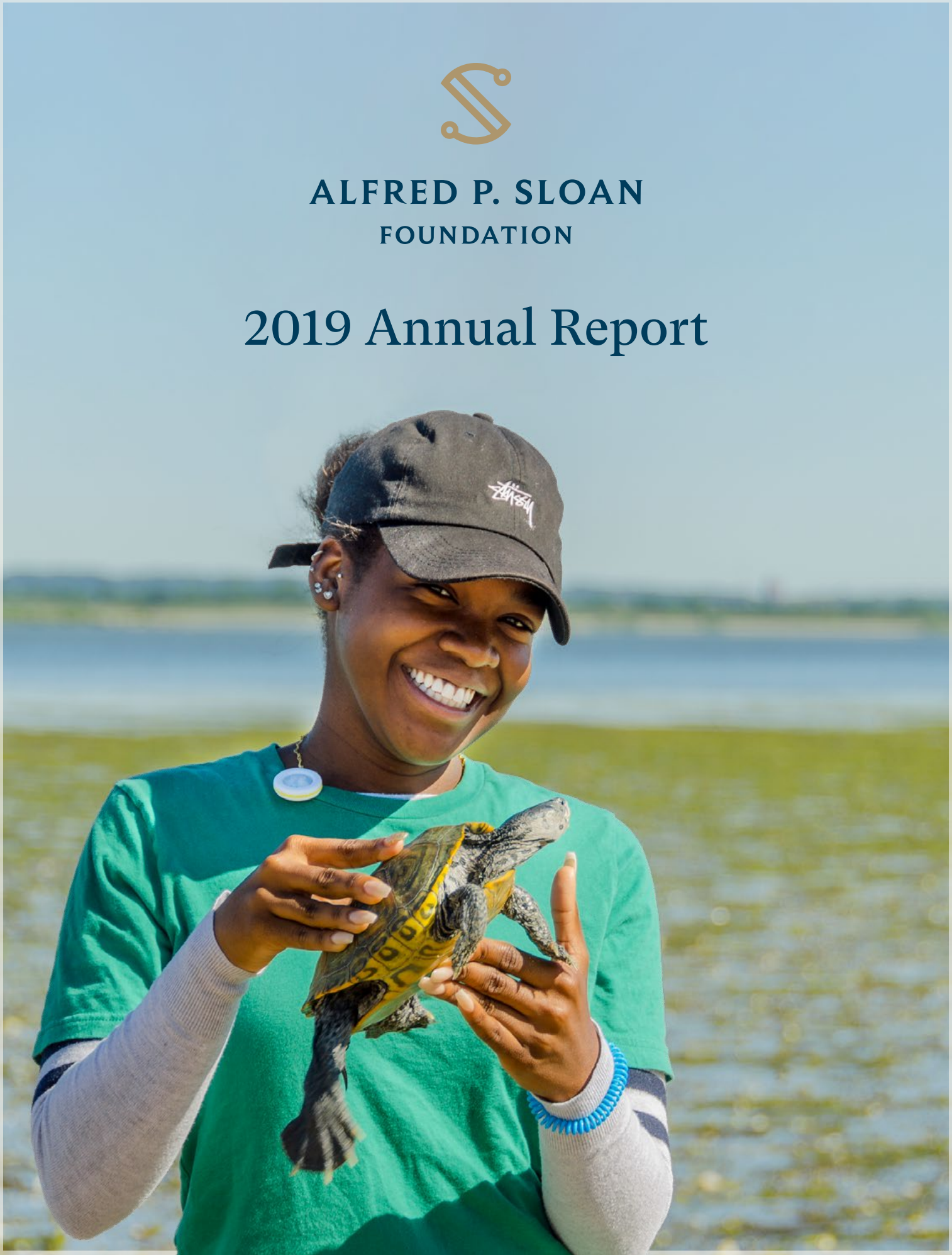
ALFRED P. SLOAN
FOUNDATION

2019 Annual Report



Driven by the promise of great ideas.

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Cover: A student participant in the Environmentor program holds a turtle. An initiative of RISE (the Rockaway Institute for Sustainability), the Environmentor program is a Sloan-supported science research mentorship that offers NYC high school students the opportunity to conduct authentic, hands-on environmental research on Jamaica Bay and the Rockaway shoreline.
(PHOTO: RISE ROCKAWAY)

Preface

The **Alfred P. Sloan Foundation** administers a private fund for the benefit of the public. It accordingly recognizes the responsibility of making periodic reports to the public on the management of this fund. The Foundation therefore submits this public report for the year 2019.

Mission

The Alfred P. Sloan Foundation makes grants primarily to support original research and education related to science, technology, engineering, mathematics, and economics. The Foundation believes that these fields—and the scholars and practitioners who work in them—are chief drivers of the nation's health and prosperity. The Foundation also believes that a reasoned, systematic understanding of the forces of nature and society, when applied inventively and wisely, can lead to a better world for all.

From the President

ADAM F. FALK

This letter serves as the introduction to a report on grantmaking by the Alfred P. Sloan Foundation in 2019. I find myself writing it, however, in May of 2020, as the COVID-19 pandemic rages here in New York City and throughout the world. So much in our society has changed since we made the grants described herein, and by the time this report is published, many things will no doubt have changed again, in ways I would not now presume to anticipate.

How should the Sloan Foundation respond to a world in which a global pandemic has upturned so much of what was once stable and familiar? How do we assure our work is relevant, that we are using to fullest advantage the extraordinary opportunity afforded us to improve the world through our grantmaking?

The answer, I believe involves both immediate action and considered reflection. In the short term, there is immense and pressing need for institutions of all types to do what they can to blunt the impact of the pandemic. Beginning in the spring of 2020, the Foundation has responded by making a series of grants aimed at mitigating the worst of its harms. We have made grants to aid public health initiatives, to alleviate conditions here in New York, to support institutions made vulnerable by economic shutdowns, and to study the various effects of the pandemic. We will continue to look for opportunities over the coming weeks and months where Foundation funds and expertise can best be leveraged to help adapt to the evolving crisis.

In the longer term, the dire seriousness of this situation impels us to recommit to an essential principle. The initiatives we choose to support, the programs we choose to mount, the questions we choose to investigate—these things must truly matter, must go to the heart of issues of fundamental importance for society, for science, and for the world.

That is, we must take this moment to step back and look not just at what we choose to do, but at why we choose to do it.

I find myself encouraged by such an examination of the Sloan Foundation's programs, that they speak directly to singularly important and enduring issues. Our Technology Program, for example, is a response to the profound changes computing and the internet have wrought in the ways we share our ideas, our thoughts, and our lives. Our Diversity, Equity, and Inclusion in STEM Higher Education program is a response both to extraordinary demographic changes in 21st century America and to the lasting impact of hundreds of years of racism and sexism in academia and our larger society. And our Energy & Environment program is a response to the permanent changes we humans are making to our only planet, changes whose meaning we are far from fully understanding.

Because our programs address enduring issues, they speak to COVID-19 as well, even though the Foundation does not fund biomedical research directly. In our Technology program we've funded many of the tools that enable the global scientific collaboration necessary to solving the many puzzles of COVID-19. In our Microbiology of the Built Environment and Chemistry of the Indoor Environment programs, we've funded scientists investigating issues central to understanding coronavirus transmission, like how ventilation systems interact with microbial communities indoors. In our Economics program, we support behavioral economists who study the effectiveness of policy "nudges" designed to induce pro-social behaviors such as mask-wearing, as well as researchers mounting surveys to study the impacts of the pandemic on our society. And our Public Understanding of Science program has long worked to build in our society a deeper appreciation of science and scientists, seeking to bridge the sorts of cultural divides that too easily bedevil us in times of crisis.

Beyond examining individual programs, however, there's a deeper lens for understanding what we do at Sloan. In supporting projects in science, technology, and economics, we are driven by four fundamental questions.

- **What** can we learn?
- **How** will research be done?
- **Who** participates in research?
- **Why** does it matter?

Every grant we make, in every program, addresses at least one of these fundamental questions. Many address all four. Whatever the field, we seek not only to acquire new knowledge, but to support and improve the communities that do the research. And we believe that the purposes and impacts of research matter profoundly and are everybody's business.

Last year we at Sloan took some time to examine our own identity, asking questions such as "how do we understand ourselves?" and "what do we project to the world?". What we learned is that we've been quite successful at conveying the rigor and care that we bring to our grantmaking, but less thoughtful about conveying the deep sense of purpose and, in fact, joy we feel in doing this work. We support the projects we support not merely because we believe they will succeed, but because we believe their success matters. Among the outcomes of this exercise were a new, more approachable logo and visual identity, reflected in the design of this report, and a new tagline that we think captures the essence of who we are: *Driven by the promise of great ideas.*

Alfred P. Sloan, I believe, was truly driven by the promise of great ideas: in the manufacture of the best ball bearings, in the building of General Motors, and in the establishment of the foundation that bears his name. We are the stewards of his legacy, and I believe he would look upon what we are doing today and agree that his foundation continues to be driven by the promise of great ideas, just as he was, and that great ideas continue to matter, perhaps never so urgently than in a world caught in a tumult of fear and hope, endeavor and peril.

On Racism and Our Responsibilities

ADAM F. FALK, PRESIDENT

On June 4, 2020, in reaction to widespread protests and social unrest in cities across the nation over the issue of racial injustice in policing, President Adam Falk issued the following statement on behalf of himself and the Alfred P. Sloan Foundation.

The sickening murders of George Floyd and Ahmaud Arbery, recorded and then viewed by millions, represent but the smallest and most visible part of a centuries-long history of racist violence directed against Black Americans. Once again, Americans are speaking up in public spaces to express our shame at the racism our society permits and indeed encourages, and our desperate hope that we can be better. Equally important, we are also striving to listen, carefully and with humility, to the voices of those who have been harmed and continue to be harmed by the anti-Black racism that infects every corner of our society.

It is tempting to feel we have been here before, that over the past half-century there has been scant progress and there is little hope for progress in the future. Beyond the searing images of murders caught on camera, the sight of peaceful demonstrators removed violently from a public park near the White House evokes memories of past cruelties that are hardly confined to our past. Let us be clear: the deployment of the military, and of military tactics, against nonviolent demonstrators is intolerable to our democracy. We must insist, publicly and without compromise, on the First Amendment "right of the people peaceably to assemble, and to petition the Government for a redress of grievances." This statement is not an expression of partisan politics; it is the statement of a core American value.

In the face of these stark truths and this perilous situation, what are institutions such as Sloan to do… or to say? Despairing for the future is no good option. Our inboxes are bursting with statements from leaders of colleges and universities, scientific organizations, cultural institutions, and major corporations. To a one, these well-meaning messages strive to capture something of this current moment, find some reason to hope, and point a way forward. But is there anything to be said that could truly be adequate to our situation? Out of the concern that mere statements cannot be enough, I initially hesitated to presume to cast more words into the growing cacophony of voices. But in the end, I suspect the sin of silence is worse than the sin of inadequacy. So I'd like to try, on my behalf and that of the Sloan Foundation, to capture this moment, find reason to hope, and point a way forward.

It's essential to begin by recognizing the extraordinary privilege inherent to working at Sloan, privileges that are enjoyed by the Foundation as a whole and by each of us as individuals. We are profoundly grateful for the opportunity to make the world better by deploying the fortune accumulated by Alfred P. Sloan. But we must acknowledge that the accumulation of that fortune, of any industrial fortune, required the labor of thousands of women and men who never enjoyed the privileges that Sloan did, or that we do. Our history, the privilege we have inherited, imposes on us an inescapable responsibility to use our grantmaking in the service of the public good. And in particular, in this moment, we must redouble our own efforts to alleviate the toxic effects of racism in our society.

For many decades, the Sloan Foundation has funded programs to promote the inclusion of marginalized people in STEM fields. At present, our largest initiatives directed to this purpose are two graduate scholarship programs for underrepresented minorities, the University Centers for Exemplary Mentoring and Sloan Indigenous Graduate Partnership programs. While we are deeply committed to these efforts, we are also well aware that providing funding is by far the easiest part. We are humbled to see the difficult and sometimes painful work of faculty, administrators, and most

importantly of students, to both survive and reimagine academic structures still plagued by racism and sexism. We are proud of the work they do, and grateful for the opportunity to support them, as well as our other grantees who do similar and equally essential work in fields like economics, astronomy, and mathematics.

Beyond that, Sloan has long required that every proposal we fund include a meaningful and convincing account of how the work to be funded will advance the inclusion of marginalized people. We recommit ourselves to making this requirement a real and lived one, in every single case.

And finally, we must speak less and learn to truly listen. For generations, Black Americans have spoken and written of their experience of racism and racist violence. Our society has not wanted to hear these voices, has not been willing to face truths that if fully faced would shame us all. In our Public Understanding program, we have supported remarkable works, such as Margot Lee Shetterly's book Hidden Figures and Charly Evon Simpson's play Behind the Sheet, that serve as compelling testaments to the dignity, agency, fortitude, and brilliance of Black Americans under even the most oppressive conditions. These are works that cry out for us to listen with our full attention: to see with humility and searing honesty what it is truly like for so many of us to live in this society. At Sloan, we must keep seeking out these stories and ensuring that they are told by those whose lived experience informs the telling.

Each of us must participate in the work of opposing and dismantling racism, both as individuals and within the communities and institutions of which we are a part. The Sloan Foundation is one such institution. Within the scope of our mission, we must dig deeper, go further, do more. Within the scope of our lives, we must all dig deeper, go further, do more.

The Year in Discovery

"Discovery" is a word you hear a lot around the offices of the Sloan Foundation. We like its excitement, its optimism, its joy. It captures the fun that comes from learning something new, of solving a puzzle, of finding something out, of seeing a phenomenon you've never seen before.

There are many wonderful things about being a grantmaker in science and technology. One is that we get to work with extraordinarily talented people. Another is that we get to support so many wonderful institutions that share our goal of creating a better world by increasing our understanding of how the world works and our place within it. But maybe our favorite perk is that, in making grants in science and technology, we get the opportunity to work with discoverers, with women and men of passion and curiosity who love to find out new things and to share what they've found. Sloan's grantees—we have some 1600 active grants at any given time—are all engaged in discovery in one form or another. And while we cannot possibly mention all that they discovered in 2019, an accounting of our year wouldn't be complete without mentioning some of it.

Chemistry of Indoor Environments

The Foundation's grantmaking in the Chemistry of Indoor Environments supports researchers who are trying to understand the complex chemical interactions going on inside built spaces. What chemicals are in the air and surfaces in our homes and schools? How do they interact? How do human activities affect the equation? What role do our lotions and colognes and hairsprays and cleaning supplies play?

In 2019, a team led by University of Colorado, Boulder chemist Paul Zieman partnered with the campus art museum to study the fate of chemicals emitted into the museum air.[1] They found that certain compounds, like lactic acid and emissions from paint, were disappearing from the air faster than the air was being vented from the building. The compounds were instead sticking to the walls, floor, ceiling and other surfaces in the room, frustrating attempts by the ventilation system to remove them. In the case of lactic acid—read "sweat"—the team found that 97 percent ended up deposited on surfaces instead of being vented out. The finding has interesting implications for the design of ventilation systems generally, and, in the case of museums,

1 Pagonis et al., "Time-Resolved Measurements of Indoor Chemical Emissions, Deposition, and Reactions in a University Art Museum."

for efforts to protect precious but fragile artifacts from damage and degradation.

The importance of surfaces to indoor chemistry was confirmed by another study in 2019, this one by a multi-university team studying the effects of cleaning activities in a model house at the University of Texas.[2] Cleaning the house with common, commercially available bleach products, the team found that most of the noxious chemicals the products released into the air—hypochlorous acid, chlorine, and nitryl chloride—were disbursed not by ventilation nor destroyed by sunlight (a powerful oxidant and destroyer of nasty airborne chemicals), but instead by interactions on the surfaces in the home.

Lastly, a computational modeling exercise by Donghyun Rim and associates at Penn State University and the University of California, Irvine found that oils produced by human skin can react with and destroy ozone—a form of oxygen that can be toxic.[3] The effect is particularly pronounced, for better or worse, when wearing "dirty" clothes that have had the chance to absorb high levels of skin oils, removing up to 70 percent of ozone from the air. But don't stop washing your clothes just yet. The process of destroying ozone, the team found, itself creates chemical byproducts that can cause skin and lung irritations.

Economic Institutions, Behavior & Performance

Sloan is the largest private funder of basic economic research in the country, and our grants in this program aim to help researchers produce high quality, well-supported results about the structure, behavior, and performance of U.S. economic institutions that policymakers can use to strengthen their decision-making on issues of national importance.

One of the most dramatic changes to society over the past ten years has been the change in behavior associated with the rise of immensely popular social media platforms like Facebook, Instagram, and Twitter. Participation in these platforms is obviously influencing us in ways large and small, with many Americans using them for many hours every single day, but so far there has been little rigorous research attempting to precisely quantify their effects.

That changed when Stanford economist Matthew Gentzkow launched one of the first randomized controlled trials studying the effects Facebook has on its users.[4] Gentzkow studied 2700 Facebook users who deactivated Facebook for a month leading up to the 2018 midterm elections. Without Facebook, his study found, test subjects had about an hour more free-time on average each day, which they filled mainly with a combination of increased socializing with friends and family and more time spent watching TV. The study also demonstrated that Facebook serves as an important source of news for users, with subjects demonstrating a reduced knowledge of both political and non-political news compared to those still plugged in. Cutting out Facebook also led to higher levels of satisfaction among subjects. Self-reports of happiness and well-being went up and reports of anxiety and depression went down. Lastly, asked to evaluate the value of Facebook in the aftermath of the study, participants said they thought deactivating Facebook was good for them, and on average they reported using the site about 20% less than they had before the experiment.

"Nudge Theory" has consistently shown that slight, inexpensive changes to the information people face when making a decision can have important impacts on behavior, even without forbidding any options or changing people's economic incentives. Much less is understood about whether these "nudges" are ultimately beneficial or damaging to individuals, and about what other factors should be taken into account to uncover the "welfare effects" of nudging, especially in public policymaking, which usually calls for well-balanced, nuanced approaches when making decisions. One such case is deciding whether and how to intervene in consumers' consumption of goods that could negatively impact society. Do people actually think consuming these goods could be bad for them? Is nudging enough or is it needed to pull more powerful economic levers like, say, taxes? When you tax a good, you make it more expensive and consumers consequently buy less of it. But how do lawmakers decide which goods we want less of, and thus, which goods to tax? The answer, ideally, is just those goods that consumers *themselves* wish they consumed less of. A 2019 paper by NYU economist Hunt Alcott and others found that one of these items is soda and other sugary drinks.[5] Surveying households, Alcott and his team found frequent misconceptions about the nutritional content of sodas, along with a general desire to consume less. The average household, they found, would consume about 1/3 fewer sodas if they knew how much

2 Mattila et al., "Multiphase Chemistry Controls Inorganic Chlorinated and Nitrogenated Compounds in Indoor Air during Bleach Cleaning."

3 Lakey et al., "The Impact of Clothing on Ozone and Squalene Ozonolysis Products in Indoor Environments."

4 Allcott et al., "The Welfare Effects of Social Media."

5 Allcott, Lockwood, and Taubinsky, "Should We Tax Sugar-Sweetened Beverages? An Overview of Theory and Evidence."

sugar was in them and had perfect self-control. The effect was even more pronounced in poorer households, which consume twice the amount of soda as richer ones, and which would drink half as much soda if they could. Analyzing consumer purchasing behavior, they found that a 1-2 cent per ounce tax on soda would be optimal, reducing household consumption to what consumers say they want. This is roughly double the rate of current American state and city taxes on soda.

Many US economic policies focus on fostering innovation, looking to seed today's scrappy start-ups that will become tomorrow's Amazon or Google. But these start-ups, if they are to succeed, need talented, motivated workers. Economists Michael Roach and John Skrentny tracked more than 2000 recent PhDs in STEM fields, cataloging their first employment in industry.[6] They found that foreign nationals were less than half as likely to apply and receive jobs at technology start-ups as opposed to established tech firms like Facebook and Google, even controlling for individual preferences. The finding suggests that the current H1-B visa process, which allows foreign nationals to live and work in the U.S., gives an edge to bigger, more established firms, allowing them to outcompete start-ups in the war to attract talent.

Energy & Environment

There is no question that averting the worst consequences of a changing global climate will require the United States to transition to a low-carbon economy. To make that transition effectively, stakeholders from all sectors need a detailed understanding of how the U.S. energy system works and a better grasp of the economic and environmental issues related to the increased deployment of low-carbon technologies. Grants in our Energy and Environment Program aim to provide that knowledge through supporting rigorous investigation of the energy system, training the next generation of scholars and practitioners in the field, and disseminating findings to inform how the potential impact of such reforms in energy and climate systems might improve the quality of American life.

In 2019, researchers from Carnegie Mellon University examined the potential and challenges faced by a variety of novel energy technologies, with multiple papers published in the journal *PNAS*. In one project, a multi-disciplinary team of scholars including Jay Whitacre, Inês Azevedo, Shawn Litster, Kate Whitefoot, Constantine Samaras, and Michael Whiston found that many experts in the field of fuel cell research anticipate that fuel cell technologies are on a pathway to achieve desired performance characteristics at reduced costs.[7] Moreover, this team highlighted specific areas in need of additional funding and attention from policymakers, including the development of new catalysts and electrode materials. The results of another project, published by Liza Reed, Granger Morgan, Parth Vaishnav, and Daniel Armanios, identified the cost effectiveness of converting high voltage alternative current (AC) transmission lines to high voltage direct current (DC) transmission lines.[8] Upgrading America's energy infrastructure in this way could make it possible to more easily move power generated by clean, renewable resources across wider swaths of the country.

Also in 2019, a team led by Daniel Sarewitz and Mahmud Farooque at Arizona State University's Consortium for Science, Policy and Outcomes conducted in-depth interviews and group discussions with citizens from all walks of life about their concerns and priorities related to solar radiation management (SRM).[9] SRM is a group of technologies and public policy interventions that attempt to mitigate the effects of climate change by either absorbing or reflecting incoming sunlight, thereby preventing it from heating the atmosphere. This social science research found that the participants collectively expressed a deep concern about the unintended consequences of potential SRM interventions, with fewer than 20% in favor of strategies like stratospheric aerosol injection, where tiny crystals are disbursed into the atmosphere to reflect light away from the Earth. On issues of governance, the participants were insistent that SRM research and interventions should be fully transparent, yet there was a diversity of views about which institutions should oversee funding and directing such interventions, whether it be the government, private sector, or the military. The research provides needed evidence and public input to policymakers about the work that would be needed to build broad public engagement strategies for SRM interventions before these technologies are deployed.

Amy Myers Jaffe convened experts at the Council on Foreign Relations to examine and draw attention to the myriad risks a changing climate pose to the U.S.

6 Roach and Skrentny, "Why Foreign STEM PhDs Are Unlikely to Work for US Technology Startups."

7 Whiston et al., "Expert Assessments of the Cost and Expected Future Performance of Proton Exchange Membrane Fuel Cells for Vehicles."

8 Reed et al., "Converting Existing Transmission Corridors to HVDC Is an Overlooked Option for Increasing Transmission Capacity."

9 Leah Kaplan et al., "Cooling a Warming Planet? Results from Public Forums on Climate Intervention Research."

energy system.[10] The results are sobering. To take one example, the predicted rise in sea levels and increased incidence of severe hurricanes predicted by climate models threaten to rile the normally placid waters of the Gulf of Mexico, home to nearly 40 percent of US oil and gas refinery capacity that are at risk of being disrupted if hit by such storms. To take another challenge, nearly all energy-generating facilities in the U.S. require significant amounts of water, often to keep reactors or furnaces from overheating. The predicted increase in droughts brought about by climate change, however, could significantly impact the availability of water for energy generation purposes, raising costs to consumers (with corresponding drags on the economy) and requiring more frequent shutdowns of these facilities. Jaffe and her colleagues also found that insurance markets are not effectively pricing in climate risk when insuring America's utilities. Insufficiently insured, a wave of utility bankruptcies like the one experienced by California's PG&E in 2019 could cascade across the entire financial and energy system.

Sloan Digital Sky Survey

Since it achieved first light in 1999, the Sloan Foundation Telescope, the primary instrument of the Sloan Digital Sky Survey (SDSS), has been a revolutionary presence in astronomy and cosmology. Over its twenty years of operation, the Sloan Telescope has collected optical and infrared spectra of thousands upon thousands of stars, galaxies, and other celestial objects and has radically improved our understanding of some of the most pressing issues in modern astronomy, including the structure of the Milky Way and the expansion history of the universe.

In 2019, astronomers using SDSS data discovered a planet four times the diameter of the star it was orbiting.[11] Located some 2,000 light years from earth, the gaseous planet is orbiting a white dwarf, the dying core of a formerly huge red giant star. The finding is the first planet ever discovered that has survived the stellar transition from red giant to white dwarf.

In another discovery, Ohio State University astronomer Todd A. Thompson and a team of others were pouring over SDSS data looking for binary stars. In the course of their work, they discovered the smallest black hole ever cataloged, one only three times the mass of our sun.[12] The finding is exciting not merely for its novelty, but for expanding our knowledge of black holes. Ironically, what enables us to study "black" holes is their luminosity. Matter being sucked into the hole's intense gravitational field—its accretion disk—emits light. The more massive the black hole, the more matter it consumes, and the more light that gets emitted from its accretion disk. This makes large black holes the easiest to study, introducing a selection bias into those that get the most scientific attention. The discovery of a super low-mass black hole adds interesting nuance to that scientific picture.

One of the most revolutionary aspects of the SDSS is its attitude towards data. All data SDSS collects is released to the public, so both professional astronomers and amateur stargazers alike can use that data in their own research. In late January 2019, the SDSS collaboration issued a massive data release from its MaNGA survey (**Ma**pping **N**earby **G**alaxies at **A**pache Point Observatory, where the Sloan Foundation telescope is sited.)[13] The release constitutes a "stellar library" containing the spectra of more than 3000 stars of all colors and sizes from the Milky Way. When completed, the library will be the single largest collection of optical stellar data ever assembled. Though the library is a boon to those interested in studying individual stars, it also servers a larger purpose. By studying how the light from stars combines in our own Milky Way, astronomers can build models from which one can deduce the stellar composition of far away galaxies by examining the light they emit, even when they are too distant to make out the individual stars that comprise them.

Sloan Research Fellowships

The Sloan Research Fellowships, which give $75,000 to early career researchers in eight scientific and technical fields, is the Foundation's oldest grantmaking program and the only current program started by Alfred P. Sloan himself. The program has stood the test of time for a reason: it was a great idea in 1955, and it continues to be a great idea today, to support the work of the nation's most promising researchers at a crucial juncture in their careers when funding and recognition can make a real difference.

The 2019 cohort of Sloan Research Fellows consists of 126 young researchers who are doing groundbreaking research at the forefront of their fields. They include Yongjie Hu, a chemist at UCLA who is developing new

10 Myers Jaffe et al., "Impact of Climate Risk on the Energy System: Examining the Financial, Security, and Technology Dimensions."

11 Gänsicke et al., "Accretion of a Giant Planet onto a White Dwarf Star."

12 Thompson et al., "A Noninteracting Low-Mass Black Hole–Giant Star Binary System."

13 "Science in the Library | SDSS | Press Releases."

high-thermal-conductivity materials to use in computer chips; Gabriel Zucman, an economist who studies how the world's super-rich shelter their money in tax havens; Hosein Mahimani, a molecular biologist whose algorithms were used to the discover the first naturally occurring antibiotic ever found by a computer; and Marcelle Soares-Santo, an astronomer from Brandeis who led a project that resulted in the first optical observation of two neutron stars colliding.

Sloan Research Fellows often go on to lead careers of influence and prominence in their field. In 2019, astronomer and former Sloan Research Fellow Jim Peebles was awarded the Nobel Prize in physics for a lifetime of important contributions to cosmology. Peebles is the 50th Sloan Research Fellow to receive the Nobel Prize. The Abel Prize, commonly considered the Nobel Prize of mathematics, was awarded to Sloan Fellow Karen Uhlenbeck for her pioneering role in the development of modern geometric analysis. Uhlenbeck is the first woman to receive the Prize since its inception in 2003.

Tabletop Particle Physics

The year 2019 was an exciting one, as we made a collection of grants in a completely new area for us: fundamental particle physics. Led by new Foundation program director Ernie Glover, the Foundation made grants in 2019 totaling nearly $6 million to support five complementary experiments to measure deformities in the roundness of an electron, as well as a theory grant to deepen our understanding of what such measurements can tell us. Such deformities, should they exist, would most likely be due to as-yet undiscovered particles, pointing the way to new fundamental physics, and at a fraction of the cost associated with the construction of large particle accelerators. This grantmaking represents an exciting opportunity both to push forward our knowledge of the building blocks of the universe, and to support innovation in the methods of experimental particle physics. You can read more on this exciting program of grants on page 61.

Working Longer

This was the final year of grantmaking in our Working Longer program, which sought to advance our understanding of the labor market decisions of older workers, and what legal, regulatory and institutional changes ought to be made to accommodate those workers who want or need to work past traditional retirement age.

A poll conducted by the National Opinion Research Council in cooperation with the Associated Press found that 45 percent of adults, and a third of adults over the age of 50, report that that they will not be financially prepared when it comes time to retire.[14] The nationally representative survey of more than 1400 U.S. adults also found that nearly 1 in 4 adults say they expect never to retire. The findings underscore the need for regulatory and other changes that will remove barriers that disincentivize work at older ages.

A Sloan grant to the Urban Institute allowed researchers to update the Institute's influential DYNASIM microsimulation model, a state-of-the-art modeling platform that allows researchers to model economic forces in the U.S. economy and simulate the effects of potential policy reforms across a variety of economic variables. In 2019, Urban Institute published *Nine Charts about the Future of Retirement*, using projections from the updated DYNASIM model.[15] The model predicts that, assuming there are no cuts in Social Security benefits, Xennials (defined as those born between 1976 and 1985) will earn about 24 percent more in retirement than someone born in 1936, a finding in stark contrast to the widespread belief that recent generations are less prepared for retirement than their predecessors. The model also predicts, however, that these savings will still be insufficient for many, with one in three Xennials seeing a drop in their standard of living once they retire. The model also predicts that racial and ethnic gaps in retirement security will persist when the Xennials retire, with median after-tax retirement income some 26% lower for black retirees and 49% lower for Hispanic retirees as compared to white retirees.

A Sloan funded partnership between news watchdog ProPublica and the non-partisan Urban Institute analyzed data from the Health and Retirement Study, which follows a nationally representative panel of American workers from the age of 50 until the end of their lives.[16] What they found was deeply concerning. 56 percent of workers over 50 are, at some point in their late careers, laid off or leave their jobs involuntarily. Though many of these workers find other employment subsequent to their termination, there is a steep cost. Only about 1 in 10 make as much money in their new jobs as they did in the one they lost. With some 40 million Americans aged over 50 in the workforce, the statistic implies that as many as 22 million older American workers with steady jobs may experience an involuntary termination from steady employment as they are readying for retirement.

14 Soergel, "Poll."

15 Johnson et al., "Nine Charts about the Future of Retirement."

16 Gosselin, "If You're Over 50, Chances Are the Decision to Leave a Job Won't Be Yours."

Diversity, Equity & Inclusion in STEM Higher Education (DEI)

Diversity benefits the research enterprise and is necessary for innovation. Yet, Blacks, Hispanics, and Native Americans make up only 6.3 percent of doctoral recipients in STEM fields in the U.S.[17,18] resulting in persistent underrepresentation of these groups in both STEM faculty positions and the STEM workforce. To address this underrepresentation, the Foundation's grantmaking in our Diversity, Equity, and Inclusion in STEM Higher Education program partners with universities and other stakeholders to work together to attract students from underrepresented groups to STEM fields, prepare them for success in graduate study, and help craft inclusive, welcoming educational environments in which they can thrive.

As of the end of 2019, the Foundation and its university partners were supporting 610 underrepresented graduate students in STEM fields. This number is one we are particularly proud of, since in the United States only about 2200 STEM doctorates are granted to underrepresented scholars each year. Sloan-supported students, called Sloan Scholars, receive not only direct fellowship support during their graduate study, but also access to faculty and peer mentoring, networking and professional development resources, social events, and webinars and workshops aimed to help them successfully navigate their graduate programs and earn their degrees.

In addition to direct support to students, the Foundation also supports projects large and small to help encourage diversity, equity, and inclusion in STEM higher education.

Though support for the arts is normally confined to our program in the Public Understanding of Science and Technology, the DEI program in 2019 funded the staging of *Truth Values*, a play by Gioia DeCari about her encounters with personal and systemic sexism as a MIT graduate student in mathematics. DeCari partnered with CUNY professor Silvia Mazzula to host a two-day series of intensive workshops after the production. The events were designed to raise awareness of issues of gender inequity and harassment inside higher education and encourage other women graduate students and faculty to tell their own stories, network, and identify strategies and resources for resilience in the face of continued sexism inside the academy.

17 "Doctorate Recipients from U.S. Universities 2018 | NSF - National Science Foundation."

18 This number excludes doctorates granted to foreign students and non-permanent U.S. residents.

In late 2019, the National Academy of Sciences released its consensus study, *The Science of Effective Mentorship in STEMM*.[19] Funded in part through a grant from Sloan, the study brought together leading experts to collect in one report what we know about the efficacy of mentoring as a pedagogical tool in STEMM[20], what makes it work, and how to structure mentoring programs and relationships in ways that demonstrably improve outcomes for students. The report includes practical advice on a host of topics, including matching mentors to mentees, different mentorship models, developing culturally responsible mentorship practices, the usefulness of mentorship compacts and mentoring plans, and how to structure mentoring programs so they can be rigorously evaluated and improved.

A separate grant to the National Academy of Sciences supported the dissemination of *Sexual Harassment of Women: Climate, Culture and Consequences in the Academic Sciences, Engineering and Medicine*. The report takes an unflinching look at gender inequity and the disenfranchisement of women in higher education, with practical advice on how to create cultures of gender inclusion within academia. The report has been very well received and has been downloaded more than 26,000 times since 2019, putting it in the top 1% of reports produced by the NAS.

Technology

The Foundation's grantmaking in technology supports the development of innovative technologies and attempts to shape the broader social and institutional context in which they are developed and deployed to give institutions and communities the ability to generate, analyze, and share knowledge at unprecedented speed and scale.

In 2017, the Foundation made a two-year grant to help continue the development of the Julia programming language, a robust and increasingly popular computing platform inside research communities. The resulting improvements have powered robust growth, and by the end of 2019 Julia was in use in over 1,500 universities and had been downloaded over 11 times. The number of "packages" available—customizations of the Julia framework for specific purposes—nearly doubled between 2018 and 2019, from 1688 to 3,119. Improvements to Julia include more user-facing documentation, like setup guides and use tutorials; a clearer, more useful error messaging framework; and improvements in package

19 National Academies of Sciences and Medicine, *The Science of Effective Mentorship in STEMM*.

20 STEMM = Science, Technology, Engineering, Mathematics, and Medicine.

installation and performance measurement. The Julia team, however, was committed to more than just improving the technological chops of the platform. Grant funds were also used to broaden and diversify the Julia user-base. The team implemented ambitious plans to improve the diversity of its community, hiring a full time Director of Diversity and Training who held more than 40 trainings over the grant period with Julia user groups.

In addition to directly funding software, the Technology program actively supports efforts to develop and implement best practices in scientific software development. The Open Source Alliance for Open Scholarship published an online, freely available handbook[21] filled with best practices for scientists and other researchers wanting to create productive, open source collaborations in academia. The handbook includes useful tips on budgeting basics, sustainability models, tips on grant-writing and finding funding, guidance on hiring and promoting diversity and inclusion in open source projects, governance models, and more. The handbook is an indispensable resource for anyone wishing to start and sustain an open source collaboration.

Hackathons are a specific mechanism by which open source projects gain new contributors. These events, typically lasting a few intense days, bring together computer programmers, software engineers, and other technologists meet to collaboratively produce software, and have become more common in research communities in recent years. (See, for example, the Hack Week model that emerged from the Moore-Sloan Data Science Environments[22]). With Sloan funding, James Herbsleb at Carnegie Mellon University studied hackathon design and outcomes. His work contrasted hackathons whose goal is to form a community around a new project with those intended to foster new work (and even businesses) on top of already-thriving software resources. In addition to a series of peer-reviewed publications, the project produced a toolkit, available for free at hackathon-planning-kit.org, that contains detailed, practical guidance on 12 crucial decisions to be made by any hackathon planner and covers everything from sample agendas to participant recruitment strategies to how often to schedule breaks.

Universal Access to Knowledge

The Foundation's Universal Access to Knowledge Program works to harness advances in technology to facilitate the openness and accessibility of all knowledge in the digital age for the widest public benefit under fair and secure conditions. A partnership with the Wikimedia Foundation that dates back to 2008 is helping the organization attach structured data to photographs and other media files in its 60-million-file collection and to create tools that allow these files to be more easily located by well over half-a-billion monthly users. By the end of 2019, nearly 13 million files on the site had been updated with structured metadata, alongside the launch of helpful new search features like multilingual photo captions, keyword searching, and an updated easy-to-use interface allowing users to more readily add structured data to media files. Sloan remains one of Wikipedia's largest ongoing funders.

With Foundation help, Annual Reviews, the publisher of a prestigious series of expansive reviews of developments in 47 fields in the natural and social sciences, launched *Knowable Magazine*, a digital publication devoted to making the scientific research in these reviews more accessible to the public. Since its 2016 launch, *Knowable* has been publishing at an impressive clip, publishing 290 smart, timely, but easy-to-read pieces that reference some 500 articles in its academic literature.

The Digital Public Library of America (DPLA) is the first national digital library and aims to become the leading repository for the nation's scientific and cultural heritage in all its forms. DPLA's recent efforts have focused on eBook access, and Foundation support has allowed it to launch both Open Bookshelf, a collection of free ebooks, and the DPLA Exchange, a pilot not-for-profit ebook marketplace. As of 2019, these two initiatives have expanded to include partners in all 50 states and have more than 300,000 ebooks, including some 12,000 free books available to school-aged children from low income families.

Public Understanding of Science & Technology

The Foundation's program in the public understanding of science and technology seeks to expand and deepen public engagement with science and scientists through encouraging new and established artists in many media—authors, playwrights, screenwriters and directors for tv and film, radio producers, podcasters, even the occasional composer, librettist, or choreographer—to take up scientific themes and characters in their work.

Six books were published through the Foundation's Book program in 2019, including the *New York Times* bestseller *Bottle of Lies* by Katherine Eban, an unflinching investigation into the generic drug industry and how it evades regulatory scrutiny; *The Ice at the End of the World*, by Jon Gertner, a first-hand look at the practical

21 "The Open Source Alliance for Open Scholarship Handbook."

22 Huppenkothen et al., "Hack Weeks as a Model for Data Science Education and Collaboration."

effects of climate change through the lens of the rapidly melting ice sheet in Greenland; and M. R. O'Connor's *Wayfinding*, about the features of human cognition that made that made us, uniquely, into a species capable of navigating the entire world. At the end of 2019, women scientists featured in the Sloan-supported book *Hidden Figures* were awarded the Congressional Gold Medal, the nation's highest civilian honor, and feted at a major Sloan-hosted reception in the Capitol.

Three science-themed feature films premiered with support of the Sloan Film program in 2019, including Michael Tyburski's *The Sound of Silence*, about a "house tuner" (played by Peter Sarsgaard) who investigates how ambient sound affects our psychological well-being; *One Man Dies a Million Times*, by Jessica Oreck, about a city's decision to raid a local seed bank in the midst of a famine; and *Oliver Sacks: His Own Life*, a documentary about the life of the famous neurologist, which features never before seen footage from the last year of Sacks' life.

In the television program, a partnership with Kikim Media produced *Look Who's Driving*, a penetrating look at the development of autonomous driving technology and the remaining challenges before driverless cars become a widespread reality. Also in 2019, acclaimed documentary series and longtime Sloan grantee *American Experience* premiered several science-themed episodes, including award winner *Chasing the Moon*, celebrating the 50th anniversary of the moon landing. *Light Falls*, about Albert Einstein's discovery of relativity, aired on the 100th anniversary of the solar eclipse that demonstrated his theory. *Distemper,* an award-winning television pilot about pathologist and LGBT icon Louise Pearce, won the inaugural Sloan / North Fork TV Festival Award.

In the Theater program, the Foundation's longtime partner Ensemble Studio Theater premiered *Behind the Sheet*, based on the story of Dr. J. Marion Sims, the controversial "father of modern gynecology" who conducted his surgical research on enslaved Black women. The play was a *New York Times* Critic's Pick and was extended three times due to its unprecedented popularity. The Manhattan Theatre Club produced *Continuity*, a biting comedy about climate change by Bess Wohl set on the stage of a big budget action film whose production disasters mirror events in the real world.

In our Radio program, LA Theatre Works recorded two new radio dramas based on Sloan-commissioned plays, *Lenin's Embalmers* and *Please Continue,* joining a collection of plays that air on radio stations around the world and reach millions of listeners. All female produced and hosted *Gastropod* celebrated its fifth birthday and released high-quality science-themed episodes on topics from CRISPR to personalized nutrition.

In our New Media program, the Foundation supported a pioneering classical music composition, *Casop: A Requiem for Rice*, based on the exploitation of Black slaves in the South Carolina and Georgia low country and the underappreciated value of their innovative technologies for growing rice. The Institute for Computational and Experimental Research in Mathematics (ICERM) at Brown University hosted a semester-long Sloan-supported program called "Illustrating Mathematics," focused on visualizing and illustrating mathematical concepts.

New York City Program

The Sloan Foundation has called New York City home since our beginning, and a portion of our grantmaking has always been focused locally, to help our city thrive and prosper in ways consonant with our larger mission.

With support from a Sloan grant, the United Hospital Fund of New York brought together epidemiologists and health experts from around the country for a workshop to measure the national impact of the opioid epidemic on children. Though much has been written about the steep costs of this scourge, much less has been written about how having an opioid-addicted parent affects the mental and physical health, educational and cognitive development, and family responsibilities of the children and adolescents living in those families. The report produced through the workshop, *The Ripple Effect: National and State Estimates of the U.S. Opioid Epidemic's Impact on Children*[23], makes for sobering reading. It estimates that, as of 2017, 2.2 million American children and adolescents either had a parent with opioid use disorder (OUP) or themselves suffered from it, and that OUP forces some 75,000 children into foster care each year. If current trends continue, the report estimates lifetime costs of OUP on children will amount to $400 billion in additional spending on health care, special education, child welfare programs, and criminal justice.

The Sloan Public Service Awards, funded by the Foundation since 1985 and administered by the Fund for the City of New York, honor the extraordinary contributions of six lifetime New York City civil servants. Among the 2019 honorees was Keith Kerman, who oversees the nearly 31,000 vehicles used by New York City municipal agencies and who successfully spearheaded an initiative to make it the nation's greenest fleet, with some 20,000 vehicles converted to electric or using

23 United Hospital Fund, "The Ripple Effect."

green fuels like biodiesel. Candy Rodriquez has been a school safety officer for 43 years on Manhattan's Upper West Side, whose dedication, vigilance, and hard-won relationships with students and parents has made her school one of the safest in the city. John Gallagher has been a pioneer for mental health services at Riker's Island, where he developed internal trainings that teach corrections officers how to de-escalate situations involving inmates with mental health issues and oversaw the creation of seven mental health units at Rikers to provide inmates with first-class mental health care. Renee Parham has run New York's Emergency Services Bureau for 35 years, where it is her team's responsibility to quickly and effectively respond to the 30,000 emergency housing repair crises reported in the City each year, including burst pipes, collapsed ceilings, and lack of heat in the cold winter months.

Conclusion

Alfred P. Sloan once wrote that the greatest thrill life offers is to create, to construct, to develop something useful. We agree. And some 80 years later, Mr. Sloan's Foundation continues to be driven by that very insight. But looking over all that our grantees have accomplished in 2019, we'd like to add that discovery provides thrills of its own. We are so grateful to our amazing grantees to be able to support their discoveries, and we look forward with anticipation, and even a bit of a thrill, at the prospect of what they will discover next.

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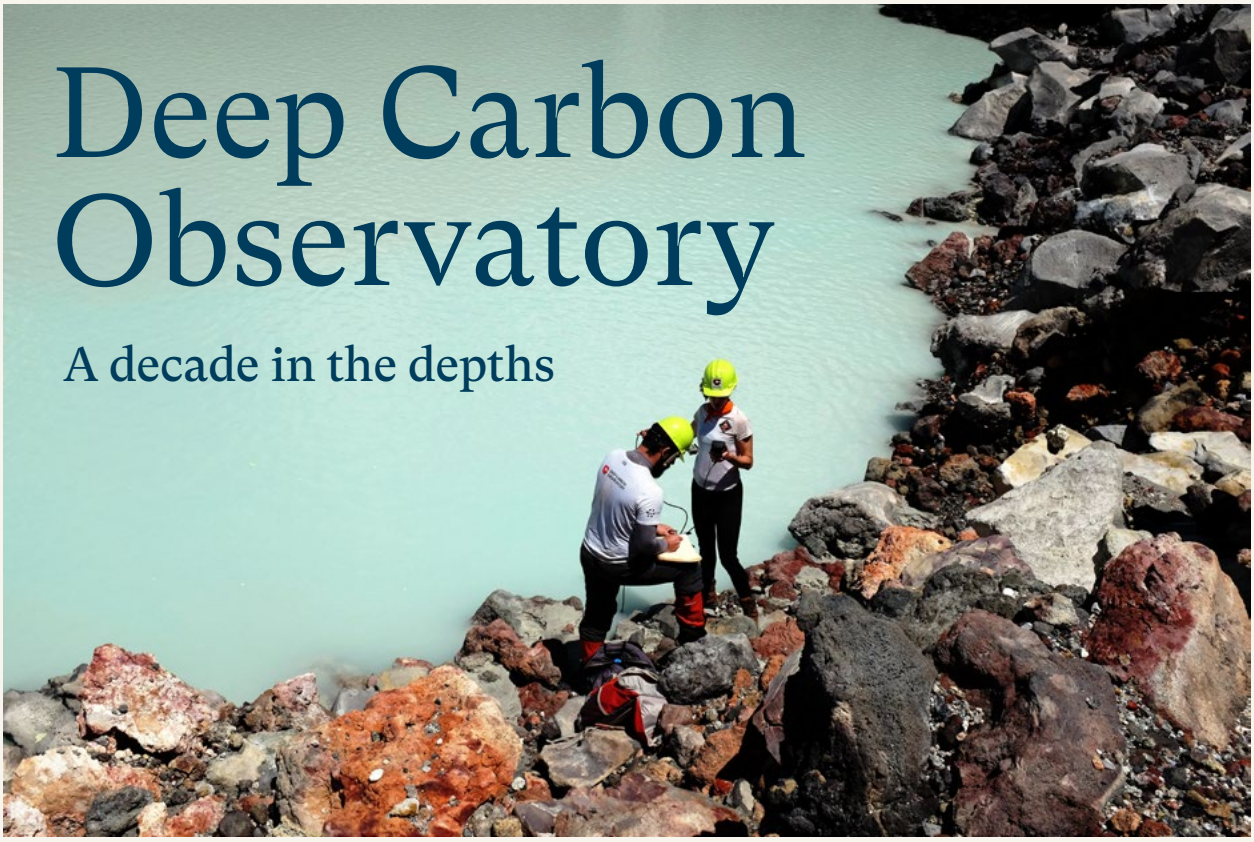
Deep Carbon Observatory

A decade in the depths

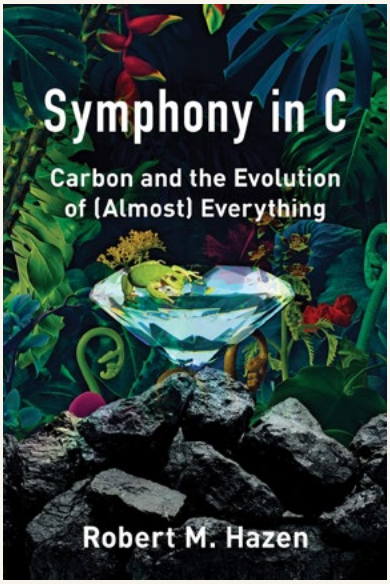


DCO investigations have expanded our understanding of the extreme conditions microbial life can adapt to, eking out a living in even the most hostile environments. Here, microbiologists Donato Giovannelli (Rutgers) and Karen Lloyd (University of Tennessee, Knoxville) collect samples of the hyperacidic waters in the crater lake of Poas volcano in Costa Rica. (PHOTO BY KATIE PRATT.)

"We've never drilled deeper than life."

That observation, made by Sloan program director Jesse Ausubel in 2008, was simple but provocative. Humans have been drilling into the earth since the drill was invented: for water, for minerals, for oil and gas. No matter how deep we drilled, we always found signs of life among the rocks. How deep does it go? Is it all just the remains of surface life that has been buried and pushed down to the depths? Or has life somehow found a way to eke out an existence alongside the intense temperatures and pressures of the deep earth? And if there is life living down there, what on earth (literally) is it living on? What else is down there?

The depth of the deep biosphere is not the only interesting puzzle about the deep Earth. Little was known about subsurface carbon generally, including how much of it there was; how it cycled to and from the surface; the role it played in the global climate cycle;



One of the most engaging conceptual innovations emerging from the DCO is the notion of "mineral evolution", the idea that the mineral diversity of the Earth is interrelated in complex ways with the evolution of the biosphere. The concept was developed by DCO Executive Director Robert Hazen, and expounded in his 2019 book, *Symphony in C: Carbon and the Evolution of (Almost) Everything*.

whether significant quantities of "fossil fuels" like oil and gas might be produced not by the compression of decaying biomass, but instead abiotically; and what happens to the chemical and physical properties of carbon in the extreme environment of the earth's interior.

At the Sloan Foundation, we are always looking for new frontiers, uncharted territory ripe for exploration and discovery. One new frontier, it turns out, is right beneath our feet. Exploring that new frontier was the primary goal of the Deep Carbon Observatory

Launched in 2009, the Deep Carbon Observatory (DCO) was a ten-year international research collaboration devoted to radically transforming our understanding of the quantities, movements, distribution and properties of deep Earth carbon and its role in the limits and origin of life, the creation of hydrocarbons, and the global carbon cycle. Researchers from all across the globe came together to explore the mysteries of carbon through probing the deep Earth. Led by a governing secretariat headquartered at the Carnegie Institution for Science, the DCO benchmarked the current state of deep carbon science, set a research agenda, funded hundreds of coordinated research projects, launched field campaigns, spearheaded the development of new instruments, and synthesized the findings to help uncover the secrets of the Earth's deep carbon.

A decade later, the results speak for themselves. More than 1200 researchers participated in the DCO, publishing over 1000 peer-reviewed articles, with more in the pipeline to be published in the months and years to come. We cannot hope to convey, even in summary, all the things they learned, but even a sampling of their discoveries is enough to astonish. They found never before discovered minerals, pockets of water left untouched for more than a billion years, and diamonds that had been formed 1000 km beneath the surface. far deeper than we had ever imagined. They discovered bizarre new life in the depths, including microbes with metabolisms so slow they take centuries to reproduce, and that life can survive in environments as hot as 122 degrees Celsius (251 degrees Fahrenheit). They learned that the global carbon cycle involves the entire earth and not just the near

Technological innovation was an essential element of the DCO research agenda. Here, researchers perform a test flight of a MultiGAS-equipped Matrix Quadcopter. The drone, which measures atmospheric carbon, was used by DCO scholars during a 4,000-kilometer voyage from Peru to Chile that aimed to help quantify and model volcanic carbon emissions. (PHOTO COURTESY OF THE DEEP CARBON OBSERVATORY)

The Four Scientific Directories

Research in the DCO was coordinated through four scientific directorates, each tasked with advancing our understanding of an important aspect of deep carbon science.

Deep Life

Devoted to characterizing the exotic microbial communities in the deep Earth, how they survive, and their relation to life on the surface

Extreme Physics and Chemistry

Devoted to exploring how the high temperatures and pressures deep in the earth alter the physical and chemical properties of carbon.

Reservoirs and Fluxes

Devoted to understanding where and how much carbon is in the earth, and how and why it moves between the mantle, crust, and surface.

Deep Energy

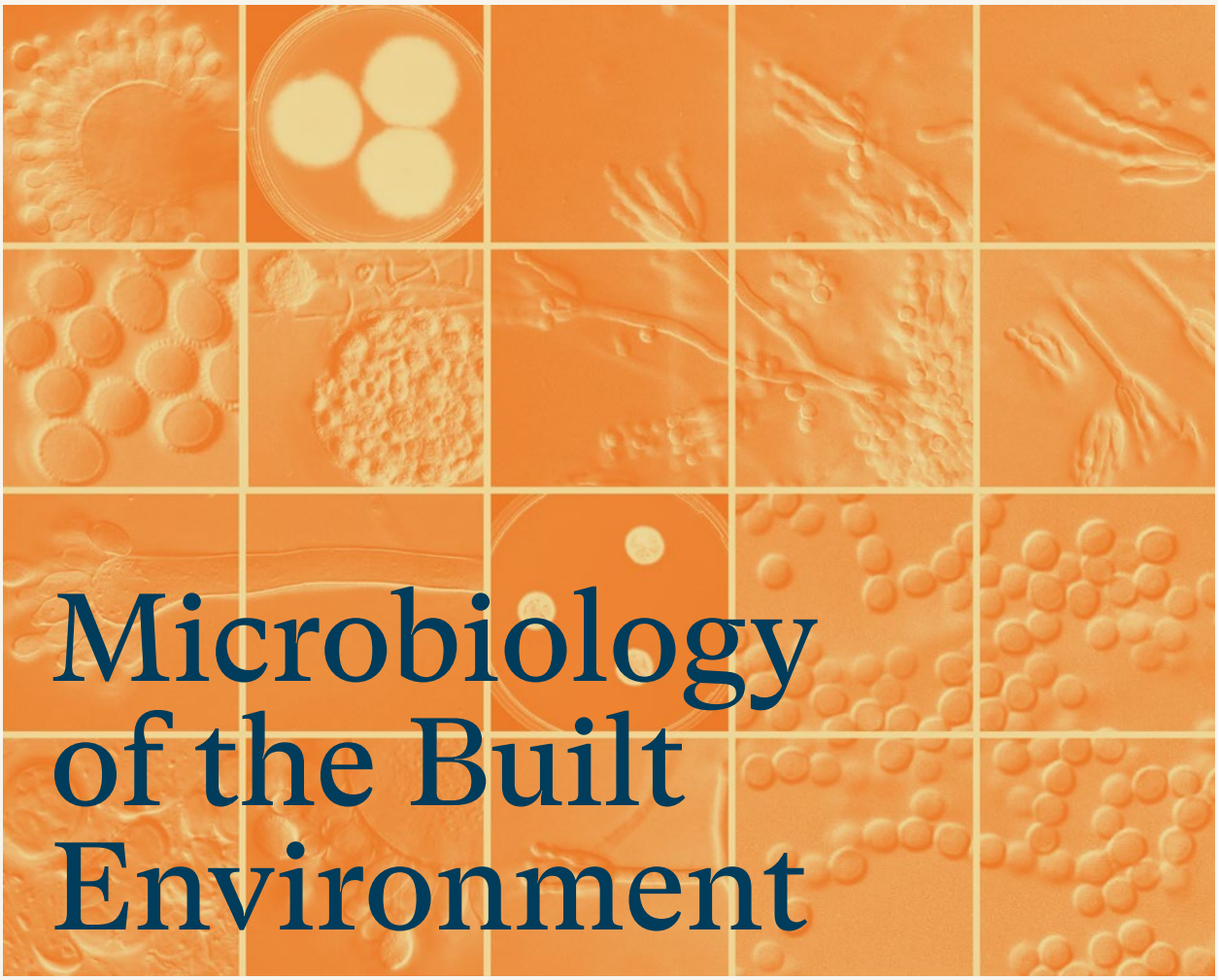
Devoted to examining the abundance, distribution, and origins of abiotic hydrocarbons and reactions between water and rock that produce energy.

Rhodochrosite, one of more than 500 carbon-bearing minerals documented by DCO researchers. The effort included an innovative experiment in citizen science, the "Carbon Mineral Challenge," a global hunt by professional and amateur geologists for theorized but as-yet-undiscovered carbon minerals that resulted in the discovery of 31 minerals totally new to science. (PHOTO BY JJ HARRISON HTTPS://WWW.JJHARRISON.COM.AU CC BY-SA 4.0)

subsurface, extending down into the mantle, and that carbon likely makes up part of the Earth's core. They studied deep sea rifts, boreholes, volcanoes. They put together the most precise scientific estimate of the contribution volcanic carbon outgassing contributes to climate change, showing it pales in comparison to the contributions made by human activity. They built new instruments: a tunable infrared laser absorption spectrometer and drones so hardy they can fly into the mouth of an active volcano. And they discovered that the solid earth actually "evolves" over time, its mineral diversity expanding in an eons-long symbiotic dance with the biosphere.

Not only a groundbreaking exercise in scientific discovery, the Deep Carbon Observatory was also an ambitious experiment in scientific collaboration. Organizing and synthesizing the work of 1200 scientists working across 55 nations is no mean task. Aided by dedicated teams devoted to data science and internal and external communications, the DCO governing secretariat raised funds, coordinated international field campaigns, hosted conferences and workshops, promulgated and enforced data collection and archiving standards, tracked findings and other outputs, and bound together a diverse community of researchers in pursuit of a common goal. We are especially proud of the attention paid to attracting and training the next generation of deep carbon scientists. From its very beginnings, the DCO implemented plans to draw in young researchers, train them in cutting edge geoscience, and give them opportunities to participate meaningfully in the DCO's research agenda.

The Alfred P. Sloan Foundation is extremely proud of the role it has played in the creation and support of the Deep Carbon Observatory, but that pride is dwarfed by the gratitude we feel when we contemplate the contributions made by the hundreds of dedicated, hardworking scientists, technologists, and researchers who made the DCO a success. It has been an honor to support their efforts. We look forward with anticipation to the insights and discoveries the next decade will bring. The Foundation's ten-year commitment to the DCO may be complete, but deep carbon research is very much only beginning. We've still never drilled deeper than life.



Microbiology of the Built Environment

One of the most exciting aspects of starting a new field in biology is the opportunity to discover entirely new forms of life. Pictured here are *Penicillium alfredi* and *Aspergillus sloanii,* two new forms of microbial life discovered in dust taken from an English home. The new microbes were named in recognition of the Alfred P. Sloan Foundation's early support for research in indoor microbial ecology. (PHOTOGRAPH BY K. SEIFERT

The Sloan Foundation's Microbiology of the Built Environment (MoBE) program was a fifteen-year, $50 million-dollar effort to found a new field of scientific inquiry, one devoted to exploring the complex microbial ecology of built and indoor spaces. Launching a new field of scientific inquiry is an arduous journey even when the winds are blowing in your favor, but in this case, back in 2004, the route to creating indoor microbial ecology looked to be filled with rough weather. For one, ecologists tend to be outdoorsy types with a taste for woods and wilds. Shopping malls, schools, and office parks lack the romantic allure of the bog, the river, the tundra. For another, any good science of the indoor environment would have to be thoroughly interdisciplinary. Microbiologists couldn't do it on their own. They'd need architects, engineers, experts in plumbing, ventilation and building construction to help them understand the spaces they would be studying. These experts, however, had almost no connection with microbiologists. They went to different schools, attended different conferences, published in different journals, walked in different professional circles.

Yet the need was great, a fact underscored in 2001 by a series of terrorist attacks involving the sending of powdered anthrax through the mail. The attacks focused national attention on the possibility of using chemical and biological agents as weapons of terror and the consequent need to be able to detect both when buildings had been attacked and when the air inside them had returned to normal. And yet, there was no scientific body of knowledge about what a "normal"

indoor environment looked like. While humans spend an inordinate amount of time indoors—up to 90% of our lives by one estimate—when it came to understanding the microbial ecology of those environments, we didn't know the first thing.

And so, in 2004, under the leadership of program director Paula J. Olsiewski, the Sloan Foundation began its support of researchers studying the microbiology of built environments. The questions they raised were easy to ask, but difficult to study. What microbial populations are living inside our homes and schools and other structures? How stable or mutable are these populations? How similar are microbial communities to one another? How do they differ within a building or between buildings and what explains whatever differences we find? What role do the attributes of the structure play in shaping microbial communities? And what role do human occupants play in shaping the indoor microbiome?

In the fifteen years that followed, a diverse, multidisciplinary community of microbiologists, technologists, architects, HVAC experts, materials scientists and others came together to pursue a common goal. Their investigations led them to study habitats all over the world, from the United States to the Cherokee Nation, Amish country, and equatorial South America. Their research reached into homes and hospitals, subways and schools, aquaria and wineries, and even the International Space Station. This work, published across of hundreds of papers, workshops, and conferences, has revealed a dynamic, complex, fascinating world of invisible microbes living among us. We can provide only the briefest sketch of what they have discovered.

In 2004, indoor microbes were most commonly thought of as agents of sickness, germs to be done away with as efficiently and completely as possible. Studies of the indoors found that indeed there are pathogens in our homes, particularly in the water supply. Analyzing biofilms in bathroom showerheads and in our drinking water, researchers discovered *Legionella* and *Mycobacterium*. It was also found increased levels of Legionella in private wells in the aftermath of floods and that certain green buildings, in the well-meaning attempt to conserve water, were allowing water to stagnate, giving *Legionella* the opportunity to bloom.

Over the past 15 years, however, our attitudes towards microbes have changed significantly. Not all germs are created equal—there are good germs and there are bad germs—and you can now find "probiotics" in the health supplement aisle of every pharmacy. That change was driven in no small part by findings coming from the study of the indoor microbiome. One study looked into the curious fact that Amish children develop asthma at much lower rates than Hutterite children, despite similarities in their heritage, lifestyle, and diet. What they found was that the indoor microbial worlds of these populations are different, because the Amish live in much closer contact with animals than the Hutterites do. The study provided powerful evidence that the microbes we come into contact with can have powerful prophylactic effects and has spawned an entire subbranch of asthma studies.

Another astonishing series of findings have revealed the human microbiome to be aggressively imperialistic, colonizing the spaces around it. The microbiomes of indoor spaces quickly become dominated by microbes shed from the skin their human occupants, an effect so pronounced that one study found that each human being has his own microbial signature, as distinct as a fingerprint, that imprints itself on any rooms he or she occupies. Our personal microbes colonize not only the spaces we live in, they also colonize each other. A study of a college doromitory found that room-

The University of Oregon's Biology and the Built Environment (BioBE) Center, founded by Dr. Jessica Green, was the nation's first research center focused on indoor microbial ecology and provides an essential hub for researchers to convene, share ideas and methods, and discuss common challenges. Here, Dr. Green speaks at the 2017 National Academies symposium on future research and applications of the study of the microbiology of built environments. (PHOTO BY LYNN SCHRIML)

Microbiologist Maria Dominguez-Bello takes measurements inside a structure in Puerto Almendra, Peru as part of a study of how the indoor microbiome differs across cultures. Her study found that as you move from more ancient to more modern structures, the indoor microbiome becomes increasingly less dominated by outdoor microbes and increasingly dominated by microbes from human occupants. (PHOTO BY HUMBERTO CAVALLIN.)

mates' microbiomes began to resemble each over time. Another found that the same happens with our pets.

Finally, researchers found that the built environment evolves in complicated patterns driven by the the complex interactions of light, humidity, surface composition, ventilation, and temperature of the structures they inhabit. We are just now beginning to be able to model and understand this interplay, but preliminary results have profound implications for building design, green architecture, hospital care, and many other areas of built environment construction.

These discoveries were enabled, in part, by significant advances made by researchers in the tools and techniques used to study the built environment, including researcher-driven breakthroughs in air sampling, computational analysis, microbial gene sequencing, and the visualization of microbial population characteristics. These breakthroughs have pushed forward the possibilities for discovery when studying the built environment and will continue to push the research frontier for years to come.

As the Foundation completed its funding in indoor microbial ecology, the National Academy of Sciences published a consensus report, *Microbiomes of the built Environment: A Research Agenda for Indoor Microbiology, Human Health, and Buildings*. A NAS report like this is a watershed moment in the development of any new field, a formal recognition of the untapped potential of an area of scientific inquiry and a call to the scientific community to come together to address the pressing questions early research has successfully raised.

We can only thank our grantees in aggregate here, but, to be sure, thanks are due. The creation of a new field of inquiry is a risky bet. New tools may not work, interdisciplinary collaborations may founder, journals may not publish results. But the gains to be made are substantial, and the researchers who risk the gamble may rightly think of themselves as the founders of a new field of human inquiry. To them goes the honor of being the first to walk into unexplored territory and cast light into the unknown. To our grantees, thank you for taking that risk with us.

About the Grants Listing

Grants listed in this report are divided into two types.

Trustee Grants are grants for amounts greater than $250,000. All trustee grants are reviewed by an independent panel of experts and are presented quarterly to the Board of Trustees for approval.

Officer Grants are grants for amounts less than or equal to $250,000. Depending on the amount or subject matter of the grant, officer grants may or may not have been subject to external review by an independent panel of experts. Officer grants made by the Foundation are reported to the Board of Trustees quarterly.

Grants are listed by program, then by grant type, then alphabetically by the name of the institution receiving the grant. Not all programs make grants of each type each year.

2019 Grants by Program

Sloan Research Fellowships

PROGRAM DIRECTOR: DANIEL L. GOROFF

Established in 1955 by Alfred P. Sloan Jr., these $70,000 awards accelerate scientific breakthroughs by providing support and recognition to outstanding early-career faculty based on their research accomplishments and promise in eight fields: chemistry, computer science, computational and evolutionary molecular biology, economics, mathematics, neuroscience, ocean sciences, and physics. An independent panel of senior scholars in each field selects fellowship winners. Since the beginnings of the program, some $456 million (2019$) has been awarded to more than 5,700 fellows, many of whom have gone on to highly esteemed careers: 50 Sloan Research Fellows have become Nobel Laureates; 17 have received the Fields Medal in mathematics; 19 Fellows have won the John Bates Clark Medal in economics; and 69 have been awarded the National Medal of Science. Hundreds of others have received notable prizes, awards, and honors in recognition of their major research achievements.

University of Alberta
Stephanie Green, *OCEAN SCIENCES*

Boston College
Masayuki Wasa, *CHEMISTRY*

Boston University
Emily Whiting, *COMPUTER SCIENCE*

Brandeis University
Marcelle Soares-Santos, *PHYSICS*

Brown University
Lorin Crawford, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*
Kathryn Mann, *MATHEMATICS*
Brenda M. Rubenstein, *CHEMISTRY*
Amitai Shenhav, *NEUROSCIENCE*

California Institute of Technology
Philip Isett, *MATHEMATICS*

University of California, Berkeley
Courtney Dressing, *PHYSICS*
Shirshendu Ganguly, *MATHEMATICS*
Moritz Hardt, *COMPUTER SCIENCE*
Sergey Levine, *COMPUTER SCIENCE*
Priya Moorjani, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*
Philipp Strack, *ECONOMICS*
Gabriel Zucman, *ECONOMICS*

University of California, Davis
Rachael Bay, *OCEAN SCIENCES*
Eduardo da Silva Neto, *PHYSICS*
Patrick Shih, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*
Inna Vishik, *PHYSICS*

University of California, Los Angeles
Denis Chetverikov, *ECONOMICS*
Yongjie Hu, *CHEMISTRY*

University of California, Riverside
Wei Liu, *OCEAN SCIENCES*

University of California, San Diego
Tianyi Zheng, *MATHEMATICS*

University of California, San Francisco
Saul Kato, *NEUROSCIENCE*

University of California, Santa Barbara
Thomas Sprague, *NEUROSCIENCE*
Xin Zhou, *MATHEMATICS*

Carnegie Mellon University
Florian Frick, *MATHEMATICS*
Bernhard Haeupler, *COMPUTER SCIENCE*

Carnegie Mellon University
Hosein Mohimani, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*

University of Central Florida
Xiaofeng Feng, *CHEMISTRY*

The University of Chicago
John Anderson, *CHEMISTRY*
Clara Blättler, *OCEAN SCIENCES*
Mengjie Chen, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*
Matthew Kaufman, *NEUROSCIENCE*

Cold Spring Harbor Laboratory
David McCandlish, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*

University of Colorado, Boulder
Edward Chuong, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*
Sandeep Sharma, *CHEMISTRY*

Columbia University
Andres Bendesky, *NEUROSCIENCE*
Melissa Ness, *PHYSICS*
Lorenzo Sironi, *PHYSICS*

University of Connecticut
Katherine Whitaker, *PHYSICS*

Cornell University
Jeremy Baskin, *CHEMISTRY*
Song Lin, *CHEMISTRY*
Brad Ramshaw, *PHYSICS*

Duke University
Xiuyuan Cheng, *MATHEMATICS*
Rong Ge, *COMPUTER SCIENCE*

Emory University
Chethan Pandarinath, *NEUROSCIENCE*

Georgia Institute of Technology
Eva Dyer, *NEUROSCIENCE*
Matthew McDowell, *CHEMISTRY*
Konstantin Tikhomirov, *MATHEMATICS*

University of Georgia
Elizabeth Harvey, *OCEAN SCIENCES*
Rachel Roberts-Galbraith, *NEUROSCIENCE*

Harvard Medical School
Po-Ru Loh, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*

Harvard University
Nicholas Bellono, *NEUROSCIENCE*
Christina Woo, *CHEMISTRY*

University of Hawaii
Daniel Huber, *PHYSICS*

Icahn School of Medicine at Mount Sinai
Kanaka Rajan, *NEUROSCIENCE*
Daniel Wacker, *NEUROSCIENCE*

University of Illinois, Urbana-Champaign
Haitham Hassanieh, *COMPUTER SCIENCE*
Diwakar Shukla, *CHEMISTRY*

Johns Hopkins University
Muyinatu Bell, *PHYSICS*

Astrophysicist Jim Peebles was awarded the Nobel Prize in 2019 for a lifetime of important contributions to cosmology. As a young scientist, Dr. Peebles received a Sloan Research Fellowship in physics (Class of 1968) PHOTO COURTESY OF FLICKR USER JUAN DIEGO SOLER, CC BY 2.0

University of Maryland, College Park
Zohreh Davoudi, *PHYSICS*

Massachusetts Institute of Technology
Nikhil Agarwal, *ECONOMICS*
Daniel Harlow, *PHYSICS*
Andrew Lawrie, *MATHEMATICS*
Yufei Zhao, *MATHEMATICS*

University of Massachusetts, Amherst
Barna Saha, *MATHEMATICS*
Romain Vasseur, *PHYSICS*
Mingxu You, *CHEMISTRY*

McGill University
Yang Cai, *COMPUTER SCIENCE*
Arjun Krishnaswamy, *NEUROSCIENCE*

Michigan State University
Kristen Hendricks, *MATHEMATICS*

University of Michigan
Reetuparna Das, *COMPUTER SCIENCE*
Alison Narayan, *CHEMISTRY*
Alexandra Rosati, *NEUROSCIENCE*

North Carolina State University
Veronica Augustyn, *CHEMISTRY*

Northeastern University
Christopher Wilson, *COMPUTER SCIENCE*

Northwestern University
Bao Le Hung, *MATHEMATICS*
Raffaella Margutti, *PHYSICS*
Jonathan Rivnay, *CHEMISTRY*

Ohio State University
David Nagib, *CHEMISTRY*

The Pennsylvania State University
John Lesieutre, *MATHEMATICS*

University of Pennsylvania
Jessica Anna, *CHEMISTRY*
Davi Maximo, *MATHEMATICS*
Aaswath Raman, *PHYSICS*

Princeton University
Will Dobbie, *ECONOMICS*
Annegret Falkner, *NEUROSCIENCE*
Ralph Kleiner, *CHEMISTRY*
Gillat Kol, *COMPUTER SCIENCE*
Michal Kolesár, *ECONOMICS*
Francesco Lin, *MATHEMATICS*
Wyatt Lloyd, *COMPUTER SCIENCE*
Ricardo Mallarino, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*
Laure Resplandy, *OCEAN SCIENCES*
Jeff Thompson, *PHYSICS*

Rice University
Mark Torres, *OCEAN SCIENCES*
Ming Yi, *PHYSICS*

University of Rochester
Nancy Chen, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*
Ellen Matson, *CHEMISTRY*

Scripps Research Institute
Keary Engle, *CHEMISTRY*

University of Southern California
Carly Kenkel, *OCEAN SCIENCES*
Jason Lee, *COMPUTER SCIENCE*
Smaranda Marinescu, *CHEMISTRY*
Mahdi Soltanolkotabi, *MATHEMATICS*

Stanford University
Rebecca Diamond, *ECONOMICS*
Ben Feldman, *PHYSICS*
Keren Haroush, *NEUROSCIENCE*
Melanie Morten, *ECONOMICS*
Keith Winstein, *COMPUTER SCIENCE*
Mary Wootters, *COMPUTER SCIENCE*
Yan Xia, *CHEMISTRY*

Texas A&M University
Junehyuk Jung, *MATHEMATICS*

University of Toronto
Aaron Reinke, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*

Vanderbilt University
Marta Verweij, *PHYSICS*

University of Virginia
Kent Yagi, *PHYSICS*

Washington University in St. Louis
Jason Yi, *NEUROSCIENCE*

University of Washington
Alvin Cheung, *COMPUTER SCIENCE*
Kelley Harris, *COMPUTATIONAL & EVOLUTIONARY MOLECULAR BIOLOGY*
Shayan Oveis Gharan, *COMPUTER SCIENCE*

University of Waterloo
Christine Muschik, *PHYSICS*

University of Wisconsin, Madison
Mihaela Ifrim, *MATHEMATICS*
Botong Wang, *MATHEMATICS*

Yale University
Meng Cheng, *PHYSICS*
Nir Navon, *PHYSICS*
Hailiang Wang, *CHEMISTRY*

Research

Chemistry of Indoor Environments

PROGRAM DIRECTOR: PAULA J. OLSIEWSKI

The Chemistry of Indoor Environments program aims to grow a new field of scientific inquiry focused on understanding the fundamental chemistry taking place in indoor environments and how that chemistry is shaped by building attributes and human occupancy.

Grants in this program aim to:

- **Generate new knowledge** by directly supporting original, high-quality research to identify indoor chemical sources, characterize the chemical and physical transformations taking place indoors, and determine how indoor chemistry is shaped by building attributes and occupancy;
- **Develop a modeling consortium** to improve the cohesiveness of the community and its ability to integrate findings;
- **Build a thriving, multidisciplinary research community** of chemists; environmental, civil, and mechanical engineers; architects; atmospheric scientists; microbiologists; and environmental health experts that will endure beyond the program's timeline;
- **Train the next generation of scholars** and introduce new voices into the field through educating and engaging graduate and postgraduate researchers;
- **Advance capacity for discovery** through development of new tools for data collection, sampling, analysis, and visualization.
- **Attract dedicated funding from federal agencies** by demonstrating the existence of important gaps in our scientific knowledge and the potential for federal intervention to fill them.

Trustee Grants

California Institute of Technology

PASADENA, CALIFORNIA

$499,424 over 36 months to examine the role of autoxidation in indoor environments.

PROJECT DIRECTOR: **Paul O. Wennberg**

This grant supports a collaboration between Paul Wennberg, R. Stanton Avery Professor of Atmospheric Chemistry and Environmental Science and Engineering, California Institute of Technology, and Henrik Kjaergaard, Professor of Chemistry at the University of Copenhagen, to examine the role of autoxidation (a series of unimolecular processes that rapidly yield oxidized compounds) in indoor environments. Kjaergaard will use computational chemistry methods to diagnose the autoxidation pathways and estimate the rate coefficients for the organic peroxy radical chemistry initiated by the reactions of ozone and the hydroxyl radical with chemicals typically found indoors, especially a suite of terpenes. Complementing this approach, Wennberg will study terpene chemistry in the laboratory to evaluate the computational work and provide guidance for how to extend the calculations to more organic substrates.

The pair will publish a suite of mechanistic schemes that describe the chemistry in peer-reviewed manuscripts, present their findings at conferences and meetings, and integrate their work into existing indoor chemical models.

University of California, Berkeley

BERKELEY, CALIFORNIA

$900,000 over 36 months to provide renewed support to examine the processes controlling abundance, sources and fates of organic chemicals indoors.

PROJECT DIRECTOR: **Allen H. Goldstein**

This grant supports research by atmospheric chemist Allen Goldstein and environmental engineer William Nazaroff to examine the processes controlling abundance, sources, and fates of organic chemicals indoors. The work will focus on the roles of human occupants, emissions from the building and its contents, and the intrusion of outdoor pollutants as agents influencing indoor air chemistry.

In a series of experiments, Goldstein and Nazaroff will characterize organic compound composition of the air in residential spaces, cataloging the relative abundance of volatile (VOC), intermediate volatile (IVOC), and semi-volatile (SVOC) organic compounds in both the gas and particle phases, and to compare this composition with outdoor air. They will then analyze how organic compound composition changes across various dimensions: by time, by location inside the residence, and by human occupancy. Their methods will enable them to apportion indoor air organics into major source categories: building fabric and contents, occupants and activities, and outdoor air, with the ultimate objective of understanding the role of emissions influencing indoor air chemistry.

This work will advance the state of knowledge regarding the contributions of humans, human activities, surface interactions, and oxidation processes influencing indoor air composition in residences. This new knowledge will be shared through peer-reviewed publications and presentations at conferences and meetings. At least three students will be trained.

University of California, Irvine

IRVINE, CALIFORNIA

$789,771 over 18 months to provide renewed support to the indoor chemistry modeling consortium.

PROJECT DIRECTOR: **Manabu Shiraiwa**

The Modeling Consortium for the Chemistry of Indoor Environments (MOCCIE) is a multi-institutional collaboration devoted to developing comprehensive, integrated, physical-chemical models that simulate how occupants, indoor activities, and buildings influence indoor chemical processes. Founded with Sloan support in 2017, and overseen by Manabu Shiraiwa, Associate Professor of Chemistry at the University of California, Irvine, and Nicola Carslaw, Reader, University of York, MOCCIE links and modifies existing chemical models across a diverse range of physical scales and timeframes. The consortium also partners with experimental chemists working on the indoor environment in mutually beneficial ways. Experimental data can be used to test MOCCIE simulations, resulting in better predictions. These improved predictions, in turn, can then be used by experimentalists to generate hypotheses for further testing.

Funds from this grant provide 18 months of continued support for MOCCIE. Over that time, MOCCIE will assess gaps in the fundamental understanding of indoor chemistry processes, guide experimental measurements through identification of parameters responsible for model uncertainties, indicate key species with predicted concentrations, improve design of experimental/fieldwork studies, and aid in interpretation of data from laboratory and field experiments.

University of Colorado, Boulder

BOULDER, COLORADO

$590,000 over 36 months to investigate the sources and processes that influence the composition of organic chemicals in indoor environments through laboratory, field, and modeling studies.

PROJECT DIRECTOR: **Paul J. Ziemann**

This grant funds work by Paul Ziemann, professor of chemistry at the University of Colorado, to investigate the sources and processes that influence the composition of organic chemicals in indoor environments and to improve predictions of the chemistry of indoor air.

Ziemann and his team will conduct field studies in several locations on and around the University of Colorado campus. Study sites have been chosen to reflect the diversity of indoor environments: a carpeted meeting room in the Sustainability, Energy, and Environment Community building; the Chapel Theatre in Old Main, which is the oldest building on campus and which contains extensive wooden paneling; and the swimming pool at the university's recreation center. State-of-the-art instruments and methods will be used to measure organic chemicals and other reactive species at each site. Measurements will include gas (volatile organic compounds and other trace gases), aerosols, surface composition (functional groups and single compounds), and air exchange. Laboratory studies will be conducted to investigate the fundamental interactions of organic chemicals with surfaces composed of common indoor materials, including bare plastics, bare wood, varnished wood, and carpet polymers.

Results of the field and laboratory studies will be used to develop models to describe and quantify indoor chemical emissions, deposition, and reactions; and to determine the effects of chemical and physical variables such as organic gases, oxidants, surfaces, humidity, acids, light and temperature, and human occupancy on the composition of indoor air.

University of Colorado, Boulder

BOULDER, COLORADO

$375,000 over 12 months to continue the development of community building and data infrastructure for the Chemistry of the Indoor Environments (CIE) program.

PROJECT DIRECTOR: **Marina Eller Vance**

Funds from this grant support an ongoing project led by Marina Vance, assistant professor of mechanical and environmental engineering at the University of Colorado, Boulder, and Delphine Farmer, associate professor of chemistry at Colorado State University, to build community and data infrastructure for researchers working in indoor chemistry. Over the course of the grant period, Vance and Farmer will develop a data sharing infrastructure for indoor chemistry studies, merge and synthesize data collected from the HOMEChem field experiment with additional chemical datasets, further analyze that data, plan and host a scientific meeting for researchers in the Chemistry of Indoor Environment program, and continue outreach and community building among indoor chemistry researchers through the IndoorChem website and social media properties.

Drexel University

PHILADELPHIA, PENNSYLVANIA

$468,436 over 36 months to examine the chemical and physical transformations occurring within a heating, ventilation, and air conditioning (HVAC) system.

PROJECT DIRECTOR: **Michael J. Waring**

This grant funds research by Michael S. Waring, Associate Professor of Architectural and Environmental Engineering and Peter DeCarlo, Associate Professor of Environmental Engineering and Chemistry at Drexel University, that will examine the chemical and physical transformations occurring within a heating, ventilation, and air conditioning (HVAC) system. Waring and DeCarlo's work will focus on aerosol and gas-phase transformations, exploring how aerosol processing, composition, and component-based filtration are influenced by extreme and abrupt changes in temperature, relative humidity, and aerosol concentration as air is thermally conditioned and filtered.

Utilizing a controllable HVAC system in a Drexel office building, Waring and DeCarlo will make seasonal measurements of the chemical composition of aerosols and trace gases at four locations in the HVAC system—outdoor, mixed, supply, and return air—to isolate the impact of HVAC system aerosol and gas composition. Aerosol composition will be measured using a high-resolution aerosol mass spectrometer with other instruments capturing trace concentrations of CO, CO2, H2O, O3, NO, NO2.

Grant funds also support Waring and DeCarlo's continued analysis of data collected during 2018's Sloan-funded HOMEChem field project.

The Indoor Chemical Human Emissions and Reactivity (ICHEAR) project aims to characterize the chemical impact of human beings on indoor spaces. Here, subjects engage in normal activity (i.e. messing around on their phones) while their respiration is piped into an adjoining chamber. The experimental setup allows researchers to differentiate the chemical contributions of respiration from those contributed by emissions from the skin, hair, and clothing. (PHOTO COURTESY OF THE TECHNICAL UNIVERSITY OF DENMARK. PHOTOGRAPHY BY MIKAL SCHLOSSER/ MEDIAK WWW.MEDIAK.DK)

Northwestern University

EVANSTON, ILLINOIS

$375,000 over 36 months to investigate the fundamental chemistry of indoor surfaces using advanced spectroscopy.

PROJECT DIRECTOR: **Franz M. Geiger**

This grant funds research by surface chemist Franz Geiger, Dow Professor of Chemistry at Northwestern University, that will investigate the fundamental chemistry of indoor surfaces. Using advanced spectroscopy, Geiger plans to expand our understanding of how indoor volatile and semivolatile organic compounds absorb from air to surfaces; how submonolayer amounts of these absorbed organic compounds convert into indoor molecular, nano-, and microlayers; the propensity of these newly formed layers to interact with oxidants; and how the dynamic response of molecular, nano-, and microlayers to gas-phase species vary with changes in relative humidity. The approach includes both mechanistic studies of idealized model surfaces as well as work on surfaces of samples derived from real-world indoor environments.

Results will be shared through peer-reviewed publications and presentations at conferences and meetings.

University of Toronto

TORONTO, CANADA

$900,000 over 57 months to provide renewed support to study multiphase chemistry in indoor environments.

PROJECT DIRECTOR: **Jonathan Abbatt**

This grant funds research by University of Toronto chemist Jonathan Abbatt, who is trying to forge better kinetic and mechanistic understandings of multiphase chemistry occurring indoors. Abbatt's work focuses on the oxidation kinetics in both the condensed-phase and volatile products and the effects of oxidation on the gas-aerosol-surface partitioning of semivolatile species. Grant funds will allow Abbatt to use state-of-the-art mass spectrometric techniques in the laboratory to address the multiphase chemistry of a range of indoor surface materials. Abbatt will document what gas-phase and condensed-phase products arise from ozonolysis of the components of skin and cooking oils, characterize the oxidation kinetics and mechanisms of indoor combustion materials, such as cigarette and cannabis smoke, determine the fate of HOCl, an important oxidant released by bleach washing, and investigate how surface oxidation affects the partitioning of surface-sorbed species.

Abbatt and his team will generate important new insights into indoor chemistry. This new knowledge will be shared through peer-reviewed publications and presentations at conferences and meetings. At least two postdoctoral researchers and three students will be trained.

Officer Grants

American Association for the Advancement of Science

WASHINGTON, DISTRICT OF COLUMBIA

$85,296 over 8 months to support a one-day symposium on the Chemistry of Indoor Environments.

PROJECT DIRECTOR: **Annette L. Olson**

University of California, San Diego

LA JOLLA, CALIFORNIA

$198,325 over 36 months to coordinate efforts to integrate surface chemistry data by establishing the SURFace Consortium for Chemistry of Indoor Environments (SURF-CIE).

PROJECT DIRECTOR: **Vicki H. Grassian**

College of William and Mary

WILLIAMSBURG, VIRGINIA

$29,220 over 12 months to disseminate key results from the Chemistry of Indoor Environments and Microbiology of the Built Environment programs at the 2019 American Association for Aerosol Research (AAAR) meeting.

PROJECT DIRECTOR: **Rachel O'Brien**

Fractured Atlas

NEW YORK, NEW YORK

$50,000 over 14 months to incorporate scientific findings from HOMEChem into the TV show "Home Diagnosis".

PROJECT DIRECTOR: **Theresa Hubbard**

National Academy of Sciences

WASHINGTON, DISTRICT OF COLUMBIA

$25,000 over 6 months to support a planning meeting for a consensus study on the environmental health implications of emerging indoor chemistry research.

PROJECT DIRECTOR: **Marilee Shelton-Davenport**

University of North Carolina, Chapel Hill

CHAPEL HILL, NORTH CAROLINA

$25,000 over 12 months to disseminate key results from the Chemistry of Indoor Environments program at the 6th Indoor and Workplace Aerosols Conference.

PROJECT DIRECTOR: **Glenn Morrison**

Northwestern University

EVANSTON, ILLINOIS

$41,150 over 19 months to disseminate key results from the Chemistry of Indoor Environments program and the Microbiology of the Built Environment program.

PROJECT DIRECTOR: **Erica L. Hartmann**

University of Notre Dame

NOTRE DAME, INDIANA

$50,000 over 12 months to measure the levels of poly-fluoroalkyl substances (PFAS) in indoor facilities and examine their rates of transformation under conditions commonly found in indoor facilities.

PROJECT DIRECTOR: **Kyle Doudrick**

The Pennsylvania State University

UNIVERSITY PARK, PENNSYLVANIA

$100,000 over 11 months to disseminate key results from the Chemistry of Indoor Environments program at Indoor Air 2020.

PROJECT DIRECTOR: **Donghyun Rim**

Economic Institutions, Behavior, and Performance

PROGRAM DIRECTOR: DANIEL L. GOROFF

The Foundation's program on Economic Institutions, Behavior, and Performance supports rigorous and unbiased research projects on U.S. economic structure, behavior, and performance whose findings inform and strengthen decision-making by regulators, policymakers, and the public.

Grants made through this program span three broad subject areas:

- **Behavioral Economics Theory and Applications**
  Projects in this area study households and individuals, specifically the role of "choice architecture" on their economic decision-making as well as the mechanisms underlying seemingly irrational behavior. Research topics include behavioral macroeconomics; salience and attention; risk-taking and insurance markets; time inconsistencies and the annuity paradox; cognitive biases; behavioral applications to policy; experimental testing of nudges or other regulatory interventions and the measurement of their effects on welfare; obfuscated markets; consumer finance.
- **Economic Analysis of Science and Technology**
  Projects in this sub-program study universities and groundbreaking industries, specifically regarding human capital development and applications of information technology. Research topics include: the productivity of the scientific enterprise; labor markets for scientists and engineers; patterns of scientific publication, collaboration, and intellectual property protection; markets for scientific equipment and instrumentation; the economics of digitization; new developments in U.S. productivity dynamics and measurement; the economics, statistics, and socioeconomics of artificial intelligence, robots, and other autonomous technology; and the social returns on investments in research and development.

- **Empirical Economic Research Enablers**
  Projects in this sub-program study economic researchers, specifically with regard to their needs, opportunities, incentives, and professional practices. Research topics include: causal inference; external validity; persistent identifiers; identification and tracking systems for scholars; federal statistics; smart disclosure platforms for obfuscated markets; data and metadata management protocols; the mathematics of privacy; access to social science datasets containing sensitive information; the replicability and generalizability of empirical research; the economics of knowledge contribution and distribution, and the challenges and opportunities associated with "administrative data" not originally collected for research purposes.

Trustee Grants

Brookings Institution

WASHINGTON, DISTRICT OF COLUMBIA

$650,000 over 36 months to continue supporting the production and dissemination of high-quality, influential, and policy-oriented economics research through the Brookings Papers on Economic Activity.

PROJECT DIRECTOR: **Janice C. Eberly**

The Brookings Papers on Economic Activity (BPEA) synthesize and popularize the policy implications of cutting-edge research in economics. Founded almost 50 years ago, BPEA remains a highly respected and influential outlet for economic ideas, as BPEA articles are consistently reliable, readable, and nonpartisan. They are often cited both in the popular media and in official policy documents produced by Congress, the executive branch, and other institutions like the Federal Reserve, the World Bank, and the International Monetary Fund.

Funds from this grant provide operational and administrative support for the continued production of the Brookings Papers on Economic Activity for a period of three years. Some of the topics that BPEA will focus on during this period include productivity and the economics of technological innovation, household decision-making, and data improvement.

University of California, Berkeley

BERKELEY, CALIFORNIA

$405,322 over 36 months to build, test, and study online platforms for collecting and cataloguing expert forecasts about the results of social science experiments.

PROJECT DIRECTOR: **Stefano DellaVigna**

What constitutes progress in empirical social science research? It is easy to talk about "new knowledge," but hard to measure it. To evaluate what constitutes new knowledge requires measuring not only what scholars think of an experiment after it is performed, but also what they forecast about the results in advance.

This grant supports an initiative by a team led by Stefano DellaVigna at the University of California, Berkeley to build, test, and study an online platform for collecting and cataloguing forecasts and prior beliefs about the results of social science experiments. DellaVigna and his team will write up summaries of intended experiments that forecasters can quickly read and absorb, and will find interesting. Those experts would, in turn, use the developed platform to enter their best estimates about how the experiment will turn out, including their predictions of the effect sizes. These answers can then be compared to the actual results of the experiments.

The platform DellaVigna and his collaborators will develop has the potential to allow researchers to capture forecasts, control publication bias, improve the trans-

parency and reproducibility of research designs, and advance the use of Bayesian methods more generally by helping quantify prior probabilities.

Canadian Institute for Advanced Research

TORONTO, CANADA

$475,000 over 36 months to connect causal inference considerations with advanced research on learning in machines and brains by sponsoring an interdisciplinary conference and a series of small catalyst grants.

PROJECT DIRECTOR: **Yoshua Bengio**

Drawing causal inferences about the effect of one variable on another is something people do all the time. Machine learning (ML) and artificial intelligence (AI), in contrast, are only able to perform statistical correlations and pattern discovery. Umbrellas are associated with rain, for example, but carrying an umbrella does not make water droplets fall from the clouds. This is obvious to humans, but neither machine learning nor even classical statistics can even pose, let alone investigate, such basic assertions.

One of AI's most distinguished research groups is embarking on a mission to bring causal considerations like these to their work on ML. Founded almost 15 years ago by Geoff Hinton, the Learning in Machines and Brains program (LMB), organized and partially funded by the Canadian Institute for Advanced Research, has made causal inference a top priority for its next phase. Funds from this grant support efforts by LMB to hold a multidisciplinary conference on causal inference in AI, bringing together top experts in economics, econometrics, statistics, neuroeconomics, and logic, to discuss the challenges and opportunities in developing machine learning protocols and platforms that can detect causal relationships in data. Additional grant funds will support a series of six $50,000 "catalyst" grants that will spur innovation by funding targeted research projects on these and related issues.

Columbia University

NEW YORK, NEW YORK

$362,268 over 19 months to support the continued development, maintenance, and dissemination of the probabilistic programming language Stan.

PROJECT DIRECTOR: **Andrew Gelman**

The "external validity" of a scientific finding is its robustness in the face of additional observations or alternative model specifications. Statistically significant findings can often be weakened or reversed if either the same analysis had been done with a different sample or if a different model specification had been applied to the same data. Bayesian statistical techniques are particularly well suited to address such issues, but their uptake has been impeded by their awkward, difficult implementation in the standard statistical programs most commonly used by researchers.

This grant provides funds for the continued development and adoption of Stan, an open source, probabilistic programming language developed by Columbia University statistician Andrew Gelman. Stan elegantly implements advanced Bayesian methods for analyzing external validity and for many other issues and has gained increasing popularity in recent years. Grant funds will allow the continued growth of Stan with a specific focus on developments aimed at making the program more useful and useable by economists and other social scientists. Planned grant activities include the development of new modules specifically addressing the complex and multilevel systems that social scientists study, as well as the production of open-access tutorials, research papers, and reproducible case studies.

Duke University

DURHAM, NORTH CAROLINA

$496,004 over 36 months to expand and bolster internationally linked summer institutes on computational social science for early-career researchers.

PROJECT DIRECTOR: **Christopher Bail**

The Summer Institutes in Computational Social Science (SICSS) are annual summer courses that aim to accelerate the growth and strength of computational social science; to seed interdisciplinary research that builds on this field; to create open source teaching materials that support training in the field; to ensure that the new field develops appropriate norms and standards that are in the long-term interests of science and society; and to create a community of scholars—supported by partner organizations such as companies and universities—that will help advance computational social science into the mainstream of economics, data science, sociology, political science, and other social science fields.

Founded by Christopher Bail of Duke and Matt Salganik of Princeton, the courses are held each summer on the Duke and Princeton campuses, while simultaneously being broadcast to 11 different educational institutions around the world. Almost 300 graduate students, postdoctoral fellows, and junior faculty participated in

2019 alone, with applications far exceeding the spots available. Funds from this grant support the continued operation, expansion, and development of the SICSS for a period of three years.

University of Florida

GAINESVILLE, FLORIDA

$843,062 over 15 months to provide open geographic and demographic data about precincts, as well as visualization and mapping software that calls on this data, for use by social scientists, government officials, and the general public.

PROJECT DIRECTOR: **Michael P. McDonald**

Boundary information about census blocks, precincts, and districts can be critically valuable for research in a range of social science disciplines, including economics, political science, and finance. Recent research in household finance, for example, has used such data to investigate how foreclosures affect neighborhoods. In most countries, the boundary coordinates of geographical regions, such as voting precincts, are readily available for all to use. In many U.S. states, however, such information is astonishingly difficult to collect.

This grant supports an initiative by Michael McDonald, one of the nation's foremost experts on fine-grained political geography, to collect detailed data on the geospatial boundaries of U.S. electoral precincts and districts, to make that data available to researchers and the public, and to develop open, easy-to-use software that will facilitate the use and analysis of this data by researchers.

Georgetown University

WASHINGTON, DISTRICT OF COLUMBIA

$597,792 over 24 months to develop linkage, deduplication, and other tools that demonstrate how administrative data can improve the accuracy of demographic and economic research.

PROJECT DIRECTOR: **Maria Cancian**

Administrative data can enable a wide variety of new and more accurate statistical work by researchers in academia, government, business, and other organizations. In the United States, no statistical findings are more fundamental for economists and social scientists than those produced by the Census Bureau, including the Decennial estimates of population counts and characteristics. But declining response rates to any kind of survey, not to mention concerns about interference and privacy, have raised serious apprehensions about the accuracy of the upcoming count in 2020. This is an equity issue in addition to a statistical one, since concern is particularly acute about miscounts of historically underrepresented or underprivileged groups.

A "smart" vending machine developed by Caltech economist Colin Camerer selectively varies its user interface to measure the role habit plays in people's economic decisions. (PHOTO COURTESY OF MARCOS GALLO.)

Funds from this grant support a project by the Massive Data Institute (MDI) at Georgetown to use state-level administrative data to bolster the Decennial Census. MDI will work with various states to identify government sources of administrative data that describe people from across geographic areas and subpopulations; determine how to access the data legally and securely; develop tools to clean and standardize that data; and provide documentation, training, and protocols for use by other states.

Harvard University

CAMBRIDGE, MASSACHUSETTS

$884,838 over 15 months to develop a robust, trusted, popular, and extensible library of open-source software for privacy-protecting data analysis.

PROJECT DIRECTOR: **Salil Vadhan**

An important question in the social sciences is how researchers can responsibly study large datasets containing confidential information about individuals, and how organizations can safely share such data while preserving the privacy of their users. Every query answered inevitably leaks some privacy. The only conceptual framework for specifying, measuring, and controlling such leakage is known as "differential privacy." Imagine analysts who use a query mechanism to interrogate a dataset held by a trusted curator. An example of a differentially private mechanism would be one that returns an answer after adding a small amount of random noise drawn from a carefully selected distribution. That noise provably limits whether the analyst can even find out whether any given person is in the dataset, let alone anything else about that individual.

Sloan has been an early funder of the development and application of this approach. This grant funds efforts by Salil Vadhan of the Harvard Privacy Tools Project to create a library of industrial-strength, open source differential privacy software called OpenDP.

Like other open source development communities, OpenDP participants will cooperate to develop trusted, robust, and scalable tools that are easily accessible and adoptable in a wide variety of settings. Vadhan will convene a group of experts and users to guide the project's overall architecture, features, progress, and sustainability planning.

Massachusetts Institute of Technology

CAMBRIDGE, MASSACHUSETTS

$1,994,088 over 36 months to promote the rigorous empirical study of economic issues in North America by helping researchers design, pilot, and implement randomized controlled trials.

PROJECT DIRECTOR: **Amy Finkelstein**

Founded with Sloan Foundation support in 2013 and based at MIT, J-PAL North America is a regional hub of the Abdul Latif Jameel Poverty Action Lab, a global network of economic researchers who share a dedication to promoting the use of randomized controlled trials (RCTs) in economics. RCTs are a powerful research methodology in social science, the "gold standard" for drawing robust conclusions about causal relationships. Researchers affiliated with J-PAL North America have completed nearly 100 rigorous studies of a wide range of relevant issues, including the effect of summer jobs on juvenile delinquency, whether you can improve student performance by paying for good grades, what information can reduce consumer reliance on payday loans, and a host of other studies on the topics of voting, crime, discrimination, and health care. This grant provides core operating support to J-PAL North America for the continuation of these and related activities for three years.

Funded activities under this grant include a new series of Design Within Reach forums, in which researchers exchange early feedback on the design of planned RCTs; a Short-Term Research Management program that provides hands-on administrative assistance to researchers during the early stages of planning, piloting, and implementing an RCT; an outreach initiative to promote interactions between researchers and policymakers; and an ongoing collaboration with the global J-PAL network to address the challenges and opportunities posed by administrative data.

Massachusetts Institute of Technology

CAMBRIDGE, MASSACHUSETTS

$1,083,750 over 24 months to improve policy-relevant research by facilitating the use of administrative data among economists who design, run, and analyze randomized controlled trials.

PROJECT DIRECTOR: **Anja Sautmann**

The Abdul Latif Jameel Poverty Action Lab (J-PAL) is a global network of economic researchers who share a dedication to promoting the use of randomized controlled trials (RCTs) in economics as a way of generating real and reliable solutions to important social problems. J-PAL's 170 affiliated researchers have conducted more than 800 high-quality RCTs since its founding on a wide range of issues including poverty, crime, discrimination, education, and voting behavior. The network has also trained some 1,500 researchers on how to effectively design and implement randomized controlled trials and has launched and promoted an RCT registry now housed at the American Economic Association.

This grant supports a new initiative by J-PAL Global, called Innovations in Data and Experiments (IDEA), which aims to facilitate and improve researcher access to and use of administrative data. J-PAL Global will encourage data holders to work with researchers,

provide technical, legal, and practical guidance to researchers who want to work with administrative data, and help avoid duplicate efforts to obtain, clean, and document administrative datasets. Grant funds will support IDEA's core technical staff, two pilot projects in the United States, and the creation of several handbooks and workshops on using administrative data in economic experiments.

National Bureau of Economic Research

CAMBRIDGE, MASSACHUSETTS

$963,499 over 36 months to provide partial support for thousands of participants in over 50 programs that comprise the Summer Institute run annually by the National Bureau of Economic Research.

PROJECT DIRECTOR: **Janet Currie**

The Summer Institute run by the National Bureau of Economics Research (NBER) is an annual gathering of empirical economists that takes place over three weeks of July in Cambridge, Massachusetts. It is widely recognized as the most significant meeting of its kind. In 2018, more than 2,200 economists from 427 institutions participated in at least one of over 50 workshops on a wide range of economic topics, from behavioral macroeconomics to innovation and digitization. Indeed, organizers of the Summer Institute work hard to attract the highest quality research and researchers. The selection process is highly competitive. In 2018, for example, over 5,800 submissions were made and fewer than 10% were accepted. The structure and range of activities taking place at the Summer Institute make it a unique venue for cross-fertilization of ideas. Workshops and lunches are deliberately scheduled to overlap in order to increase the likelihood of interaction between researchers interested in related fields. Participant surveys show high satisfaction with the quality and breadth of the presentations, and appreciation for the opportunity to meet other researchers and initiate new collaborations.

This grant provides operating support to NBER to continue to host the Institute for three years.

A recent Sloan-supported study by Dong Won Oh, Eldar Shafir, and Alexander Todorov found that people assign higher "competence" to pictures of richly dressed people than to identical-looking but poorly dressed ones. The effect persists even when subjects are exposed to the photos only briefly or when reminded that clothing style has little to do with ability. (PHOTO COURTESY OF MARCO GALLO)

National Bureau of Economic Research

CAMBRIDGE, MASSACHUSETTS

$619,016 over 36 months to grow and strengthen research on Behavioral Macroeconomics by providing pre-doctoral fellowship and training support to early-career scholars in this field.

PROJECT DIRECTOR: **Yuriy Gorodnichenko**

This grant to the National Bureau of Economic Research (NBER) supports a predoctoral fellowship program that will support Ph.D. students carrying out research in behavioral macroeconomics. Four dissertation fellowships will be awarded to promising graduate students for a period of two years each. Potential dissertation topics include the aggregate implications of limited information, decision-making with flawed models, how expectations are formed, optimal policy design, and the interaction of economic agents with different levels of knowledge or economic sophistication. In addition to the fellowships, grant funds will support an NBER initiative to expand the community of behavioral economists by holding one-week boot camps each year that will train two dozen young scholars in topics in behavioral macroeconomics.

National Bureau of Economic Research

CAMBRIDGE, MASSACHUSETTS

$468,441 over 36 months to support research and data infrastructure concerning the economics of Household Finance.

PROJECT DIRECTOR: **Stephen P. Zeldes**

This grant provides three years of continued operational support to the Household Finance Working Group (HFWG) at the National Bureau of Economic Research. The group brings together leading economists, econometricians, regulators, and policymakers working on issues broadly related to understanding how households make economic decisions. Specific topics addressed by the working group include household saving, portfolio behavior, borrowing decisions, investment choices, risk management, and bankruptcy.

Over the next three years, the HFWG will continue its work with a focus on how changes in technology are affecting both household decision-making and the opportunities to study it. Topics to be examined include the rise of fintech, big data, and machine learning in the provision of consumer financial services; the impact of electronic payment systems, such as cryptocurrencies, on traditional financial institutions; and both the challenges as well as the opportunities posed by the use of administrative data for research on consumers and their financial decisions.

NumFOCUS

AUSTIN, TEXAS

$431,265 over 19 months to develop and test privacy-protection techniques for encrypting, linking, and analyzing sensitive data.

PROJECT DIRECTOR: **David Cousins**

Funds from this grant support work by a team, led by David Cousins at a company called Duality, to develop mathematical tools and techniques that will enable social scientists and other researchers to link and analyze privacy-sensitive financial data without the risk of exposing protected information in the data. Partnering with the Institute for Research on Innovation and Science (IRIS), which collects administrative records from universities with the expectation that no sensitive information about one institution's employees, students, or finances will be revealed to any another, Cousins and the Duality team will work on the development of methods that use a type of advanced cryptography known as fully homomorphic encryption (FHE) to develop analysis tools that are powerful and scalable enough to be used in a wide variety of research contexts, yet satisfy very stringent data privacy standards. All developed software and code will be open source and deposited in freely accessible software libraries.

Stanford University

STANFORD, CALIFORNIA

$575,000 over 24 months to model the supply of and demand for research data, including decisions about hoarding, sharing, and privacy protection.

PROJECT DIRECTOR: **Liran Einav**

This grant funds a project by Stanford economist Liran Einav to study the factors influencing researchers' decisions about when and how to share data. Topics to be studied include researchers' incentives for data sharing, the perceived privacy risk if data are shared, the impact of data-sharing decisions on scientific progress, and the relevant policy implications. On the privacy issue, specifically, Einav will develop and train a machine learning algorithm to estimate the vulnerability of different datasets to privacy violations, a potentially useful tool in and of itself, as it would bring more objectivity to risk assessment than current processes, through which researchers and review boards try to estimate these risks subjectively.

Using the algorithmic risk assessment and many other field-specific variables as inputs, Einav and his team will then develop econometric models of researchers' data-sharing and data-hoarding decisions. The regression coefficients calculated from this estimation should permit causal insights about the relative importance of different factors in those decisions, as well as generate predictions of the effect of various policy changes on scientific progress. This research therefore stands to inform and empower the many existing efforts to encourage better data practices among academics.

Yarn Labs

CAMBRIDGE, MASSACHUSETTS

$1,633,681 over 24 months to enable research on the innovation process, from initial funding through economic impacts, by compiling, linking, and documenting comprehensive datasets about patents and patenting.

PROJECT DIRECTOR: **Adam Jaffe**

Progress in understanding the relationship between basic research and economic growth requires high-quality data on patents and patenting. Barriers to acquiring, cleaning, and sharing such data remain a significant hurdle to conducting empirical research on a wide range of topics, including the return on investment to basic science investment, the productivity of scientific teams, regulatory impacts on patenting and innovation, and much more.

This grant provides funding to the "Innovation Information Initiative," or I3, a collaborative project to build a linked series of state-of-the-art, open databases that make high-quality patent data easily available to researchers. Led by Yarn Labs, a not-for-profit spin off of the MIT Media Lab, the project will clean and document existing sources of patent data; create new data products that include a catalog of links between patents and products; disambiguate authors, institutions, funders, and titles; and compile patent citations to the scholarly literature. To facilitate use of these new resources, the team will develop user-friendly interfaces and a series of models, algorithms, and other analysis tools. Outreach plans include organizing an annual research meeting alongside the NBER Summer Institute; an annual meeting to coordinate technical matters; and fellowships for Ph.D. students interested in the rigorous study of patenting.

Officer Grants

Azavea

PHILADELPHIA, PENNSYLVANIA

$249,101 over 6 months to improve the scalability and performance of open source mapping software that makes geographic, demographic, and redistricting data usable by social scientists and the public.

PROJECT DIRECTOR: **Robert Cheetham**

Boston University

BOSTON, MASSACHUSETTS

$249,824 over 24 months to develop and test new modeling techniques for studying the long-term impact of artificial intelligence on the economy generally, and its impact on household labor and saving decisions in particular.

PROJECT DIRECTOR: **Laurence Kotlikoff**

University of California, Berkeley

BERKELEY, CALIFORNIA

$250,000 over 12 months to support a special semester of research on lattice methods for fully homomorphic encryption and on applications for privacy-preserving computations on confidential data.

PROJECT DIRECTOR: **Shafi Goldwasser**

Center for Innovative Governance

WASHINGTON, DISTRICT OF COLUMBIA

$20,000 over 2 months to fund student scholarships for participation in a conference on the economic implications of mechanism design and other market-based organizational innovations.

PROJECT DIRECTOR: **Mark Lutter**

Columbia University

NEW YORK, NEW YORK

$20,000 over 2 months to develop and validate new methods of using natural language processing to study how scientific publications inform patentable innovations.

PROJECT DIRECTOR: **Bhaven Sampat**

The Conversation

BOSTON, MASSACHUSETTS

$50,000 over 7 months to develop articles and resources that highlight uses of the Decennial Census and other data produced by federal statistical agencies.

PROJECT DIRECTOR: **Beth Daley**

Cornell University

ITHACA, NEW YORK

$20,000 over 12 months to support a conference on research using linked employer-employee data to study labor markets and disseminate these insights to the wider economics community.

PROJECT DIRECTOR: **Lars Vilhuber**

Council of Professional Associations on Federal Statistics

ALEXANDRIA, VIRGINIA

$29,637 over 5 months to hold an interdisciplinary workshop on new opportunities and guidelines concerning how federal statistics can safely share data with one another, with researchers, and with the public.

PROJECT DIRECTOR: **Cynthia Clarke**

Data Foundation

WASHINGTON, DISTRICT OF COLUMBIA

$50,000 over 6 months to support plans to improve government administrative data linkages that would enhance social science research.

PROJECT DIRECTOR: **Nick Hart**

Duke University

DURHAM, NORTH CAROLINA

$249,909 over 36 months to develop and test algorithms based on Bayesian and Machine Learning techniques for efficient entity resolution when linking datasets.

PROJECT DIRECTOR: **Rebecca Steorts**

Georgetown University

WASHINGTON, DISTRICT OF COLUMBIA

$31,300 over 12 months to support two multidisciplinary workshops and research on data co-ops.

PROJECT DIRECTOR: **Ali Whitmer**

Harvard University

CAMBRIDGE, MASSACHUSETTS

$20,000 over 8 months to support the Fifth Annual Conference on Big Data at the Harvard Center for Mathematical Sciences and Applications.

PROJECT DIRECTOR: **Shing-Tung Yau**

Hopewell Fund

WASHINGTON, DISTRICT OF COLUMBIA

$248,360 over 6 months to plan and prototype an end-to-end multiparty system for sharing, linking, modeling, and analyzing sensitive datasets while protecting the privacy of each.

PROJECT DIRECTOR: **Iris Kong**

Indiana University

BLOOMINGTON, INDIANA

$19,960 over 12 months to support a workshop on improving rigor, reproducibility, and transparency in science.

PROJECT DIRECTOR: **David Allison**

Industrial Organizational Society

BOSTON, MASSACHUSETTS

$22,000 over 21 months to support graduate student presentations at the International Industrial Organization Conference.

PROJECT DIRECTOR: **Marc Rysman**

University of Minnesota

MINNEAPOLIS, MINNESOTA

$124,767 over 12 months to quantify the impact of differential privacy on the utility and accuracy of Decennial Census data for social science research.

PROJECT DIRECTOR: **Steven Ruggles**

University of North Carolina, Chapel Hill

CHAPEL HILL, NORTH CAROLINA

$49,590 over 12 months to study, by compiling a novel database, how and why entrepreneurs become science philanthropists.

PROJECT DIRECTOR: **Maryann Feldman**

Northwestern University

EVANSTON, ILLINOIS

$249,946 over 36 months to study the impact of funding and funding schemes on the progress of scientific research using broad measures and quasi-experimental methods.

PROJECT DIRECTOR: **Dashun Wang**

Partnership for Public Service

WASHINGTON, DISTRICT OF COLUMBIA

$47,453 over 12 months to develop a community of data experts that help federal agencies with data-driven decision-making and data-policy implementations.

PROJECT DIRECTOR: **Chantelle Renn**

Russell Sage Foundation

NEW YORK, NEW YORK

$50,000 over 36 months to publish a special volume of the Russell Sage Foundation Journal of the Social Sciences on labor market trends and their economic implications.

PROJECT DIRECTOR: **Suzanne Nichols**

Stanford University

STANFORD, CALIFORNIA

$232,361 over 9 months to study the behavioral economics of smartphone use by testing methods for improving self-control and long-run welfare.

PROJECT DIRECTOR: **Matthew Gentzkow**

Tufts University

MEDFORD, MASSACHUSETTS

$50,000 over 6 months to produce an interdisciplinary white paper on differential privacy and the Census.

PROJECT DIRECTOR: **Moon Duchin**

Tufts University

MEDFORD, MASSACHUSETTS

$50,000 over 12 months to support the operations of EconoFact, an online source that disseminates policy-relevant economics research.

PROJECT DIRECTOR: **Michael Klein**

University College London

LONDON, UNITED KINGDOM

$20,000 over 12 months to support the operations of Microeconomic Insights, an online source for summaries of top microeconomics research.

PROJECT DIRECTOR: **Richard Blundell**

University of Washington

SEATTLE, WASHINGTON

$249,836 over 6 months to assess how the privacy and accuracy of social science research will be affected by new disclosure-avoidance algorithms governing the release of 2020 Census data.

PROJECT DIRECTOR: **Abraham Flaxman**

Yale University

NEW HAVEN, CONNECTICUT

$15,000 over 12 months to support the inaugural ACM Symposium on Computer Science and Law and launch the ACM's efforts in this field.

PROJECT DIRECTOR: **Joan Feigenbaum**

Energy & Environment

PROGRAM DIRECTOR: EVAN S. MICHELSON

The Alfred P. Sloan Foundation's Energy and Environment Program completed its fifth year of formalized grantmaking at the end of 2019. This program aims to advance our understanding about the economic, environmental, security, and policy tradeoffs associated with the increased deployment of low-and no-carbon resources and technologies across the energy system. Since its launch, the program has become a paradigmatic example of how the Foundation can achieve its mission by influencing a field, shaping the direction of research toward under-explored questions that warrant further attention, supporting interdisciplinary research across the social and natural sciences, training early career students, linking research with practice, and partnering with other funders to amplify programmatic impact. The program has made substantial progress in each of its five established outcome areas:

- **Generate Novel Research and New Knowledge:** The primary focus of this program is to build an impartial economic, science, technology, engineering, and policy knowledge base related to the societal transition toward low-carbon energy systems as a public good.
- **Train Next Generation of Scholars and Practitioners:** An important program element is introducing new voices into the field and training the next generation of individuals capable of anticipating and addressing emerging energy challenges and opportunities.
- **Build Multidisciplinary Networks and Communities:** Grantmaking aims to strengthen existing research networks and create longstanding communities of practice that will endure beyond the program's timeline.

- **Educate Stakeholders and Disseminate Information for Decision-Making:** Grantmaking will encourage stakeholders to engage with high quality, impartial research when developing policies and practices that address the deployment of low- and no-carbon technologies and resources.
- **Attract Additional Resources:** This program aims to seed new ideas that stimulate additional support for research on these topics by government, industry, and philanthropy.

Using the energy system as a guiding framework, the Foundation investigates underexplored and targeted research questions in select areas. Regarding energy sources (supply), the program supports investigation and systemic analyses of the energy system and energy technology innovation. Regarding midstream infrastructure, the program examines multidisciplinary research on transmission and distribution systems along with studying the siting of energy infrastructure. Regarding energy use (demand), the program explores social science research in the area of transportation and empirical analyses of variable pricing and other behavioral interventions that may impact energy consumption.

The program includes support for additional cross-cutting opportunities, such as energy data analytics, disseminating research findings, and strategically organized convenings. Recently, the Foundation expanded the program to explore opportunities to support collaborative science and engineering research projects led by early- and mid-career scholars in two areas: the use of sensor technologies to monitor energy and environmental systems, and research on net-zero interventions and negative emissions technologies.

Due to the significant funding available from both public and private sources for energy and environmental research, the Foundation is very selective in the grants it makes in this area. Support is only provided for non-partisan, balanced, evidence-based analysis, and the Foundation does not and will not support energy policy lobbying or advocacy.

Trustee Grants

American University

WASHINGTON, DISTRICT OF COLUMBIA

$410,000 over 24 months to incorporate a broad portfolio of negative emissions technologies into existing integrated assessment models.

PROJECT DIRECTOR: **David Morrow**

Many canonical integrated assessment models examining the relationship between energy, climate, economics, and public policy represent negative emissions interventions poorly and haphazardly, if these approaches to decarbonization are included at all in such models. This grant supports work by scholars at the Institute for Carbon Removal Law & Policy at American University to improve how negative emissions technologies are represented in two of the most often used integrated assessment models. One of these models, EnROADS, is a highly aggregated economy-climate-energy model. The other, the Global Change Assessment Model (GCAM), is one of the most widely used open source energy and climate models in the field. Grant funds will support two postdoctoral researchers, who will work to develop extensions of these two models to better account for the potential emergence of negative emissions (decarbonization) technologies over the coming decades.

University of California, Irvine

IRVINE, CALIFORNIA

$1,500,000 over 36 months to advance electrochemical carbon dioxide capture and concentration technology.

PROJECT DIRECTOR: **Jenny Yang**

Direct air capture (DAC) is one of the most exciting and novel advancements in negative emissions science and technology. DAC systems remove carbon dioxide (CO2) from the atmosphere by flowing ambient air through a filter. Sorbent chemicals embedded in the filter bind to the atmospheric CO2, trapping it. The trapped CO2 is subsequently removed from the filter for capture, disposal, or reuse. Doing so, however, requires heating the filter, and thus typically requires proximity to an appropriate heat source. This requirement substantially limits where DAC systems can be sited and increases their carbon footprint, since energy must be expended to produce the needed heat.

This grant funds exciting new work by a team led by University of California, Irving chemist Jenny Yang to address this core challenge by exploring new electrochemical processes that would facilitate the capture and concentration of CO2 at room temperature, without the need for added heat. This would allow DAC to take place at ambient temperatures, greatly increasing the range of conditions where DAC systems could be deployed. Yang and her team will identify and test various kinds of electrochemical CO2 capture materials using computational chemistry methods and then use chemistry modeling techniques to determine how well different materials might perform as ambient temperature DAC filter systems. Promising materials will be tested in laboratory-scale CO2 separation chambers to determine their performance under various conditions.

Colorado School of Mines

GOLDEN, COLORADO

$600,000 over 24 months to provide programmatic and administrative support for a new multidisciplinary doctoral training program in advanced energy systems.

PROJECT DIRECTOR: **Morgan Bazilian**

The Colorado School of Mines, in collaboration with the National Renewable Energy Laboratory (NREL), has established a new, unique graduate program in Advanced Energy Systems. Working closely with faculty and researchers from both institutions, doctoral students will move seamlessly between Mines and NREL to augment their academic training with hands-on experience, providing a robust, multidisciplinary foundation for understanding and analyzing energy systems.

This grant supports this innovative new doctoral program in three ways. First, it will provide two years of salary support for a program director staff position; the program director will be responsible for overseeing program management, student recruitment, external partnerships, and donor outreach. Second, it provides funds for a student-run seminar series that will allow students to bring in external energy experts to enrich the training program. Third, it provides funds for the development and implementation of a summer research program for enrolled doctoral students, helping select students in the Ph.D. program pursue individualized research projects in furtherance of their training and education.

Columbia University

NEW YORK, NEW YORK

$1,486,360 over 44 months to examine carbon mineralization in rock formations for carbon dioxide removal from air and for solid storage.

PROJECT DIRECTOR: **Christine McCarthy**

Weatherization and mineralization are natural processes by which rocks of certain chemical compositions react with carbon dioxide (CO2)—either from ambient air or from concentrated CO2 streams collected during industrial processes—and undergo reactions that lead to the CO2 binding to the rock. These processes thus represent a potential pathway for decarbonization, an opportunity to use natural processes to sequester large amounts of atmospheric carbon in mineralized form.

This grant supports research by Christine McCarthy and Ah-Hyung Park that will investigate key questions about the basic physics and chemistry of rock weathering and mineralization, with an aim toward understanding how these processes can be enhanced and accelerated. For example, mineralization can result in an effect called "reactive cracking" in which pores or fissures in the rock open, creating more surface area that allows for additional mineralization. This generates a positive CO2 solidification feedback loop. Sometimes, however, mineralization does not result in reactive cracking. Instead, as a rock mineralizes, pores within the rock become clogged by carbonated minerals, leading the rock pores to become "clogged" and hindering further mineralization. The team led by McCarthy and Park will study what factors lead to differences between these "cracking" versus "clogging" effects, and they will assess how these reactions might impact larger-scale efforts to mineralize CO2 in geologic systems.

This study will include a series of laboratory experiments that will examine a range of different stress, temperature, and acidity conditions that might hinder or accelerate such cracking or clogging processes, with these lab-based results used to model how such findings might scale up in real-world field conditions.

Council on Library and Information Resources

WASHINGTON, DISTRICT OF COLUMBIA

$547,321 over 36 months to support a second cohort of postdoctoral fellows in data curation for energy economics at three leading energy research centers.

PROJECT DIRECTOR: **Charles Henry**

This grant supports a cohort of three postdoctoral fellows in data curation for energy social science, overseen by the Council on Library and Information Resources (CLIR). One fellow will be placed at each of the following three institutions, involving both their respective energy research centers and university libraries: Scott Institute for Energy Innovation at Carnegie Mellon University, the University of Michigan Energy Institute, and the Center for Energy and Environmental Policy Research at the Massachusetts Institute of Technology.

In addition to recruiting, selecting, and placing the postdoctoral fellows, CLIR organizes training programs and mentorship activities throughout the two-year fellowship program. This includes an initial introductory summer institute, regular mentoring calls with fellows and their institutional hosts, funding for travel to present at and attend conferences, and a pool of resources to help initiate collaborative projects developed by the fellows. This second phase of CLIR postdoctoral fellowships builds on a successful first round of fellowship support that is nearing conclusion. The program offers a unique opportunity to train the next generation of scholars and practitioners, while simultaneously providing core energy research institutions with expertise in cutting-edge data science analysis.

Duke University

DURHAM, NORTH CAROLINA

$513,839 over 24 months to establish a multidisciplinary research collaboration studying the role of regional transmission organizations and independent systems operators in electricity markets.

PROJECT DIRECTOR: **Katherine Konschnik**

Regional transmission organizations (RTOs) and independent system operators (ISOs) are key parts of the U.S. electricity system. Although RTOs and ISOs operate wholesale electricity markets that serve about two-thirds of U.S. electricity customers, there is very little research comparing how these institutions work, what influence stakeholder groups have on their behavior, or which aspects of these institutions might be portable to similar organizations.

This grant funds a collaborative project, co-led by Kate Konschnik, who directs the Climate and Energy program at Duke University and associate professor Seth Blumsack of Pennsylvania State University, to undertake a set of studies to explore these and related questions associated with the governance, structure, and operation of RTOs and ISOs. Konschnik and Blumsack have assembled a multidisciplinary group of research-

ers from economics, law, public policy, energy systems operations, and engineering to contribute to this effort. The project will produce approximately 10 academic research articles across multiple fields, in addition to associated policy briefs or white papers for broad dissemination to a wide range of stakeholders. Grant funding will cover graduate student participation, direct support for research expenses, and bringing participating scholars together to ensure project coordination.

Environmental Defense Fund Inc.

NEW YORK, NEW YORK

$600,000 over 36 months to provide final support for a training and networking program for early-career energy and environment professionals conducting economic and scientific research in applied settings.

PROJECT DIRECTOR: **Steven Hamburg**

This grant supports an innovative training and professional development program at the Environmental Defense Fund (EDF) to give early-career scientists and economists the skills needed to effectively conduct policy-relevant research in an applied setting, outside a college or university. Training covers such topics as communications, proposal writing, program management, and team leadership and features a series of workshops that separately target postbaccalaureates and postdoctoral researchers to reflect the different skill development needs of these two groups.

Funds from this grant will allow EDF to enhance and expand this program. Formerly focused on training EDF's in-house junior scientists, the program will expand through a series of institutional partnerships to include other early-career researchers at other universities and NGOs. The curriculum will also expand to include a series of monthly in-person or virtual workshops on relevant topics, including data science and empirical research methods. Additional funds support efforts to track and evaluate the impact of the program, to place trained scientists in policy-relevant positions at NGOs or in government, and to distill and disseminate lessons learned to those institutions interested in starting similar programs. EDF plans to integrate aspects of this program into its standard professional development activities by the conclusion of this grant.

Johns Hopkins University

BALTIMORE, MARYLAND

$507,244 over 34 months to develop a spatiotemporally detailed energy systems dataset in order to examine land use requirements for different generation technologies.

PROJECT DIRECTOR: **Sarah Jordaan**

Comparisons of the land use estimates of different electricity generation technologies often rely on poorly estimated, rule-of-thumb calculations, with little direct observation of how much land each of these components actually occupies in the real world. This grant supports a project by Sarah Jordaan, Vishal Patel, and Benjamin Hobbs to rigorously estimate the land use requirements for different electricity generation technologies and their associated fuel supplies.

The team will conduct satellite imagery analysis that can more accurately account for the individual land footprint of different components of the energy system. The focus of this effort will be on the United States portion of what is known as the Western Interconnection, a region from the Rocky Mountains westward that includes almost every type of power generation facility (including natural gas, coal, nuclear, wind, and, solar), elements of their supply chains (natural gas production facilities, coal mines, uranium mines, and pipelines), and transmission and distribution lines for connecting wind and solar sites to the grid.

The team has access to high-resolution satellite data that not only allows them to accurately detect the land use implications of large-scale infrastructure like generation facilities, but also harder-to-determine infrastructure like pipes and transmission lines. This study will also provide the tools to better assess the power density and land use intensity of each generation technology.

University of Maryland, College Park

COLLEGE PARK, MARYLAND

$300,000 over 24 months to undertake a multidisciplinary study to assess the costs and benefits of installing electric heat pumps.

PROJECT DIRECTOR: **Yueming (Lucy) Qiu**

Most home heating systems involve burning natural gas or oil. However, a less carbon-intensive technology is becoming more readily available: electric heat pumps. Heat pumps can provide heating services through interchanges with the ambient air or from the

ground. Heat pumps have become increasingly more efficient than conventional oil or gas systems, with the potential to reduce carbon dioxide emissions.

This grant funds a multi-institutional project led by economist Yueming Lucy Qiu at the University of Maryland, College Park, engineer Parth Vaishnav at Carnegie Mellon University, and economist Pengfei Liu at the University of Rhode Island that will examine the economic and engineering tradeoffs associated with heat pump installation. Qiu and her team have procured access to a detailed dataset drawn from Zillow, the popular real estate website, that contains records on nearly four million homes with heat pumps installed, the most extensive dataset on heat pumps that is readily available. Analyzing the Zillow data, Qiu and her team will examine how heat pump installation impacts home property values and how federal, state, and local incentive policies impact consumer decisions to install heat pumps. The team plans to produce a number of academic articles on these topics for both social science and engineering journals, and the dataset will be made available for other scholars for their own analyses.

University of Michigan

ANN ARBOR, MICHIGAN

$1,422,772 over 36 months to use airborne and satellite measurements to monitor offshore energy production and natural gas flaring.

PROJECT DIRECTOR: **Eric Kort**

Few rigorous studies have attempted to accurately measure greenhouse gas (GHG) emissions from offshore oil and gas facilities or sites that flare natural gas. Similarly, it is also important to measure GHG emissions from onshore operations that flare natural gas, a common occurrence at shale fracking sites. Getting better estimates of GHG emissions from offshore oil and gas sites and natural gas flaring sites can have a marked effect on our understanding of actual emissions from these understudied domains of energy production.

This grant funds a coordinated field campaign, led by Eric Kort at the University of Michigan, to rigorously measure emissions from offshore oil and gas production facilities and onshore natural gas flaring sites. The research team will estimate GHG emissions by combining and synthesizing remote sensing satellite data with direct observations collected from a series of aircraft flights over multiple oil and gas production sites. The study will target offshore production facilities in the Gulf of Mexico and off the California and Alaska coasts, and it will measure emissions at flaring sites in both west Texas and North Dakota's Bakken Shale. Remote sensing data will be pulled from a recently launched environmental monitoring satellite called TROPOMI, and by a new satellite to be launched by the Environmental Defense Fund.

If successful, the project will deploy sensor technologies in novel ways, collect and integrate data across multiple scales, and break new scientific ground by making more detailed measurements of GHG emitting sites than had previously taken place.

National Academy of Sciences

WASHINGTON, DISTRICT OF COLUMBIA

$500,000 over 22 months to undertake a consensus study examining the technological, policy, and societal dimensions of deep decarbonization efforts in the United States.

PROJECT DIRECTOR: **Keith John Holmes**

This grant provides partial support to the National Academy of Sciences, Engineering, and Medicine for the production and dissemination of an ambitious consensus study that will examine the technological, policy, and societal dimensions of deep decarbonization efforts in the United States across a range of sectors, including manufacturing, food and agriculture, transportation, electricity generation, and carbon dioxide removal. This consensus study will be conducted under the auspices of the Board on Energy and Environmental Systems (BEES) and led by Director and Scholar John Holmes. The plans for this consensus study were developed following an initial public workshop, and this process will bring together experts from multiple disciplines to assess the best way to scale up decarbonization developments across different sectors and offer a roadmap for how to move forward.

The consensus study is also expected to lead to the formation of a longer-running Deep Decarbonization Forum, an ongoing dialogue effort that would involve developing a set of additional dissemination products. The Deep Decarbonization Forum will hold a series of workshops and briefings to continue the discussion of these critical, long-term topic areas for years to come.

Members of the Open Energy Outlook project gather at its inaugural meeting (CREDIT: NORTH CAROLINA STATE UNIVERSITY)

National Bureau of Economic Research

CAMBRIDGE, MASSACHUSETTS

$399,895 over 36 months to advance understanding of the economics of energy technology innovation.

PROJECT DIRECTOR: **David Popp**

This grant supports an effort by the National Bureau of Economic Research (NBER) to increase scholarly attention to how market and government forces impact innovation in the energy sector. NBER will hold two open calls for papers, one on what can be learned from recent successes and failures in energy technology, and a second on the forces that contribute to breakthroughs in energy technology innovation. Fourteen projects in total will be selected for support from those responding to the calls and NBER will organize a research conference for each call where supported papers will be presented and discussed. Finally, NBER will hold a third conference aimed at sharing research findings with energy decision-makers and other interested stakeholders.

North Carolina State University

RALEIGH, NORTH CAROLINA

$400,000 over 36 months to utilize an open source energy system model to create an Open Energy Outlook for the United States.

PROJECT DIRECTOR: **Joseph DeCarolis**

Temoa (Tools for Energy Model Optimization and Analysis) is a modern, open source software platform for modeling energy systems. Developed by Joe DeCarolis at North Carolina State University, Temoa is a model modeling framework. It's open source, well-documented, small enough to run without access to huge computing resources, and accompanied by guides and tutorials that make its features accessible for new and experienced modelers alike. Funds from this grant support a project led by DeCarolis and his collaborator, Paulina Jaramillo of Carnegie Mellon University, to utilize Temoa to create an Open Energy Outlook report for the United States. The report will lay out several scenarios for how the U.S. energy system might evolve over the coming decades, including detailed consideration of how sector specific developments in buildings, electricity, fuels, heavy industry, policy and economics, and transportation might contribute to that evolution. The report promises to be an important complement to the Energy Information Administration's Annual Energy Outlook and other similar modeling efforts. Grant funds will support two iterations of the Open Energy Outlook Report, intra-team meetings and workshops, and development of the Temoa model to support the new analysis.

Ohio State University

COLUMBUS, OHIO

$1,494,969 over 48 months to research the development and evaluation of pathways to net-zero emission agriculture and cropping systems.

PROJECT DIRECTOR: **Laura Lindsey**

This grant supports an interdisciplinary project led by Laura Lindsey at Ohio State University to study how various agricultural practices might promote the uptake and storage of carbon dioxide (CO2) in soils, plants, and crops. Lindsey and her team of soil scientists, biologists, and environmental scientists drawn from multiple institutions will focus on examining three practices that could be deployed in commercial agriculture. The first is the application of biochar into crop systems. Biochar is a charcoal-like material that is applied to soils to improve carbon uptake from the atmosphere. The second process is the use of cover crops, which are plants designed to help maintain carbon fixation in soils. The third process is the implementation of better nitrogen management practices that reduce nitrous oxide emissions.

In addition to laboratory research, Lindsey and her team will conduct five field studies across Kentucky, Ohio, and Michigan, testing different combinations of these three agricultural practices (biochar, cover crop, nitrogen management) to determine their relative impact, alone and in combination, on carbon sequestration in agriculture systems.

Oregon State University

CORVALLIS, OREGON

$1,486,403 over 36 months to develop and deploy novel sensor technologies for improved Wildland Urban Interface (WUI) fire resilience.

PROJECT DIRECTOR: **Erica Fischer**

This project tackles a particularly pressing challenge with respect to sensor development and deployment: the ability to quickly identify damage to energy infrastructure and water pipelines following wildfires and other natural disasters. Wildfires, earthquakes, and other natural disasters have the potential to damage, degrade, or destroy wires, pipelines, and other vital parts of America's energy and water infrastructure. Yet public and private utilities have very limited ability to detect when and where such damage has occurred.

This grant funds a project led by Erica Fisher of Oregon State University to develop, construct, and test new sensor technology that could be used to detect environmental damage to energy and water infrastructure. Over the next three years, Fischer and her team aim to develop low-cost, low-powered sensors capable of withstanding the high temperatures common in wildfires. The team plans to test these sensors in the laboratory on a number of representative materials used in energy and water pipeline infrastructure and in simulated real-world conditions in a buried pipeline network located on the Oregon State campus. They will also conduct two case studies in locations that recently experienced devastating fires (Santa Rosa and Paradise, California) that will allow them to test and integrate data across multiple scales—remote sensing data, *in situ* sensor data, and crowdsourced social media information—to develop a tool that stakeholders can use to better monitor potential pipeline damage more quickly and efficiently.

Resources for the Future

WASHINGTON, DISTRICT OF COLUMBIA

$450,000 over 24 months to better understand the role of variable pricing, consumer incentives, and smart technologies in shifting energy demand.

PROJECT DIRECTOR: **Karen Palmer**

Funds from this grant will allow researchers from Resources for the Future and the University of Chicago to study how consumers respond to time-varying electricity pricing schemes. One component of this project is undertaking a unique field experiment in collaboration with a smart thermostat company called Ecobee. This randomized controlled trial (RCT) will look at how 4,000 households use a new product feature available on Ecobee thermostats that gives households the ability to program their thermostat to automatically adjust air conditioning schedules to take advantage of different time-of-use electricity rates. The second research component is a methodological project that will attempt to use machine learning techniques to replicate a previously conducted RCT that examined consumer energy use under different electricity pricing schemes. If successful, the developed methods are likely to be applicable in generating more accurate counterfactual comparative groups in the many situations where conducting an RCT of energy consumers is not feasible.

Findings from both components of the project will be disseminated through a final workshop that will engage stakeholders from multiple sectors in discussing the potential impacts of increased adoption of time-varying electricity pricing programs.

Participants in the 2019 Advanced Energy Storage Scialog conference, organized in partnership with the Research Corporation for Science Advancement (CREDIT: RESEARCH CORPORATION FOR SCIENCE ADVANCEMENT)

Officer grants

Arizona State University

TEMPE, ARIZONA

$36,666 over 24 months to support Dr. Candace Chan in undertaking a collaborative research project on the solid electrolyte interphase in batteries, resulting from the 2018 Scialog conference on advanced energy storage.

PROJECT DIRECTOR: **Candace Chan**

Boise State University

BOISE, IDAHO

$36,666 over 24 months to support Dr. Claire Xiong in undertaking a collaborative research conference on the solid electrolyte interphase in batteries, resulting from the 2018 Scialog conference on advanced energy storage.

PROJECT DIRECTOR: **Hui (Claire) Xiong**

Boston University

BOSTON, MASSACHUSETTS

$89,345 over 14 months to organize a workshop on integrating new electric mobility systems with the electric grid infrastructure.

PROJECT DIRECTOR: **Christos Cassandras**

Boston University

BOSTON, MASSACHUSETTS

$29,068 over 12 months to provide partial support for a workshop to examine the role of systems and synthetic biology (SSB) in reducing atmospheric carbon dioxide.

PROJECT DIRECTOR: **Charles DeLisi**

Boulder Housing Coalition

BOULDER, COLORADO

$160,000 over 20 months to make energy data openly available and easily accessible for researchers by expanding the Public Utility Data Liberation (PUDL) platform.

PROJECT DIRECTOR: **Lincoln Miller**

Panelists Anna Siefken, Michael Dorsey, Morgan Bazilian, and Martha Broad at the University Energy Institute Leadership Summit at Carnegie Mellon University (CREDIT: CARNEGIE MELLON UNIVERSITY)

Brown University

PROVIDENCE, RHODE ISLAND

$50,000 over 22 months to disseminate research findings from the Oil Climate Index.

PROJECT DIRECTOR: **Deborah Gordon**

University of California, Berkeley

BERKELEY, CALIFORNIA

$100,000 over 12 months to investigate traveler behavior implications of autonomous vehicles.

PROJECT DIRECTOR: **Joan Walker**

University of California, Berkeley

BERKELEY, CALIFORNIA

$50,000 over 20 months to support two annual Energy Camp workshops to facilitate collaboration and initiate new research projects among top junior and senior energy economists.

PROJECT DIRECTOR: **Lucas Davis**

University of California, Davis

DAVIS, CALIFORNIA

$249,456 over 24 months to understand how future electric vehicle demand will impact the development of electricity distribution infrastructure.

PROJECT DIRECTOR: **Alan Jenn**

University of California, Los Angeles

LOS ANGELES, CALIFORNIA

$50,000 over 24 months to establish an External Environmental Economics Advisory Committee consisting of leading energy and environmental economists to analyze cost-benefit tradeoffs.

PROJECT DIRECTOR: **George (JR) DeShazo**

Carnegie Mellon University

PITTSBURGH, PENNSYLVANIA

$45,000 over 12 months to organize a workshop that will assess the prospects for forming a national consortium of university energy institutes and research centers.

PROJECT DIRECTOR: **Jay Whitacre**

Carnegie Mellon University

PITTSBURGH, PENNSYLVANIA

$36,666 over 24 months to support Dr. Venkat Viswanathan in undertaking a collaborative research project on lithium battery performance, resulting from the 2018 Scialog conference on advanced energy storage.

PROJECT DIRECTOR: **Venkat Viswanathan**

Center for Strategic and International Studies

WASHINGTON, DISTRICT OF COLUMBIA

$50,000 over 15 months to support two annual Energy Futures Forums in identifying and evaluating key energy economics, policy, and technology trends.

PROJECT DIRECTOR: **Sarah Ladislaw**

Columbia University

NEW YORK, NEW YORK

$36,666 over 16 months to support Dr. Yuan Yang in undertaking a collaborative research project on aqueous flow batteries, resulting from the 2018 Scialog conference on advanced energy storage.

PROJECT DIRECTOR: **Yuan Yang**

Columbia University

NEW YORK, NEW YORK

$36,666 over 24 months to support Dr. Lauren Marbella in undertaking a collaborative research project on lithium battery performance, resulting from the 2018 Scialog conference on advanced energy storage.

PROJECT DIRECTOR: **Lauren Marbella**

George Washington University

WASHINGTON, DISTRICT OF COLUMBIA

$115,000 over 24 months to examine community choice aggregation programs, with a focus on studying the factors that contribute to the adoption of community solar programs.

PROJECT DIRECTOR: **Ekundayo Shittu**

Information Technology and Innovation Foundation

WASHINGTON, DISTRICT OF COLUMBIA

$74,800 over 19 months to organize a week-long training program that introduces early career researchers to the practical considerations that shape policy and managerial decisions about energy innovation in the United States.

PROJECT DIRECTOR: **David Hart**

Iowa State University Foundation

AMES, IOWA

$249,978 over 24 months to assess the characteristics of different residential, commercial, and industrial load types as potential demand response resources.

PROJECT DIRECTOR: **Kristen Cetin**

National Academy of Sciences

WASHINGTON, DISTRICT OF COLUMBIA

$75,000 over 11 months to organize a workshop examining the barriers and opportunities for deploying deep decarbonization technologies at scale in the United States.

PROJECT DIRECTOR: **Keith John Holmes**

National Council for Science and the Environment

WASHINGTON, DISTRICT OF COLUMBIA

$36,000 over 4 months to support the 2020 Annual Conference: Science in Environmental Decision-Making.

PROJECT DIRECTOR: **Erica Goldman**

New York University

NEW YORK, NEW YORK

$249,905 over 24 months to study the role of information asymmetry among stakeholders in distribution system planning and the implementation of distributed energy resources.

PROJECT DIRECTOR: **Yury Dvorkin**

Ohio State University

COLUMBUS, OHIO

$36,666 over 24 months to support Dr. Anne Co in undertaking a collaborative research project on the solid electrolyte interphase in batteries, resulting from the 2018 Scialog conference on advanced energy storage.

PROJECT DIRECTOR: **Anne Co**

University of Oregon

EUGENE, OREGON

$44,760 over 15 months To analyze data from a randomized field experiment to evaluate how dynamic pricing programs interact and impact household electricity consumption.

PROJECT DIRECTOR: **Grant Jacobsen**

Purdue University

WEST LAFAYETTE, INDIANA

$36,666 over 24 months to support Dr. Partha Mukherjee in undertaking a collaborative research project on lithium battery performance, resulting from the 2018 Scialog conference on advanced energy storage.

PROJECT DIRECTOR: **Partha Mukherjee**

University of Tennessee

KNOXVILLE, TENNESSEE

$237,415 over 24 months to understand the relationship between customer incentives to invest in distributed solar generation and utility incentives to invest in new resource and transmission assets.

PROJECT DIRECTOR: **Charles Sims**

The University Corporation o/b/o California State University, Northridge

NORTHRIDGE, CALIFORNIA

$36,666 over 16 months to support Dr. Kah Chun Lau in undertaking a collaborative research project on aqueous flow batteries, resulting from the 2018 Scialog conference on advanced energy storage.

PROJECT DIRECTOR: **Kah Chun Lau**

United States Association for Energy Economics

CLEVELAND, OHIO

$15,000 over 7 months to support the Ph.D. Day event and Women in Energy roundtable at the 2019 USAEE North American conference in Denver, CO.

PROJECT DIRECTOR: **Eric Hittinger**

Utah State University

LOGAN, UTAH

$36,666 over 16 months to support Dr. Tianbiao Liu in undertaking a collaborative research project on aqueous flow batteries, resulting from the 2018 Scialog conference on advanced energy storage.

PROJECT DIRECTOR: **Tianbiao Liu**

Outsourcing: Impacts on the U.S. Workforce

PROGRAM DIRECTOR: KATHLEEN E. CHRISTENSEN

Though few would deny that outsourcing labor is an important and increasingly deployed business strategy across many sectors of the U.S. economy, the impacts of such on the U.S. workforce have been the subject of little systematic study. Existing data are often sparse or unavailable, and even the most fundamental questions—like how many U.S. workers are doing outsourced work or whether there is more outsourcing today than ten years ago—are difficult or impossible to answer with any confidence or precision. This gap in our knowledge has important consequences. Much economic and policy analysis assumes that workers stand in traditional employer-employee relationships governed by long-standing labor laws and that worker behavior will be structured by these relationships. As outsourced labor—sometimes including alternative work arrangements—becomes a more important part of the U.S. economy, those assumptions no longer hold. What's vitally needed is a new approach, one that draws on expertise across economics, law, organizational psychology, industrial relations, and management, that seeks to deliver a robust understanding of outsourcing and its impact on U.S. workers and that can be used by employers, employees, and policymakers alike as they work to meets the needs of a modern, information-economy workforce.

Grants in this program support impartial, high-quality research that advances scholarly, policy, and public understanding of the prevalence of outsourcing across the U.S. economy and how that outsourcing affects American workers.

Trustee Grants

Stanford University

STANFORD, CALIFORNIA

$563,555 over 36 months to develop a new outsourcing survey with the U.S. Census Bureau to collect data on 50,000 U.S. establishments to evaluate the drivers and effects of outsourcing.

PROJECT DIRECTOR: **Nicholas Bloom**

While there has been a great deal of debate over the impact of outsourcing on workers and incomes, empirical research on the prevalence of these arrangements has been limited due to the lack of large-scale microdata. This grant funds a project by economists Nicholas Bloom of Stanford, Steven Davis of the University of Chicago's Booth Business School, Raffaella Sadun of the Harvard Business School, and John Van Reenen of MIT to address this gap through designing and fielding the first large-scale microsurvey of firms' outsourcing activities. Data will be collected by adding new outsourcing-related questions to the 2020 Management and Organizations Practices Survey (MOPS), a mandatory survey on a stratified sample of 50,000 U.S. manufacturing establishments.

The research team will match these new outsourcing data with a wide variety of other data, including the Longitudinal Employer-Household Dynamics (LEHD) matched employer-employee data, the Census of Manufacturing, the Longitudinal Firm Trade Transaction Database, and MOPS management data. These linkages will enable researchers to examine a host of important but currently difficult-to-examine issues, including the causes and consequences of outsourcing and its impacts on earnings, employment levels, and volatility.

Officer grants

Brandeis University

WALTHAM, MASSACHUSETTS

$249,800 over 20 months to explore a broad conception of outsourcing—"fissuring," the shift of activities traditionally done by lead firms in U.S. economy to other business organizations—and its effects on a wide range of jobs across the skill and education spectrum.

PROJECT DIRECTOR: **David Weil**

University of British Columbia

VANCOUVER, CANADA

$45,000 over 24 months to provide empirical evidence that can be used to assess domestic outsourcing as a broad managerial strategy beyond simply reducing firms' labor costs.

PROJECT DIRECTOR: **Raffaele Saggio**

Cornell University

ITHACA, NEW YORK

$131,366 over 18 months to research the effect of franchising on the labor market outcomes of managers and frontline employees.

PROJECT DIRECTOR: **Rosemary Batt**

Dartmouth College

HANOVER, NEW HAMPSHIRE

$249,998 over 24 months to investigate the role of platforms in changing outsourcing relationships, labor markets, and worker outcomes.

PROJECT DIRECTOR: **Geoffrey Parker**

University of Illinois at Chicago

CHICAGO, ILLINOIS

$249,741 over 24 months to examine how the constraints that result from subcontracting arrangements impact both the business models and employment decisions of warehouse operators.

PROJECT DIRECTOR: **Beth Gutelius**

A Sloan grant is supporting University of Pennsylvania researcher Steve Viscelli in a study of how technology platforms affect "last-mile delivery" at Amazon, a business practice where the mega-retailer uses independent contractors to bring packages from centralized drops-offs to businesses and residences.

JUST Capital

NEW YORK, NEW YORK

$150,000 over 12 months to engage companies in exploring the range of impacts of outsourcing on the U.S. workforce.

PROJECT DIRECTOR: **Alison Omens**

University of Pennsylvania

PHILADELPHIA, PENNSYLVANIA

$223,545 over 27 months to research how last-mile delivery drivers experience, understand, and respond to technology-enabled outsourcing.

PROJECT DIRECTOR: **Steve Viscelli**

Princeton University

PRINCETON, NEW JERSEY

$49,280 over 12 months to investigate an as-yet undertheorized link between outsourcing and automation.

PROJECT DIRECTOR: **Janet Vertesi**

Upjohn Institute for Employment Research

KALAMAZOO, MICHIGAN

$249,991 over 24 months to increase the impact of the new program on the impact of outsourcing, through the creation of a topical research network.

PROJECT DIRECTOR: **Susan N. Houseman**

Washington Center for Equitable Growth

WASHINGTON, DISTRICT OF COLUMBIA

$249,917 over 24 months to fund an RFP focused on advancing research on outsourcing and its impact on U.S. workers.

PROJECT DIRECTOR: **Kate Bahn**

Tabletop particle physics

PROGRAM DIRECTOR: ERNIE GLOVER

The dominant method for discovering new fundamental particles in physics has been the construction of extremely large, expensive facilities, such as particle colliders. These massive instruments crash tiny particles together at breakneck speeds, momentarily creating the super high-energy conditions theory tells us will form this or that fundamental particle. Physicists then observe the collision in the hope the theorized particle shows up. The problem with such facilities is that they are extremely expensive—perhaps prohibitively so—and take over a decade to construct. Advancement in particle physics has correspondingly slowed in the supercollider era. There's a need for new avenues of discovery that can test theory more rapidly and at lower cost.

Quantum theory has opened just such an avenue. We do not, quantum theory tells us, have to create Big-Bang-like conditions to detect the presence of new fundamental particles. All fundamental particles fluctuate into and out of existence, though for very brief periods. What we need is an instrument sensitive enough to detect them. That instrument is the electron.

Electrons are charged particles that, in isolation, are perfectly round. When a particle pops into existence near an electron, however, it deforms the electron's charge distribution, warping it in ways systematically related to the mass of the fluctuating particle. If we can detect how deformed the electron's charge is, we can find out something about the particle that deformed it. We know how deformed the electron should be due to fluctuations from the types of fundamental particles currently known to physics. As yet undiscovered particles can make electrons even more deformed, so measuring electron roundness—inside physics this is called measuring the electron's *electric dipole moment* (EDM)—can reveal signatures of new particles.

Grants in Tabletop Particle Physics, made in partnership with the Gordon and Betty Moore Foundation and the National Science Foundation, support a range of different efforts to find signs of new particles by measuring electron roundness. Five teams will each pursue a different experimental approach to measuring electron roundness and one theory team will improve our understanding of the connection between electron roundness and certain classes of hypothesized new particles. Success is far from assured. Constructing an effective detector requires using complicated techniques to exercise precise control over the electrons in ultracold molecules or solids, so that their charge distribution can be accurately measured. The potential rewards, however, are high. If successful, the experiments could reveal signatures of entirely new building blocks of the universe, and at a fraction of the cost associated with a super-collider, perhaps pointing the way towards a new era of discovery in particle physics.

Trustee Grants

California Institute of Technology

PASADENA, CALIFORNIA

$1,511,058 over 36 months to evaluate the feasibility of using laser cooled and trapped ytterbium hydroxide molecules for an ultraprecise measurement of the electron's Electric Dipole Moment.

PROJECT DIRECTOR: **Nicholas Hutzler**

Funds from this grant support an effort by Assistant Professor Nicholas Hutzler at Caltech and Professor John Doyle at Harvard to build advanced instrumentation capable of detecting new fundamental particles through precision measurement of the distortions these particles cause to the distribution of electric charge in an electron.

Hutzler and Doyle's primary detection strategy is to use intersecting lasers to create an electromagnetic "lattice" that holds polyatomic molecules at a fixed point in space. The held molecules can then be measured for perturbations in their electrical charge. The approach has significant theoretical advantages over other methods. First, optical traps can hold neutral molecules and neutral molecules can be packed very densely—charged particles disrupt one another when they are too close together—allowing for more measurements to be made per unit of space. Second, holding molecules still, as optical trapping does, allows the molecules to be measured for thousands of times longer than efforts using molecules in motion.

While other experiments of this type aspire to laser-cool diatomic molecules, diatomic molecules have limits. They don't offer the same powerful suppression of experimental noise as the molecules used in the leading experiments of this field. Polyatomic molecules should, however, and this experiment proposes using laser-cooled polyatomic molecules as an experimental platform with strong noise suppression and ultralow temperature via laser cooling. Both effects contribute to the promise of an ultraprecise measurement.

The project will produce high-profile publications, talks and posters at major conferences, and training for two postdoctoral and six Ph.D. students each year.

University of Colorado, Boulder

BOULDER, COLORADO

$1,268,213 over 60 months to search for evidence of physics beyond the Standard Model and attempt to cast light on the Original Asymmetry (matter/antimatter asymmetry) of the universe.

PROJECT DIRECTOR: **Eric Cornell**

Funds from this grant support the third iteration of an effort by researchers at JILA/University of Colorado, Boulder to build advanced instrumentation capable of detecting new fundamental particles through precision measurement of the distortions these particles cause to the distribution of electric charge in an electron.

A team led by JILA Fellows Eric Cornell and Jun Ye will attempt to use laboratory-generated electric fields to trap and hold molecular ions, which can then be measured to detect deformations in their electrical charge. Held still, ions can be monitored for thousands of times longer than if they were in motion, thereby increasing the probability of a successful detection of a charge-distorting particle.

Cornell and Ye's third-generation experiment will seek to improve on their prior efforts in several ways. First, they will switch from hafnium fluoride (HfF+) to thorium fluoride ions (ThF+) as the primary ion used for detection. This will result in greater sensitivity, as thorium is known to be more sensitive to the sorts of electrical distortions the group is attempting to measure. Second, Cornell and Ye will redesign their experimental apparatus to boost the number of ions that can be measured at one time from a few thousand to a few hundred thousand. Taken together, the improvements are expected to increase the sensitivity of their experiments by a factor of 10.

This project will produce high-profile publications, talks at major conferences, public lectures, and training for six Ph.D. students.

Harvard University

CAMBRIDGE, MASSACHUSETTS

$332,999 over 36 months to better understand how precise electric dipole moment measurements could guide efforts to obtain a more complete fundamental theory of nature.

PROJECT DIRECTOR: **Matthew Reece**

This grant supports theoretical work in particle physics by Professor Matthew Reece of Harvard University. Dr. Reece's funded work will focus on better understanding the theoretical implications of the detection or non-detection of small asymmetries in the distribution of electrical charge in an electron. Distortions in the distribution of the electrical charge of an electron can be caused by the presence of fundamental particles, with the magnitude of the distortion inversely proportional to the mass of the intruding particle. The larger the particle's mass, the smaller the distortion it causes. Theory tells us, however, that this only holds for particles that participate in so-called CP-violating interactions. Electron measurement experiments therefore do not put significant limits on these types of particles and it is important to understand which kinds of possible particles fall into this category, that is, to know which kinds of particles electron measurement experiments constrain. Professor Reece's research will categorize the types of particles and interactions that weakly violate CP-symmetry and therefore that could explain a tiny but nonzero distortion of an electron's electrical charge. This will, in turn, provide help in interpreting the results of the experiments that aim to detect new particles through measuring the charge of electrons.

Imperial College London

LONDON, UNITED KINGDOM

$777,098 over 36 months to produce a sample of optically-trapped, ultracold ytterbium fluoride molecules that can be used to precisely measure the electron's electric dipole moment.

PROJECT DIRECTOR: **Michael Tarbutt**

Funds from this grant support efforts by researchers led by Professor Michael Tarbutt and Professor Edward Hinds, both at Imperial College London, to build advanced instrumentation capable of detecting new fundamental particles through precision measurement of the distortions these particles cause to the distribution of electric charge in an electron.

Tarbutt and Hinds's primary detection strategy is to use intersecting lasers to create an electromagnetic "lattice" that holds diatomic molecules at a fixed point in space. The held molecules can then be measured for perturbations in their electrical charge. The approach, called optical trapping, has significant theoretical advantages over other methods. First, optical traps can hold neutral molecules and neutral molecules can be packed very densely—charged particles disrupt one another when they are too close together—allowing for more measurements to be made per unit of space. Second, holding molecules still, as optical trapping does, allows the molecules to be measured for thousands of times longer than efforts using molecules in motion.

The technical challenge is that only very cold molecules can be caught in an optical trap. Tarbutt and Hinds's primary activities over the grant period will be to see if ytterbium fluoride (YbF) molecules can be cooled to the microkelvin temperatures needed to make them candidates for optical trapping. They plan to bring YbF molecules into collision with a super-cold cryogenic buffer gas, which will cool the molecules sufficiently to allow laser-based techniques to take over and cool the molecules to the appropriate temperature. If successful, this would put the team in position to improve existing detection methods by a factor of 1,000, representing a significant leap in detection technology.

The project will produce several papers on laser slowing and cooling of an EDM relevant molecule, as well as training for two postdoctoral and two graduate students.

Yale University

NEW HAVEN, CONNECTICUT

$1,329,631 over 60 months to search for new fundamental particles by using cold thorium oxide molecules to measure whether an electron has an asymmetric distribution of charge.

PROJECT DIRECTOR: **David P. DeMille**

Funds from this grant support ACME III, the third-generation Advanced Cold Molecule Electron electric dipole moment (EDM) search. ACME III is a Yale-Harvard-Northwestern collaboration to build advanced instrumentation capable of detecting new fundamental particles through precision measurement of the distortions these particles cause to the distribution of electric charge in an electron.

Led by Professor David DeMille at Yale, Professor John Doyle at Harvard, and Professor Gerald Gabrielse at Northwestern, the ACME team will attempt to measure the electrical charge of electrons present in a dense beam of thorium oxide molecules, made super-cold by colliding the molecules with a cryogenic buffer gas. The technique proved successful in the first and second iterations of the ACME experiment, and phase III looks to build on this record of success. ACME III will increase both the number of molecules measured and the duration of each measurement, boosting the overall sensitivity of the experiment, compared to ACME II, by a factor of 30.

The project will produce high-profile publications, talks, and posters at major conferences, training for two postdoctoral and six Ph.D. students each year, and at least four Ph.Ds. during the grant period.

York University

TORONTO, CANADA

$681,000 over 36 months to evaluate the feasibility of using polar molecules trapped in cryogenic solid argon for an ultraprecise electron Electric Dipole Moment measurement.

PROJECT DIRECTOR: **Eric Hessels**

Funds from this grant support an effort by Professor Eric Hessels at York University, Professor Amar Vutha at the University of Toronto, and Assistant Professor Jaideep Singh at Michigan State University to build advanced instrumentation capable of detecting new fundamental particles through precision measurement of the distortions these particles cause to the distribution of electric charge in an electron.

Hessels, Vutha, and Singh's primary detection strategy is to trap barium fluoride molecules in a matrix of solid argon. Once held, the electrons in these trapped molecules can be measured for distortions in the distribution of their electric charge. This methodology has several significant theoretical benefits over competing methods. First, holding molecules still, as a solid matrix would, allows the molecules to be measured for thousands of times longer than using molecules in motion. Second, molecules can be very densely packed in a solid matrix—the York University team will aim to trap a few billion—thereby increasing the number of detection measurements that can be made per unit of space.

The method faces obstacles as there is uncertainty about whether a precision measurement can be performed on molecules embedded in a solid matrix. Phonon vibrations of the solid or other effects could make precision measurement of the trapped molecules impractical. The York team will implant the barium fluoride molecules into a solid argon matrix while it is being grown, and then perform spectroscopic measurements on the embedded molecules to see if a precision measurement is practical. In situdiagnostics will probe the growth and implantation process and different growth and annealing schedules will be followed to optimize the platform. If successful, the method could improve our detection capabilities by a factor of 200.

The project will lead to six papers, talks and posters at relevant conferences, and training for 30 students and postdoctoral researchers over the project's three-year arc.

Sloan Digital Sky Survey

PROGRAM DIRECTOR: EVAN S. MICHELSON

The Sloan Digital Sky Survey (SDSS) is one of the most productive, detailed, and highly cited telescopic surveys in the history of astronomy, pioneering an innovative model of scientific collaboration that has broadly influenced how institutions work together, how instruments are built, how data are shared, how scientists are trained, and how the public can be engaged in astronomical discovery. Every SDSS phase aims to answer fundamental questions in astronomy, astrophysics, and cosmology by expanding our understanding of the large-scale evolution and structure of the universe, the formation of stars and galaxies, and the history of the Milky Way. SDSS remains the Sloan Foundation's longest-running basic science research program and is one of the flagship research enterprises for which the Foundation is known throughout the scientific community.

In cooperation with the Astrophysical Research Consortium, the Foundation has helped build and operate the Sloan Foundation Telescope and associated instruments at Apache Point Observatory in New Mexico to observe and archive information on millions of stars, galaxies, quasars, and other cosmological phenomena. The fourth phase of SDSS (SDSS-IV), led by Michael Blanton of New York University, has over 50 collaborating institutional partners. SDSS-IV continues the survey's rich tradition of cutting-edge data collection by partnering with the du Pont Telescope at the Las Campanas Observatory in Chile, allowing for observations of regions of the sky not visible from the Northern hemisphere and helping to fully realize the truly global nature of the collaboration.

The forthcoming fifth phase of SDSS (SDSS-V), led by Juna Kollmeier of the Carnegie Observatories, is scheduled to begin observations in 2020. SDSS-V already has over 40 collaborating institutional partners

and has received additional funding by other science philanthropies. SDSS-V will further expand the collaboration between these two observatories to create one of the most extensive spectroscopic observation programs in operation through the middle of the next decade. SDSS-V will study the forces shaping the origin, structure, and future of galaxies; the nature of supermassive black holes that sit at the center of the Milky Way and other galaxies; and the role interstellar and intergalactic regions play in celestial evolution. The data collected will be prodigious: infrared spectra of over six million stars in the Milky Way, optical spectra of over four hundred thousand black holes, and over twenty-five million optical spectra of interstellar gas. Both SDSS-V telescopes will be equipped with rapidly reconfigurable fiber positioning technologies that will dramatically reduce the time it takes to observe the spectra of an observed object, allowing SDSS to complement and augment many other astronomical research programs that are examining stars, galaxies, exoplanets, and black holes.

All SDSS data continues to be released to the public on an annual basis under open principles. Data from the SDSS survey has been used in over 9,700 papers that collectively have been cited over 515,000 times in the literature. With Sloan Foundation funding, SDSS has worked to improve the collaboration's data infrastructure, working in close partnership with data scientists at the University of Utah and Johns Hopkins University. The collaboration is also focused on influencing the culture of astronomy by undertaking programmatic activities to engage underrepresented minorities through its Faculty and Student Team (FAST) initiative that aims to increase the number of underrepresented minority scholars pursuing doctoral degrees in astronomy and astrophysics, an effort that has already led to numerous under-represented minority scholars to enroll in graduate school in these and related fields.

This program made no grants in 2019.

Working Longer

PROGRAM DIRECTOR: KATHLEEN E. CHRISTENSEN

The goal of the Working Longer program is to expand and deepen scholarly, policy, and public understanding of older Americans' labor market activities and to identify ways in which institutional adjustments may facilitate employment of those who need or want to work beyond conventional retirement ages. Launched in 2010, our Working Longer program examines one of today's most pressing social issues: the aging of the U.S. workforce. According to the U.S. Bureau of Labor Statistics, by 2020, one of four people working will be 55 years old or older. Research in this multidisciplinary program is creating a body of knowledge about how well the labor market functions for older workers, the companies that employ them, as well as what can be done to support and strengthen this shift in how Americans work. Adjusting U.S. labor market institutions for the new demographic realities is a tier-one challenge for the 21st century.

Grants in this program aim to

- Fund original, high quality scientific research that examines both the supply and demand sides of older worker labor markets;
- Evaluate policy options to remove barriers to working longer;
- Identify critical labor market institutions' activities that reflect a deeper understanding of the consequences of an aging workforce;
- Create new federal and administrative data sources that bear on answering questions about older workers;
- Foster a robust, thriving multi-disciplinary community of scholars investigating issues at the intersection of aging and work;
- Advance in-depth, insightful coverage in top media outlets of issues related to delayed retirement, economic security of older Americans, and working longer.

Trustee Grants

Boston College

CHESTNUT HILL, MASSACHUSETTS

$299,148 over 24 months to evaluate older workers' value to employers and to inform policymakers as to any potential hurdles to working longer that retirees will face.

PROJECT DIRECTOR: **Alicia H. Munnell**

Many older Americans are both healthy enough to work past conventional retirement age and want or need to stay in the labor market. But do employers need and want older workers? This grant to the Center on Retirement Research (CRR) at Boston College aims to produce an enhanced understanding of the extent to which employers are ready and willing to hire and retain older workers.

The CRR initiative will involve four separate, but integrated research projects. First, the CRR team will survey a large sample of employers to acquire their perceptions of the productivity and costs of their older workers relative to their younger ones. Second, they will analyze a large proprietary dataset provided by RetirementJobs.com, a nationally recognized job site for workers over the age of 50, and analyze the sorts of jobs being offered to workers on the site. Third, they will use multiple data sources to construct an index that ranks occupations by how easy it is for older workers to stay working or be hired into that occupation. Fourth, they will use data from the Longitudinal Employer-Household Dynamics Survey (LEHD), the Census Business Register (CBR), and the Longitudinal Business Register (LBR) to compare quantitative measures of worker value—the actual productivity (revenue per worker) and profitability (revenue divided by wages)—at firms based on the age distribution of their employees.

National Academy of Sciences

WASHINGTON, DISTRICT OF COLUMBIA

$499,722 over 18 months to review and assess the available research and data on the labor market participation of older workers and provide a roadmap for future research on aging and work.

PROJECT DIRECTOR: **Malay Majmundar**

This grant to the National Academy of Sciences (NAS) supports the research, production, and dissemination of a consensus study, Understanding the Aging Workforce and Employment at Older Ages. Conducted by the National Academies' Committee on Population (CPOP) in collaboration with the Committee on National Statistics (CNSTAT) in the Division of Behavioral and Social Sciences and Education, the NAS will convene a multidisciplinary committee of nine experts from economics, sociology, demography, organizational psychology, and statistics/methodology, who will meet over the course of four meetings and 18 months to produce their final consensus report. The committee will review and assess the existing research and data on the labor market activities of older workers, including individual-level human capital and demographic characteristics associated with decisions to continue working at older ages—work history, occupation, cognitive abilities, financial literacy, and financial resources—as well as the social and structural factors that inhibit or enable employment, such as economic insecurity, family structure, workplace and personnel practices, policy levers, and available opportunities for self-employment. The report will then lay out conclusions and recommendations for future work by researchers, policymakers, and funding organizations and will be disseminated to key stakeholders, including relevant federal funding agencies, Congressional staff, academic researchers, and media.

National Bureau of Economic Research

CAMBRIDGE, MASSACHUSETTS

$949,900 over 48 months to renew support for a postdoctoral fellowship program focused on the labor market consequences of an aging population and to support a set of research projects designed to provide new insights on these issues.

PROJECT DIRECTOR: **Nicole Maestas**

This grant provides four years of continued funding for postdoctoral fellowships, for junior scholars to work on the labor market consequences of the aging of the U.S. workforce. Awarded through a competitive process, each fellowship will run for one year under the supervision of senior scholars in NBER's well-regarded Economics of Aging or Labor Studies programs. Fellowships will be awarded on the basis of a candidate's potential to make an important contribution to our understanding of labor markets for older workers. Additional monies will support a small competitive grants program, run by Alexander Gelber, associate professor at the University of California, San Diego, department of economics and School of Global Policy and Strategy, and RFPs for small economic research projects on issues related to the aging workforce. Over the course of the four-year grant, six projects will be

funded on topics that include the determinants of work at older ages, age discrimination, productivity effects of an aging workforce, or how differences in workplace policies, training, and structure affect older workers.

RAND Corporation

SANTA MONICA, CALIFORNIA

$599,160 over 24 months to construct, field, and analyze a new survey to collect information about employers' incentives and willingness to consider alternate work conditions for aging workers.

PROJECT DIRECTOR: **Jeffrey Wenger**

While some evidence exists about the types of job conditions that could encourage older workers to remain in the labor force, it is unknown whether and the extent to which those conditions are or could be available in the labor market. Surveys of older workers, for instance, regularly report high demand for workplace flexibility—specifically hours flexibility—as well as other conditions. Yet, employee preferences for job conditions like these are only half of the labor market equation. Substantially less research has been done on the employer side of the equation to understand firm-level incentives and capabilities.

This grant funds a project by Jeffrey Wenger and David Powell at the RAND Corporation, in collaboration with a team at the Indeed Hiring Lab that will survey human resource (HR) professionals, hiring managers, and employers to collect information about firms' working conditions, the variation in those working conditions across workers in the same firm, and the varying on-the-job amenities from which workers can select. In addition to collecting and analyzing these data, the team will construct a set of vignettes that display the tradeoffs between job conditions and wages that firms are capable of and willing to make. This project will produce some of the first evidence about firm-level behavior regarding the willingness of employers to accommodate older workers with specific work conditions.

Urban Institute

WASHINGTON, DISTRICT OF COLUMBIA

$573,819 over 17 months to provide federal and state policymakers with the necessary information to inform sound policies that eliminate work disincentives at older ages, facilitate paid employment for older adults, and improve older adults' financial security.

PROJECT DIRECTOR: **Richard W. Johnson**

This grant supports a project by the Urban Institute, in partnership with the American Enterprise Institute, to harness the rich research findings from the Foundation's Working Longer program to stimulate a meaningful, nonpartisan, fact-based policy discussion on older workers and retirement security. Urban Institute will not make specific policy recommendations, but instead will use Foundation-supported research to identify challenges and impediments to working past conventional retirement age and discuss how various policy reforms might both facilitate work at older ages and improve retirement income security.

Supported activities include conducting a systemic review of findings of Sloan-supported articles, reports, and books on working longer; writing a synthesis report describing the policy implications of those findings; holding an expert roundtable to assess the merits of various reform options; conducting original policy analyses of the likely impacts of promising but understudied policy options that might facilitate work at older ages; producing and disseminating briefs, blog posts, and fact sheets that highlight the most promising reform proposals; and holding a series of public forums to engage federal and state policymakers.

Officer grants

University of California, Irvine

IRVINE, CALIFORNIA

$155,958 over 30 months to build upon previously Sloan-funded research on age discrimination, by studying the effects of ageist stereotypes in job ads on the age composition of job applicants for those jobs.

PROJECT DIRECTOR: **David Neumark**

Greater Washington Educational Telecommunications Association Inc.

ARLINGTON, VIRGINIA

$200,000 over 20 months to produce a nine-part series covering the challenges faced by older workers who want or need to stay on the job and by prospective employers.

PROJECT DIRECTOR: **Lee Koromvokis**

Harvard University

CAMBRIDGE, MASSACHUSETTS

$197,008 over 18 months to support research on the effects of a range of institutional policies and programs in higher education on faculty retirement decisions.

PROJECT DIRECTOR: **Frank Dobbin**

National Bureau of Economic Research

CAMBRIDGE, MASSACHUSETTS

$166,750 over 24 months to fund a final grant to support the NBER's International Social Security Project.

PROJECT DIRECTOR: **Courtney Coile**

North Carolina State University

RALEIGH, NORTH CAROLINA

$249,957 over 24 months to study the effects of an aging labor force on firms' decision to modify employment conditions and compensation programs.

PROJECT DIRECTOR: **Robert L. Clark**

Higher Education

Diversity, Equity, and Inclusion in STEM Higher Education

PROGRAM DIRECTOR: ELIZABETH S. BOYLAN

Alfred P. Sloan demonstrated in words and actions his concern about the underrepresentation of women and racial and ethnic minorities in STEM fields and in economics. Grantmaking under successive Foundation presidents over the past 6+ decades has continued this commitment to promoting successful educational and career progress for individuals from historically underrecognized and marginalized populations in the United States.

The Foundation believes that all people deserve to be welcomed for their potential to become full partners and vital contributors to the scientific enterprise. The Foundation commits itself to supporting women and racial and ethnic minorities, who historically have been marginalized in these fields, to achieve success in a wide variety of careers in science and economics. It also commits to catalyzing institutional change to diversify STEM and economics faculties to expand the cohort of underrepresented graduates who succeed in these professions.

The Foundation's interests in STEM education focus exclusively on the higher education sector, with an emphasis on graduate education. The two signature initiatives of the program are the Minority PhD Program's University Centers of Exemplary Mentoring and the Sloan Indigenous Graduate Partnership. Projects aimed at early- to mid-career professionals from underrepresented groups are of interest, as are initiatives proposing novel or underexplored mechanisms to build institutional capacity for diversity, equity, and inclusion. Research projects may be invited that explore barriers to entry to STEM and economics higher education or the workforce, or that promote strategies affecting the performance and fulfillment of students.

Projects targeting K-12 science education, informal science education, or K-12 science educators are not considered.

Trustee Grants

American Association for the Advancement of Science

WASHINGTON, DISTRICT OF COLUMBIA

$500,000 over 12 months to provide institutions of higher education with the information they need to continue enhancing diversity efforts in ways that are mission-aligned and legally sustainable.

PROJECT DIRECTOR: **Shirley M. Malcom**

The Handbook on Diversity and the Law: Navigating a Complex Landscape to Foster Greater Faculty and Student Diversity in Higher Education is a comprehensive handbook for college and university administrators that provides practical, actionable guidance on how to design effective, legally compliant programs that advance diversity. Originally produced in 2010 with the help of a Sloan Foundation grant, the Handbook needs an update that reflects the myriad changes to the legal landscape since its publication. This grant to the American Association for the Advancement of Science provides funding for that purpose.

The Handbook on Diversity and the Law Edition 2 will add descriptions and analyses of recent court and agency decisions and changes to federal policy; provide new suggestions for process management, governance, structural barrier removal, and communications; and operationalize these resources through new user-friendly tools and training materials.

American Geophysical Union

WASHINGTON, DISTRICT OF COLUMBIA

$930,200 over 36 months to address sexual harassment and other related matters that affect gender inclusion through new educational resources and validated measurement tools.

PROJECT DIRECTOR: **Billy M. Williams**

Funds from this grant support a major initiative by the American Geophysical Union (AGU) to increase gender inclusion and reduce sexual and gender harassment in the academic STEM research community, generally, and in the geosciences in particular. Partnering with the National Center for Professional Research Ethics (NCPRE), the AGU will expand the influential SOURCE assessment system, a series of tools and services that allow universities to assess their research ethics climates at the departmental level and to benchmark their own practices against those of their institutional peers. AGU will work with NCPRE to expand and adapt SOURCE so it can be used to effectively assess university work environments for their degree of gender inclusion and their tolerance of sexual or gender harassing behaviors. AGU and NCPRE will then work to raise awareness of the new SOURCE capabilities and to spur adoption by universities.

In addition, AGU will launch several new services aimed at helping its members implement more effective anti-sexual harassment policies and inculcate more thriving cultures of gender inclusion. This will include yearly training workshops, production of a series of scenario-based web videos that provide practical training for dealing with issues of sexual harassment and gender exclusivity, and a leadership development program with an emphasis on effectively leading on ethics, diversity, and inclusion issues.

Barnard College

NEW YORK, NEW YORK

$350,000 over 60 months to shape and implement a program to build undergraduate science and math pipelines to engineering degrees at the master's level, aimed particularly at women and underrepresented minority students.

PROJECT DIRECTOR: **Linda Bell**

This grant funds a joint effort by Barnard College and Columbia University's School of Engineering to prepare undergraduate women to succeed in an accelerated M.S. degree program in engineering. Selected students will complete a four-year undergraduate major at Barnard coupled with a one-year master's degree at Columbia Engineering, for a "4+1" program. Students from racial and ethnic groups traditionally underrepresented in engineering will be a special target for recruitment into the program, particularly those from low-income families. Four cohorts of eight students each will receive support across their junior and senior years at Barnard and their master's year at Columbia.

Barnard and Columbia Engineering will build a comprehensive structure of support for students in the program, including direct faculty advising, well-delineated paths for academic courses beginning in the junior year, career counseling, cohort-level support, and financial aid to encourage participation and success. All students will be guaranteed support for summer research experiences for two years, research-based cohort activities, and intensive faculty advising.

Sloan Scholar Andrea Robinson is a Texan by birth, where she studied kinesiology as an undergraduate. Following a post-baccalaureate fellowship with the NIH, she is now pursuing an advanced degree studying immunology, epidemiology, and international health at Cornell's School of Biomedical and Biological Sciences. (PHOTO COURTESY OF NACME)

Nine diverse scholastic pathways have been identified through the program to date, including mapping a major in chemistry to an M.S. in chemical engineering, and opportunities for math, statistics, economics, computer science, or physics majors to earn one of five M.S. degrees in the Columbia Department of Industrial Engineering and Operations Research.

National Action Council for Minorities in Engineering

ALEXANDRIA, VIRGINIA

$3,300,000 over 60 months to support graduate student fellowships, mentoring, and related activities at the University Centers of Exemplary Mentoring (UCEM) at Cornell University, Georgia Institute of Technology, and Pennsylvania State University, as well as general UCEM support.

PROJECT DIRECTOR: **Michele Lezama**

This grant to the National Action Council for Minorities in Engineering (NACME) covers expected costs and obligations associated with three years of continued operation of the University Centers of Exemplary Mentoring (UCEMs) at Cornell University, Georgia Institute of Technology, and the Pennsylvania State University. UCEMs are the primary funding model for the Sloan Foundation's Minority Ph.D. (MPHD) program and NACME provides administrative and fiscal support for management of all Sloan funding for UCEMs. Funds granted to each UCEM are used primarily for $40,000 scholarships for underrepresented minority doctoral students in STEM fields. Across the three UCEMs, an estimated 61 students will receive such scholarships over the next three years, with an estimated 21 "matching" students receiving additional support from UCEM host institutions. All these students will be designated as Sloan Scholars and become eligible for other Sloan-supported opportunities and services. Additional grant funds support programmatic expenses associated with the recruitment, retention, and mentoring of these students; activities to promote their successful completion of graduate study; efforts to institutionalize UCEM priorities, policies, and practices by the conclusion of the three-year grant period; and a series of interrelated activities by NACME to support the UCEM community.

Social Science Research Council

NEW YORK, NEW YORK

$2,200,000 over 48 months to provide mentoring, networking and professional development services to Sloan MPHD graduates through the Sloan Scholars Mentoring Network (SSMN), and to review the impacts of the SSMN and MPHD as Sloan Scholars move through their careers.

PROJECT DIRECTOR: **Ron Kassimir**

Operated by the Social Science Research Council, the Sloan Scholars Mentoring Network (SSMN) is an alumni organization for graduates of Sloan's Minority Ph.D. program. SSMN provides networking and continued professional development opportunities for those alumni who continue to work in academia. The network also provides a means for the Foundation to follow the careers of program graduates and thus to help in assessing its impact. SSMN offerings include a directory with up-to-date information on the 1,124 graduates of the Minority Ph.D. program, a digital newsletter featuring relevant community news as well as long-form interviews and short spotlight pieces highlighting the achievements of Sloan Scholar alumni, a boot camp for early-career academics, a skill-development webinar series, a biennial leadership program for tenured alumni, and a grants program that provides travel or research funding for selected program graduates. Additional funds will support initial work exploring whether and how the network might be expanded to provide services to the roughly 40 percent of Sloan alumni who work outside academia.

Southern Regional Education Board

ATLANTA, GEORGIA

$1,408,919 over 48 months to support the Institute on Teaching and Mentoring as part of the national effort to increase doctoral degrees awarded to members of underrepresented minorities in STEM fields, with a special focus on preparation for careers in higher education.

PROJECT DIRECTOR: **Ansley A. Abraham**

The Institute on Teaching and Mentoring is an annual 3.5-day professional development conference for underrepresented minority doctoral students and recent Ph.D. recipients. Organized by the Southern Regional Education Board, the Institute is the single largest gathering in the country of underrepresented scholars pursuing advanced degrees. It presents an unrivaled opportunity for building community with and among such scholars and for addressing their specific educational and professional needs. The Institute also plays a central role in the Foundation's Minority Ph.D. program. More than 150 scholars supported through the Sloan University Centers of Exemplary Mentoring attend each year. Attendees hear plenary speakers talk on substantive issues in graduate education and may choose from a large variety of workshops addressing topics across every stage of the educational pipeline, from the challenges of adapting to graduate study as a first-year student, to dissertation guidance, to making informed choices about the job market. The Institute also offers programming designed to build community among attendees, forge professional connections, celebrate the achievements of scholars, and introduce attendees to professional mentors and recruiters.

Funds from this grant provide partial support for the Institute for a period of four years.

Spelman College

ATLANTA, GEORGIA

$655,936 over 36 months to address the scarcity of Black women who earn degrees in economics, and grow the number of Black women economists in the professoriate.

PROJECT DIRECTOR: **Marionette Holmes**

According to the American Economic Association, only 15 Black Americans received a Ph.D. in economics in 2016. Of those 15, only five were women. This grant supports an effort by Spelman College to meaningfully improve those numbers through a set of interrelated initiatives designed to instill in black undergraduate women an interest in economics as a profession and prepare them to succeed in graduate study in the field. Funded activities include a summer bridge program for incoming freshmen aimed at strengthening participants' core mathematical competencies; a distinguished speaker series featuring successful women of color who have made a career in economics; initiatives designed to improve the chances of successful application to an economics graduate program, including a journal club, GRE prep training, and a summer program that would provide economic research experience; and facilitated discussions of the challenges women and women of color face in white-male-dominated environments. The program will be supplemented with a scholarship fund that will ensure equal access to program offerings regardless of students' economic circumstances. Grant funds will support these and associated administrative costs for three years.

Officer grants

American Council on Education

WASHINGTON, DISTRICT OF COLUMBIA

$200,000 over 15 months to fund phase 1 of a multi-year research effort aimed at developing practice-based insights relative to equity-minded leadership in higher education and sharing the findings with the field at large.

PROJECT DIRECTOR: **Lorelle Espinosa**

American Physical Society

COLLEGE PARK, MARYLAND

$161,124 over 12 months to support two conferences that seek to increase the number of underrepresented minority (URM) students who are well-prepared for doctoral programs and who complete PhDs in the physical sciences.

PROJECT DIRECTOR: **Theodore Hodapp**

American Physical Society

COLLEGE PARK, MARYLAND

$49,500 over 31 months to provide three years of support for a keynote lecture and associated activities at the annual Conference for Undergraduate Women in Physics (CUWiP) while the Society builds an endowment for the "Millie Dresselhaus Fund for Science and Society".

PROJECT DIRECTOR: **Theodore Hodapp**

Brookings Institution

WASHINGTON, DISTRICT OF COLUMBIA

$50,000 over 9 months to provide partial support for the second Sadie T. M. Alexander Conference for Black Women in Economics and Related Fields, a professional development event for 200+ participants in February 2020.

PROJECT DIRECTOR: **David Wessel**

Kadija Yllla, Chief Strategy Officer at the Sadie Collective, speaks about their upcoming annual conference at a Brookings Institution event. Named after the first African American woman to receive a Ph.D in economics in the United States, the Sadie Collective is an organization devoted to improving the representation of black women in economics and related fields. (PHOTO COURTESY OF STEPHANIE CENCULA/BROOKINGS INSTITUTION. PHOTOGRAPH BY PAUL MORIGI.)

The University of Chicago

CHICAGO, ILLINOIS

$250,000 over 24 months to increase the diversity of the professoriate in computing at research universities through the FLIP Alliance, as a means to diversify the entire field.

PROJECT DIRECTOR: **Valerie Taylor**

Colorado State University

FORT COLLINS, COLORADO

$20,000 over 15 months to facilitate greater HBCU and HSI participation in the November 2020 Reinvention Collaborative's national conference and leaders' meeting.

PROJECT DIRECTOR: **Steven P. Dandaneau**

Council of Graduate Schools

WASHINGTON, DISTRICT OF COLUMBIA

$157,881 over 32 months to address a gap in the STEM community's understanding of graduate student mental health and wellness that creates special barriers to degree completion and success for underrepresented minorities.

PROJECT DIRECTOR: **Suzanne Ortega**

Sloan Scholar Sarah Garcia is pursuing her Ph.D. in computer science at the University of South Florida, where she is studying the brain computer interface, machine learning, and virtual reality. Here, Garcia wears an experimental device that reads electrical signals in her brain, allowing her to control the drone using only her mind. (PHOTO BY SANDRA ROA, REPUBLISHED COURTESY OF THE UNIVERSITY OF SOUTH FLORIDA)

Duke University

DURHAM, NORTH CAROLINA

$35,000 over 18 months to fund the 2020 Blackwell-Tapia Conference providing early-career minority mathematicians with enhanced understanding of their field, networking with peers, and interactions with senior researchers.

PROJECT DIRECTOR: **David Banks**

Georgia Institute of Technology

ATLANTA, GEORGIA

$233,049 over 24 months to formalize descriptive data associated with receipt of scholarships from the Sloan Minority PhD Program and to produce a framework for measuring student and program outcomes.

PROJECT DIRECTOR: **Kaye Husbands Fealing**

Georgia Institute of Technology

ATLANTA, GEORGIA

$150,000 over 24 months to study efficacy parameters of Georgia Tech's Online Master's Program in Computer Science (OMSCS) among mid-career adults with special attention to the outcomes of women and people of color.

PROJECT DIRECTOR: **Julia Melkers**

Hampton University

HAMPTON, VIRGINIA

$50,000 over 12 months to fund a Computer Science Academy for African American girls (Grade 8-11) with a two-week summer residential camp and academic year student engagement.

PROJECT DIRECTOR: **Jean Muhammad**

Massachusetts Institute of Technology

CAMBRIDGE, MASSACHUSETTS

$175,000 over 12 months to develop a demonstration project on gender inclusion through study of the careers of MIT science and engineering (S&E) faculty in the biotech innovation ecosystem for application to gendered patterns of S&E innovation in other technology sectors.

PROJECT DIRECTOR: **Fiona E. Murray**

Mathematical Sciences Research Institute

BERKELEY, CALIFORNIA

$49,993 over 12 months to address the underrepresentation of early career African American research mathematicians by increasing their number, visibility, and research productivity.

PROJECT DIRECTOR: **Helene Barcelo**

University of North Carolina, Chapel Hill

CHAPEL HILL, NORTH CAROLINA

$50,000 over 24 months to expand partnership between the Morehead Planetarium and Science Center and Elizabeth City State University focusing on underserved rural upper elementary students as a means to create equity in access to STEM learning resources and career pathways.

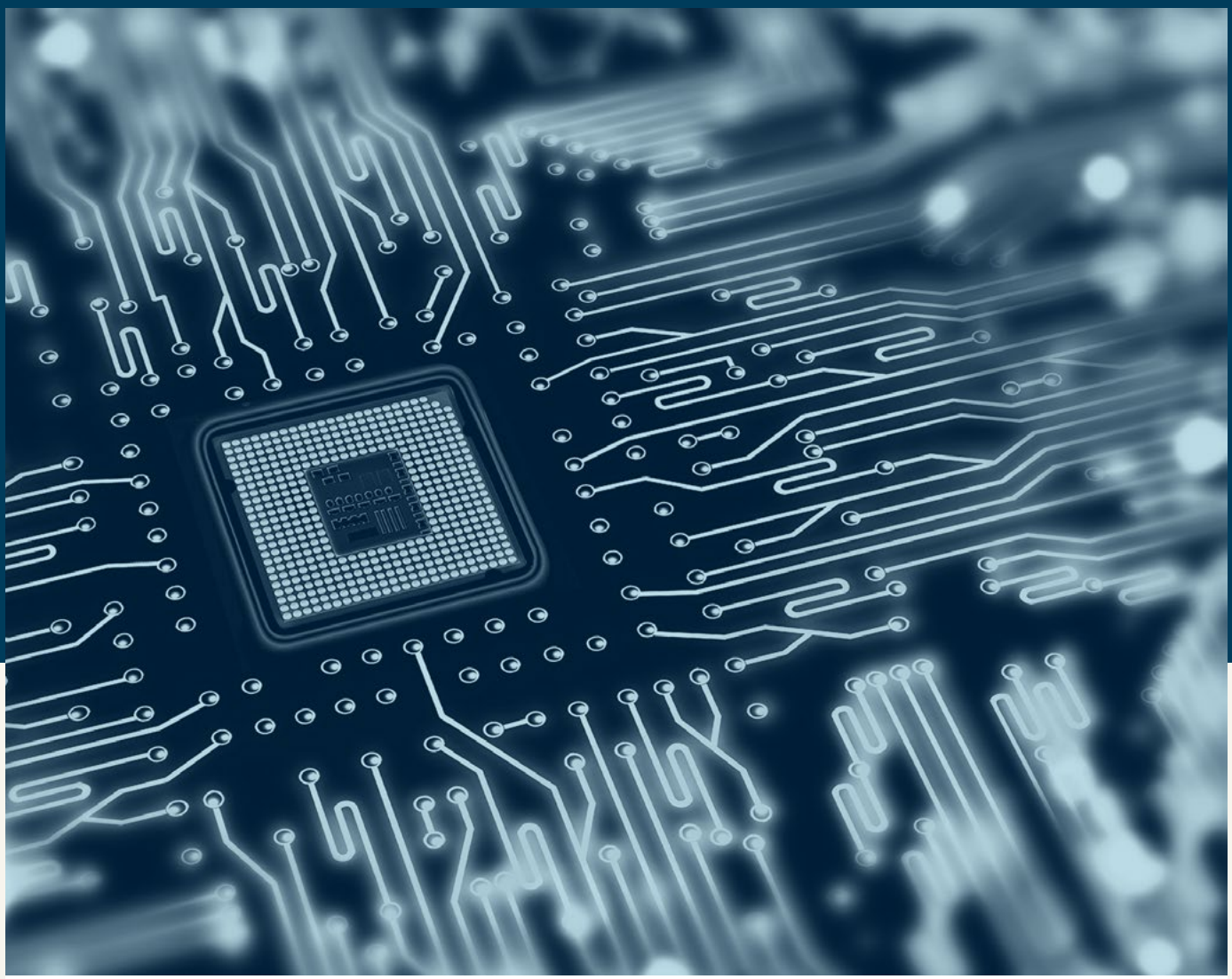
PROJECT DIRECTOR: **Todd Boyette**

Purdue University

WEST LAFAYETTE, INDIANA

$25,632 over 12 months to develop a robust program at SUNY ESF to support indigenous STEM scholars and to integrate into and contribute to the national SIGP.

PROJECT DIRECTOR: **Kevin D. Gibson**



Technology

Better Software for Science

PROGRAM DIRECTOR: JOSHUA M. GREENBERG

Software is increasingly central to scientific research, but academia often fails to leverage best practices for software engineering from industry or elsewhere. To realize the full potential of software in advancing discovery—whether in data science, computational modeling, or machine learning—this program aims to adapt and extend approaches from other contexts into academic software development while recognizing the unique workflows and incentives of the research enterprise. Rather than funding individual scientific software development projects, grants in this area focus mainly on tooling, institutions, economic models, and incentives around the production, maintenance, and adoption of research software.

Current areas the Foundation is exploring include:

- Open source as more than licensing strategy
- How to reconcile software development best practices with research workflows and scholarly communication systems
- Career paths and incentives for those who build and maintain scientific software

Trustee Grants

University of California, Berkeley

BERKELEY, CALIFORNIA

$677,783 over 24 months to develop and promulgate best practices in the review of statistical research software.

PROJECT DIRECTOR: **Karthik Ram**

Supported by the Sloan Foundation since 2013, rOpenSci is an open source community that develops research software inside the R computing environment, especially focusing on the creation of expansions and modifications of R useful to the research scientist. The rOpenSci community has become known for high-quality, trusted research software, largely because every user-developed package is run through a robust peer review process before it is added to the rOpenSci suite.

Increased access to basic data science skills combined with the demand for research software has led to rapid growth in software packages, many of which implement statistical methods. A large proportion of these software packages are highly variable in quality and lack appropriate tests to ensure that the software

produces correct results consistently, across a variety of conditions. Much of this is due to the lack of clear standards (within and across fields) and guidance on how to implement them. Funds from this grant support a two-year effort to address this pressure on two fronts: to extend the rOpenSci model of scientific software peer review into substantial assessment of the implementation of statistical methods, and to build out a technical infrastructure to manage this expanded review process.

Officer Grants

Arizona State University

TEMPE, ARIZONA

$124,973 over 24 months to support standards and community development to improve the flexibility and interoperability of computational models.

PROJECT DIRECTOR: **Michael Barton**

California Institute of Technology

PASADENA, CALIFORNIA

$64,032 over 12 months to develop community best practices and standards for discipline-specific software registries and repositories.

PROJECT DIRECTOR: **Stephen Davison**

University of California, Santa Barbara

SANTA BARBARA, CALIFORNIA

$115,115 over 24 months to document and study the histories of the R and Python programming languages.

PROJECT DIRECTOR: **Dan Sholler**

Code for Science and Society

PORTLAND, OREGON

$50,000 over 12 months to establish a network aimed at integrating and expanding open infrastructure initiatives.

PROJECT DIRECTOR: **Kaitlin Thaney**

Educopia Institute

ATLANTA, GEORGIA

$45,824 over 7 months to partially support a conference on the subject of maintenance across research, policy, and practice.

PROJECT DIRECTOR: **Jessica Meyerson**

Harvard University

CAMBRIDGE, MASSACHUSETTS

$116,290 over 12 months to construct a quantitative index of the health and sustainability of open source software projects used in academia.

PROJECT DIRECTOR: **Merce Crosas**

NumFOCUS

AUSTIN, TEXAS

$20,000 over 6 months to support travel to and attendance at JuliaCon2019 by underrepresented minorities in computing who are users of and contributors to the Julia programming language.

PROJECT DIRECTOR: **Jane Herriman**

NumFOCUS

AUSTIN, TEXAS

$30,000 over 6 months to partially support participation in the 2019 NumFOCUS Project Sustainability Summit.

PROJECT DIRECTOR: **Leah Silen**

Princeton University

PRINCETON, NEW JERSEY

$143,191 over 12 months to establish and strengthen professional networks of research software engineers in the United States.

PROJECT DIRECTOR: **Ian Cosden**

Rhizome

NEW YORK, NEW YORK

$187,125 over 18 months to prototype the alignment of software and network preservation in the context of a new publishing platform for Emulation as a Service.

PROJECT DIRECTOR: **Dragan Espenschied**

Data & Computational Research

PROGRAM DIRECTOR: JOSHUA M. GREENBERG

Recent advances in our ability to collect, transmit, analyze, store, and manipulate data have offered the opportunity to accelerate discovery, open new avenues for investigation, and enhance the robustness and reliability of research. At the same time, the scale and scope of the data now routinely used by researchers posed new challenges for effective data management, analysis, and reproducibility. Grants in this program sought to partner with research communities to develop tools, standards, practices, and institutions that enable the efficient management and sharing of data and code at every point in the scientific pipeline—from acquisition through analysis to archiving.

As funding under Data and Computational Research ramps down, resources will increasingly focus on the legacies of Sloan grantmaking in this area, shoring up existing projects and platforms that have received Sloan funding and setting these institutions up for continued operation after Sloan funding ceases.

Trustee Grants

Hopewell Fund

WASHINGTON, DISTRICT OF COLUMBIA

$1,500,000 over 36 months to enable networks of academic data science communities to share knowledge, ideas, and lessons learned, thereby facilitating the institutional changes needed to integrate data science into university research and training.

PROJECT DIRECTOR: **Micaela Parker**

Funds from this grant build from the Moore-Sloan Data Science Environments (DSEs) to support a broader series of community-building and support activities aimed at building capacity in academic data science. Funded in partnership with the Gordon and Betty Moore Foundation, the three DSEs—one at NYU, one at UC Berkeley, and one at the University of Washington—have been devoted to enhancing scientific discovery through the creation of data tools and platforms, the brokering of relationships between disciplinary scientists and institutional data resources, and pushing for innovation in university career paths for data science.

This funding will support the establishment of the Academic Data Science Alliance, a new national organization dedicated to a vision of campus data science that strengthens the interface of research domains and computational/statistical methods. Specific activities include continued efforts to facilitate communication and coordination between the three DSE campuses, annual summits for data science leadership across North America, the creation of a network and seed grant program for the growing community of young data science faculty, and the dissemination of best practices in academic data science more widely.

Ocean researchers discuss a group project at Oceanhackweek 2019. Hosted by the University of Washington's eScience Institute with the help from a grant from the Sloan Foundation, "hackweeks" are an ongoing series of workshops that bring disciplinary researchers together to get practical, hands-on training and experience using cutting-edge data tools to further research in their field. (PHOTO: JANE KOH)

Officer Grants

University of California, Los Angeles

LOS ANGELES, CALIFORNIA

$50,000 over 12 months to support a workshop and develop a future research agenda on Knowledge Infrastructures.

PROJECT DIRECTOR: **Christine Borgman**

Community Initiatives

OAKLAND, CALIFORNIA

$49,710 over 12 months to support in-person meetings of The Carpentries community to advance strategic planning, community building and leadership, skills sharing, and plans for reaching new communities.

PROJECT DIRECTOR: **Kari Jordan**

Friends of Index on Censorship

FREDERICK, MARYLAND

$48,103 over 4 months to support participation by academic and nonprofit-based social scientists at Social Science Foo Camp.

PROJECT DIRECTOR: **Jodie Ginsberg**

University of Zurich

ZURICH, SWITZERLAND

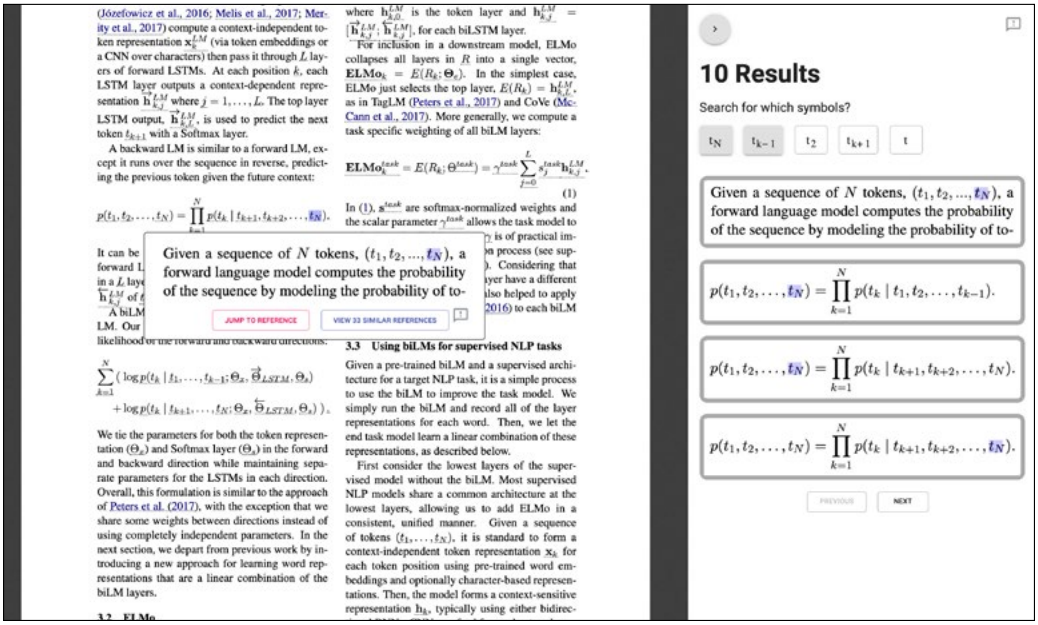
$49,886 over 12 months to support research on the processes by which researchers construct survey instruments for the study of Internet uses.

PROJECT DIRECTOR: **Eszter Hargittai**

Exploratory Grantmaking in Technology

PROGRAM DIRECTOR: JOSHUA M. GREENBERG

The Sloan Foundation continually explores the intersection of research and technology to identify emerging focus areas where recent innovation, changing contexts, or scarce funding open up potential opportunities for new programs. Exploratory grantmaking is intended to bring community needs and priorities into sharper focus and allow us to determine whether there is a clear strategy and potential impact for the Foundation in a specific area. Supported activities may include workshops and other expert convenings, early software development and prototyping, landscape analyses, development of protocols and standards, initial research on and engagement with potential user communities, and demonstration or other proof-of-concept projects.



The draft user interface for ScholarPhi. The program, being developed with Sloan support by UC Berkeley computer scientist Marti Hearst, is able to identify technical terms, functions, and equations in a paper and provide contextualized definitions of those terms, allowing readers to more easily comprehend and digest difficult and highly technical scholarship. (IMAGE COURTESY OF SCHOLARPHI PROJECT: MARTI HEARST, PRINCIPAL INVESTIGATOR)

Current areas the Foundation is exploring include:

- **Open Hardware**
  Open and cheap hardware has the potential to revolutionize the creation and deployment of sensors and other scientific instruments, expanding access and lowering barriers to innovation in data-driven research methods. Grants in this focus area seek to explore the potential for Foundation support to have an impact on the development of best practices, data standards, and emerging new practitioner communities in open hardware.
- **Trust in Algorithmic Knowledge**
  The complexity and opacity of AI-driven research methods has raised new questions about the degree to which their results can or should be trusted. Issues examined in this focus area include identifying and mitigating algorithmic bias, the role of training and benchmarking datasets in AI development, how Machine Learning techniques enhance or degrade rigor and reproducibility, and the ways that algorithmic recommendation systems influence trust in knowledge. Grants focus on exploring these issues with an eye toward understanding the potential for Foundation impact.

Trustee Grants

University of California, Berkeley

BERKELEY, CALIFORNIA

$280,942 over 24 months to develop new interfaces for scientific literature that include context-relevant explanations of technical terms and notation.

PROJECT DIRECTOR: **Marti Hearst**

Whether you call it machine learning, deep learning, or AI, a new set of methods at the interface of statistics and computer science are being applied to research across the sciences. A consequence of the excitement about these new methods is that disciplinary researchers eager to use them in their research must both get up to speed quickly and maintain an awareness of a new literature, one which is moving at high volume and velocity. Increased interest in the AI literature, however, comes just as that literature is getting harder to read thanks to a combination of short publish-response cycles and rapidly evolving norms about what should be cited and explained in a given paper.

This grant funds a project by computer scientist Marti Hearst to develop interfaces to the AI literature that offer additional context and support for readers not deeply acquainted with the field. Hearst's lab will develop algorithms and software to help readers see the meanings of symbols and terms anywhere in the text of a given article, regardless of where they are defined, and pull in explanations from papers in the co-citation network of the paper being read where definitions are not present in the text itself. The resulting software, implemented in a lightweight interface that integrates with PDF readers to ensure wide adoption, will be of value to researchers across the sciences who are adopting machine learning methods.

Harvard University

CAMBRIDGE, MASSACHUSETTS

$390,634 over 24 months to improve access to and provenance of research data, software, and hardware from CubeSat missions.

PROJECT DIRECTOR: **Daina Bouquin**

The definition of an open cube satellite (CubeSat) architecture substantially drove down the cost of designing a satellite and putting it into orbit for professional and citizen scientists across multiple disciplines. As CubeSats become more common, however, it is unclear how metadata and specifications about the hardware and specific mission will interface with existing data repositories. Nearly all CubeSat missions develop their own protocols and documentation and have no clear designated place to connect them with deposited and shared data collected by a given mission.

This grant funds an effort led by Daina Bouquin, Head Librarian of the Harvard-Smithsonian Center for Astrophysics, to develop a unified metadata schema that links data, software, and hardware related to CubeSat missions. To speed adoption of the schema, Bouquin will partner with an existing global network of "ground stations" that receive CubeSat scientific research data at no cost and will launch a pilot extension of this network to a set of public libraries.

New York University

NEW YORK, NEW YORK

$1,999,053 over 36 months to study and build a research community around the genesis of data used to train and evaluate the performance of AI systems.

PROJECT DIRECTOR: **Jason Schultz**

Artificial intelligence (AI) algorithms are being built and trained to perform a wide variety of tasks—recognizing faces, identifying objects in photos, processing natural language by extracting concepts from text. Once a system is built and trained, however, how do we know how well it performs relative to other such systems? How do we know if the data used to train the system reflect the context in which the system will be used? To answer these questions, we need to scrutinize the training datasets that are used to construct AI systems, and the benchmarking datasets against which these systems are assessed.

This grant supports work by Meredith Whittaker and Kate Crawford—the co-founders of the AI Now Institute at New York University—and NYU Law professor Jason Schultz. Over the course of three years, Whittaker, Crawford, Schultz, and their team will dig deeply into the history, design, and technical details of some of the most foundational AI datasets, investigating where they came from, how they have evolved, and how they have been used over time. They will use these findings to catalyze a broader conversation about how to understand and appropriately govern the AI systems that are informed by these datasets. The grant outputs will include multiple papers produced for both academic and lay audiences, visualizations of the provenance and uses of specific datasets, and workshops that will bring together the growing community of researchers studying the data that underpins AI research.

Installed on the roof of the John G. Wolbach Library in Cambridge, MA, this antenna is one node in a network of "ground stations" that receive research data from small micosatellites launched into orbit by scientists. A Sloan-funded effort by librarian Daina Bouquin is seeking to standardize and expand this network, with planned expansions at public libraries from Moldova to Texas. (PHOTO COURTESY OF JOHN G. WOLBACH LIBRARY, CENTER FOR ASTROPHYSICS | HARVARD & SMITHSONIAN. PHOTOGRAPHER: NICO CARVER)

University of Notre Dame

NOTRE DAME, INDIANA

$387,826 over 24 months to improve metadata standards and data management tools for use by researchers capturing data via small unmanned aircraft flights.

PROJECT DIRECTOR: **Jane Wyngaard**

Small Unmanned Aircraft Systems (sUAS), colloquially known as "drones," can be used to generate data in a number of scientific fields. The rapid expansion of use of sUAS flights for data collection, particularly by private companies, hasn't been accompanied by the development of metadata standards and tools that capture all the relevant context in which that data is generated. This means that there is no uniform, widely accepted way for scientists to describe sUAS hardware, flight paths, and other relevant contextual information, much less integrate it into existing data repositories.

This grant supports efforts by data scientist Jane Wyngaard of the Center for Research Computing at the University of Notre Dame, to complete a comprehensive sUAS metadata ontology and then seed its application in discipline-specific projects. As the ontology develops, Wyngaard will convene a series of community meetings designed to bring together researchers who actively rely on sUAS flights to ensure the schema fits the needs of field researchers. To speed adoption, Wyngaard will then develop a well-documented Application Programming Interface that will allow others to build software on top of the completed sUAS schema. Finally, Wyngaard will organize two Deployment Hackathons, which will bring together tool builders to develop research-focused applications for the schema.

Woodrow Wilson International Center for Scholars

WASHINGTON, DISTRICT OF COLUMBIA

$650,001 over 24 months to understand the current capacity and future potential for low-cost hardware to accelerate science and broaden participation in scientific research.

PROJECT DIRECTOR: **Anne Bowser**

This grant funds a project by Anne Bowser, Director of Innovation at the Woodrow Wilson International Center for Scholars, to conduct a comprehensive review of the use of low-cost, including open source, hardware in scientific research. Open hardware refers to the licensing of the design specifications of a physical object in such a way that the described object can be created, modified, used, or distributed by anyone. Open hardware sensors or other instruments present an attractive opportunity to expand the frontiers of scientific research by dramatically lowering the costs of instrumentation. Despite this promise there is, as yet, no comprehensive account of the full range of low-cost and open source hardware solutions; how hardware is being used by researchers and public policy communities; what, if any problems have arisen for those using open hardware related to data quality, governance, and standards; and what institutions and norms are needed to encourage adoption. Bowser and her team will conduct a wide-ranging review of low-cost hardware and the open hardware movement, combining broad landscape synthesis and convenings with commissioned reports on critical issues like data quality, governance, and the relationship between open hardware and other open paradigms.

Officer Grants

Data & Society Research Institute

NEW YORK, NEW YORK

$225,000 over 12 months to better understand ways that the legitimacy of data can be called into question through historical case studies of the US Census.

PROJECT DIRECTOR: **danah boyd**

Woodrow Wilson International Center for Scholars

WASHINGTON, DISTRICT OF COLUMBIA

$43,209 over 2 months to better understand how creative, private sector, government, and research communities perceive the opportunities and limitations for using democratized hardware in large-scale environmental research campaigns.

PROJECT DIRECTOR: **Anne Bowser**

Scholarly Communication

PROGRAM DIRECTOR: JOSHUA M. GREENBERG

The ability for anyone to publish and access anything on the Internet has disrupted the traditional role of academic journals in directing the attention of researchers and has also opened space for new research outputs like preprints, datasets, and codebases to be valued on their own terms. In this context, important scholarly practices like review, annotation, and curation needed to be updated to reflect and take advantage of this new technological landscape. Grants in this program have aimed to support innovative discovery and review of diverse scholarly materials, and established new forms of publication connecting data, code, and analysis as first-order research outputs.

As funding ramps down in this area, any new grants under Scholarly Communication will focus on the legacies of Sloan grantmaking, shoring up existing projects and platforms that have received Sloan funding and setting these institutions up for continued operation after Sloan funding ceases.

Trustee Grants

Australian National University Foundation

WILMINGTON, DELAWARE

$899,998 over 36 months to build, enhance, and promote a new path to document creation and publishing for next-generation scientific textbooks and lectures.

PROJECT DIRECTOR: **John Stachurski**

The Jupyter notebook is a popular, open source, Python-powered computing platform originally designed to allow researchers to easily execute, annotate, and share computationally sophisticated research. Since its launch, however, some researchers have discovered the notebook can also be used as an effective platform for the creation and sharing of textbooks, articles, lecture series, and other educational resources. Because the Jupyter system was not originally designed with this use-case in mind, modules and other add-ons need to be developed to streamline it as a pedagogical tool. This grant funds a collaborative project by John Stachurski, Greg Caporaso, and Chris Holdgraf to build a generic publishing workflow on top of the core Jupyter system that will simplify its use in producing educational materials.

A packed house watches a presentation on data metrics at a meeting of the Research Data Alliance (RDA). With Sloan support, the RDA's *Making Data Count* initiative works with scientists and other researchers to help make data a fully respected output of the scientific process, on par with more regularly cited outputs like scholarly books and articles. (PHOTO: DANIELLA LOWENBERG)

Dryad

DURHAM, NORTH CAROLINA

$635,915 over 24 months to support the integration of both community and technology initiatives in a central data curation hub for both researchers and institutions.

PROJECT DIRECTOR: **Tracy Teal**

This grant supports the expansion of Dryad, a well-respected nonprofit and open source data repository that has focused on the deposit and curation of datasets in fields lacking a disciplinary data repository. Partnering with the University of California's California Digital Library and CERN's Zenodo repository, Dryad aims to develop a community data curation and publication platform driven by researcher needs and institutional values. The envisioned expansion will integrate Dryad with other software systems commonly used by researchers across the academic research and publication pipeline, including Jupyter, rOpenSci, DataSeer, ScholarOne, and Editorial Manager. Additional funds will support a partnership with Zenodo to integrate the two systems, supporting publishers and researchers, and allowing for triaged deposits to best practice repositories based on content type.

University of Virginia

CHARLOTTESVILLE, VIRGINIA

$495,578 over 15 months to support development on Scholia, a software tool to facilitate the exploration and curation of the research literature.

PROJECT DIRECTOR: **Daniel Mietchen**

This grant supports an effort led by staff at the UVA Data Science Institute to develop and augment Scholia, an open access software platform that indexes, organizes, and presents citation and other bibliographic information stored in Wikipedia's free knowledge database, Wikidata. Working closely with both the WikiCite and Wikidata communities, Mietchen will make needed backend and user experience improvements to Scholia and then leverage a set of disciplinary "corpora" of citations and other scholarly metadata in specific targeted areas to make more tangible the potential of Scholia and Wikidata as a resource. The resulting platform will not only provide a useful new entrant to the academic citation service market, but increase the usefulness of depositing bibliographic information in the Wikidata database.

Officer Grants

The American Assembly

NEW YORK, NEW YORK

$50,000 over 3 months to support technical and interface work in advance of the release of the Open Syllabus Explorer 2.0.

PROJECT DIRECTOR: **Joseph Karaganis**

Code for Science and Society

PORTLAND, OREGON

$197,225 over 12 months to further support the development and adoption of a community platform for preprint review.

PROJECT DIRECTOR: **Daniela Saderi**

Columbia University

NEW YORK, NEW YORK

$34,804 over 6 months to plan a professional development copyright education initiative for librarians and other cultural heritage professionals.

PROJECT DIRECTOR: **Rina Pantalony**

FORCE11

SAN DIEGO, CALIFORNIA

$20,000 over 12 months to partially support the 2019 Future of Research Communication and eScholarship conference.

PROJECT DIRECTOR: **Daniel O'Donnell**

Harvard University

CAMBRIDGE, MASSACHUSETTS

$110,338 over 18 months to refine and promulgate a data standard for time-related information, in order to lower barriers to the creation of flexible online timelines.

PROJECT DIRECTOR: **Alyssa Goodman**

OCTO

WOODINVILLE, WASHINGTON

$76,501 over 6 months to support the development of a general-purpose tool to compare versions of a digital file.

PROJECT DIRECTOR: **Michael Hay**

Universal Access to Knowledge

PROGRAM DIRECTOR: DORON WEBER

The goal of the Universal Access to Knowledge program is to harness advances in digital information technology to facilitate the openness and accessibility of all knowledge in the digital age for the widest public benefit under fair and secure conditions. Current grantmaking focuses on identifying and crafting solutions to the commercial, legal, and institutional barriers to universal access to knowledge and on supporting broadly collaborative efforts such as the Digital Public Library of America (DPLA), championed by the Foundation since its inception, to become the leading repository for the nation's—and ultimately the world's—scientific and cultural heritage in all its forms. The DPLA serves as a link to thousands of libraries and cultural institutions across the country, and it contains millions of digitized items.

The Foundation supports DPLA's work on the Open eBooks Initiative, launched in 2016 with First Book, the New York Public Library, and the White House to provide low-income students with popular and classic eBooks for free. One goal is to leverage DPLA's national network for the creation of a free eBook collection, Open Bookshelf, available in 50 states and a pilot eBook marketplace, the DPLA Exchange, for thousands of libraries and schools. Both Open Bookshelf and the DPLA Exchange have launched and contain 12,000 and over 300,000 books, respectively. A grant was made to the New York Public Library in 2019 to support the continued development of the SimplyE e-reader application in order to make the DPLA Exchange and other ebooks available to an increasing number of large libraries and consortia under nonproprietary conditions.

Since 2008, the Foundation has been the lead funder and trusted advisor to Wikipedia, which is now the largest encyclopedia in human history and the fifth largest website in the world, available in

299 languages, and a model of open, collaborative text production. Most recently, the Foundation made a grant to transform Wikipedia Commons' media files from free text into machine-readable, structured data, enabling new uses for millions of media files on Wikipedia and across the web. Wikimedia Commons is the world's largest repository of freely licensed educational media, with more than 60 million files of photos, videos and audio.

In 2016, the Foundation made a grant to Annual Reviews, a non-profit publisher of a prestigious series of multi-author reviews in 47 discipline-specific fields in science and social science, to launch a digital magazine that unlocks scientific research to inform the public discourse in multiple subjects with compelling, timely, and impartial knowledge. *Knowable Magazine* has produced over 290 pieces of content since its launch, referencing 500 Annual Reviews journal articles.

Trustee Grants

New York Public Library

NEW YORK, NEW YORK

$500,000 over 12 months to support the continued development of the SimplyE e-reader application in order to make the DPLA Exchange and other ebooks available to an increasing number of large libraries and consortia under nonproprietary conditions.

PROJECT DIRECTOR: **Tony Ageh**

The grant supports a collaboration between the New York Public Library (NYPL), the Digital Public Library of America (DPLA), and LYRASIS to enhance and improve SimplyE—a state-of-the-art open source e-reader application that is used by libraries to make ebooks readily available to their patrons. Planned improvements include enhancing SimplyE's user experience (UX), particularly for first-time users, improving accessibility and document rendering, and upgrading the system's digital rights management. Additional grant funds will go toward promotion and outreach activities aimed at speeding adoption of the platform among libraries, with a goal of 1,000 public libraries using SimplyE by the end of 2022.

Officer Grants

Digital Public Library of America

CAMBRIDGE, MASSACHUSETTS

$215,633 over 13 months to develop infrastructure for the ingestion of data from national aggregators into Wikimedia Commons using content from the Digital Public Library of America in a pilot effort.

PROJECT DIRECTOR: **Michael Della Bitta**

This year's DPLAfest, a conference hosted by grantee the Digital Public Library of America and highlighting Sloan-supported projects, took place in Chicago, IL in April 2019. Sessions included an address by DPLA Executive Director John Bracken (pictured), as well as a conversation with Executive Director of Wikimedia Katherine Maher and Sloan Foundation Vice President and Program Director Doron Weber.
PHOTO CREDIT: DPLA

Public Understanding of Science, Technology & Economics

Books

PROGRAM DIRECTOR: DORON WEBER

Books are critical entry points for the entire Public Understanding program. They allow us to delve deeply into any subject and uncover or synthesize new knowledge while imparting the profoundest understanding of issues and individuals. Books also frame important questions and concerns for the public in an enlightened and accessible context. The Foundation remains committed to books, both for their intrinsic value as a matrix of uniquely rich experience and deep learning, and for their adaptability to other media for broader dissemination and popularization.

After passing in both the Senate and the House, a bill was signed into law by President Trump to award the real-life women scientists portrayed in the Sloan-supported book *Hidden Figures* with the highest civilian honor, the Congressional Gold Medal. The bill names Katherine Johnson and Christine Darden and posthumously also honors Mary Jackson and Dorothy Vaughan, as well as the thousands of other women computers, for their contributions to science during the space race. In December 2019, the Foundation hosted an official celebration with Senator Chris Coons and Representative Eddie Bernice Johnson to celebrate the women and present a copy of the bill to Darden (pictured here).
PHOTO CREDIT: LISA HELFERT

The current book program began in 1996 and has supported over 140 authors. Previously, the Foundation supported the Sloan Series of Scientific Autobiographies in the 1980s and the Sloan Technology Series in the 1990s. Critically acclaimed books such as Margot Lee Shetterly's *Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race*, Dava Sobel's *Galileo's Daughter*, Kai Bird and Martin Sherwin's *American Prometheus*, Richard Rhodes's *Hedy's Folly*, Jared Diamond's *Collapse*, and Eric Kandel's *The Age of Insight* are among those that have been supported by the program. Recently published books include *The Ice at the End of the World: An Epic Journey into Greenland's Buried Past and Our Perilous Future* by Jon Gertner, *Bottle of Lies: The Inside Story of the Generic Drug Boom* by Katherine Eban, *Wayfinding: The Science and Mystery of How Humans Navigate the World* by M. R. O'Connor, *Power Trip: The Story of Energy* by Michael Webber, *Physics and Dance* by Emily Coates and Sarah Demers, and *Lasers, Death Rays, and the Long, Strange Quest for the Ultimate Weapon* by Jeff Hecht.

New efforts include an Alfred P. Sloan Desk for one science or technology writer at the Writers Room in New York City, a fellowship for biographies through the Leon Levy Center for Biography at The City University of New York, and a television platform for Foundation-supported authors via interviews on PBS's *The Open Mind*.

Officer Grants

Center for Strategic and International Studies

WASHINGTON, DISTRICT OF COLUMBIA

$50,000 over 16 months to support the research and writing of China's Road, a book on the technology at the center of China's Belt and Road Initiative, to be published by Yale University Press in 2020.

PROJECT DIRECTOR: **Jonathan Hillman**

Jason Dearen

GAINESVILLE, FLORIDA

$50,000 over 7 months to support the research and writing of "Kill Shot: The Race to Stop a Deadly Disease and the Shadow Industry that Unleashed It," published by Penguin Random House.

PROJECT DIRECTOR: **Jason Dearen**

Quinn Eastman

DECATUR, GEORGIA

$30,000 over 6 months to support the research and writing of "The Woman Who Couldn't Wake Up," published by Columbia University Press.

PROJECT DIRECTOR: **Quinn Eastman**

Carl Erik Fisher

BROOKLYN, NEW YORK

$50,000 over 16 months to support Over the Dark Edge, a book on the scientific, cultural, intellectual, and philosophical history of addiction, to be published by Penguin Press in 2020.

PROJECT DIRECTOR: **Carl Erik Fisher**

Jaime Greenring

BROOKLYN, NEW YORK

$51,400 over 10 months to support the research and writing of "The Possibility of Life," published by Hanover Square Press in 2021.

PROJECT DIRECTOR: **Jaime Greenring**

Island Press-Center for Resource Economics

WASHINGTON, DISTRICT OF COLUMBIA

$50,000 over 18 months to support an illustrated edition of biologist E.O. Wilson's autobiography, Naturalist, to be published by Island Press in 2020.

PROJECT DIRECTOR: **David Miller**

Johns Hopkins University

BALTIMORE, MARYLAND

$48,830 over 2 months to support the research and writing of Unique, a book about the science of human individuality, to be published by Basic Books in 2020.

PROJECT DIRECTOR: **David Linden**

Daniel J. Kevles

NEW YORK, NEW YORK

$49,500 over 18 months to support the research and writing of Vital Properties, a book about the history of innovation and intellectual property protection in living organisms, to be published by Alfred A. Knopf in 2020.

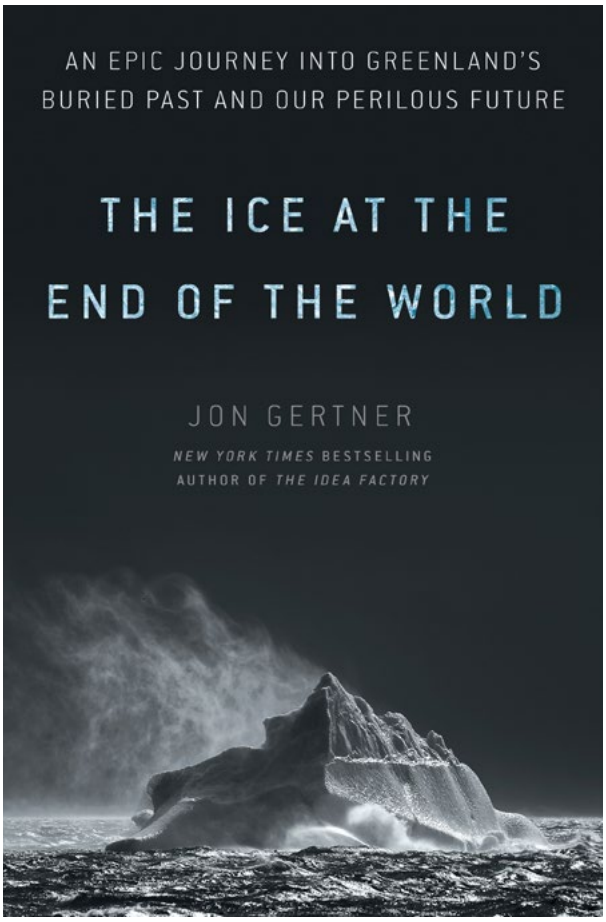
PROJECT DIRECTOR: **Daniel J. Kevles**

Elizabeth Kolbert

WILLIAMSTOWN, MASSACHUSETTS

$38,000 over 24 months to support the research and writing of a book on technologies and strategies to overcome human impact on the environment.

PROJECT DIRECTOR: **Elizabeth Kolbert**



Jon Gertner's *The Ice at the End of the World: An Epic Journey into Greenland's Buried Past and Our Perilous Future* was published in June 2019. The book is about the scientific and technological history of Greenland, especially as it pertains to our understanding of climate change.

Dan Levitt

CAMBRIDGE, MASSACHUSETTS

$54,000 over 12 months to support the research and writing of "What's Gotten Into You: A History of Your Body from the Big Bang Through Last Night's Dinner," published by Flatiron Press in 2020.

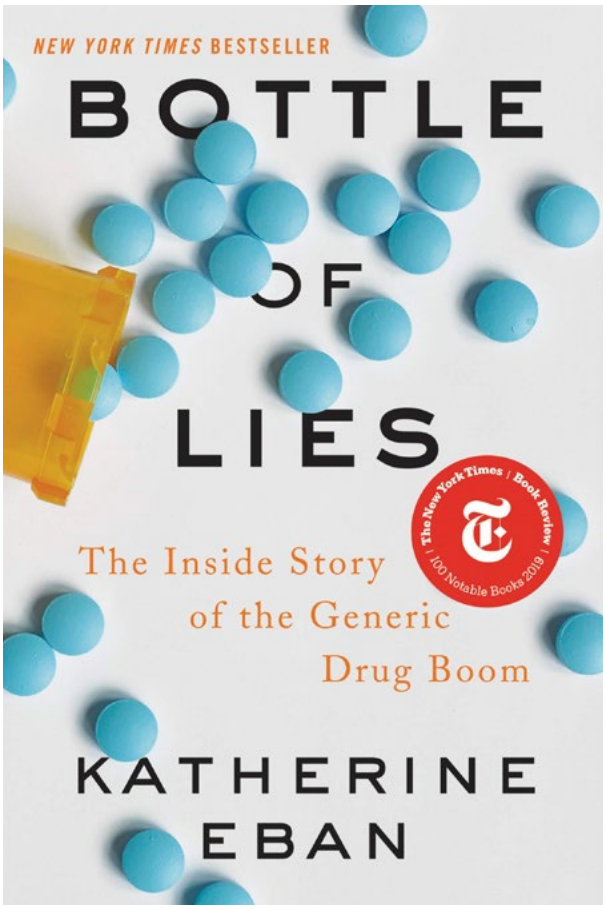
PROJECT DIRECTOR: **Dan Levitt**

University of Maryland, Baltimore County

BALTIMORE, MARYLAND

$37,000 over 24 months to support the research and writing of the book "How to Build the Universe Using Only Numbers," published by W.W. Norton.

PROJECT DIRECTOR: **Manil Suri**



Katherine Eban's *Bottle of Lies: The Inside Story of the Generic Drug Boom* was published in May 2019. The *New York Times* best-seller is a deep-dive investigation into the manufacturing of generic drugs, exposing dangerous factory practices in overseas drug manufacturers, F.D.A. regulations that fail to curb these practices, and the potentially harmful effects the drugs cause in consumers.

Fred Nadis

SANTA BARBARA, CALIFORNIA

$37,500 over 9 months to support the research and writing of Star Settlers, a book about space exploration and colonization, to be published by Pegasus Books in 2021.

PROJECT DIRECTOR: **Fred Nadis**

North Carolina State University

RALEIGH, NORTH CAROLINA

$49,999 over 13 months to support the research and writing of "Rivers: Ten Rules for Understanding the Future of Life and Human Civilization," published by Basic Books.

PROJECT DIRECTOR: **Robert C. Dunn**

North Carolina State University

RALEIGH, NORTH CAROLINA

$29,909 over 10 months to support the research and writing of The End of Everything, a book on astrophysics and the various possibilities for the end of the universe, published by Scribner in 2020.

PROJECT DIRECTOR: **Katherine J. Mack**

Northeastern University

BOSTON, MASSACHUSETTS

$49,879 over 12 months to support the research and writing of "Seven Insights about the Brain," to be published by Houghton Mifflin Harcourt.

PROJECT DIRECTOR: **Lisa Feldman Barrett**

University of Notre Dame

NOTRE DAME, INDIANA

$33,467 over 12 months to support the research and writing of Mary Shelley and the Politics of Making Artificial Life, to be published by the University of Pennsylvania Press by 2021.

PROJECT DIRECTOR: **Eileen Hunt Botting**

Richard Rhodes

HALF MOON BAY, CALIFORNIA

$125,000 over 12 months to support the first full biography of entomologist and evolutionary biologist E.O. Wilson.

PROJECT DIRECTOR: **Richard Rhodes**

Charles Seife

NEW YORK, NEW YORK

$43,275 over 12 months to support the research and writing of a non-hagiographic biography of Stephen Hawking, published by Basic Books by 2022.

PROJECT DIRECTOR: **Charles Seife**

Writers Room Inc.

NEW YORK, NEW YORK

$50,000 over 36 months to support an Alfred P. Sloan Desk for one science or technology writer per year over three years.

PROJECT DIRECTOR: **Donna Brodie**

Film

PROGRAM DIRECTOR: DORON WEBER

The goal of the Film program is to influence the next generation of filmmakers to tackle science and technology themes and characters, to increase visibility for feature films that depict this subject matter, and to produce and disseminate new films about science and technology and about scientists, engineers, and mathematicians. Film is a universal language and an unrivaled medium for advancing public understanding of the scientific and technological enterprise and of the human beings at its center.

Launched in 1996, Sloan's Film program has awarded grants to over 650 film projects from some of the nation's most innovative filmmakers and has created a film development pipeline consisting of multiple program partners though which Sloan nurtures and develops individual projects. Over the past two decades the Foundation has partnered with six of the top film schools in the country—including the American Film Institute, Carnegie Mellon University, Columbia University, New York University, The University of California, Los Angeles, and the University of Southern California—and established annual awards in screenwriting and film production, along with an annual best-of-the best Student Grand Jury Prize. Two years ago, the Foundation added six new public film schools, which award a new annual Student Discovery Award. The Foundation also supports screenplay development programs at the Sundance Film Institute, the Tribeca Film Institute, SFFILM, the Black List, the Athena Film Festival, and Film Independent's Producer's Lab and Fast Track program. Sloan-supported films that premiered in 2019 include: Michael Tyburski's *The Sound of Silence,* which debuted at the Sundance Film Festival; Jessica Oreck's *One Man Dies a Million Times,* which premiered at South by Southwest; and Ric Burns' *Oliver*

Sacks: His Own Life, which debuted at the New York Film Festival and Telluride Film Festival. Additional completed feature films developed by the Sloan pipeline include Shawn Snyder's *To Dust*, Matthew Brown's *The Man Who Knew Infinity*, Morten Tyldum's *The Imitation Game*, Michael Almereyda's *Experimenter*, Jake Schreier's *Robot & Frank*, Rob Meyer's *A Birder's Guide to Everything*, Musa Syeed's *Valley of Saints*, and Andrew Bujalski's *Computer Chess*. To gain distribution for Sloan films, the Foundation has expanded Coolidge Corner Theater's *Science on Screen* effort into a nationwide program that has awarded 237 grants to 86 independent cinemas in almost every state, each of which shows at least one Sloan-supported film a year.

Trustee Grants

Columbia University

NEW YORK, NEW YORK

$351,393 over 36 months to encourage the next generation of filmmakers to write screenplays and produce short films about science and technology through enhanced research, mentorship, and award opportunities.

PROJECT DIRECTOR: **Trey Ellis**

Funds from this grant provide support to a program at Columbia University's School of the Arts to incentivize and encourage graduate students to write screenplays and produce short films about science and technology. Supported activities include three annual $10,000 awards given to the best student screenplay with a scientific or technological theme; two annual $21,000 production awards to help produce a science-themed film project; an annual information session and scientific panel that introduces students to cutting edge scientific research, and an intensive competitive mentorship program in which students meet regularly under the supervision of a scientific advisor as they jointly develop science-themed scripts or film projects. Grant funds support these and related administrative costs for three years.

Coolidge Corner Theatre Foundation

BROOKLINE, MASSACHUSETTS

$763,700 over 24 months to sustain and expand the national Science on Screen program to all 50 states, with a focus on extending its reach to in-person audiences.

PROJECT DIRECTOR: **Beth Gilligan**

This grant provides two years of continued support for the Coolidge Corner Theatre's *Science on Screen* series, a grant program that helps independent theaters across the country pair current, classic, cult, and documentary film screenings with thoughtful introductions by notable figures from the fields of science, technology, and medicine. Grant funds will allow Coolidge to make 56 grants to independent theaters over the next two years, which will bring to over 100 the number of independent cinema houses across the country that participate in the program. Each theater in the *Science on Screen* series receives a grant of between $4,000 and $8,500 to facilitate three screenings a year with expert STEM speakers, at least one of which is a film developed or awarded a prize through the Sloan Foundation's Film program. Additional grant funds support a National Week of Science on Screen in which all participating theaters hold coordinated screenings, an expanded two-year grant program for cinemas participating for the first time, and an alumni program that provides support at a reduced level for the program's most committed cinemas. Other funds support marketing, promotion, and social media outreach designed to expand participation to theaters in all 50 U.S. states, and an ongoing presence at Arthouse Convergence, the largest annual gathering of independent cinema operators in the country.

New York University

NEW YORK, NEW YORK

$432,364 over 36 months to support screenwriting and production of science and technology films and games by top film and game design students.

PROJECT DIRECTOR: **Michael Burke**

This grant continues support to New York University's Tisch School of the Arts for a series of initiatives that encourages student filmmakers and game designers to develop screenplays, short films, and games that feature science or technology. Grant funds support an annual colloquium that brings students together with working scientists, a yearly $30,000 production award that helps a promising science-themed film project move toward completion, three $10,000 screenplay awards given to help develop science themed scripts, and an annual Game Center award to develop an interactive game that creatively integrates gameplay with science and technology. Additional funds provide stipends for working scientists to judge student submissions on their scientific content and to serve as dedicated science advisors and mentors on student projects. Grant funds support these and related administrative and outreach activities for three years.

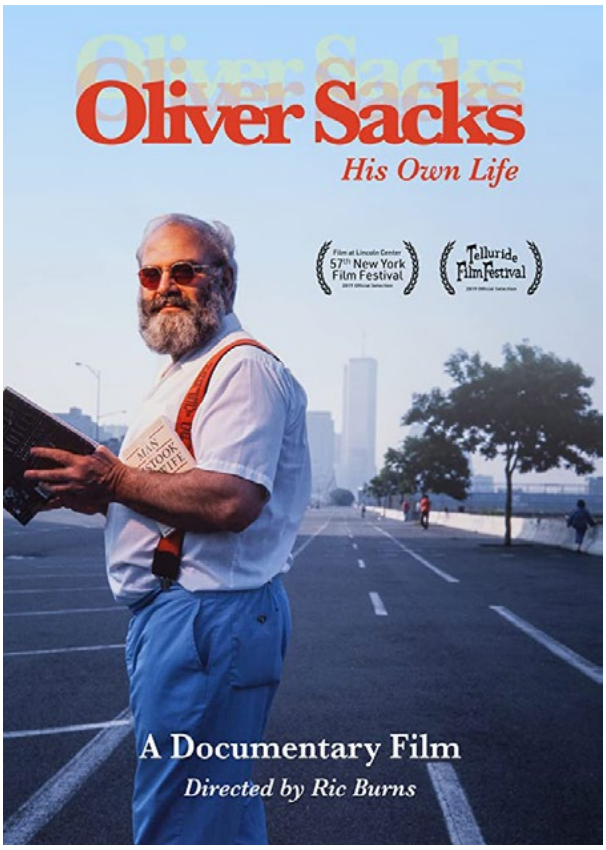
SFFILM

SAN FRANCISCO, CALIFORNIA

$467,500 over 24 months to nurture, develop, and champion films that explore scientific or technological themes and characters.

PROJECT DIRECTOR: **Elizabeth O'Malley**

This grant supports a series of activities by SFFILM, the organization that hosts the annual San Francisco Film Festival, to nurture, develop, and champion films that explore scientific or technological themes and characters. Supported activities include the awarding of two $35,000 Sloan Science in Cinema Fellowships each year to promising feature film or episodic screenwriters who are exploring scientific or technological themes in their work. SFFILM also gives an annual award, the Sloan Science in Cinema Prize, to the best science-themed feature film submitted to the San Francisco Film Festival and promotes the winning film at the festival with a ceremony, screening, post-screening panel, and reception. SFFILM also compiles a yearly Sloan Stories of Science Sourcebook, which includes the best science stories and the most up-to-date scientific discoveries of the year and offers awards to two filmmakers who can develop original scripts based on these stories or ideas. Lastly, SFFILM partners with the Black List to identify promising science-themed scripts and bring them to the attention of developers, producers, and other film industry executives. Grant funds support these activities and associated operational costs for the next two years.



Oliver Sacks: His Own Life, a Sloan-backed documentary on the world-renowned neurologist, clinician, and writer, premiered in September 2019. Upon receiving a fatal diagnosis in 2015, Sacks invited award-winning documentary filmmaker Ric Burns and his team to film his final days. The film draws on eighty hours of this unique footage, in addition to telling the story of Sacks' remarkable life and career.

Sundance Institute

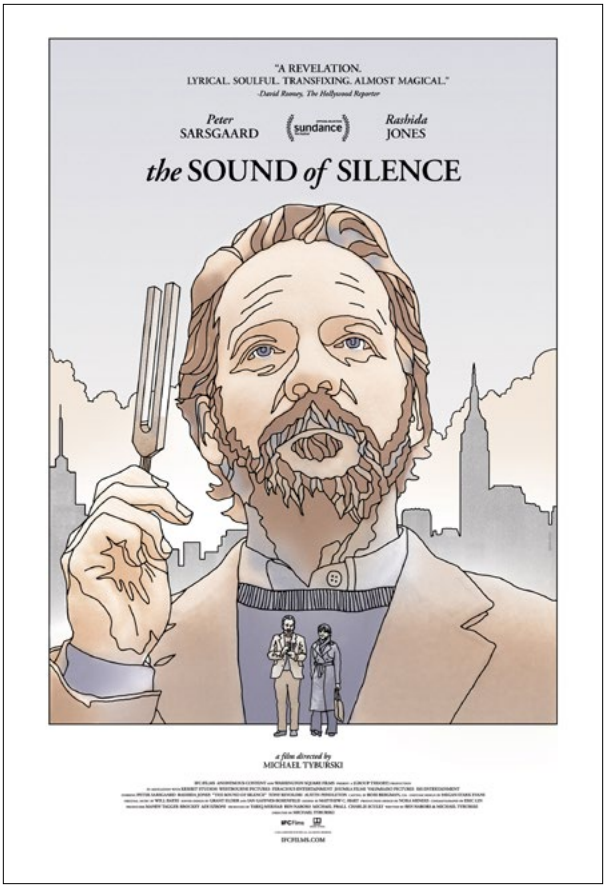
LOS ANGELES, CALIFORNIA

$500,000 over 24 months to support a science and technology film program at the nation's pre-eminent independent film center that includes screenwriting fellowships, feature film prizes, science and film panels, and associated outreach.

PROJECT DIRECTOR: **Michelle Satter**

This grant continues a Sloan partnership with the Sundance Film Institute for a series of initiatives that promote the development, production, and distribution of science-themed films. Annual initiatives include the

Sloan Commissioning Fellowship, which is awarded to a screenwriter or producer to support the development of an early-stage science-themed project. The award includes a $25,000 cash grant, a stipend for a science advisor and research, mentorship, and year-round staff support from Sundance. The Sloan Development Fellowship in the Sundance Institute Feature Film Program supports the participation of a filmmaker and his or her science-themed script in the Screenwriters Lab, Screenwriters Intensive, or Creative Producing Summit. Winners participate in the Feature Film Fellows track at the Sundance Film Festival and are eligible for additional Feature Film Program labs. The fellowship also includes a $15,000 cash grant to support the development of the project, including funds for scientific mentoring and advice. The Sloan Episodic Story Fellowship supports a writer with an early-stage, science-themed episodic project developed for television, streaming, or other platforms. It includes a $10,000 cash grant to support the development of the project, a stipend for a science advisor, and mentorship and other support from Sundance staff. The Alfred P. Sloan Feature Film Prize is awarded by a jury of esteemed filmmakers and scientists to the writer and director of an outstanding feature film focusing on science or technology as a theme, or depicting a scientist, engineer, or mathematician as a major character. The award is presented at a reception at the annual Sundance Film Festival and comes with a $20,000 cash prize. Last, the Science-in-Film Forum is a moderated panel discussion, open to all Sundance participants, featuring independent filmmakers and leading scientists and technologists who discuss compelling topics relevant to the depiction of science and technology in film and television. Grant funds support these initiatives and additional outreach, publicity, and administrative costs for a period of two years.



Michael Tyburski's *The Sound of Silence* premiered at the Sundance Film Festival in January 2019. The film, whose script won the 2014 Sloan Screenwriting Grant at the Hamptons International Film Festival, follows Peter Lucien, a New York City "house tuner," who adjusts the sounds in people's apartments to improve their moods.

Tribeca Film Institute

NEW YORK, NEW YORK

$878,500 over 24 months to build on the TFI Sloan Filmmaker Fund's success in developing new science films to production and to raise the profile of Sloan screenings, readings, and panels at the Tribeca Film Festival.

PROJECT DIRECTOR: **Bryce Norbitz**

Funds from this grant continue a partnership with the Tribeca Film Institute (TFI) to promote the development and release of science-themed films and support filmmakers who explore scientific or technological themes in their work. Each year, the TFI Sloan Filmmaker Fund issues an open call for new and established filmmakers to submit science-themed film treatments, finished screenplays, or works-in-progress. After a rigorous independent review process, two to six projects are selected each year for support. Winning projects receive between $10,000 and $75,000 to help usher the project toward completion. In addition, winners receive year-round support from TFI, including mentorship, workshops, readings, inclusion in the annual TFI Network market, a professionally produced "sizzle" reel to bolster promotion and engagement with funded projects, and arranged industry meetings. TFI also hosts a highly publicized and well-attended screening and panel discussion of a science-themed film at the Tribeca Film Festival each year along with an associated reception. Last, TFI operates an Alumni Discretionary Fund that provides microgrants of up to $5,000 to previously supported projects, providing a critical intervention that helps ensure supported projects are continuing to move toward production and release. This grant supports these and related activities for a period of two years.

Officer Grants

SFFILM

SAN FRANCISCO, CALIFORNIA

$250,000 over 19 months to provide completion funding for a feature-length film about the life and scientific contributions of Nikola Tesla.

PROJECT DIRECTOR: **Elizabeth O'Malley**

Women Make Movies

NEW YORK, NEW YORK

$249,929 over 5 months to support the production of "The Eyes to See," a documentary film about bias and discrimination against women in science.

PROJECT DIRECTOR: **Barbara Ghammashi**

Women Make Movies

NEW YORK, NEW YORK

$200,000 over 12 months to support a feature documentary about the bias encoded in automated decision-making and machine-learning algorithms, based on the work of Joy Buolamwini.

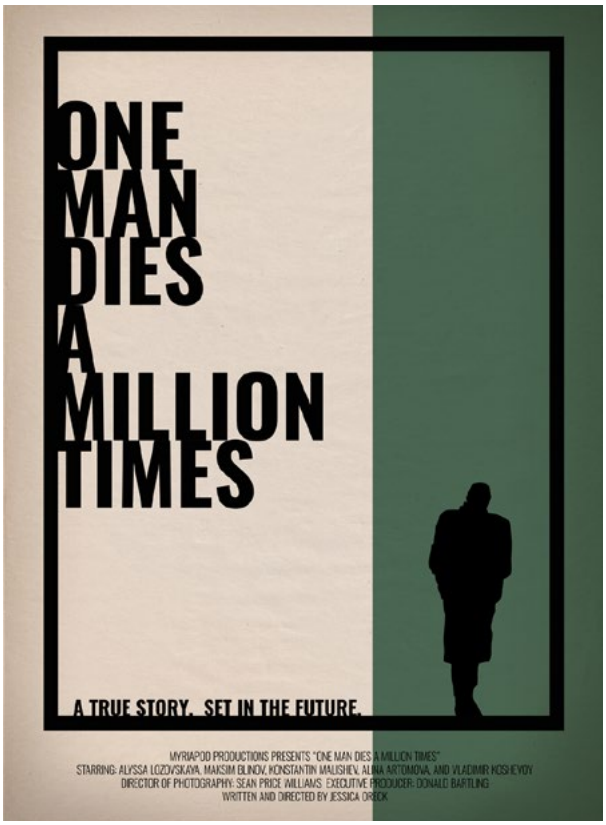
PROJECT DIRECTOR: **Debra Zimmerman**

Women Make Movies

NEW YORK, NEW YORK

$95,700 over 11 months to support the production of a feature-length documentary on neurologist Phil Kennedy, a pioneer in brain-computer interfacing, and how technology is affecting our brains.

PROJECT DIRECTOR: **Barbara Ghammashi**



Jessica Orek's *One Man Dies a Million Times* premiered at South by Southwest in March 2019. The film, which won a 2017 Tribeca Film Institute/ Sloan Production Award, is set in the future and tells a story about a heroic group of scientists who sacrifice everything to protect seeds and genetic diversity amid war and famine.

Radio

PROGRAM DIRECTOR: DORON WEBER

The Foundation supports original, high-quality programming on a range of radio programs tackling science, technology, and economics and seeks to increase both the quantity and the quality of science and technology coverage. Sloan grants started the science and technology desk at National Public Radio and at Public Radio International's *The World*; have supported feature radio series, such as the Peabody-Award winning *The DNA Files;* and sponsored science coverage on commercial radio, such as *The Osgood File*.

Current partnerships include support for the innovative, award-winning, and iconic podcast *Radiolab,* which the Foundation helped launch; Ira Flatow's perennially popular *Science Friday,* a live, weekly two-hour show with call-ins and guests about all things science; the Public Radio Exchange (PRX), the largest consortium of independent radio producers, including the female-hosted podcasts *Transistor* and *Orbital Path;* the hip economics podcast *Planet Money*, which has won many awards for its engaging explanations on how the economy works; WNYC's healthcare reporting unit, which produces the podcast *Only Human* and deep-dive reporting series on the economics of healthcare in the New York region; *Gastropod,* an award-winning podcast that brings a scientific approach to the popular subject of food and agriculture; and *Nerdette,* a podcast about "nerding out" that connects science to popular culture and the humanities. The Foundation also supports *LA Theatre Works* to record full-length science plays with A-list actors as part of a series called *Relativity*, broadcast on public radio. The over thirty recordings include more than twenty plays originally commissioned by the Foundation's theater program.

Trustee Grants

Greater Washington Educational Telecommunications Association Inc.

ARLINGTON, VIRGINIA

$500,000 over 15 months to support Making Sen$e, Paul Solman's economic and business segments on PBS NewsHour, and related online content.

PROJECT DIRECTOR: **Lee Koromvokis**

This grant provides one year of support to the PBS NewsHour to continue its regular broadcast of Making Sen$e with Paul Solman, a biweekly segment that explains business and economic issues clearly and engagingly to a general audience both on air and online. Grant funds support the production of 25 7-to-10-minute Making Sen$e broadcast segments on major issues facing the American and global economy, such as how populism and the Trump administration are reshaping economic policy, how to interpret the Bureau of Labor Statistics' monthly jobs report, how the Federal Reserve works, the impact of new corporate tax breaks on the deficit, and trends in the job market, wages, and money management.

Additional grant funds will support the production of hundreds of original pieces of web native content that deepen and extend the issued covered in Solman's on-air segments.

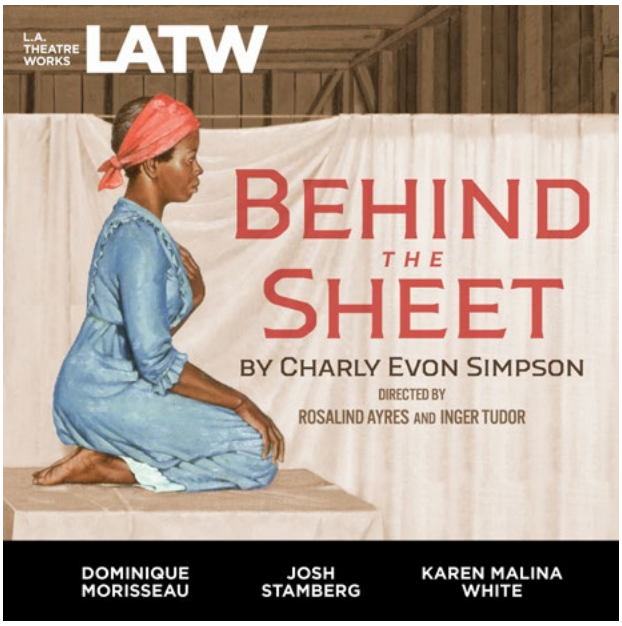
National Public Radio

WASHINGTON, DISTRICT OF COLUMBIA

$650,000 over 24 months to support NPR's coverage of economics via two podcasts, Planet Money and The Indicator; online short videos; educational outreach; and live events.

PROJECT DIRECTOR: **Christopher Turpin**

This grant provides funding to National Public Radio for production of the Planet Money podcast and a series of related initiatives designed to bring deeply reported stories on key economic issues to a general audience in an accurate, accessible, and engaging way. Over the next two years, grant funds will support production of the twice weekly Planet Money podcast as well as production of the Indicator, a podcast covering economic and business events in the news which is broadcast every weekday. In addition, grant funds will support the production of 12 online videos in the Planet Money Shorts series; 16 pieces of deep-dive written reporting; a live Planet Money event; and extended outreach to increase social media engagement, expand the Planet Money newsletter, and promote use of Planet Money content in America's classrooms.



In 2019, Sloan-commissioned plays *Behind the Sheet* and *Please Continue* were added to LA Theatre Works' *Relativity* series of Sloan-supported science radio dramas, which reaches millions of people via broadcast, podcasts, and streaming.

Science Friday Initiative

NEW YORK, NEW YORK

$700,000 over 36 months to support Science Friday, focusing on science and the arts, including radio broadcasts, digital science videos, blog posts, live events, and associated media.

PROJECT DIRECTOR: **Ira Flatow**

This grant provides three years of support for the production and distribution of Science Friday, the only regular weekly show on public radio devoted to all things science. Hosted by Ira Flatow and reaching a weekly audience of some two million through radio, streaming, social media, and the web, Science Friday is a uniquely powerful platform for advancing the public understanding of science. Supported activities over the grant period include production and distribution of 150 radio segments for broadcast; 12 to 18 digital videos; 36 digital pieces in the popular SciCandy series on photography; continued production of the biweekly Science Friday newsletter, Science Diction; the hosting of three live events in the "Science Goes to the Movies" series; and continuation of the Sci Arts Book Club. Additional grant funds support outreach and engagement activities to publicize Science Friday content and broaden its audience.

Officer Grants

Documentary Educational Resources

WATERTOWN, MASSACHUSETTS

$150,774 over 18 months to support two radio documentaries on the evolving role of libraries and library technology as part of the Humankind public radio series.

PROJECT DIRECTOR: **David Freudberg**

Food & Environment Reporting Network

NEW YORK, NEW YORK

$239,646 over 36 months to support immersive science storytelling on food and agriculture via the award-winning, female-hosted Gastropod podcast.

PROJECT DIRECTOR: **Tom Laskawy**

PRX Incorporated

BOSTON, MASSACHUSETTS

$75,000 over 9 months to support a one-day symposium on the emerging systemic threats to the openness of podcasting, including corporate consolidation and data privacy.

PROJECT DIRECTOR: **Andrew Kuklewicz**

Television

PROGRAM DIRECTOR: DORON WEBER

The Foundation's goal with television is to tell stories, both historical and contemporary, about science and technology, and to portray the lives of the men and women engaged in scientific and technological pursuits. Television continues to be the most powerful medium in terms of audience, with public television, regularly delivering several million viewers per show.

Since 1996, Sloan's Television program has been helping to integrate science and technology—and profiles of scientists, engineers, and mathematicians—into the nation's regular programming. Foundation-supported shows such as PBS's *The American Experience*, the longest running history series on television, receive support for highlighting the role of science and technology in society, and for broadening our view of the nation's history and of the central role of science,

"Chasing the Moon," part of the flagship *American Experience* series, premiered across three nights in July 2019 to celebrate the 50th anniversary of the moon landing. Using never-before-seen footage, the award-winning PBS film explores the events leading up to the historic journey to the moon. PHOTO CREDIT: PBS

technology, and engineering in the country's narrative. The Foundation also supports *American Masters*, National Geographic Television, *NOVA*, and economics coverage on *The NewsHour*. Recently aired television programs supported by the Foundation include *American Experience*'s "Sealab" and 2019 centerpiece film "Chasing the Moon," which celebrated the 50th anniversary of the moon landing; *Light Falls*, about Albert Einstein's journey to his theory of general relativity, performed live on the opening night of the World Science Festival and aired on PBS in celebration of the 100th anniversary of the solar eclipse that proved Einstein's theory; *Look Who's Driving*, produced by the award-winning team at Kikim Media, which debuted on PBS and explored topics from the history of driverless cars to today's state of the art autonomous vehicle technology and its possible pitfalls; and privacy segments on *Consumer 101*, Consumer Reports' nationally broadcast series that gives millions of viewers a behind-the-scenes look into the science used to test every kind of product.

Through its film program, the Foundation also supports the development of episodic television scripts with half a dozen partners (see the film program for more details). Sloan's newest episodic series partner, the North Fork TV Festival, presented its inaugural Sloan Science + Tech award in 2019 to Maxwell Pitagno for his screenplay *Distemper*, about pathologist and LGBT icon Louise Pearce and her work to find a cure for African Trypanosomiasis, also known as African sleeping sickness. The pilot features well-known actors and was recognized by the Los Angeles Film Festival.

The Foundation has a longtime interest in the under-appreciated role of women and minorities in science and technology, and is supporting work about such figures as Vera Rubin, Alice Ball, Lise Meitner, Marie Curie, Rosalind Franklin, Jane Goodall, and Hedy Lamarr. The Foundation also supports television programs based on topics it has backed in other media, especially books.

Trustee Grants

Consumer Reports

YONKERS, NEW YORK

$500,000 over 8 months to support segments on digital privacy on the nationally broadcast television show Consumer 101.

PROJECT DIRECTOR: **Gwendolyn Bounds**

Consumer 101 is an educational TV show, launched in 2018 and produced by Consumer Reports, that "gives viewers a behind-the-scenes look into the science used to test every kind of product, from cars and smart televisions to payment apps and food." Broadcast on NBC on Saturday morning and targeting 13- to 16-year-olds, the show aims to help teens turn themselves into smart consumers by showing them how things work, revealing tips to get the most out of everyday items, and providing them a window into unexpected career paths in science and technology. The show has reached an audience of over one million viewers.

Funds from this grant support the production and broadcast of 10 segments of Consumer 101 focused on digital privacy and security. Possible topics include smartphone security, targeted ads and search protection, smart speakers, password managers, app permissions, online privacy traps, privacy solutions, and deleting old accounts on services one no longer uses. Additional grant funds will support promotion and outreach efforts for the produced segments on traditional and social media.

WGBH Educational Foundation

BOSTON, MASSACHUSETTS

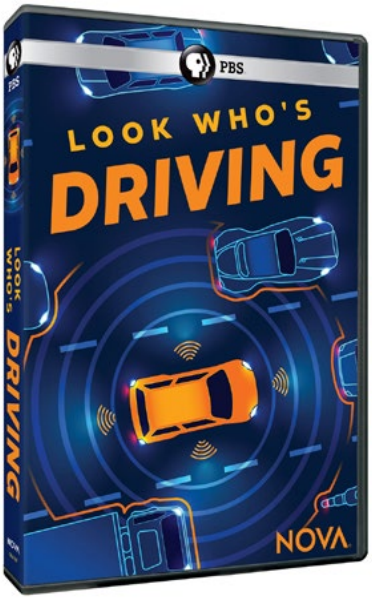
$2,000,000 over 24 months to support the production and associated marketing and promotion of four prime time American Experience documentary films about the role of science and technology in history.

PROJECT DIRECTOR: **Mark Samels**

This grant provides support to WGBH Educational Foundation to research, produce, and broadcast four science- and technology-themed episodes on its

The first winner of the Sloan/ North Fork TV Festival Science + Tech Script Competition, *Distemper* written by Maxwell Pitagno and starring *Blue Blood*'s Abigail Hawk, premiered at the 2019 North Fork TV Festival in Greenport, Long Island. (Post-screening panel with actors and filmmakers pictured.) PHOTO CREDIT: THE NORTH FORK TV FESTIVAL

popular, award-winning documentary history series American Experience. The four shows are "The Poison Squad," based on Deborah Blum's book about Dr. Harvey Washington Wiley, chief chemist for the U.S. Department of Agriculture, whose dogged efforts to test the health effects of popular chemical food additives led to modern standards of food safety; "The Man Who Tried to Feed the World," about Norman Borlaug, an Iowa agronomist who introduced innovative breeding techniques for wheat and overcame many obstacles to help feed millions in Mexico, Pakistan, and India; "The Codebreaker," about Elizabeth Smith Friedman, cryptanalyst-in-charge for the U.S. Treasury Department, whose codebreaking skills helped bring down a Nazi spy network in South America; and "Mr. Tornado," about Tetsuya Theodore "Ted" Fujita, professor of meteorology at the University of Chicago, who proved that tornadoes were not random but predictable and whose discovery of microbursts—intense downdrafts that caused airplanes to suddenly drop from the sky—led to life-saving advances in aviation.



Look Who's Driving, NOVA's Sloan-supported documentary film on autonomous vehicles, debuted in October 2019. The one-hour special produced by the award-winning team at Kikim Media explored topics from the history of driverless cars to today's autonomous vehicle technology and its possible pitfalls.

Officer Grants

North Fork TV Festival

NEW YORK, NEW YORK

$125,000 over 10 months to recruit, curate, and exhibit a high-quality science or technology focused television pilot at the 2019 North Fork TV Festival.

PROJECT DIRECTOR: **Noah Doyle**

WGBH Educational Foundation

BOSTON, MASSACHUSETTS

$150,000 over 25 months to support a one-hour NOVA special about the scientific, technological, social, and criminal justice implications of personal DNA testing.

PROJECT DIRECTOR: **Chris Schmidt**

Theater

PROGRAM DIRECTOR: DORON WEBER

The goal of this program is to engage leading playwrights, actors, directors, and producers to create and develop new works for the theater about science and technology and about scientists, engineers, and mathematicians, and to support the production of plays with dramatically engaging high-quality science content. Over the past twenty years, the Foundation has developed a nationwide theater program with participants in many regions anchored by two acclaimed New York City partners—Ensemble Studio Theatre and Manhattan Theatre Club. This seminal program has backed such early Tony and Pulitzer Prize-winning works as *Proof* and *Copenhagen*, made dozens of subgrants to regional theaters nationwide, and is today recognized as the leading supporter of science plays in the country.

Bess Wohl's *Continuity*, a Manhattan Theatre Club/ Sloan commissioned play about a director and film crew who work to create a big-budget thriller about climate change and eco-terrorism, opened in May 2019. PHOTO CREDIT: MATTHEW MURPHY

In addition to its two main partners, the Foundation is working with the National Theatre in London and in the past has worked with New York-based Playwrights Horizons to develop and stage new works. Sloan's theater program has provided support to plays such as Nick Payne's critically acclaimed *Incognito* and the Broadway hit *Constellations*, starring Jake Gyllenhaal and Ruth Wilson, Frank Basloe's *Please Continue*, Nell Benjamin's *The Explorer's Club,* and Anna Ziegler's *Boy* and *Photograph 51*, which had an award-winning production starring Nicole Kidman in London's West End. In 2019, *Behind the Sheet,* inspired by the life of Dr. J. Marion Sims, a controversial 19th century physician credited as "the father of modern gynecology," was the Ensemble Studio Theatre/ Sloan mainstage production. After a positive Critic's Pick review in the *New York Times* by top theater critic Ben Brantley, the play was extended three times to meet audience demand. Manhattan Theatre Club/ Sloan commission *Continuity,* a biting comedy about a director and film crew working with a science advisor to create a big-budget thriller about climate change and eco-terrorism, was also produced in 2019 at MTC. To date, the theater program has received over 2,000 submissions for new plays, has commissioned more than 300 works, and has staged more than 60 plays in New York City alone, with dozens travelling to more than 30 theaters across the country and internationally.

Trustee Grants

Ensemble Studio Theatre

NEW YORK, NEW YORK

$1,920,000 over 36 months to commission, develop, produce and disseminate new science plays in New York and across the country.

PROJECT DIRECTOR: **William Carden**

This grant continues support for a suite of programs by New York's Ensemble Studio Theatre (EST) to develop, produce, and disseminate new science plays. Each season, EST commissions between 15 and 20 new science-themed scripts from emerging and established playwrights; hosts its annual First Light festival, which celebrates science-themed plays with staged readings, workshops, and other events; sponsors events to bring the theater and scientific community together; makes seed grants to regional theaters around the country to develop science-themed plays with local writers; and produces a mainstage production of one play addressing scientific or technical themes or featuring a scientist, engineer, or mathematician as a major character. Grant funds provide support for these activities for three years.

L.A. Theatre Works

VENICE, CALIFORNIA

$400,000 over 24 months to record four new Sloan plays for public radio broadcast and online streaming and a 12-play podcast while disseminating 16 science plays to millions of people and thousands of libraries and schools.

PROJECT DIRECTOR: **Susan Albert Loewenberg**

Funds from this grant support the Relativity series, a Foundation partnership with L.A. Theatre Works

Charly Evon Simpson's *Behind the Sheet*, an acclaimed Ensemble Studio Theatre/ Sloan commissioned play about the controversial father of modern gynecology and the enslaved black women he experimented on, premiered in January 2019. The play was a *New York Times* critics pick and was extended three times due to its popularity.
PHOTO CREDIT: JEREMY DANIEL

(LATW) to produce, broadcast, and disseminate audio versions of the best science- and technology-themed plays supported by Sloan. Relativity now totals 35 science plays, of which 22 have been commissioned, developed, and/or produced through the Sloan Theater program. LATW productions are high-quality, feature leading actors, and give recorded plays a life well after their theatrical runs. They are broadcast with significantly expanded audiences on more than 50 public radio stations in the United States, on Radio Beijing in China, on the BBC World Service (which reaches listeners in 60 countries from Canada to Australia), and online via free streaming and downloads.

Grant funds will enable LATW to record, in studio and live in performance, four new Foundation-supported plays over the next two years. These four plays will be produced into broadcast episodes that will be expanded to include play-related supplemental interviews and features for online streaming and distribution to libraries and schools.

During the grant period, LATW will nationally broadcast the four new plays and 12 existing science plays from the Relativity library, reaching an estimated total listenership of three million.

LATW will produce two new educational guides to be distributed to 2,000 teachers, reaching an estimated 60,000 middle and high school students. They will also continue their comprehensive marketing and distribution activities for the platform and development of the LATW website and Relativity educational portal.

Officer Grants

Ensemble Studio Theatre

NEW YORK, NEW YORK

$150,000 over 1 months to extend the run of the Sloan-commissioned hit play Behind the Sheet for four weeks at EST.

PROJECT DIRECTOR: **William Carden**

Hunter College Foundation

NEW YORK, NEW YORK

$27,292 over 2 months to support 16 performances of Link Link Circus, a comedic science play on the cognitive abilities of animals, written and performed by actress Isabella Rossellini.

PROJECT DIRECTOR: **Diana Reiss**

Prospect Theater Company

NEW YORK, NEW YORK

$25,000 over 2 months to support the theatrical run of "Einstein's Dreams," a musical about Albert Einstein's work on the Theory of Special Relativity.

PROJECT DIRECTOR: **Cara Reichel**

State Theatre Regional Arts Center at New Brunswick

NEW BRUNSWICK, NEW JERSEY

$5,000 over 1 months to support the presentation of Music and the Mind, a panel discussion on the effects of music on the brain, on February 26, 2019.

PROJECT DIRECTOR: **May R. Van Norman**

New Media

PROGRAM DIRECTOR: DORON WEBER

The Foundation sponsors innovative efforts using a range of media and other platforms to reach a broad, cross-cultural audience or to target specific segments of the public to enhance public understanding of science. These efforts may take the form of conferences, multimedia events, performances, eBooks, interactive games, science and arts festivals, and more.

The Foundation is a founding sponsor of the annual World Science Festival; has funded the Science Festival Alliance; has backed a short VR film allowing viewers to experience the workings of the LIGO gravitational wave detector; has supported a catalogue and traveling exhibition featuring the seminal drawings of Santiago Ramón y Cajal, the father of modern neuroscience; has funded an interactive virtual chemistry set developed by the Chemical Heritage Foundation; has provided support to *The Secret Lives of Scientists,* a spin-off of the Sloan-supported NOVA ScienceNOW commissioned and funded exclusively by Sloan as a web-based experiment; has provided support to other projects such as an interactive eBook developed by the New York Hall of Science on the science of DNA and its role in overturning wrongful convictions; and has funded an art and technology exhibit at the Whitney Museum of American Art.

In 2019, the Foundation funded many unique new media projects including *Quantified Self*, an immersive theater piece that incorporates the audience's personal data to increase understanding of the ethics of computer science and data collection; a semester-long program at Brown University on illustrating mathematics; a short documentary film produced by Retro Report about driverless cars that was featured in *The New York Times; Casop: A Requiem for Rice*, a contemporary classical musical piece about the enslaved work

of black people in the South Carolina and Georgia Lowcountry and the underappreciated exploitation of their technologies for growing rice; and four short animated documentary films about little-known women in STEM fields as part of UNLADYLIKE 2020, a digital multimedia series women of great accomplishment.

In 2018, the Foundation made a grant to Consumer Reports (CR) to research consumer attitudes on digital privacy, convene experts and test technology platforms on their privacy practices, and educate consumers about digital privacy and security. CR examined the privacy policies, terms of use, conditions of use, account settings, end-user license agreements, privacy control dashboards, and other indicators of 15 major platforms such as Google, Microsoft, Apple, and AT&T, providing the first behind-the-scenes look at who these companies really are and how they track our information. CR is building on this work through a new grant to create tools and research methodologies to map the collection, manipulation, and sharing of consumer data across three major industries.

Casop: A Requiem for Rice, a Sloan-supported contemporary classical musical piece about the enslavement of black West Africans in the South Carolina and Georgia Lowcountry and the underappreciated exploitation of their technologies for growing rice, debuted in February 2019 at Carnegie Music Hall in Pittsburgh, Pennsylvania. Pictured here are narrator Michele Williams, composer John Christopher, executive producer and librettist Dr. Edda L. Fields-Black, conductor Leslie B. Dunner, and narrator Hyle Hayden.

Trustee Grants

Consumer Reports

YONKERS, NEW YORK

$1,002,500 over 24 months to build and apply tools and research methodologies to map the collection, manipulation, and sharing of consumer data across three industries—IoT, automotive, and data brokers—and provide consumers with information to protect their privacy and security.

PROJECT DIRECTOR: **Justin Brookman**

This grant supports an ongoing initiative by Consumer Reports to empower consumer choices of products and services by conducting research, developing tools, and providing accurate, easy-to-understand reporting on how companies and products collect and use consumer data. Led by Justin Brookman, Director of Consumer Privacy and Technology Policy, Consumer Reports will engage researchers and technologists over the next two years to build tools and construct research methodologies to map the collection, manipulation, and sharing of consumer data across three pivotal industries: the Internet of Things (devices in our homes, such as smart thermostats and other internet-connected appliances); automobiles (geolocation data, sensors); and data brokers (second and third parties who collect and sell information about consumers). Grant funds will support a series of dedicated fellowships for technologists and other digital experts who will help create new tools and research methodologies with the goal of creating state-of-the-art testing capacity that Consumer Reports will use to generate insights into how companies and products in these three spaces collect and use data. These insights will then be made public through Consumer Reports' impartial, evidence-driven journalism, which will aim both to improve consumers' ability to choose products effectively and create incentives for market participants in these industries to improve and make more transparent their data collection and use policies.

Documentary news team Retro Report released a short, Sloan-supported film that examines how realistic driverless cars are in the near future. From the challenge of creating a detailed map to guide autonomous cars to the safety features installed in regular cars as a result of research into self-driving vehicles, the documentary shows how, while this technology is advancing, there's still a long way to go.

Officer Grants

Adler Planetarium

CHICAGO, ILLINOIS

$74,791 over 22 months to engage faith-based and interfaith communities with scientific research through citizen science projects on Zooniverse.

PROJECT DIRECTOR: **Grace Wolf-Chase**

American Friends of the National Gallery, London

NEW YORK, NEW YORK

$100,000 over 7 months to support "Leonardo: Experience a Masterpiece," an immersive digital exhibition that integrates the art and science of Leonardo da Vinci.

PROJECT DIRECTOR: **Caroline Campbell**

The Aspen Institute

NEW YORK, NEW YORK

$50,000 over 12 months to support the launch of the Aspen Institute's Science & Society program.

PROJECT DIRECTOR: **Elliot Gerson**

Bricolage Production Company

PITTSBURGH, PENNSYLVANIA

$50,000 over 10 months to support Quantified Self, an immersive theater piece that incorporates the audience's personal data to increase understanding of the ethics of computer science and data collection.

PROJECT DIRECTOR: **Michael Skirpan**

Brown University

PROVIDENCE, RHODE ISLAND

$50,000 over 12 months to support a semester-long program on "Illustrating Mathematics," bringing together artists and mathematicians with an interest in illustrating mathematics with computational tools.

PROJECT DIRECTOR: **Brendan Hassett**

California Institute of Technology

PASADENA, CALIFORNIA

$30,000 over 4 months to support an international conference on the history of science at the California Institute of Technology in April 2019.

PROJECT DIRECTOR: **Diana Kormos Buchwald**

Carnegie Mellon University

PITTSBURGH, PENNSYLVANIA

$125,000 over 12 months to support the orchestral debut of and related materials for "Casop: A Requiem for Rice," a contemporary classical musical piece about the enslavement of black people in the South Carolina and Georgia Lowcountry and the underappreciated exploitation of their technologies for growing rice.

PROJECT DIRECTOR: **Edda Fields-Black**

Columbia University

NEW YORK, NEW YORK

$20,000 over 10 months to support the development of a brain-computer interface that generates music without physical movement and a live public performance and seminar demonstrating the technology.

PROJECT DIRECTOR: **Pamela Smith**

Foundation for Independent Artists

NEW YORK, NEW YORK

$70,328 over 10 months to support two productions of "Differential Cohomology, Dance of the Diagram," a math-based dance performance.

PROJECT DIRECTOR: **Alex Goleman**

The Futuro Media Group

NEW YORK, NEW YORK

$235,000 over 18 months to support four short animated documentary films and related outreach about little-known women in STEM fields as part of a multimedia series about great women distributed digitally and broadcast on PBS American Masters.

PROJECT DIRECTOR: **Charlotte Mangin**

Library Foundation of Los Angeles

LOS ANGELES, CALIFORNIA

$20,000 over 10 months to support a series of events at the Los Angeles Public Library that pairs leading scientists and thinkers with top journalists to discuss timely topics in science and technology.

PROJECT DIRECTOR: **Kenneth Brecher**

Pioneer Works

NEW YORK, NEW YORK

$124,410 over 11 months to establish a Media Lab at Pioneer Works by supporting the development of a strategic plan and the production of pilot science channel, podcast, video, and VR science programs.

PROJECT DIRECTOR: **Janna Levin**

Women Make Movies

NEW YORK, NEW YORK

$50,000 over 5 months to support the development of a TV or web-based series featuring science and technology innovators from underrepresented groups.

PROJECT DIRECTOR: **Barbara Ghammashi**

New York City Program

The New York City Program

PROGRAM DIRECTOR: PAULA J. OLSIEWSKI

Since its founding in 1934, the Alfred P. Sloan Foundation has been proud to call New York City home. In the New York City Program, the Foundation responds to unique opportunities to benefit the New York City metro area with an eye toward advancing the Foundation's other interests in research and education in science, technology, engineering, mathematics, and economics.

Major projects supported through this program include:

- **Sloan Public Service Awards:** Annual awards that honor the lifetime contributions of six NYC civil servants.
- **Sloan Awards for Excellence in Teaching Science and Mathematics:** Annual awards that recognize extraordinary science and math teachers in NYC public schools.
- **BioBus:** A retooled school bus, transformed into a mobile biology lab, brings immersive, fun science education to underserved students all over the city.
- **The DNA Learning Lab:** A new branch of Cold Spring Harbor Laboratory's DNA Learning Center, to be located in New York City, which will bring innovative, high-quality, genomics education to NYC students.
- **New York Genome Center:** A new, state-of-the-art genomic research and sequencing facility in Manhattan that provides services to a consortium of a dozen prominent NYC research organizations.

In recent years, grantmaking in this program has focused on revitalizing the NYC science, technology, and engineering sector.

Though the New York City Program is the only Sloan grant program specifically designed to benefit New York, it is not the only way the Foundation contributes to the state. Approximately one out of every four Foundation grant dollars goes to an institution based in New York.

Trustee Grants

BIOBUS

NEW YORK, NEW YORK

$800,000 over 36 months to provide renewed support to expand activities while creating the physical, fundraising, and evaluation infrastructure to ensure sustainable growth.

PROJECT DIRECTOR: **Benjamin J. Dubin-Thaler**

In 2008 Ben Dubin-Thaler, a passionate science educator and entrepreneur, purchased an old New York City bus, outfitted it with state-of-the-art microscopy, developed a curriculum, and started visiting local schools. The result was the BioBus, a fully mobile research laboratory that brings a science field trip to school and community groups, with a focus on delivering high-quality science education to underserved communities. Since 2008, the organization has grown considerably, adding and outfitting a second bus and establishing two local community education centers (called BioBases), one on the Lower East Side and one in Harlem. BioBus also increased the breadth of their educational services by launching an internship program for high school and college students and a 12-week after school learning curriculum for interested middle and high schoolers. Since its founding, BioBus has brought innovative, fun science education to an estimated 250,000 students at more than 500 New York City schools.

Funds from this grant support efforts to expand the number of students participating in BioBus programs over the next three years while creating the physical, fundraising, and evaluation infrastructure to ensure sustainable future growth. Funded activities include efforts to increase BioBus's capacity to provide science research and mentorship opportunities; complete a three-year evaluation plan of the internship program that will provide data and insights to maintain program excellence while expanding capacity, and create a sustainable business plan for increased government support.

A student measures a turtle with a caliper as part of the Environmentor program, a Sloan-supported science mentorship program that brings high school students together with educators to conduct authentic environmental research on New York's Jamaica Bay and Rockaway shoreline.
(PHOTO: RISE ROCKAWAY)

A school group tours the greenhouse at Red Hook Farms, Brooklyn's largest urban farm. A Sloan grant helps fund a partnership between Red Hook and local schools that will bring more than 500 schoolchildren to the farms to learn about plants, agriculture, sustainability, and nutrition.
(PHOTO: RED HOOK FARMS, A PROJECT OF RED HOOK INITIATIVE)

Council for Economic Education

NEW YORK, NEW YORK

$545,000 over 36 months to promote economics education in metropolitan New York high schools by recognizing innovative teachers, promoting successful pedagogies, and motivating diverse students.

PROJECT DIRECTOR: **Christopher Caltabiano**

This grant supports efforts by the Council for Economic Education (CEE) to attract a more diverse pool of individuals to economics by exposing precollege students to high-quality economics education. Grant funds support the Alfred P. Sloan Teaching Champion Awards, an annual program for recognizing innovative, effective high school economics teachers in the New York City metropolitan area. Winners receive $5,000 and their schools receive an additional $2,500 to enhance the economics curriculum. Winners are also celebrated at CEE's annual Visionary Awards dinner each October, an event popular with leaders in business, education, economics, and the media. Additional grant funds support a series of three-day training boot camps and other online and in-person professional development programs that reach over 55,000 teachers per year, two-thirds of whom teach in schools serving students from low-income families. Last, CEE hosts the New York Economics Challenge, an annual quiz-bowl-style competition that helps students discover and develop a passion for economics. The grant's funds support these and related activities for a period of three years.

Fund for the City of New York

NEW YORK, NEW YORK

$1,425,000 over 57 months to provide renewed support for the Sloan Awards for Excellence in Teaching Mathematics and Science in New York City Public High Schools.

PROJECT DIRECTOR: **Mary McCormick**

This grant provides five years of support to the Fund for the City of New York (FCNY) to offset administrative and organizational expenses associated with the Sloan Awards for Excellence in Teaching Science and Mathematics, an annual awards program that honors exceptional math and science teachers working in New York City's public high schools. Each year FCNY conducts a city-wide search for superb nominees from all five boroughs. Seven winners are selected by an expert panel of distinguished New Yorkers and winners are then honored at a city-wide celebration presided over by the chancellor of the NYC Department of Education. Winners receive a cash award of $5,000 and their schools each receive an award of $2,500 to augment their educational offerings.

Officer Grants

Civic Hall Labs

NEW YORK, NEW YORK

$250,000 over 12 months to strengthen the digital skills of civic and social organizations in New York City.

PROJECT DIRECTOR: **Jessica Quinn**

Manhattan College

BRONX, NEW YORK

$30,000 over 12 months to conduct sustainability planning activities for the Engaging, Educating, Empowering Means Change (E3MC) program.

PROJECT DIRECTOR: **Andrew Skotnicki**

The Metropolitan Museum of Art

NEW YORK, NEW YORK

$95,000 over 10 months to conduct a series of planning activities to identify the scientific needs of the NYC museum community.

PROJECT DIRECTOR: **Marco Leona**

The Mr. October Foundation for Kids

CARMEL, CALIFORNIA

$50,000 over 12 months to provide partial support for an afterschool and summer STEM enrichment program at six public schools in the Bronx.

PROJECT DIRECTOR: **Alan Gomez**

The New School

NEW YORK, NEW YORK

$249,500 over 30 months to study new city and state policies regarding driver pay and congestion on the New York City for-hire vehicle (FHV) labor market.

PROJECT DIRECTOR: **James Parrott**

Red Hook Initiative

BROOKLYN, NEW YORK

$25,000 over 12 months to provide partial support for the Farm-Based Learning Program on Red Hook Farms for students in Red Hook, Brooklyn.

PROJECT DIRECTOR: **Jill Eisenhard**

Rockaway Waterfront Alliance

FAR ROCKAWAY, NEW YORK

$50,000 over 12 months to provide renewed partial support for the Environmentor Program, a science research internship program.

PROJECT DIRECTOR: **Jeanne DuPont**

Sponsors for Educational Opportunity

NEW YORK, NEW YORK

$20,000 over 10 months to promote underrepresented minorities within the investment management industry by strengthening the pipeline of diverse talent. Ensure that minority talent is supported during their final undergraduate year and during the early stages of their career.

PROJECT DIRECTOR: **Julian C. Johnson**

Special Initiatives

Special Initiatives

The Foundation occasionally makes small, out-of-program grants in support of the philanthropic community, science philanthropy, or to take advantage of unique philanthropic opportunities. In recent years, grants have focused on the support of a host of institutions that provide services to philanthropy and philanthropists and of the Science Philanthropy Alliance, an organization devoted to increasing private charitable contributions to basic scientific research.

Officer Grants

New Venture Fund

WASHINGTON, DISTRICT OF COLUMBIA

$175,000 over 12 months to encourage charitable giving in support of basic scientific research through Sloan membership in the Science Philanthropy Alliance.

PROJECT DIRECTOR: **Valerie Conn**

University of Washington

SEATTLE, WASHINGTON

$50,000 over 12 months to support an endowed professorship for Dr. Ann Nelson in the Department of Physics honoring her legacy of advocacy for diversity and inclusion in the field of physics.

PROJECT DIRECTOR: **Robert Stacey**

The Wilderness Society

WASHINGTON, DISTRICT OF COLUMBIA

$30,000 over 12 months to support the Wilderness Society's Energy and Climate program's policy research.

PROJECT DIRECTOR: **Chase Huntley**

American Institute of Mathematics

SAN JOSE, CALIFORNIA

$45,000 over 13 months to bring engaging mathematics education to unaccompanied minors awaiting immigration decisions.

PROJECT DIRECTOR: **Brianna Donaldson**

Candid

NEW YORK, NEW YORK

$75,000 over 12 months to support work on behalf of the nonprofit and charitable community.

PROJECT DIRECTOR: **Bradford K. Smith**

Candid

NEW YORK, NEW YORK

$10,000 over 12 months to support work on behalf of the nonprofit and charitable community.

PROJECT DIRECTOR: **Bradford K. Smith**

Philanthropy New York

NEW YORK, NEW YORK

$28,000 over 12 months to support work on behalf of the nonprofit and charitable community.

PROJECT DIRECTOR: **Ronna D. Brown**

Technology Affinity Group

CHICAGO, ILLINOIS

$5,000 over 12 months to support 2019 Membership Dues for this affinity group of the Council on Foundations.

PROJECT DIRECTOR: **Chantal Forster**

2019 Financial Review

The financial statements and schedules of the Foundation for 2019 and 2018 have been audited by Grant Thornton LLP. They include the consolidated statements of financial position, consolidated statements of activities, consolidated statements of functional expense, consolidated statements of cash flows, notes to consolidated financial statements and supplementary information including the schedule of grants and appropriations.

Investment income for 2019 was $13,751,293, an increase of $5,046,632 from $8,704,661 in 2018. After the deduction of realized and unrealized gains/losses, investment expenses and provision for taxes, net investment return was $289,863,622 in 2019 as compared to ($64,363,876) for the prior year. Total investment expenses and provision for taxes equaled $10,309,355 in 2019 versus $8,923,783 in 2018.

The fair value of the Foundation's total assets was $1,952,076,486 at December 31, 2019 including investments valued at $1,926,510,393 as compared with total assets of $1,754,284,643 at December 31, 2018 including investments valued at $1,728,497,906.

Grants (net of grant refunds) and program expenses and management expenses during 2019 totaled $108,940,413 as compared to $95,498,756 for the prior year. Of this total, grants and program expenses amounted to $104,592,841 and management expenses were $4,347,572. For the prior year, grants and program expenses amounted to $90,785,384 and management expenses were $4,713,372. Grant payments in 2019 were $81,372,353 compared to $79,236,198 for the prior year.

Grants authorized and payments made during the year ended December 31, 2019 are summarized in the following table:

Grants unpaid at December 31, 2018	$	71,847,209
Authorized during 2019		95,888,277
Payments during 2019		(81,372,353)
Grants unpaid at December 31, 2019	$	86,363,133

Consolidated Financial Statements and
Supplementary Information Together with
Report of Independent Certified Public Accountants

ALFRED P. SLOAN FOUNDATION

December 31, 2019 and 2018

Audited Financial Statements and Schedules

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Grant Thornton

GRANT THORNTON LLP
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Report of Independent Certified Public Accountants

To the Board of Trustees of
Alfred P. Sloan Foundation:

We have audited the accompanying consolidated financial statements of the Alfred P. Sloan Foundation (the "Foundation"), which comprise the consolidated statements of financial position as of December 31, 2019 and 2018, and the related consolidated statements of activities, functional expenses, and cash flows for the years then ended, and the related notes to the consolidated financial statements.

Management's responsibility for the financial statements
Management is responsible for the preparation and fair presentation of these consolidated financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of consolidated financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's responsibility
Our responsibility is to express an opinion on these consolidated financial statements based on our audits. We conducted our audits in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the consolidated financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the consolidated financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the Foundation's preparation and fair presentation of the consolidated financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Foundation's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Grant Thornton

Opinion

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the consolidated financial position of the Alfred P. Sloan Foundation as of December 31, 2019 and 2018, and the changes in their net assets and their cash flows for the years then ended, in accordance with accounting principles generally accepted in the United States of America.

Other matters

Supplementary information

Our audits were conducted for the purpose of forming an opinion on the 2019 consolidated financial statements as a whole. The schedule of grants and appropriations for the year ended December 31, 2019 on pages 147 through 156 are presented for purposes of additional analysis and is not a required part of the consolidated financial statements. Such supplementary information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the consolidated financial statements. The information has been subjected to the auditing procedures applied in the audits of the consolidated financial statements and certain additional procedures. These additional procedures included comparing and reconciling the information directly to the underlying accounting and other records used to prepare the consolidated financial statements or to the consolidated financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America. In our opinion, the supplementary information is fairly stated, in all material respects, in relation to the consolidated financial statements as a whole.

Grant Thornton LLP

New York, New York
July 16, 2020

Alfred P. Sloan Foundation

Consolidated Statements of Financial Position

As of December 31, 2019 and 2018

	2019	2018
ASSETS		
Cash	$ 1,302,905	$ 1,554,235
Redemption receivable	24,263,188	24,232,502
Investments (Note 3)		
Direct investments—equities	63,261,467	46,427,936
Direct investments—fixed income	36,573,118	19,706,744
Direct investments—mutual and exchange traded funds	245,743,499	176,840,197
Alternative investments	1,580,932,309	1,485,523,029
Total investments	1,926,510,393	1,728,497,906
Total assets	$ 1,952,076,486	$ 1,754,284,643
LIABILITIES AND NET ASSETS		
LIABILITIES		
Grants payable (Note 8)	$ 86,363,133	$ 71,847,209
Federal excise tax payable (Note 5)	16,157,886	13,449,834
Accrued expenses	1,156,561	1,391,126
Accrued postretirement health benefit obligation (Note 7)	5,395,501	4,797,647
Total liabilities	109,073,081	91,485,816
Commitments (Notes 3, 4, and 9)		
NET ASSETS—without donor restrictions	1,843,003,405	1,662,798,827
Total liabilities and net assets	$ 1,952,076,486	$ 1,754,284,643

The accompanying notes are an integral part of these consolidated financial statements.

Alfred P. Sloan Foundation

Consolidated Statements of Activities

For the years ended December 31, 2019 and 2018

	2019	2018
INVESTMENT RETURN		
Interest and dividends	$ 13,751,293	$ 8,704,661
Net realized gain on disposal of investments	61,554,807	125,514,983
Unrealized gain (loss) on investments, net of deferred federal excise tax expense of $8,020,651 in 2019 and $7,023,219 in 2018	224,866,877	(189,659,737)
Investment expenses, net provision for taxes (Note 5)	(10,309,355)	(8,923,783)
Net investment return	289,863,622	(64,363,876)
Other income	1,133	4,010
Net total income (loss)	289,864,755	(64,359,866)
EXPENSES		
Grants and program	104,592,841	90,785,384
Management and general	4,347,572	4,713,372
Total expenses	108,940,413	95,498,756
Increase (decrease) in net assets before postretirement benefit adjustments	180,924,342	(159,858,622)
Other components of net period pension cost	(373,155)	4,239,369
Pension-related changes other than net periodic pension cost	(346,609)	(664,322)
Total non-operating postretirement benefit adjustments	(719,764)	3,575,047
Increase (decrease) in net assets	180,204,578	(156,283,575)
Net assets at beginning of year	1,662,798,827	1,819,082,402
Net assets at end of year	$ 1,843,003,405	$ 1,662,798,827

The accompanying notes are an integral part of these consolidated financial statements.

Alfred P. Sloan Foundation

Consolidated Statements of Functional Expenses

For the years ended December 31, 2019 and 2018

	2019			2018		
	Grants and Program	Management and General	Total	Grants and Program	Management and General	Total
Salaries	$ 4,521,410	$ 1,961,587	$ 6,482,997	$ 4,306,139	$ 1,654,661	$ 5,960,800
Employee benefits	1,417,948	462,046	1,879,994	1,006,983	1,142,195	2,149,178
	5,939,358	2,423,633	8,362,991	5,313,122	2,796,856	8,109,978
Grants, net of refunds of $520,050 in 2019 and $435,821 in 2018	95,888,277	—	95,888,277	82,697,469	—	82,697,469
Occupancy	963,502	736,796	1,700,298	856,794	734,396	1,591,190
Professional fees	776,726	114,352	891,078	851,955	291,236	1,143,191
Office expenses	424,721	322,937	747,658	381,862	323,069	704,931
Travel	398,349	137,352	535,701	382,068	117,266	499,334
Board of Trustees	—	360,608	360,608	—	331,883	331,883
Communications	1,197	251,894	253,091	110,793	118,666	229,459
Conferences and events	200,711	—	200,711	191,321	—	191,321
Total expenses	$104,592,841	$ 4,347,572	$108,940,413	$ 90,785,384	$ 4,713,372	$ 95,498,756

The accompanying notes are an integral part of these consolidated financial statements.

Alfred P. Sloan Foundation

Consolidated Statements of Cash Flows

For the years ended December 31, 2019 and 2018

	2019	2018
CASH FLOWS FROM OPERATING ACTIVITIES		
Increase (decrease) in net assets	$ 180,204,578	$ (156,283,575)
Adjustments to reconcile increase (decrease) in net assets to net cash used in operating activities		
Net realized gain on disposal of investments	(61,554,807)	(125,514,983)
Unrealized (gain) loss on investments	(225,864,309)	188,028,412
(Increase) decrease in redemption receivable	(30,686)	22,201,461
Increase in federal excise tax payable	2,708,052	1,759,963
Increase in grants payable	14,515,924	3,461,271
Increase (decrease) in accrued postretirement health benefit obligation	597,854	(3,440,818)
Decrease in accrued expenses	(234,565)	(182,374)
Decrease in other liabilities	—	(245,726)
Net cash used in operating activities	(89,657,959)	(70,216,369)
CASH FLOWS FROM INVESTING ACTIVITIES		
Proceeds from sales of investments	103,160,690	78,912,607
Purchases of investments	(13,754,061)	(8,705,177)
Net cash provided by investing activities	89,406,629	70,207,430
Net decrease in cash	(251,330)	(8,939)
Cash at beginning of year	1,554,235	1,563,174
Cash at end of year	$ 1,302,905	$ 1,554,235

The accompanying notes are an integral part of these consolidated financial statements.

Alfred P. Sloan Foundation

Notes to Consolidated Financial Statements

December 31, 2019 and 2018

1. ORGANIZATION

The Alfred P. Sloan Foundation (the "Foundation") is a not-for-profit grantmaking institution that supports high quality, impartial scientific research; fosters a robust, diverse scientific workforce; strengthens public understanding and engagement with science; and promotes the health of the institutions of scientific endeavor. The Foundation funds research and education in science, technology, engineering, mathematics and economics. The Foundation believes that these fields, and the scholars and practitioners who work in them are chief drivers of the nation's health and prosperity. The Foundation also believes that a reasoned, systematic understanding of the forces of nature and society, when applied inventively and wisely, can lead to a better world for all. In selecting projects for funding, the Foundation seeks proposals for original initiatives led by outstanding individuals or teams. The Foundation is interested in projects that have a high expected return to society, exhibit a high degree of methodological rigor, and for which funding from the private sector, the government, or other foundations is not yet widely available. The Foundation's investment portfolio provides the financial resources to support its activities. The investment strategy for the investment portfolio is to invest prudently in a diversified portfolio of assets with the goal of maintaining or growing the real value of the portfolio over long-term periods.

In June 2009, Sloan Projects LLC was established under the Delaware Limited Liability Company Act. The Foundation and Sloan Projects LLC share the common charitable and educational purpose of supporting, among other projects, film, theatrical, and television projects that promote education about science, technology, economics, and the scholars who do research in these areas. Sloan Projects LLC is a single member limited liability company ("LLC") with the sole member being the Foundation. Sloan Projects LLC is consolidated with the Foundation for financial statement and tax purposes. Refer to the subsequent events note at the end of Note 2.

2. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Basis of Accounting

The accompanying consolidated financial statements have been prepared on the accrual basis of accounting and include the assets, liabilities, net assets, and financial activities of Alfred P. Sloan Foundation and Sloan Projects LLC (collectively, the "Foundation"). All significant inter-organization balances and transactions have been eliminated in consolidation.

Income Taxes

The Foundation is exempt from federal income tax under Section 501(c)(3) of the Internal Revenue Code (the "Code") and is a private foundation as defined in Section 509(a) of the Code. Sloan Projects LLC is a single member LLC and is a disregarded entity for tax purposes. The Foundation recognizes the effect of income tax positions only if those positions are more likely than not of being sustained.

Alfred P. Sloan Foundation

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Fair Value Measurements

Fair value is defined as the price that would be received to sell an asset in an orderly transaction between market participants at the measurement date. Fair value is a market-based measurement, not an entity-specific measurement, and sets out a fair value hierarchy with the highest priority being quoted prices in active markets. The Foundation discloses fair value measurements by level within that hierarchy. The fair value hierarchy maximizes the use of observable inputs and minimizes the use of unobservable inputs by requiring that the most observable inputs be used when available. Observable inputs are those that market participants would use in pricing the asset or liability based on market data obtained from sources independent of the Foundation as of the reporting date. Unobservable inputs reflect the Foundation's assumptions about the inputs market participants would use in pricing the asset or liability developed based on the best information available in the circumstances. The fair value is categorized into three levels based on the inputs as follows:

Level 1 — Valuations based on unadjusted quoted prices in active markets for identical assets or liabilities that the Foundation has the ability to access at the measurement date. An active market for the asset or liability is a market in which transactions for the asset or liability occur with sufficient frequency and volume to provide pricing information on an ongoing basis. A quoted price in an active market provides the most reliable evidence of fair value and shall be used to measure fair value whenever available. Since valuations are based on quoted prices that are readily available and regularly available in an active market, valuation of these securities does not entail a significant degree of judgment.

Level 2 — Valuations based on quoted prices in markets that are not active or for which all significant inputs are observable, either directly or indirectly.

Level 3 — Valuations based on inputs that are unobservable and significant to the overall fair value measurement. Unobservable inputs shall be used to measure fair value to the extent that observable inputs are not available, thereby allowing for situations in which there is little, if any, market activity for the asset or liability at the measurement date.

The categorization of a financial instrument within the fair value hierarchy is based upon the pricing transparency of the instrument and does not necessarily correspond to the Foundation's perceived risk of that instrument. As permitted by Accounting Standards Update ("ASU") 2015-07, the Foundation has excluded investments that are measured at fair value using the net asset value ("NAV") per share practical expedient from the fair value hierarchy.

The Foundation follows the accounting standards of the Financial Accounting Standards Board ("FASB") Accounting Standards Codification ("ASC") Subtopic, 820-10-35-59, *Fair Value Measurement and Disclosures—Fair Value Measurements of Investments in Certain Entities That Calculate Net Asset Value per Share (or its Equivalent)*. This allows for the estimation of the fair value of investments in investment companies, for which the investment does not have a readily determinable fair value, using net asset value per share or its equivalent, as provided by the investment managers. The Foundation reviews and evaluates the values provided by the investment managers and agrees with the valuation methods and assumptions used in determining the net asset values of these investments as of the measurement date. These estimated fair values may differ significantly from the values that would have been used had a ready market for these securities existed.

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Investments
Investments in equity securities with readily determinable fair values are reported at fair value based on quoted market prices. Investments in debt securities are measured using quoted market prices where available. If quoted market prices for debt securities are not available, the fair value is determined using an income approach valuation technique that considers, among other things, rates currently observed in publicly traded markets for debt with similar terms to companies with comparable credit risk, the issuer's credit spread, and illiquidity by sector and maturity.

Gains and losses on disposal of investments are determined on the first-in, first-out basis on a trade date basis.

Cash
Cash consists of cash on hand and held in bank and money market accounts. At times, such deposits may be in excess of federally insured amounts.

Concentrations of Credit Risk
Financial instruments which potentially subject the Foundation to concentrations of credit risk consist of cash and cash equivalents, equity and fixed-income securities and alternative investments. The Foundation maintains its cash in various bank deposit accounts which, at times, may exceed federally insured limits. The Foundation's cash accounts were placed with high credit quality financial institutions. The Foundation has not experienced, nor does it anticipate, any losses with respect to such accounts. The Foundation has a significant investment in equities, fixed income securities, mutual and exchange-traded funds and alternative investments, both marketable and non-marketable, and is therefore subject to concentrations of credit risk.

Grants
Grants are recorded as an expense of the Foundation when authorized by the Board of Trustees and the grantee has been selected and notified. In certain instances (e.g., Sloan research fellowships), grants are recorded as an expense and liability when the Board of Trustees appropriates amounts for selected projects. Refunded grants are recorded as a reduction to grant expense. Conditional grants are not recorded until the conditions are substantially met.

Expenses
Expenses are recognized by the Foundation as incurred. The costs of grant making and management and general activities have been summarized on a functional basis on the consolidated statement of activities. The consolidated statement of functional expenses presents expenses by function and natural classification. Expenses directly attributable to a specific functional area are reported within that functional area. Indirect expenses that benefit multiple functional areas have been allocated based upon either time spent on each function or full-time equivalent units within each department.

Use of Estimates
The preparation of consolidated financial statements in conformity with U.S. generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the consolidated financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from these estimates.

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Reclassifications
Certain reclassifications of prior year amounts have been made to conform to the current year presentation. Such reclassifications did not change total assets, liabilities, revenues, expenses or changes in net assets as reflected in the fiscal 2018 consolidated financial statements.

Subsequent Events
The Foundation evaluated its December 31, 2019 consolidated financial statements for subsequent events through July 16, 2020, the date the consolidated financial statements were available to be issued and notes that the COVID-19 pandemic, whose effects first became known in January 2020, is having a broad and negative impact on commerce and financial markets around the world. The extent of the impact of COVID19 on the Foundation's operational and financial performance will depend on certain developments, including the duration and spread of the outbreak and its impact on its investment portfolio, grantees, employees and vendors, all of which at present, cannot be determined. Accordingly, the extent to which COVID-19 may impact the Foundation's financial position and changes in net assets and cash flows is uncertain and the accompanying consolidated financial statements include no adjustments relating to the effects of this pandemic. Additionally, the Foundation dissolved Sloan Projects LLC in March 2020. The Foundation is not aware of any other material subsequent events that would require recognition or disclosure in the accompanying consolidated statements.

Recent Accounting Pronouncements
In June 2018, the FASB issued ASU No. 2018-08, *Clarifying the Scope and the Accounting Guidance for Contributions Received and Contributions Made*, which requires organizations to determine whether a contribution is conditional based on whether an agreement includes a barrier that must be overcome and either a right of return of assets transferred or a right of release of a promisor's obligation to transfer assets. If the agreement (or a referenced document) includes both, the recipient is not entitled to the transferred assets (or a future transfer of assets) until it has overcome the barriers in the agreement. For resource providers, the amendments are effective for annual periods beginning after December 15, 2019 (i.e., fiscal year 2020). The Foundation is currently evaluating the new guidance and has not determined the impact this standard may have on the consolidated financial statements.

In February 2016, the FASB issued the new guidance, ASU 2016-02, *Leases,* which simplifies the accounting for sale and leaseback transactions primarily because lessees must recognize lease assets and lease liabilities. Under the new guidance, lessees will be required to recognize a lease liability, which is a lessor's obligation to make lease payments arising from a lease, measured on a discounted basis, and a right-of-use asset, which is an asset that represents the lessee's right to use, or control use of, a specified asset for the lease term for all leases (with the exception of short-term leases) at the adoption date. The new guidance is effective for fiscal years beginning after December 15, 2021 (i.e., fiscal year 2022), and interim periods within fiscal years after December 15, 2022. Early adoption is permitted for any interim or annual financial statements not yet issued. Lessees (for capital and operating leases) and lessors (for sales-type, direct financing and operating leases) must apply a modified retrospective approach for all leases existing at, or entered into after, the beginning of the earliest comparative period presented in the financial statements. Management is currently evaluating the impact that ASU 2016-02 will have on the consolidated financial statements.

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3. INVESTMENTS

The following tables present the fair value hierarchy of investments, the only financial instruments of the Foundation that are measured at fair value on a recurring basis, at December 31, 2019 and 2018:

	Fair Value Measurements at December 31, 2019				
	Total	Level 1	Level 2	Level 3	NAV*
Direct investments:					
Equities:					
Domestic	$ 63,261,467	$ 63,261,467	$ —	$ —	$ —
Fixed income:					
U.S. government	36,573,118	36,573,118	—	—	—
Mutual and exchange-traded funds:					
Equities	109,843,817	109,843,817	—	—	—
Fixed income	135,899,682	135,899,682	—	—	—
	245,743,499	245,743,499	—	—	—
Alternative investments:					
Equities:					
Domestic	358,638,287	—	—	—	358,638,287
International	441,544,394	—	—	—	441,544,394
Absolute return	315,230,227	11,271,505	—	—	303,958,722
Hybrid	143,752,525	—	—	—	143,752,525
Real estate	44,020,957	—	—	50,087	43,970,870
Private equity	277,745,919	—	—	—	277,745,919
	1,580,932,309	11,271,505	—	50,087	1,569,610,717
	$ 1,926,510,393	$ 356,849,589	$ —	$ 50,087	$ 1,569,610,717

* In accordance with ASC Subtopic 820-10, investments measured at fair valuing using NAV per share as a practical expedient have not been categorized in the fair value hierarchy as permitted by ASU 2015-07.

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	Fair Value Measurements at December 31, 2018				
	Total	Level 1	Level 2	Level 3	NAV*
Direct investments:					
Equities:					
Domestic	$ 46,427,936	$ 46,427,936	$ —	$ —	$ —
Fixed income:					
U.S. government	19,706,744	19,706,744	—	—	—
Mutual and exchange-traded funds:					
Equities	50,541,533	50,541,533	—	—	—
Fixed income	126,298,664	126,298,664	—	—	—
	176,840,197	176,840,197	—	—	—
Alternative investments:					
Equities:					
Domestic	299,064,318	—	—	—	299,064,318
International	423,524,840	—	—	—	423,524,840
Absolute return	358,170,854	20,617,127	—	—	337,553,727
Hybrid	159,642,668	—	—	—	159,642,668
Real estate	22,605,270	—	—	5,180	22,600,090
Private equity	222,515,079	—	—	—	222,515,079
	1,485,523,029	20,617,127	—	5,180	1,464,900,722
	$ 1,728,497,906	$ 263,592,004	$ —	$ 5,180	$ 1,464,900,722

* In accordance with ASC Subtopic 820-10, investments measured at fair valuing using NAV per share as a practical expedient have not been categorized in the fair value hierarchy as permitted by ASU 2015-07.

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Notes to Consolidated Financial Statements

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The following table presents a reconciliation for all Level 3 assets measured at fair value at December 31, 2019:

	Beginning Balance	Purchases	Settlements/ Redemptions	Realized and Unrealized Losses	Transfers In/(Out)	Ending Balance
Alternative Investments:						
Real estate	$ 5,180	$ —	$ —	$ 44,907	$ —	$ 50,087

The following table presents the reconciliation for all Level 3 assets measured at fair value at December 31, 2018:

	Beginning Balance	Purchases	Settlements/ Redemptions	Total Net Realized and Unrealized Gains	Transfers In/(Out)	Ending Balance
Alternative Investments:						
Real estate	$ 1,601,312	$ —	$ (950,370)	$ (645,762)	$ —	$ 5,180

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The following tables list the redemption terms and unfunded commitments for the alternative investments valued at NAV as of December 31, 2019 and 2018:

	2019					
	# of Funds	Fair Value	Unfunded Commitments ($ in millions)	Redemption Frequency	Redemption Notice Period	Lock-up Period
Alternative investments:						
Equities:						
Domestic	13	$ 358,638,287	$ —	monthly, quarterly, other	30–90 days	none, no more than 3 years
International	10	441,544,394	—	monthly, quarterly, other	10–60 days	none, no more than 3 years
Absolute return	14	303,958,722	—	daily, monthly, quarterly, annually, other	30–90 days	rolling 2-year
Hybrid	16	143,752,525	68	monthly, quarterly, other	45–180 days	none, rolling 2-year
Real estate	6	43,970,870	67	None	N/A	N/A
Private equity	31	277,745,919	243	None	N/A	N/A
Total		$ 1,569,610,717	$ 378			

	2018					
	# of Funds	Fair Value	Unfunded Commitments ($ in millions)	Redemption Frequency	Redemption Notice Period	Lock-up Period
Alternative investments:						
Equities:						
Domestic	13	$ 299,064,318	$ —	monthly, quarterly, other	30–90 days	none, no more than 3 years
International	11	423,524,840	—	monthly, quarterly, other	10–60 days	none, no more than 3 years
Absolute return	15	337,553,727	—	daily, monthly, quarterly, annually, other	30–90 days	rolling 2-year
Hybrid	14	159,642,668	93	monthly, quarterly, other	45–180 days	none, rolling 2-year
Real estate	4	22,600,090	38	None	N/A	N/A
Private equity	25	222,515,079	243	None	N/A	N/A
Total		$ 1,464,900,722	$ 374			

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Equities: Alternative investments in this category invest predominantly in equity securities including U.S., international developed and emerging markets, benchmarked against MSCI All Country World Index.

Absolute Return: Absolute return funds include investments such as low net exposure equity hedge funds, relative value, merger arbitrage, and diversifying funds. Such strategies are expected to generate steady risk-adjusted returns, but with low correlation to the equity markets.

Hybrid: Hybrid investments sit within Global Equities and will provide equity-like returns over a full market cycle. Strategies include public and private debt, direct lending and other opportunistic credit investing. The hybrid portfolio contains 8 funds in a drawdown structure for both 2019 and 2018.

Real Estate: Includes funds that invest primarily in commercial real estate, all of which are illiquid investments.

Private Equity: Includes buyout, venture capital, real estate and natural resources funds, all of which are illiquid investments.

Private foundations are required by the Internal Revenue Service ("IRS") to distribute 5% of average assets during the year. In order to plan and budget in an orderly manner, the Foundation implements the 5% rule by using a 12-quarter rolling average of the fair value of its investment portfolio to determine the distribution level for the year. The last quarter on the 12-quarter rolling average is September 30th.

4. FINANCIAL INSTRUMENTS WITH OFF-BALANCE-SHEET CREDIT OR MARKET RISK

The Foundation's investment strategy has the ability to incorporate certain financial instruments that involve, to varying degrees, elements of market risk and credit risk in excess of the amounts recorded on the consolidated financial statements.

During 2019, the Foundation sold S&P 500 Index put options valued at approximately $11 million at December 31, 2019. During 2018, the Foundation bought S&P 500 Index put options valued at approximately $17 million at December 31, 2018. The Foundation does not anticipate that losses, if any, resulting from its market or credit risks would materially affect its consolidated financial statements.

5. TAXES

The Code imposes an excise tax on private foundations equal to 2% of net investment income, which is defined as interest, dividends and net realized gains less expenses incurred in the production of income. The tax is reduced to 1% for foundations that meet certain distribution requirements under Section 4940(e) of the Code. For the year ended 2019, conditions to meet the 1% are unknown at the date of the financials, therefore, taxes are estimated at 2% of net investment income. The Foundation did not meet the requirements for the 1% tax for the year ended 2018, therefore, taxes are at 2% of net investment income. The excise taxes on private Foundations were simplified by the 2020 Appropriation Act. The dual tax rate is now eliminated and the excise tax on net investment income is changed to a single rate of 1.39%. This change is effective for the tax years beginning after the date of the Act's enactment, December 20, 2019 (i.e. the Foundation's year ending December 31, 2020).

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Deferred taxes principally arise from differences between the cost value and fair value of investments. Due to the change in rates indicated above, the deferred provision is based on a 1.39% rate on cumulative net unrealized gains for the year ended December 31, 2019 and on a 2.0% rate for the year ended December 31, 2018.

Additionally, certain of the Foundation's investments give rise to unrelated business income tax liabilities. Such tax liabilities for 2019 and 2018 are not material to the accompanying consolidated financial statements; however, the provision for taxes, as of December 31, 2019 and 2018, includes an estimate of tax liabilities for unrelated business income.

As a result of the 2017 Tax Cuts and Jobs Act, the Foundation is subject to a new excise tax under Section 4960 for 2019 and 2018. The amount is not material to the accompanying consolidated financial statements.

6. RETIREMENT PLAN

The Foundation has a defined contribution retirement plan covering substantially all employees under arrangements with Teachers Insurance and Annuity Association of America and College Retirement Equities Fund ("TIAA") and Fidelity Investments ("Fidelity"). Beginning in July 2018, contributions are made to Fidelity only with previous legacy funds remaining with TIAA. Retirement plan expense was $970,175 and $906,804 in 2019 and 2018, respectively.

7. POSTRETIREMENT BENEFITS OTHER THAN PENSIONS

The Foundation provides healthcare benefits for qualified retirees. The Foundation records annual amounts relating to the plan based on calculations that incorporate various actuarial and other assumptions, including discount rates, mortality, turnover rates, and healthcare cost trend rates.

The Foundation reviews its assumptions on an annual basis and makes modifications to the assumptions based on current rates and trends as appropriate. The effect of modifications to those assumptions is recorded as a charge to net assets and amortized to net periodic cost over future periods using the corridor method. The net periodic costs are recognized as employees render the services necessary to earn the postretirement benefits.

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Notes to Consolidated Financial Statements

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The following table sets forth the financial information for the plan for 2019 and 2018:

	2019	2018
Change in accrued postretirement benefit obligation:		
Benefit obligation at beginning of year	$ 4,797,647	$ 8,238,465
Service cost	92,457	433,307
Interest cost	196,820	287,896
Actuarial loss (gain)	522,944	(1,465,314)
Benefits paid	(214,367)	(299,078)
Plan amendments	—	(2,397,629)
Benefit obligation at end of year	$ 5,395,501	$ 4,797,647
Fair value of plan assets	$ —	$ —
Funded status of plan	$ (5,395,501)	$ (4,797,647)
Components of net periodic postretirement benefit cost:		
Service cost	$ 92,457	$ 433,307
Interest cost	196,820	287,896
Amortization of transition obligation	476,061	476,061
Amortization of gain	(326,272)	(99,635)
Net periodic postretirement benefit cost	$ 439,066	$ 1,097,629
Benefit obligation weighted average assumptions at December 31, 2019 and 2018:		
Discount rate	3.25%	4.22%
Periodic benefit cost weighted average assumptions for the years ended December 31, 2019 and 2018:		
Discount rate	4.22%	3.57%

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In October 2018, the Foundation amended its postretirement benefits plan, changing the eligibility requirements and implemented cost sharing. The amendment became effective January 1, 2019, and resulted in a decrease in the benefit obligation totaling $2,397,629.

The medical trend and inflation rate is 7.10% grading down to 4.40% in 2029 pre-65 and 5.50% grading down to 4.10% in 2026 post-65.

Assumed healthcare cost trend rates have a significant effect on the amounts reported for the postretirement health benefit plan. The effects of a 1% increase (decrease) in trend rates on total service and interest cost and the postretirement health benefit obligation are as follows:

	2019		2018	
	1% Increase	1% Decrease	1% Increase	1% Decrease
Effect on total service and interest cost	$ 66,034	$ (48,718)	$ 248,062	$ (171,472)
Effect on postretirement benefit obligation	848,159	(664,593)	664,356	(532,501)

Projected premium payments for each of the next five fiscal years and thereafter are as follows:

Year ending December 31:	
2020	$ 288,536
2021	270,966
2022	280,465
2023	284,754
2024	297,526
Thereafter through 2028	1,315,294
	$ 2,737,541

The accumulated amount not yet recognized as a component of net periodic benefit cost was $(5,309,965) and $(5,683,120) at December 31, 2019 and 2018, respectively. The components are as follows:

	2019	2018
Transition obligation	$ 82,918	$ 558,979
Prior service credit	(2,293,157)	(2,397,629)
Net actuarial gain	(3,099,726)	(3,844,470)
	$ (5,309,965)	$ (5,683,120)

The transition obligation, actuarial gain and prior service credit that will be amortized into net periodic benefit cost in 2020 will be $82,918, $168,211 and $104,472, respectively.

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8. GRANTS PAYABLE

The Foundation estimates that the grants payable balance as of December 31, 2019 will be paid as follows:

Year:		
2020	$	54,320,964
2021		19,622,286
2022		8,691,349
2023		3,204,427
2024		524,107
	$	86,363,133

The Foundation awards multi-year grants for certain programs with continued annual funding contingent upon the respective grantee satisfying certain performance criteria as outlined in the executed grant agreement; accordingly, the Foundation has not recorded a liability for these conditional awards which are subject to annual review. There were no conditional grant commitments at December 31, 2019 and 2018, respectively.

9. LEASE

Rent expense for 2019 and 2018, including escalations, was $1,964,012 and $1,877,704, respectively. On November 21, 2013, the Foundation modified the original lease. As a result of the lease modification, rent commencement on the substitute premises began on February 27, 2015 for a period of fifteen years ending on February 28, 2030. The fixed rent payable under the lease is an amount equal to (a) $1,740,492 per annum for the period commencing on February 27, 2015 and ending on February 26, 2020, (b) $1,874,376 per annum for the period commencing on February 27, 2020 and ending on February 26, 2025, and (c) $2,008,260 per annum for the period commencing on February 27, 2025 and ending on February 28, 2030.

10. LIQUIDITY

The Foundation's investment portfolio provides the financial resources to support its operating needs. Operating needs include management and program expenses and grant commitments expected to be paid in the subsequent year. The Foundation regularly monitors the liquidity required to meet its operating needs as they become due. The portfolio is managed with a prudent level of risk given the Foundation's long-term investment horizon, which is designed to exist in perpetuity. The portfolio can tolerate considerable volatility in short- and intermediate-term performance, provided the long-term performance meets the return objective. The Foundation's return objective and risk tolerance necessitates a meaningful allocation to asset classes with high expected returns and risk across all asset classes. Approximately 81% of the portfolio is held in assets that can be liquidated within one year or less to meet operating needs and a cash position is maintained to support immediate operating needs. In addition, the Foundation must annually pay out a minimum of 5% of the average fair value of its investment assets from the preceding year for charitable and administrative purposes in accordance with IRS requirements imposed on private foundations.

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The table below presents financial assets available for operating needs within one year at December 31, 2019 and 2018:

	2019	2018
Financial assets at year-end:		
Cash	$ 1,302,905	$ 1,554,235
Redemption receivable	24,263,188	24,232,502
Investments	1,926,510,393	1,728,497,906
Total	1,952,076,486	1,754,284,643
Less amounts not available to be used within one year		
Alternative investments	(369,700,726)	(320,572,367)
Financial assets available to meet operating needs within one year	$ 1,582,375,760	$ 1,433,712,276

SUPPLEMENTARY INFORMATION

Alfred P. Sloan Foundation

Schedule of Grants and Appropriations

For the year ended December 31, 2019

Grantee	Unpaid December 31, 2018	2019 Authorized	2019 Payments	Unpaid December 31, 2019
Adler Planetarium	$ —	$ 74,791	$ 50,000	$ 24,791
Alberta, University of	—	70,000	70,000	—
American Assembly	—	50,000	50,000	—
American Association for the Advancement of Science	867,569	585,296	792,168	660,697
American Council on Education	—	200,000	200,000	—
American Film Institute	230,000	—	115,000	115,000
American Friends of the National Gallery, London	—	100,000	100,000	—
American Friends of Toulouse School of Economics	200,000	—	100,000	100,000
American Geophysical Union	—	930,200	350,000	580,200
American Institute of Mathematics	—	45,000	45,000	—
American Institute of Physics	446,697	—	—	446,697
American Museum of the Moving Image	440,000	—	146,700	293,300
American Physical Society	—	210,624	210,624	—
American Statistical Association	898,783	—	449,392	449,391
American University	—	410,000	110,000	300,000
Annual Reviews	380,000	—	380,000	—
Arizona State University	36,942	161,639	198,581	—
Arizona, University of	135,792	—	19,000	116,792
Art of Problem Solving Foundation	330,000	—	230,000	100,000
Association of American Universities	151,550	—	100,000	51,550
Astrophysical Research Consortium	9,405,000	—	2,775,000	6,630,000
Aspen Institute	—	50,000	50,000	—
ASU Foundation for a New American University	30,000	—	30,000	—
Australian National University Foundation USA	—	899,998	354,623	545,375
Azavea, Inc.	—	249,101	249,101	—
Barnard College	300,000	350,000	300,000	350,000
BIOBUS	—	800,000	300,000	500,000
Boise State University	—	36,666	36,666	—
Boston College	378,703	369,148	497,385	250,466
Boston University	49,360	438,237	237,773	249,824
Boulder Housing Coalition	—	160,000	160,000	—
Brandeis University	—	319,800	70,000	249,800
Bricolage Production Company	—	50,000	50,000	—
British Columbia, University of	—	45,000	—	45,000

This schedule should be read in conjunction with the accompanying consolidated financial statements and notes thereto.

Alfred P. Sloan Foundation

Schedule of Grants and Appropriations

For the year ended December 31, 2019

Grantee	Unpaid December 31, 2018	2019 Authorized	2019 Payments	Unpaid December 31, 2019
Brookings Institution	$ 730,250	$ 700,000	$ 1,097,250	$ 333,000
Brown University	—	310,000	310,000	—
California Institute of Technology	102,557	2,227,636	420,305	1,909,888
California Polytechnic State University, San Luis Obispo	1,136,089	—	561,103	574,986
California State University, Northridge	—	36,666	36,666	—
California, University of, Berkeley	1,593,505	3,370,266	2,466,023	2,497,748
California, University of, Davis	100,000	529,456	580,000	49,456
California, University of, Irvine	—	2,445,729	539,000	1,906,729
California, University of, Los Angeles	372,942	310,000	441,942	241,000
California, University of, Riverside	132,743	70,000	70,000	132,743
California, University of, San Diego	324,760	333,325	584,760	73,325
California, University of, San Francisco	—	70,000	70,000	—
California, University of, Santa Barbara	—	255,115	255,115	—
Canadian Institute for Advanced Research	—	475,000	237,500	237,500
Canberra, The University of	135,373	—	135,373	—
Carnegie Institution of Washington	1,000,000	—	1,000,000	—
Carnegie Mellon University	314,500	416,666	631,166	100,000
Center for Innovative Governance	—	20,000	20,000	—
Center for Open Science	252,188	—	252,188	—
Center for Strategic and International Studies	—	100,000	80,000	20,000
Central Florida, University of	—	70,000	70,000	—
Chicago Public Media, Inc.	30,000	—	30,000	—
Chicago, University of	1,611,968	530,000	1,559,297	582,671
City College of New York—CUNY	125,000	—	125,000	—
Civic Hall Labs	—	250,000	250,000	—
Code for Science and Society	—	247,225	247,225	—
Cold Spring Harbor Laboratory	—	70,000	70,000	—
College of William and Mary	—	29,220	29,220	—
Colorado School of Mines	161,098	600,000	517,601	243,497
Colorado State University	—	20,000	—	20,000
Colorado, University of, at Boulder	—	2,373,213	630,000	1,743,213
Columbia University	478,718	2,693,157	1,705,820	1,466,055
Community Initiatives	237,188	49,710	286,898	—
Connecticut, University of	—	—	—	—

This schedule should be read in conjunction with the accompanying consolidated financial statements and notes thereto.

Alfred P. Sloan Foundation

Schedule of Grants and Appropriations

For the year ended December 31, 2019

Grantee	Unpaid December 31, 2018	2019 Authorized	2019 Payments	Unpaid December 31, 2019
Consumer Reports	$ 171,039	$ 1,502,500	$ 972,289	$ 701,250
Conversation, The	—	50,000	50,000	—
Coolidge Corner Theatre Foundation	191,000	763,700	576,600	378,100
Cooper Union for the Advancement of Science and Art	125,000	—	125,000	—
Cornell University	50,000	431,366	446,927	34,439
Council for Economic Education	—	545,000	238,846	306,154
Council of Graduate Schools	—	157,881	157,881	—
Council of Professional Associations on Federal Statistics	—	29,637	29,637	—
Council on Library and Information Resources	300,000	547,321	600,321	247,000
Creative Visions	—	—	—	—
CUNY Graduate Center Foundation, Inc.	220,500	—	110,250	110,250
Dartmouth College	43,311	249,998	—	293,309
Data Foundation	—	50,000	50,000	—
Data & Society Research Institute	—	225,000	225,000	—
Dearen, Jason	—	50,000	50,000	—
Decision Science Research Institute, Inc.	313,139	—	313,139	—
Delaware, University of	—	60,078	60,078	—
Digital Public Library of America, Inc.	1,510,542	215,633	965,633	760,542
Documentary Educational Resources	—	150,774	150,774	—
Drexel University	—	468,436	186,839	281,597
Dryad	—	635,915	158,979	476,936
Duke University	206,873	1,479,240	1,047,767	638,346
Eastman, Quinn	—	30,000	30,000	—
Educopia Institute	—	45,824	45,824	—
Ehrlich, Benjamin	5,000	—	—	5,000
Emory University	—	70,000	70,000	—
Ensemble Studio Theatre, Inc.	—	2,070,000	790,000	1,280,000
Environmental Defense Fund Incorporated	150,000	600,000	450,000	300,000
Environmental Law Institute	250,000	—	150,000	100,000
Fairfield University	25,000	—	25,000	—
Film Independent, Inc.	200,000	—	200,000	—
Fisher, Carl Erik	—	50,000	50,000	—
Flint Cultural Center Corporation	200,000	—	200,000	—
Florida, University of	124,998	843,062	406,018	562,042

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Alfred P. Sloan Foundation

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Grantee	Unpaid December 31, 2018	2019 Authorized	2019 Payments	Unpaid December 31, 2019
Food & Environment Reporting Network	$ 30,000	$ 239,646	$ 116,000	$ 153,646
FORCE11	—	20,000	20,000	—
Fordham University	7,500	—	7,500	—
Foundation Center	—	75,000	75,000	—
Foundation Center dba Candid	—	10,000	10,000	—
Foundation for Independent Artists, Inc.	—	70,328	70,328	—
Fractured Atlas, Inc.	—	50,000	50,000	—
Friends of Index on Censorship	—	48,103	—	48,103
FPF Education and Innovation Foundation	329,880	—	329,880	—
Fund for the City of New York	715,000	1,425,000	730,000	1,410,000
Futuro Media Group, The	—	235,000	160,000	75,000
Georgia Institute of Technology	—	593,049	210,000	383,049
Georgia, University of	—	70,000	70,000	—
George Washington University	50,000	115,000	165,000	—
Georgetown University	975,927	629,092	335,371	1,269,648
Greater Washington Educational Telecommunications Association Inc.	500,000	700,000	1,200,000	—
Greenring, Jaime	—	51,400	30,000	21,400
HackNY	198,950	—	198,950	—
Hampton University	—	50,000	50,000	—
Harvard Medical School	—	70,000	70,000	—
Harvard University	2,111,126	2,262,107	2,938,613	1,434,620
Haverford College	102,246	—	102,246	—
Hawaii, University of	—	70,000	70,000	—
Hopewell Fund	—	1,748,360	748,360	1,000,000
Hunter College Foundation	—	27,292	27,292	—
Icahn School of Medicine at Mount Sinai	—	140,000	140,000	—
Illinois, University of, Chicago	—	249,741	—	249,741
Illinois, University of, Urbana–Champaign	—	204,561	204,561	—
Imperial College London	—	777,098	—	777,098
Indiana, University of	473,666	19,960	286,418	207,208
Industrial Organizational Society, Inc.	—	22,000	22,000	—
Information Technology and Innovation Foundation	—	74,800	74,800	—
Innovations for Poverty Action	140,365	—	140,365	—
Institute of International Education Inc.	250,000	—	250,000	—

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Alfred P. Sloan Foundation

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Grantee	Unpaid December 31, 2018	2019 Authorized	2019 Payments	Unpaid December 31, 2019
Island Press–Center for Resource Economics	$ —	$ 50,000	$ 40,000	$ 10,000
Jacob Burns Film Center, Inc.	30,000	—	30,000	—
Johns Hopkins University	325,000	626,074	494,767	456,307
JUST Capital	—	150,000	150,000	—
Kevles, Daniel J.	—	49,500	25,500	24,000
Kolbert, Elizabeth	—	38,000	20,000	18,000
L.A. Theatre Works	—	400,000	200,000	200,000
Levitt, Dan	—	54,000	30,000	24,000
Library Foundation of Los Angeles	—	20,000	20,000	—
Louisville Research Foundation, University of	15,350	—	15,350	—
Manhattan College	—	30,000	30,000	—
Manhattan Theatre Club	683,333	—	466,667	216,666
Maryland, University of, Baltimore County	1,109,244	37,000	20,000	1,126,244
Maryland, University of, College Park	183,180	370,000	422,320	130,860
Massachusetts Institute of Technology	1,601,468	3,561,665	2,646,956	2,516,177
Massachusetts, University of, Amherst	—	210,000	210,000	—
Mathematical Sciences Research Institute	548,000	—	401,500	146,500
Max Planck Institute for Chemistry	409,975	—	409,975	—
McGill University	—	70,000	70,000	—
Metropolitan Museum of Art	—	95,000	95,000	—
Michigan State University	—	249,978	200,000	49,978
Michigan Technological University	—	—	—	—
Michigan, University of	898,966	1,632,772	759,284	1,772,454
Middlebury College	22,761	—	22,761	—
Minnesota, University of	343,701	124,767	167,765	300,703
Montana State University, Bozeman	20,000	—	20,000	—
Mr. October Foundation for Kids, The	—	50,000	50,000	—
Nadis, Fred	—	37,500	37,500	—
National Academy of Sciences	643,061	1,099,722	693,061	1,049,722
National Action Council for Minorities in Engineering, Inc.	4,904,971	3,300,000	3,400,000	4,804,971
National Bureau of Economic Research, Inc.	2,396,522	3,567,501	2,447,734	3,516,289
National Council for Science and the Environment	—	36,000	36,000	—
National Public Radio, Inc.	—	650,000	325,000	325,000
Nebraska, University of, Omaha	225,838	—	225,838	—

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Alfred P. Sloan Foundation

Schedule of Grants and Appropriations

For the year ended December 31, 2019

Grantee	Unpaid December 31, 2018	2019 Authorized	2019 Payments	Unpaid December 31, 2019
New Hampshire, University of	$ —	$ 70,000	$ 70,000	$ —
New Jersey Institute of Technology	109,038	—	—	109,038
New School, The	—	249,500	94,515	154,985
New Venture Fund	175,000	175,000	350,000	—
New York Academy of Sciences	250,000	—	125,000	125,000
New York Public Library	—	500,000	300,000	200,000
New York Public Radio	400,000	—	200,000	200,000
New York University	854,618	2,681,322	1,335,641	2,200,299
Nijhuis, Michelle	20,000	—	20,000	—
North Carolina State University	—	799,865	366,737	433,128
North Carolina, University of, at Chapel Hill	544,640	124,590	526,701	142,529
Northeastern University	122,641	119,879	222,520	20,000
North Fork TV Festival, Inc.	—	125,000	125,000	—
Northwestern University	—	876,096	626,096	250,000
Notre Dame, University of	—	471,293	280,831	190,462
NumFOCUS	159,185	481,265	488,782	151,668
OCTO	—	76,501	76,501	—
Ohio State University	—	1,601,635	606,666	994,969
Open Knowledge Foundation	499,749	—	249,875	249,874
Oregon State University	—	1,486,403	—	1,486,403
Oregon, University of	—	44,760	44,760	—
Paris School of Economics	300,000	—	300,000	—
Partnership for Public Service	—	47,453	47,453	—
Pecan Street, Inc.	644,132	—	297,000	347,132
Pennsylvania State University	50,000	170,000	220,000	—
Pennsylvania, University of	232,457	363,545	240,000	356,002
Philanthropy New York	—	28,000	28,000	—
Pioneer Works	—	124,410	124,410	—
Pittsburgh, University of	504,758	—	222,967	281,791
Postrel, Virginia	20,000	—	20,000	—
Princeton University	—	822,471	822,471	—
Private Capital Research Institute	250,000	—	100,000	150,000
Prospect Theater Company, Inc.	—	25,000	25,000	—
PRX Incorporated	235,000	75,000	310,000	—

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Alfred P. Sloan Foundation

Schedule of Grants and Appropriations

For the year ended December 31, 2019

Grantee	Unpaid December 31, 2018	2019 Authorized	2019 Payments	Unpaid December 31, 2019
Puerto Rico, University of, Mayaguez	$ 198,065	$ —	$ 100,000	$ 98,065
Purdue University	113,754	62,298	176,052	—
RAND Corporation	—	599,160	297,634	301,526
Ramirez, Ainissa	17,500	—	17,500	—
Rhizome	—	187,125	187,125	—
Rice University	—	140,000	140,000	—
Red Hook Initiative	—	25,000	25,000	—
Rensselaer Polytechnic Institute	233,423	(149,520)	83,903	—
Research Foundation of the City University of NY	1,308,345	—	436,500	871,845
Resources for the Future, Inc.	500,000	450,000	550,000	400,000
Retro Report	32,500	—	32,500	—
Rhode Island, University of	299,795	—	299,795	—
Rhodes, Richard	—	125,000	125,000	—
Rockaway Waterfront Alliance, Inc.	—	50,000	50,000	—
Rochester Institute of Technology	100,000	—	100,000	—
Rochester, University of	—	140,000	140,000	—
Russell Sage Foundation	—	50,000	50,000	—
Rutgers, The State University of New Jersey	—	70,000	70,000	—
Saskatchewan, University of	472,707	—	270,405	202,302
Schwarzlose, Rebecca	19,700	—	19,700	—
Science Friday Initiative, Inc.	—	700,000	242,450	457,550
Scripps Research Institute	—	70,000	70,000	—
Seife, Charles	—	43,275	23,275	20,000
Schillace, Brandy	36,000	—	36,000	—
SFFILM	—	717,500	517,500	200,000
State Theatre Regional Arts Center at New Brunswick, Inc.	—	5,000	5,000	—
Social Science Research Council	—	2,200,000	600,000	1,600,000
Southern California Institute of Architecture	90,000	—	—	90,000
Southern California, University of	277,103	210,000	210,000	277,103
Southern Regional Education Board	—	1,408,919	350,000	1,058,919
Stanford University	1,432,763	1,955,004	2,528,683	859,084
Sundance Institute	—	500,000	250,000	250,000
Spelman College	—	655,936	260,000	395,936
Sponsors for Educational Opportunity, Inc.	—	20,000	20,000	—

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Alfred P. Sloan Foundation

Schedule of Grants and Appropriations

For the year ended December 31, 2019

Grantee	Unpaid December 31, 2018	2019 Authorized	2019 Payments	Unpaid December 31, 2019
Technology Affinity Group	$ —	$ 5,000	$ 5,000	$ —
Tennessee, University of	—	237,415	200,000	37,415
Texas A&M University	—	70,000	70,000	—
The Brookings Institution	200,000	—	200,000	—
Toronto, University of	406,714	970,000	871,984	504,730
Tribeca Film Institute	360,818	878,500	800,068	439,250
Tufts University	—	50,000	50,000	—
United States Association for Energy Economics	—	15,000	15,000	—
University College London	—	20,000	—	20,000
Upjohn Institute for Employment Research	—	249,991	125,000	124,991
Utah State University	—	36,666	36,666	—
Urban Institute	176,162	573,819	346,316	403,665
Vanderbilt University	—	70,000	70,000	—
Vermont, University of	480,822	—	226,371	254,451
Verse Video Education, Inc.	300,000	—	300,000	—
Virginia, University of	—	690,578	492,932	197,646
Virginia Polytechnic Institute and State University	30,000	—	30,000	—
Washington Center for Equitable Growth	—	249,917	13,924	235,993
Washington State University	49,785	—	49,785	—
Washington, University of	351,792	518,352	620,308	249,836
Washington University in St. Louis	—	70,000	70,000	—
Waterloo, University of	—	70,000	70,000	—
WGBH Educational Foundation	850,000	2,150,000	1,500,000	1,500,000
Whitney Museum of American Art	50,000	—	50,000	—
Wikimedia Foundation	133,333	—	66,667	66,666
Wilderness Society, The	—	30,000	30,000	—
Wisconsin, University of, Madison	—	172,814	172,814	—
WNET.ORG	850,000	(750,000)	100,000	—
Women Make Movies, Inc.	—	595,629	459,929	135,700
Woodrow Wilson International Center for Scholars	—	693,210	372,235	320,975
Writers Room, Inc.	—	50,000	—	50,000
Yale University	770,840	1,694,631	1,135,840	1,329,631
Yarn Labs	—	1,633,681	781,150	852,531
York, University of	—	724,282	43,282	681,000

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Schedule of Grants and Appropriations

For the year ended December 31, 2019

Grantee	Unpaid December 31, 2018	2019 Authorized	2019 Payments	Unpaid December 31, 2019
Zurich, University of	$ —	$ 49,886	$ 49,886	$ —
	62,964,846	96,679,321	82,731,034	76,913,133
Sloan Research Fellowships to be granted in ensuing year	8,820,000	630,000	—	9,450,000
Other appropriations authorized but not committed	62,363	—	62,363	—
	71,847,209	97,309,321	82,793,397	86,363,133
Reduction for grant transfers	—	(900,994)	(900,994)	—
Refunded grants	—	(520,050)	(520,050)	—
Total	$ 71,847,209	$ 95,888,277	$ 81,372,353	$ 86,363,133

This schedule should be read in conjunction with the accompanying consolidated financial statements and notes thereto.

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