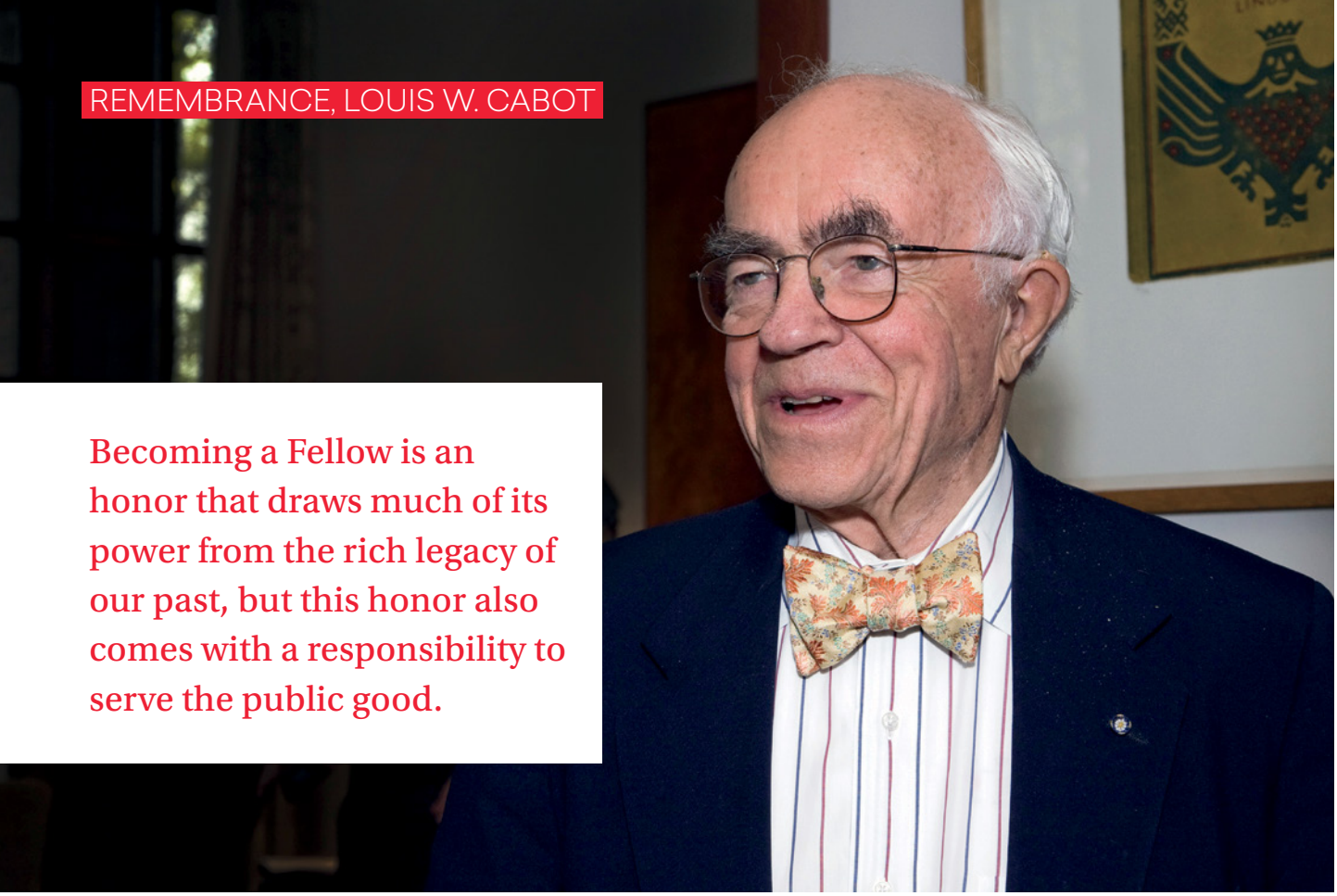
Perhaps the most noteworthy of his many contributions to the Academy was his role in shepherding the institution through a decade of growth and change, in which ever greater emphasis was placed on studies undertaken by groups of Fellows on matters of societal and intellectual importance. He emphasized the significance of this work in a contribution to the *Bulletin* in 2009:

> We live in difficult times but, perhaps, no more difficult than the revolutionary moment when the Academy was founded, when the leaders and citizens of the new republic faced profound political and economic ordeals. Since then, problems have always been with us – poverty, social strife, corruption – but we keep working with optimism and hope, buoyed by the strength of our collective vision, energy, and commitment. The Academy is a place of optimism and hope, an organization where the quest for knowledge, so vital to the human spirit, is celebrated and supported, where evidence and reasoned arguments stand in opposition to the forces of oversimplification and fear. There is great inspiration in our purpose . . . .

He underscored that "[b]ecoming a Fellow is an honor that draws much of its power from the rich legacy of our past, but this honor also comes with a responsibility to serve the public good. I cannot stress enough the importance of this purpose and the satisfaction that follows from being actively involved."

He strongly supported the expansion of the Academy's efforts to undertake a diverse suite of projects to define the means to resolve society's many difficult and most harrowing problems.

Louis was only the most recent member of his Boston Brahmin family to have a close association with the Academy. When he was elected a Fellow in 1958, both his father and his grandfather were members. In fact, he determined that at least 23 members of the Cabot family are included among our Fellows. The earliest Cabot to be elected to the Academy was George Cabot in 1788,



Becoming a Fellow is an honor that draws much of its power from the rich legacy of our past, but this honor also comes with a responsibility to serve the public good.

a brother of Louis's great-great-great grandfather. Louis was not even the first Louis Cabot to be elected; the first was an architect and Civil War veteran elected in 1891. Louis could trace his lineage to Jonathan Jackson, a successful merchant and public official, who was one of the founding members of the Academy.

Louis was a graduate of Harvard College (1943) and Harvard Business School (1948). He then went to work in his family's business as a laborer in a carbon black plant in Texas. He eventually rose to become president of the Cabot Corporation at age 39. He quipped that "selecting the right grandparents probably helped me get the job." During his years with the company, its annual sales increased from $27 million to $1.4 billion. He stepped down as chairman in 1986, and then embarked on a full-time career of public service. In accepting the Harvard Business School's Business Statesman Award in 1966, he noted that "[m]aking money as an end in itself is a fault, not a virtue." His many outside activities show that he lived by this realization.

In addition to his extensive involvement with the Academy, he served as Chair of the Brookings Institution, the Federal Reserve Bank of Boston, and the President's Circle of the National Academy of Sciences; life member of the MIT Corporation; member of the Harvard Board of Overseers; a trustee of Conservation International, the Woods Hole Oceanographic Institution, Northeastern University, Carnegie Corporation of New York, and the Maine Island Institute; and as a member of the board of several major companies. He lived a full life in recent years at his home in Tenants Harbor, Maine, excelling as a graceful skier, life-long sailor who loved cruising the Maine coast, and skilled photographer.

In 2006, Louis was awarded the Scholar-Patriot Award, the third recipient of this award in the Academy's history, in recognition of his extraordinary service. The citation noted:

> With characteristic determination, directness of speech, and "carbon black" strength of purpose, you have pursued your protean interests throughout a vigorous life in industry, public service, and philanthropy. You have filled the Academy's sails with your zeal to propel it on its historic mission and to orient this 225-year-young society in new, ever more challenging seas. We honor your unflinching commitment to society, to the nation, and to the ideals of the Academy.

His passing leaves a hole in our fellowship.

Richard A. Meserve
President Emeritus
Carnegie Institution for Science

Select Prizes and Awards to Members

Alfred Aho (Columbia University) is the recipient of the 2020 ACM A.M. Turing Award. He shares the award with **Jeffrey Ullman** (Stanford University).

Frances Arnold (California Institute of Technology) was elected a Fellow of the American Association for Cancer Research Academy.

Barbara Baird (Cornell University) has been named one of the Distinguished Women in Chemistry or Chemical Engineering for 2021 by the International Union of Pure and Applied Chemistry.

Shelley L. Berger (University of Pennsylvania) was elected a Fellow of the American Association for Cancer Research Academy.

Mark Bradford (Art + Practice) was elected a member of the American Academy of Arts and Letters.

Federico Capasso (Harvard University) was awarded the 2021 Frederic Ives Medal/ Jarus W. Quinn Prize by the Optical Society.

Don W. Cleveland (University of California, San Diego) was elected a Fellow of the American Association for Cancer Research Academy.

Catherine Dulac (Harvard University) received the NOMIS Distinguished Scientist and Scholar Award.

Richard H. Fallon, Jr. (Harvard Law School) received the 2021 Daniel J. Meltzer Award from the Association of American Law Schools.

Anthony S. Fauci (National Institute of Allergy and Infectious Diseases) was awarded a 2021 Dan David Prize. He also received the 2021 Public Welfare Medal from the National Academy of Sciences, the Ivan Allen Jr. Prize for Social Courage from the Georgia Institute of Technology, and the Legend in Leadership Award of the Yale School of Management's Chief Executive Leadership Institute.

Joshua Frieman (Fermi National Accelerator Laboratory and University of Chicago) was awarded an American Astronomical Society Fellowship.

Jonathan Galassi (Farrar, Straus & Giroux) received the 2021 Leadership Award from the Academy of American Poets.

Theaster Gates (Rebuild Foundation) was elected a member of the American Academy of Arts and Letters.

Robert Giles (Harvard University) was awarded the 2021 Bill Montgomery Literary Service Award by the National Writers Series.

Andrew Hamilton (New York University) is the recipient of the Legend in Leadership Award from the Yale School of Management's Chief Executive Leadership Institute.

Philip C. Hanawalt (Stanford University) was elected a Fellow of the American Association for Cancer Research Academy.

Joy Harjo (Tulsa, Oklahoma) was elected a member of the American Academy of Arts and Letters.

Michael Heizer (Heizer Studio) was elected a member of the American Academy of Arts and Letters.

Nancy H. Hopkins (Massachusetts Institute of Technology) was elected a Fellow of the American Association for Cancer Research Academy.

Carl June (Perelman School of Medicine at the University of Pennsylvania) was awarded a 2021 Dan David Prize. He shares the prize with Steven Rosenberg (National Cancer Institute) and Zelig Eshhar (Weizmann Institute of Science).

Cynthia Kenyon (University of California, San Francisco; Calico Life Sciences, LLC) was awarded the 2021 Dickson Prize in Medicine by the University of Pittsburgh School of Medicine.

Adrian R. Krainer (Cold Spring Harbor Laboratory) was awarded a 2021 Wolf Prize in Medicine. He shares the award with **Lynne E. Maquat** (University of Rochester School of Medicine) and **Joan A. Steitz** (Yale School of Medicine).

Spike Lee (40 Acres and a Mule Filmworks) was elected an American honorary member of the American Academy of Arts and Letters.

Glenn Ligon (Ligon Studios) was elected a member of the American Academy of Arts and Letters.

Guillermina Lozano (University of Texas MD Anderson Cancer Center) was elected a Fellow of the American Association for Cancer Research Academy.

Lynne E. Maquat (University of Rochester School of Medicine) was awarded a 2021 Wolf Prize in Medicine. She shares the award with **Joan A. Steitz** (Yale School of Medicine) and **Adrian R. Krainer** (Cold Spring Harbor Laboratory).

Gary S. May (University of California, Davis) received the 2021 Lifetime Mentor Award from the American Association for the Advancement of Science.

Sigrid Nunez (New York, New York) was elected a member of the American Academy of Arts and Letters.

Martha C. Nussbaum (University of Chicago) was awarded the 2021 Holberg Prize.

Katharine Park (Harvard University) was awarded a 2021 Dan David Prize. She shares the award with Alison Bashford (University of New South Wales) and Keith Wailoo (Princeton University).

Rob Phillips (California Institute of Technology) was awarded the Richard P. Feynman Prize for Excellence in Teaching by Caltech.

Faith Ringgold (University of California, San Diego) was elected a member of the American Academy of Arts and Letters.

Martine Roussel (St. Jude Children's Research Hospital) was elected a Fellow of the American Association for Cancer Research Academy.

Maria Schneider (Maria Schneider Orchestra) has won Le Grand Prix de l'Académie du Jazz for her album *Data Lords*.

Roberto Sierra (Cornell University) was elected a member of the American Academy of Arts and Letters.

M. Celeste Simon (University of Pennsylvania) was elected a Fellow of the American Association for Cancer Research Academy.

Lorna Simpson (Simpson Studio) was elected a member of the American Academy of Arts and Letters.

Joan A. Steitz (Yale School of Medicine) was awarded a 2021 Wolf Prize in Medicine. She shares the award with **Lynne E. Maquat** (University of Rochester School of Medicine) and **Adrian R. Krainer** (Cold Spring Harbor Laboratory).

Jeremy Thorner (University of California, Berkeley) is the recipient of the 2022 Centenary Award from The Biochemical Society.

Jeffrey Ullman (Stanford University) is the recipient of the 2020 ACM A.M. Turing Award. He shares the award with **Alfred Aho** (Columbia University).

Bert Vogelstein (Johns Hopkins University School of Medicine) was awarded the 2021 Japan Prize in Medical Science and Medicinal Science. He shares the award with **Robert A. Weinberg** (Massachusetts Institute of Technology).

Robert A. Weinberg (Massachusetts Institute of Technology) was awarded the 2021 Japan Prize in Medical Science and Medicinal Science. He shares the award with **Bert Vogelstein** (Johns Hopkins University School of Medicine).

Mark Westoby (Macquarie University) received the BBVA Foundation Frontiers of Knowledge Award in Ecology and Conservation Biology. He shares the award with Sandra Díaz (Universidad Nacional de Córdoba) and Sandra Lavorel (Laboratoire d'Ecologie Alpine).

Avi Wigderson (Institute for Advanced Study) was awarded the 2021 Abel Prize. He shares the award with László Lovász (Eötvös Loránd University).

Kevin Young (National Museum of African American History and Culture) was elected a member of the American Academy of Arts and Letters.

Pauline Yu (American Council of Learned Societies) received the 2020 Award for Distinguished Service to the Profession from the Association of Departments of Foreign Languages/Modern Language Association.

New Appointments

Abul K. Abbas (University of California, San Francisco) was appointed to the Scientific Advisory Board of Cue Biopharma, Inc.

Linda Abriola (Brown University) has been named to the Board of Trustees of Union College.

Paul Alivisatos (University of California, Berkeley) has been named President of the University of Chicago.

Nancy C. Andrews (Duke University School of Medicine) was appointed to the Board of Directors of Maze Therapeutics.

Frances H. Arnold (California Institute of Technology) was appointed Cochair of the President's Council of Advisors on Science and Technology (PCAST).

Alan Ashworth (University of California, San Francisco) was appointed to the Advisory Board of Phoenix Molecular Designs as a Scientific Advisor.

Anthony Bebbington (Clark University) was appointed International Director of the Natural Resources and Climate Change program at the Ford Foundation.

Martin J. Blaser (Rutgers University) has joined Micronoma Inc. as Chair of the Scientific Advisory Board.

Michael Bloomberg (Bloomberg LP) was appointed UN Special Envoy on Climate Ambition and Solutions.

Ursula Burns (Xerox; VEON Ltd.) was appointed to the Board of Advisors of Icertis.

Roger W. Ferguson, Jr. (TIAA) was named to the Board of Directors of Corning Incorporated.

Merrick Garland (U.S. Court of Appeals for the District of Columbia Circuit) was confirmed as the 86th Attorney General of the United States.

Katherine High (Spark Therapeutics; Perelman School of Medicine at the University of Pennsylvania) was named President for Therapeutics and a member of the Board of Directors of Asklepios BioPharmaceutical, Inc.

Donald Ingber (Harvard University) was appointed to the Board of Directors of Emulate, Inc.

Andrew Jassy (Amazon Web Services) was named CEO of Amazon.

Carl June (Perelman School of Medicine at the University of Pennsylvania) was appointed to the Scientific Advisory Board of Poseida Therapeutics, Inc.

William G. Kaelin Jr. (Dana-Farber Cancer Institute; Brigham and Women's Hospital; Harvard Medical School) was appointed to the Board of Directors of LifeMine Therapeutics Inc.

Pamela Karlan (Stanford Law School) has joined the U.S. Department of Justice as Principal Deputy Assistant Attorney General in the Civil Rights Division.

Tony Kouzarides (University of Cambridge) was appointed to the Scientific Advisory Board of EpiVario, Inc.

Eric Lander (Broad Institute of MIT and Harvard) was named Presidential Science Adviser and nominated as Director of the Office of Science and Technology Policy (OSTP).

Jeffrey Leiden (Vertex Pharmaceuticals) was appointed Non-Executive Chairman of the Board of Directors of Tmunity Therapeutics, Inc.

Tania León (Brooklyn College and the Graduate Center, City University of New York) was named to the Board of Directors of The ASCAP Foundation.

Jane Lubchenco (Oregon State University) has been appointed to the White House Office of Science and Technology Policy as Deputy Director for Climate and the Environment.

Robert C. Malenka (Stanford University) was named Chair of the Scientific Advisory Board of Mind Medicine Inc.

Alondra Nelson (Social Science Research Council) was appointed Deputy Director for Science and Society in the Office of Science and Technology Policy in the White House.

Eric Nestler (Icahn School of Medicine at Mount Sinai) was appointed to the Scientific Advisory Board of EpiVario, Inc.

Roger M. Perlmutter (Merck Research Laboratories) has been appointed Science Partner and a member of the Scientific Advisory Board of CBC Group.

Timothy Wu (Columbia Law School) has been appointed to the National Economic Council as Special Assistant to the President for Technology and Competition Policy.

Janet Yellen (Brookings Institution) was confirmed as the 78th Secretary of the Treasury of the United States.

Maria Zuber (Massachusetts Institute of Technology) was appointed Cochair of the President's Council of Advisors on Science and Technology (PCAST).

Select Publications

POETRY

Charles Bernstein (University of Pennsylvania). *Topsy-Turvy*. University of Chicago Press, April 2021

Yusef Komunyakaa (New York University). *Everyday Mojo Songs of Earth: New and Selected Poems*. Farrar, Straus and Giroux, June 2021

Arthur Sze (Institute of American Indian Arts). *The Glass Constellation: New and Collected Poems*. Copper Canyon Press, April 2021

FICTION

Francisco Goldman (Mexico City, Mexico). *Monkey Boy*. Grove Press, May 2021

Kazuo Ishiguro (London, England). *Klara and the Sun: A Novel*. Knopf, March 2021

Jeri Laber (Human Rights Watch). *The Russian Key: A Novel*. Arcade, May 2021

Paul Theroux (East Sandwich, Massachusetts). *Under the Wave at Waimea*. Houghton Mifflin Harcourt, April 2021

NONFICTION

Chimamanda Ngozi Adichie (Lagos, Nigeria). *Notes on Grief*. Knopf, May 2021

Bill Gates (Bill & Melinda Gates Foundation). *How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs We Need*. Knopf, February 2021

Henry Louis Gates Jr. (Harvard University). *The Black Church: This Is Our Story, This Is Our Song*. Penguin Press, February 2021

Jeff Immelt (General Electric Company). *Hot Seat: What I Learned Leading a Great American Company*. Avid Reader Press/Simon & Schuster, February 2021

Walter Isaacson (Tulane University). *The Code Breaker: Jennifer Doudna, Gene Editing, and the Future of the Human Race*. Simon & Schuster, March 2021

Daniel Kahneman (Princeton University), Olivier Sibony (HEC Paris), and **Cass R. Sunstein** (Harvard Law School). *Noise: A Flaw in Human Judgment*. Little, Brown Spark, May 2021

Hermione Lee (University of Oxford). *Tom Stoppard: A Life*. Knopf, February 2021

Robert J. Lefkowitz (Duke University) with Randy Hall (Emory University School of Medicine). *A Funny Thing Happened on the Way to Stockholm: The Adrenaline-Fueled Adventures of an Accidental Scientist*. Pegasus Books, February 2021

Martha C. Nussbaum (University of Chicago). *Citadels of Pride: Sexual Assault, Accountability, and Reconciliation*. W.W. Norton, May 2021

Cass R. Sunstein (Harvard Law School). *Liars: Falsehoods and Free Speech in an Age of Deception*. Oxford University Press, March 2021

Cass R. Sunstein (Harvard Law School), **Daniel Kahneman** (Princeton University), and Olivier Sibony (HEC Paris). *Noise: A Flaw in Human Judgment*. Little, Brown Spark, May 2021

Sherry Turkle (Massachusetts Institute of Technology). *The Empathy Diaries*. Penguin Press, March 2021

Neil deGrasse Tyson (American Museum of Natural History) and James Trefil (George Mason University). *Cosmic Queries: StarTalk's Guide to Who We Are, How We Got Here, and Where We're Going*. National Geographic, March 2021

Gabriel Winant (University of Chicago; Academy Visiting Scholar, 2018–2019). *The Next Shift: The Fall of Industry and the Rise of Health Care in Rust Belt America*. Harvard University Press, March 2021

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.

WAYS TO ENGAGE
WITH THE ACADEMY

There are several ways members may be involved in the life and work of the Academy.

Participate in the Member Election Process

Members may submit nominations, vote for candidates, and serve on selection panels.

Stay in Touch on Social Media

The Academy shares news, events, and updates on Facebook and Twitter. Follow, tag, and retweet to stay up to date and help promote the Academy's work.

Contribute to *Dædalus*

Each issue of the Academy's journal, *Dædalus*, explores a theme from a multidisciplinary perspective in essays written by Academy members and other experts. Members are encouraged to propose topics for issues of *Dædalus*.

Connect Locally

A national network of Local Program Committees and Representatives provides opportunities for members to connect with the work of the Academy and with each other in the communities where they live.

Share the Academy's Work

Members play a vital role in disseminating the Academy's work to policy-makers; the media; leaders in higher education, nonprofits, business, and philanthropy; scholars; and students.

Write About Your Work

The "On the Professions" section in the Academy's magazine, *The Bulletin*, provides space for members to share their work and to talk about new developments in their fields.

Attend an Event

The Academy holds events around the country and the globe, and during the COVID-19 pandemic these events have been held virtually. These gatherings bring together members and others in their communities to explore important topics through an interdisciplinary lens that draws on the Academy's breadth and expertise.

For more information about becoming involved, please contact Laurie McDonough, Morton L. Mandel Director of Membership Engagement, at lmcdonough@amacad.org.

THE ACADEMY & ITS FUTURE

A $100 Million Campaign for the American Academy of Arts & Sciences

FOR 241 YEARS, the nation has looked to the American Academy of Arts and Sciences to offer wisdom and insight into the most profound issues of the time. In 1780, that was the formation of a free republic. In the 1850s, it was understanding the changing natural environment through the theory of evolution. In 1960, it was the creation and exploration of a field called arms control – in fact, the Academy coined that term. Today, it includes such questions as how we can sustain the dream of American democracy in the face of widening divides; and how as citizens of our planet we can respond to environmental change and its implications for migration, conflict, public health, and natural resources in order to provide for a more promising global future.

Numbering nearly 6,000 of the nation's and world's most accomplished individuals, Academy members combine their extraordinary expertise and convene other critical stakeholders to put informed recommendations in the hands of those on the front lines of these issues. Though this kind of independent, balanced, and nonpartisan resource is perhaps needed now more than ever, the Academy stands among very few organizations that have the intellectual stature, interdisciplinary representation, and convening power to provide it.

WE HAVE LAUNCHED A $100 MILLION CAMPAIGN to build a sustainable financial future for the Academy to continue to serve as a source of knowledge on topics and activities of the greatest global significance.

Importantly, the Campaign for The Academy & Its Future builds on essential strengths and priorities identified through our recent strategic plan:

- **UPHOLD INDEPENDENT INQUIRY:** Examine the most pressing challenges of the time and seek solutions with urgency and independence.
- **ACHIEVE GREATER INFLUENCE AND IMPACT:** Offer policy-makers, scholars, the media, philanthropists, and those in the public and private sectors the benefit of the Academy's intellectual capital in the ways it can be of greatest service.
- **ENCOMPASS MORE VOICES AND PERSPECTIVES:** Purposefully increase the diversity of perspectives that shape the Academy's work through inclusivity of members, staff, contributors, and audiences.

Philanthropic support from foundations and individuals has long fostered our ability to be independent, interdisciplinary, and innovative. As the challenges that we face today – and our aspirations to address these challenges – outpace our existing resources, we seek to ensure our continued stability and growth in the following ways:

- **DOUBLE THE ACADEMY'S ENDOWMENT** from $35 to $70 million to enable continuity of long-term programs, provide the flexibility to explore new ideas and launch promising initiatives, and pursue opportunities to increase the Academy's visibility and impact.
- **SECURE PROGRAM GRANTS AND MAJOR GIFTS** totaling $43.5 million to fund a growing portfolio of influential initiatives.
- **GROW UNRESTRICTED ANNUAL SUPPORT** by increasing the participation of the members and affiliate institutions so that the Academy can respond to immediate needs and opportunities.

The Campaign for The Academy & Its Future, cochaired by Louise Henry Bryson and David M. Rubenstein, has raised over $80 million and is scheduled to conclude in 2022.

You can add your support at **amacad.org/donate** or by contacting the Academy's Development Office (**617-576-5066**; **dev@amacad.org**).

Gift of J. Davenport Fisher, after 1860

April showers may bring May flowers, but May flowers among archival materials can bring a host of problems.

Most of the materials in the Academy's Archives are paper-based documents and bound volumes, dating from the twentieth century. Some materials are in other formats, such as photographs and negatives, magnetic audio and video tape, and three-dimensional artifacts. Many of these materials are in stable condition and are easily preserved with the proper combination of stable environmental controls and archival preservation methods.

Some objects, however, pose particular challenges for long-term preservation. For example, the document shown here – sent to the Academy by chemist J. Davenport Fisher sometime in the latter half of the nineteenth century – features dried, pressed trailing arbutus (also known as mayflowers) adhered to a brief note. Though the flowers are pressed, they are not perfectly flat, affecting the way the document is housed in a folder. The naturally occurring pigmentation of the plant, particularly of the flower petals, has begun to break down and stain the underlying paper. The organic matter itself is a lure for insects or other pests.

To protect this item and other materials like it, several procedures have been implemented to mitigate the preservation challenges as much as possible. The letter, with the flowers still intact, has been removed from the box where it was originally housed and placed in a separate archival document case. The letter has also been placed in an enclosure of acid-free paper that is positioned inside an inert polypropylene sleeve. In addition, the environmental controls within the Archives facility keep the object at a stable temperature and relative humidity to slow the desiccation of the flowers.

The donor of this object is identified as J. Davenport Fisher, but the date of transfer is unknown. Born in March 1832 in Boston, he earned his Ph.D. in chemistry from Heidelberg University (Ohio) in 1855. In 1860, he donated five volumes on chemistry to the American Academy. During the Civil War, Fisher served for two years as a lieutenant in the 5th Massachusetts Cavalry. After the war, he taught chemistry at the Naval Academy in Annapolis and maintained ties with scientists back in Massachusetts, including Academy President Asa Gray. Settling in Milwaukee, Fisher continued to practice as a consulting chemist. Tragically he was killed by an electric streetcar in October 1911 at the age of seventy-nine.

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ONLINE

Academy members are frequently invited on television shows to share their expertise and insights. If you follow the Academy on social media, we share broadcast segments featuring members, including these:

Author **Viet Thanh Nguyen** was on "Late Night with Seth Meyers," talking about hate crimes against Asian Americans and his new novel, *The Committed*.

Ursula Burns, former CEO of Xerox, and **Kenneth Chennault**, former CEO of American Express, were on "CBS This Morning," urging corporate America to protect the voting rights of Americans.

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

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