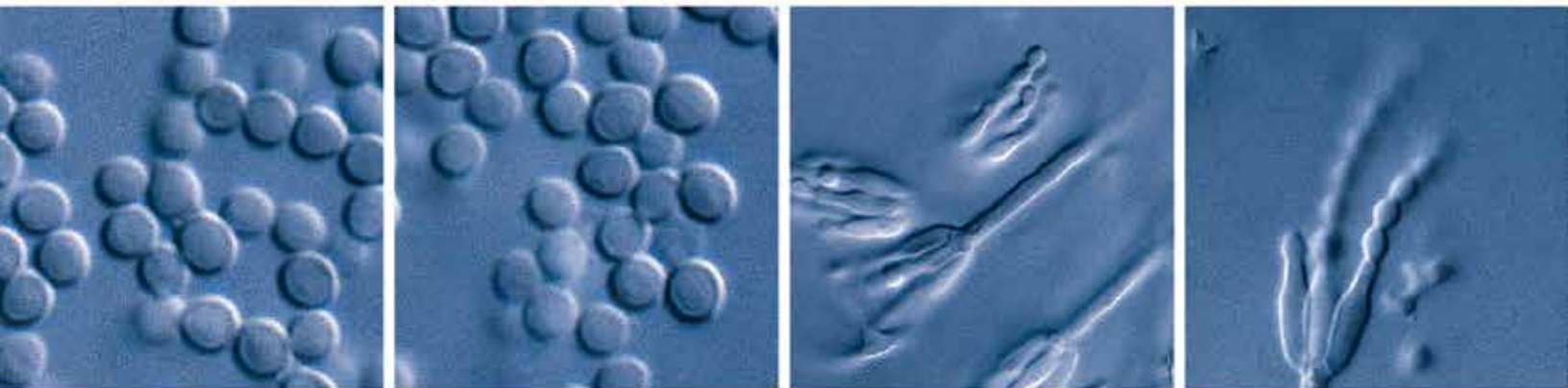


# ALFRED P. SLOAN FOUNDATION

## 2014 Annual Report



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**Cover:** Photographs of *Penicillium alfredi* and *Aspergillus sloanii*, two new forms of microbial life discovered in dust taken from an English home by researchers working in the Foundation's Microbiology of the Built Environment program. 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 © Her Majesty the Queen in the Right of Canada, as represented by the Minister of Agriculture and Agri-Food Canada)

# Preface

The **ALFRED P. SLOAN FOUNDATION** administers a private fund for public benefit. The Foundation recognizes its obligation, therefore, to report periodically the policies which govern the management of the fund and the uses to which it is put, and to name the donees who are benefited by it. Accordingly, this public report is submitted for the year 2014.

# Mission Statement

The **ALFRED P. SLOAN FOUNDATION** makes grants primarily to support original research and broad-based education related to science, technology, and economic performance. The Foundation is unique in its focus on science, technology, and economic institutions—and the scholars and practitioners who work in these fields—as chief drivers of the nation’s health and prosperity. The Foundation has a deep-rooted belief that carefully reasoned systematic understanding of the forces of nature and society, when applied inventively and wisely, can lead to a better world for all. The Foundation’s endowment provides the financial resources to support its activities. The investment strategy for the endowment is to invest prudently in a diversified portfolio of assets with the goal of achieving superior returns.

In each of our grants programs, we seek proposals for original projects led by outstanding individuals or teams. We are interested in projects that have a high expected return to society, and for which funding from the private sector, government, or other foundations is not yet widely available.

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# 2014 Year in Review

Dr. Paul L. Joskow

**T**his annual report contains an accounting of the grantmaking activities of the Alfred P. Sloan Foundation for the year ended December 31, 2014. In it, we describe the Foundation's grantmaking programs, the grants we made, to whom we made them, and what each aims to accomplish. A complete list of grants made during 2014 follows this summary Year in Review. In addition, the report contains the Foundation's independently audited financial statements and a list of our Trustees and staff. As a philanthropic organization, the Foundation feels such transparency is essential to ensuring accountability and maintaining the public trust.

The Foundation has the good fortune of being able to support some of the finest scholars in the world. No account of the Foundation's activities would be complete without some mention of the exciting ways in which our grantees are expanding the bounds of human knowledge. While I cannot hope in this small space to do justice to all our grantees have accomplished in 2014, I would like to highlight some of their notable findings, results, and achievements.

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## STEM RESEARCH

### **Sloan Research Fellowships**

The Foundation's longest running program, the Sloan Research Fellowships were started in 1955 by Alfred P. Sloan himself. The fellowships aim to stimulate fundamental scientific research through providing \$50,000 in direct research support to the brightest young minds working at U.S. and Canadian universities. In 2014, the Foundation made fellowship awards to 126 scholars, including a chemist who is devising ways to turn carbon dioxide into fuel, a neuroscientist who has discovered a "Dracula" mutation in fruit flies that makes them nocturnal, and an economist who studies the subtle and unsubtle ways health insurers weed the sick out of their risk pools.

Drawn from the most promising young researchers working today and selected by a panel of senior scientists, Sloan Research Fellows often become some of the most celebrated scientists in their fields. In 2014, French economist Jean Tirole, who received a Sloan Research Fellowship in 1985, was awarded the Nobel Prize in Economics in recognition of his significant contributions to the

theory of regulation, principal-agent problems, and anti-competitive behavior in monopolistic and oligopolistic markets. Another former Fellow, Matthew Gentzkow, received the 2014 John Bates Clark Medal, an annual award given by the American Economic Association for significant achievement by a U.S. economist under 40. In October, when the White House announced the recipients of the National Medal of Science, the highest honor bestowed on scientists by the U.S. government, three of the nine researchers honored were former Sloan Research Fellows: mathematician Alexandre J. Chorin, chemist Jerrold Meinwald, and physicist Sean C. Solomon. The presence of so many former Sloan Research Fellows among the nation's most celebrated scientific minds is one reason the fellowships continue to be one of the most prestigious and sought-after awards available to young scientists.

### Deep Carbon Observatory

The Deep Carbon Observatory (DCO) is an international, multidisciplinary community of more than 1,000 geoscientists from 40 countries who are working together to revolutionize our understanding of Earth's deep carbon. The DCO's research is grouped into four communities: Extreme Physics and Chemistry; Deep Life; Reservoirs and Fluxes; and Deep Energy. Project leadership is provided through an international secretariat headquartered at the Carnegie Institution for Science and additional teams provide data services and management to DCO researchers and facilitate internal community building and external engagement.

In 2014, grants were made to Columbia University for seven field studies integral to achieving the DCO's scientific goals and to the Smithsonian Institution for deep carbon cycle modeling and visualization. In addition, Rensselaer Polytechnic Institute received a grant for data science and management work and the University of Rhode Island received a grant to facilitate inter-community collaboration.

Exciting discoveries by DCO researchers continued to garner headlines in 2014. Impurities in a diamond pulled from a Brazilian riverbed revealed that vast oceans of water may be trapped deep in Earth's mantle. Examination of tiny quantities of Earth's early atmosphere preserved in billion-year-old rocks suggests the moon may be some 60 million years older than previously thought. A study of the chemical processes unleashed at Earth's subduction zones, areas where two tectonic plates collide, showed that plate tectonic activity releases

tremendous quantities of gaseous nitrogen, which may explain the nitrogen-dominated composition of Earth's atmosphere.

Launched in 2009 as a ten-year effort, the Deep Carbon Observatory reached its midpoint in 2014 and conducted an independent external midterm review of its activities. The review looked closely at a number of issues crucial to the DCO's success, including internal organization, progress toward the DCO's decadal goals, the quality of the research produced, fundraising success, and potential challenges and new opportunities in the years ahead. I share the independent external reviewers' confidence that the DCO is on track to achieve its decadal goals.

### Microbiology of the Built Environment

The Foundation's aim in the Microbiology of the Built Environment (MoBE) program is to nurture the development of a new field of scientific inquiry, one focused on the complex microbial ecosystems that thrive in the indoor environments in which humans live, work, and play. Several important discoveries by MoBE researchers captured headlines in 2014. A research team led by Jack Gilbert of the University of Chicago found that human microbes quickly colonized new environments, leaving a distinct microbial "fingerprint" everywhere we go. Gilbert's team found that in some cases a human occupant could completely alter the microbial profile of a room in less than a day. In a study of sewage systems, microbiologist Mark Hernandez found that microbial diversity was directly correlated to sewage pipe health, with damaged, corroded sections of sewage pipes showing much lower diversity in their local microbial populations. The findings point the way toward potential new means of monitoring sewage infrastructure, using bacteria as early warning systems that can guide us towards damaged pipes much like early twentieth century coal miners used canaries to detect poisonous gas leaks. Scientists working in the MoBE program are also expanding the horizons of zoology, discovering new forms of microbial life never found outdoors. I am pleased to report that in 2014 two of these newly discovered microbes, *Aspergillus sloanii* and *Penicillium alfredi*, were named in honor of the Sloan Foundation's pioneering role in providing early research support for indoor ecology.

Grantmaking in the MoBE program in 2014 continued to focus on filling gaps in our understanding of how microbial populations interact with building

attributes and environmental conditions. Major grants went to support interdisciplinary research that combines microbial ecology, particle transport physics, chemistry, and building architecture and to support tools for data analysis. Additional grants were made for projects to study the microbial response to water damage caused by flooding, to study the unique properties of the microbial inhabitants of wine- and cheese-making facilities, to increase our understanding of indoor molds and fungi, and to catalog the microbial differences between “green” and conventional buildings.

### Synthetic Biology

Equally important to the advance of scientific discovery is ensuring that scientific research is conducted *responsibly*, with a full understanding of the risks involved and adequate precautions taken to ensure that both scientists and the public are protected. The Foundation’s program in Synthetic Biology, which entered its final year of grantmaking in 2014, aimed to promote a vigorous, ongoing dialogue about the social, ethical, and public policy issues associated with synthetic biology research. The centerpiece of the program has been support for the Woodrow Wilson International Center for Scholars’ Synthetic Biology Project, which brought together scientists, ethicists, bioengineers, and public policymakers to further that dialogue through scholarship, workshops, and public forums. Major final grants in 2014 were made to the Wilson Center to help secure the Synthetic Biology Project’s legacy and to the National Academy of Sciences to issue a major report on ethical issues related to the publication of dual-use scientific research, an issue dramatically raised to public consciousness in 2012 when a team of Dutch researchers bioengineered the deadly H5N1 bird flu virus to be transmissible through the air. As is true for all Sloan programs, an independent external review of the Synthetic Biology program was conducted in the final year to document lessons learned and inform the grantmaking in Sloan’s other programs going forward.

### Sloan Digital Sky Survey

Over the past two decades, the Foundation has contributed approximately \$50.5 million (2014US\$) in support of the Sloan Digital Sky Survey (SDSS), an astronomical survey that uses a 2.5 meter optical telescope at Apache Point Observatory in New Mexico to advance our understanding of the composition, evolution, and structure of the universe. Over this time period additional funds of about

\$200 million (2014US\$) have been contributed by members and participants in SDSS research. 2014 was a significant year for the SDSS, as it marked the launch of the project’s fourth phase. Supported in part through a five-year, \$10 million commitment from the Sloan Foundation made in 2013, SDSS-IV will investigate the nature of dark energy, catalog the composition of thousands of nearby galaxies, and examine the structure and evolution of the Milky Way. In 2014, the Foundation made an additional \$3.5 million grant to support SDSS-IV research activities. This grant will support the design, construction, and installation of an infrared astronomical spectrograph at the 2.5 meter du Pont Telescope at Las Campanas, Chile. The new instrument will allow SDSS to expand its observations to include galaxies that are not visible from the Northern Hemisphere. The grant also facilitates participation and collaboration with five Chilean astrophysics centers, continuing SDSS’s tradition of collaboration among astrophysicists.

An early experiment in open science, SDSS was one of the first telescopic surveys in astronomy to release all its data to the public under open principles. The decision vastly expanded SDSS’s reach, making it one of the most cited surveys in the history of astronomy. Nearly 6,000 published papers cite SDSS data, and those papers have themselves been cited nearly 250,000 times. In 2014, several SDSS-powered discoveries made headlines, including the discovery of a new class of medium-sized black holes and the observation of the most distant stars ever discovered.

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## STEM HIGHER EDUCATION

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### Education and Professional Advancement for Underrepresented Groups

The Sloan Foundation has a longstanding commitment to promoting the openness of the scientific enterprise and ensuring that scientific education and careers are open to all regardless of race or gender. Our Education and Professional Advancement for Underrepresented Groups program aims to increase the diversity of higher education institutions and the workforce in STEM fields through college and university initiatives that support the education and professional advancement of high-achieving individuals from underrepresented groups.

In 2014 the Foundation continued to partner with colleges and universities in the creation of University Centers of Exemplary Mentoring (UCEMs). These campus-based initiatives provide scholarships, mentoring, and other professional support to minority graduate students in STEM fields. In April 2014, the Foundation was pleased to announce that it would partner with the University of Iowa and the University of South Florida to create two new UCEMs. The new Centers would add to three existing UCEMs established in 2013 at Cornell University, Georgia Institute of Technology, and Pennsylvania State University. The Foundation plans to support a third and final competition for three additional UCEMs with selected institutions to be announced in early 2015.

Additional grantmaking in 2014 covered a range of topics, including renewed support to encourage coordination between the four participating institutions in the Sloan Indigenous Graduate Partnership, which aims to support American Indian and Native Alaska graduate students in STEM fields; funds to develop an alumni network for scholars supported through the Sloan Minority Ph.D. program; and funds to study trends in female participation in IT and computer science.

In 2014, the Foundation also made grants that cut across program areas to support increased participation of women in the fields where the Foundation supports research. A series of small grants was made to expand our understanding of the representation of women in IT fields. In addition, a grant was made to the National Bureau of Economic Research through our Economics program to study interventions to increase the number of undergraduate women majoring in economics.

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## PUBLIC UNDERSTANDING OF SCIENCE, TECHNOLOGY & ECONOMICS

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Our multi-faceted Public Understanding of Science, Technology and Economics program aims to instill a keener appreciation of the increasingly scientific and technological world in which we live through the development of engaging, accurate, and high-quality books, theater, film, television, radio, and other media that feature scientific content, history, or characters.

Four Sloan-supported books were published in 2014: Henry Petroski's *The House with Sixteen Handmade Doors*, about the construction and design of an unusual house; Benny Shilo's *Life's Blueprint*, a visual exploration of developmental biology; Tom Shachtman's *Gentlemen Scientists and Revolutionaries*, about the scientific interests and pursuits of America's founding fathers; and the twenty-first volume of the *Correspondence of Charles Darwin*.

Five Sloan-supported films opened in theaters across the country: *Decoding Annie Parker*, *A Birder's Guide to Everything*, *I Origins*, *Particle Fever*, and *James Cameron's Deepsea Challenge*. In addition, the Foundation's *Science on Screen* program continued to expand. The program, a collaboration with the Coolidge Corner Theatre, is a national network of 38 independent and art house cinemas across the nation that screen films and host scientist-led discussion panels after each screening.

In our Theater program, the Foundation-supported Ensemble Studio Theatre in New York premiered a Sloan-commissioned play, Carla Ching's *Fast Company*, about a family of grifters who use game theory to outsmart one another.

In television, WGBH's popular history series, *The American Experience*, aired two Sloan-supported episodes with scientific and technological themes, one on the construction and destruction of New York's Penn Station, and another, *The Poisoner's Handbook*, on the birth of forensic science in jazz age New York. In addition, PBS premiered a Sloan-supported documentary, *Rickover: The Birth of Nuclear Power*, about Admiral Hyman Rickover, the father of the U.S. Navy's nuclear submarine program.

In new media, a Foundation partnership with the Innocence Project resulted in the publication of an innovative, interactive eBook, *False Conviction: Innocence, Guilt, and Science*, about how advances in genetic technology are being used to free the falsely convicted, and the Chemical Heritage Society released a virtual chemistry set app, ChemCrafter, that has been downloaded more than 300,000 times across 110 countries.

In 2014, the Foundation made grants to support seven new books. In film, major grants were made to the Science and Entertainment Exchange to strengthen its support of the role and accuracy of science in Hollywood films. Two grants were made



to Film Independent to provide support to develop science and technology scripts, to expand distribution of Sloan-supported films, and to support the Sloan Film Summit in Los Angeles. In radio, major grants went to SoundVision Productions to support *Burn: An Energy Journal*, to New York Public Radio to support a new health care reporting unit, and to the American Museum of Natural History to support *Star Talk*, hosted by Neil deGrasse Tyson. In television, WETA received a grant to help to support the production of the documentary *Cancer: The Emperor of All Maladies* to be aired in 2015. WGBH received a grant to support a two-hour *Nova* special on black holes hosted by astrophysicist Janna Levin, and WETA received a grant to increase *The PBS NewsHour's* Making Sen\$e spots hosted by Paul Solman. Finally, in theater, a major grant was made to L.A. Theater Works to record and distribute four new science-themed Sloan plays.

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## DIGITAL INFORMATION TECHNOLOGY

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### Data & Computational Research

Our Data and Computational Research program aims to accelerate scientific discovery by helping researchers fully exploit the opportunities created by recent advances in our ability to collect, transmit, analyze, and store data. 2014 was a particularly exciting year in this program. A five-year, \$37 million collaboration with the Gordon and Betty Moore Foundation was launched to support the creation of three innovative “data science environments” at New York University; the University of California, Berkeley; and the University of Washington. These centers will focus on advancing data-driven discovery by building bridges between disciplinary researchers in the natural sciences and those with expertise in data sciences like computer science and statistics. All three centers launched fellowship programs in 2014, bringing in high quality researchers to begin helping disciplinary scientists use digital technology to more effectively work with the large, complicated datasets that are increasingly the hallmark of cutting-edge scientific research. Several Sloan grants from previous years resulted in innovative new products in 2014. A Sloan-supported team at Johns Hopkins University released SciDrive, an open science data collection and dissemination platform based on the data management system originally used by the Sloan Digital Sky Survey. A team at the University

of California, Davis released Phinch, a platform for producing compelling visualizations of large sets of biological data. The University of California System also released a revised version of the DMP Tool, a user-friendly platform that helps researchers create government-compliant data management plans.

2014 was also an exciting year for new grants. The Mozilla Foundation received a grant to build resources in order to make science more open, collaborative, and efficient. Indiana University received a grant to support data sharing through the Research Data Alliance; the University of Chicago received a grant to facilitate more efficient movement, management, and sharing of research data; and the Miami Foundation received a grant to grow a system for replication and versioning of data sets in an open source framework. These grants all reflect the Foundation’s commitment to creating tools that facilitate the accuracy, reproducibility, and credibility of scientific research. The Adler Planetarium also received a grant to support a sustainable future for the Zooniverse Platform and to continue to engage and serve the rapidly expanding citizen science community.

### Scholarly Communication

The Foundation’s program in Scholarly Communication aims to empower researchers by creating new resources for managing the increasingly diverse array of digital communications channels, enabling scientists to more effectively locate relevant research, to network with other researchers, to disseminate their work to the scientific community and the public, and to improve the accuracy and credibility of scientific research.

Major funding in 2014 went to Harvard University to make empirical research more reliable and replicable by helping academic journals process, publish, and preserve datasets accompanying article submissions; to the Hypothes.is Project, an innovative new web annotation service; and to Johns Hopkins University to develop a platform that allows users to see the connections between academic publications and data. A grant was also made to the Association of Research Libraries to expand its SHARE notification system for tracking the release of research. Again, these grants illustrate the Foundation’s commitment to open access, reproducibility, accuracy and credibility of scientific research.

## Universal Access to Knowledge

The Foundation's Universal Access to Knowledge program seeks to facilitate the openness and accessibility of all knowledge for the widest public benefit under reasonable financial terms and conditions. In recent years, grantmaking has focused on support for Wikipedia and for the Digital Public Library of America (DPLA), the nation's first national digital library. The DPLA celebrated its one-year anniversary in 2014. In the year since its April 2013 launch, the number of institutions contributing content to the DPLA doubled to more than 1,300 and the DPLA's collection of digital items tripled to nearly seven million. Online utilization was also robust in the first year, with close to 10 million calls to the DPLA's API. Also in 2014, the Foundation continued its partnership with Wikipedia, the largest encyclopedia ever constructed and the internet's fifth most-visited website. A \$3 million grant to Wikipedia supports a large range of activities aimed at improving the accuracy of its articles, expanding and diversifying its editorship, and setting the organization on the road to long-term financial sustainability.

## ENERGY & ENVIRONMENT PROGRAM

2014 was a significant year for the Foundation's growing portfolio of grants related to energy and the environment. Program Officer Evan Michelson joined the Foundation at the beginning of the year and spearheaded a year-long program development process in which the Foundation consulted with energy economists, industrial organization experts, engineers, policymakers, and other stakeholders to identify promising research opportunities and craft a strategic plan to guide Foundation grantmaking in the years ahead. The Foundation's new ten-year Energy & Environment program launched in late 2014 and will focus on advancing our understanding of the economic, environmental, security, and policy trade-offs associated with the increased deployment of low- and no-carbon resources and technologies. Several energy-related grants made in prior years came to fruition in 2014, including the publication of findings by Duke University's Richard Newell of how shale oil and gas development affects the finances of local municipalities and the release of an analysis by a team at the University of Colorado of the various political coalitions engaged in shale gas regulation in New York.

In 2014, major grants were made to continue the Foundation's support for efforts to better understand the economic and environmental tradeoffs associated with the production of shale gas and shale oil. A major grant was made to the Environmental Defense Fund (EDF) to continue EDF's research on methane leaks and to expand research on the environmental effects of waste water from hydraulic fracturing. Duke University also received a grant to expand its work on the fiscal effects of shale gas and shale oil "booms" on local communities.

## ECONOMICS

### Economic Institutions, Behavior & Performance

The Foundation's multipronged program on Economic Institutions, Behavior, and Performance supports rigorous, objective, policy-relevant research projects in economics. The program had several major successes in 2014. A Sloan-supported "summer school" on regulation opened its doors at Yale University. Led by management professor Andrew Metrick, the school aims to expose current and future financial regulators to the most up-to-date academic research related to regulatory issues, including managing systemic risk and financial stability, evaluating policy responses to financial crises, and the history of attempts to regulate "shadow banking" systems. Also in 2014, the Foundation supported a major new partnership between the United Kingdom's Behavioral Insights Team (BIT) and the Behavioral Insights Group (BIG) at Harvard University. The groups are both composed of leading economic researchers, theorists, and experimentalists who are striving to bring insights from behavioral economics to the design and implementation of public policy, helping policymakers effectively craft and evaluate government policy interventions. The new partnership will create an international multidisciplinary network of researchers who can share insights, ideas, data, and research findings. 2014 also saw the launch of *The Conversation U.S.* This Sloan-supported experiment in expert-driven journalism provides a platform for academics and other experts to communicate directly with the public about their research and other matters of general interest, allowing scholars to publish news columns and articles under their own bylines, collaboratively edited with journalists for clarity and accessibility.

In 2014, the Foundation made a grant to the University of Michigan to establish an independent and reliable source of detailed information about the results of public and private investments in scientific research. This work is complementary to the Foundation's support for the Science Philanthropy Alliance. The Foundation also continued its support for research and applications of behavioral economics, privacy-preserving computational algorithms, and the integration of financial market models with macroeconomic models.

### Working Longer

Our Working Longer program aims to expand and deepen scholarly, policy, and public understanding of the labor market activities of older Americans and to identify ways in which institutional adjustments may facilitate employment of older Americans who want or need to work beyond conventional retirement age. Interesting and provocative findings from research projects funded in the program's early years are now beginning to appear in the academic literature. A team from Michigan State University studied how labor markets reacted to the passage of a law in Germany which provided incentives for partial retirement. The researchers found dramatic increases in part-time employment and that older workers responded to the new labor incentives by delaying retirement by more than a year. Work by David Cutler of Harvard and Ellen Meara of Dartmouth found that older workers are often healthy and able to continue working throughout what are or would be their early retirement years, estimating that labor force participation rates could be as much as 15% higher if pension and other financial incentives did not encourage healthy older workers to retire. A study of cognitive decline in retirees by Bob Willis and Laura Carstensen found that among cognitively intact individuals, those who stay employed full-time experience significantly less cognitive decline relative to those who fully retire and that, interestingly, returning to work after retirement provides similar protection against cognitive loss.

In 2014, major grants in this program went to Columbia University to expand an awards program that honors New York City businesses with innovative employment practices targeting older workers; to the National Opinion Research Center for a joint project with the Associated Press to inform the public about Working Longer scholarship; and for a postdoctoral fellowship program at Stanford University to support early career researchers studying the older workforce.

## CIVIC INITIATIVES

The Foundation's Civic Initiatives program aims to support and strengthen New York City and its residents in ways consonant with the Foundation's other interests in research and education in STEM fields. In 2014, the Foundation continued its partnership with the Fund for the City of New York to recognize outstanding New York City civil servants with the Sloan Public Service Awards. Six public servants were recognized in 2014 representing the City University of New York, the Department of Consumer Affairs, the Department of Cultural Affairs, the Department of Education, the Department of Health and Mental Hygiene, and the Health and Hospitals Corporation. Winners receive a \$10,000 cash prize and are honored in ceremonies held at their workplaces and at a gala at the Great Hall of The Cooper Union.

Also in 2014, the Foundation honored outstanding New York City public school teachers with the Sloan Awards for Excellence in Teaching Science and Mathematics. Started in 2009, the awards recognize exceptional, inspiring, and imaginative science and mathematics instruction in New York City public high schools. Four mathematics and three science teachers were honored in 2014, representing all five boroughs. Winners receive a \$5,000 cash prize and \$2,500 to use to further improve the science offerings at their schools and are honored in a gala celebration held at the Great Hall of The Cooper Union.

Other major grants in our Civic Initiatives program in 2014 included renewed support for two programs at the City University of New York: an initiative that provides summer research opportunities for talented undergraduates and a fellowship program for outstanding early-career CUNY faculty in STEM fields. Another major grant supports the study the microbiota of New York City's least popular residents: mice. The Foundation also provided renewed support to New York University's Center for Mathematical Talent, which runs after-school programs that nurture talented mathematics students from underserved populations.

## ACKNOWLEDGEMENTS

It has also been a busy year inside the Foundation. The Foundation has occupied the same Rockefeller Center offices since 1955 when Alfred Sloan himself was president. As you might imagine, office space built six decades ago tends to be ill-suited to the needs of a modern workplace, so after a thorough discussion with staff and the Trustees, we decided to relocate to a different floor. Moving a small business without unduly disrupting operations is a monumental task involving innumerable details large and small: hiring and coordinating dozens of contractors and technicians, acquiring various permits from licensing agencies, navigating the often byzantine requirements of the New York City building code, and conducting delicate negotiations with building management. I am happy to report that the move was accomplished with uncommon deftness and professionalism by our operations team. Led by Senior Vice President for Finance and Operations Leisle Lin and ably assisted by Chris Sia, Anne McKissick, Gail Pesyna, Julia Bellamy, Jeffrey Cunningham, and Colleen Kearins, the operations team completed the move on time and on budget and we are now comfortably settled in our new, modern office space. I speak for the entire staff when I say they have our thanks and appreciation.

In 2014 the Foundation also introduced new grants management software called FLUXX. The Foundation's grants processing system is the single most important piece of software we use, touching every aspect of the Foundation's operations. Led by our Director of Grants Management and Information Services Anne McKissick, and our Business Analyst Everod Nelson, the Foundation made a smooth transition to a new, online, modern grants management system, one that will serve as a springboard for streamlining several key Foundation processes and helping move information through the Foundation quickly and easily. The grants and IT teams did a superior job of rolling out the new system and in training staff in its new capabilities.

We also said goodbye to several longtime staff members and Trustees in 2014. Investment Directors Joe Bohrer and Travis Shore received incredible opportunities to run exciting endowments: Joe at Lafayette College and Travis at Vanderbilt University. Though we were very sorry to see them go, we are happy for the tremendous opportunities

that await them in their new positions. Longtime Sloan staffer Gail M. Pesyna announced her retirement in 2014. Joining Sloan in 1996, Gail began her career at Sloan as director of the Foundation's Industry Studies program. In 2008, she became Vice President of Program Management and Human Resources, a position she created, where she ably oversaw the Foundation's staffing needs and helped streamline and rationalize our grantmaking processes. Gail was an institution around here, roundly admired for her professionalism, her scrupulous attention to detail, and her deep kindness. She is sorely missed. Lastly, Dr. Peter Kim retired from the Sloan Board of Trustees in 2014. The President of Merck Research Laboratories, Peter joined the Board in 2008. Over the past seven years, I have been constantly amazed by the depth of his knowledge and by his extreme generosity with his time and counsel. Peter decided to return to his first love, basic research, and has accepted an offer at Stanford so he can return to the lab. He felt that his new position would leave him insufficient time to give Sloan the attention it deserves. Even in retiring, Peter was thinking about the Foundation. We all thank him for his service and wish him well in his new position.

The Foundation also welcomed several new members to the Sloan family in 2014. Dr. Evan S. Michelson joined the Foundation as Program Officer in 2014. Evan will be overseeing the Foundation's grantmaking to the Sloan Digital Sky Survey and our new program in Energy & Environment. In addition, Michael Stambaugh joined the Foundation as Managing Director, Investments. Mike has been indispensable in facilitating a smooth transition in our Investments Team and brings his years of endowment management experience to the Foundation's strategic investment planning. Also in 2014, Princeton microbiologist Bonnie Bassler joined the Board of Trustees and Tim Peterson, founder of Regiment Capital, joined the Foundation's Investment Committee. I welcome both Bonnie and Tim and look forward to working with them productively in the years ahead.

And finally, I'd like to thank all our Trustees and staff, whose hard work made all our accomplishments in 2014 possible. I am extremely proud of the relationship that Sloan management has built with our Trustees and I am deeply grateful for their knowledge and input, their advice, and their generosity with their time. I am also deeply grateful to all Sloan staff, who's long hours and constant effort

(there are approximately 30 of us making and managing some 300 grants totaling \$80 million dollars per year) make Sloan a highly efficient workplace and whose good humor make it a pleasure to come to work every day. I thank them all for their efforts.

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## CONCLUSION

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Alfred P. Sloan once wrote that societal progress depends on the pioneer, “the individual who has the courage, the ambition, to overcome the obstacles that always develop when one tries to do something worthwhile, especially when it is new and different.” That sentiment inspired Mr. Sloan to devote his Foundation to the support of the scientist, the engineer, and the economist and that sentiment continues to animate the grantmaking of his Foundation to this day. Our grantees are pioneers, explorers treading new territory at the frontiers of human knowledge. The Sloan Foundation is honored to play some small role in their explorations.

# President's Letter Dr. Paul L. Joskow



September 14, 2015

## Research Integrity and Reproducibility

### Science Is Not Broken, But It Can Be Better<sup>1</sup>

The October 19, 2013 issue of *The Economist* contains two articles that report and discuss the large fraction of important scientific papers in medicine, computer science, and other fields where scientists have been unable to reproduce the original authors' results ("How science goes wrong" 2013, "Trouble at the lab" 2013). A study by Stanford researcher Daniele Fanelli found that published papers in empirical economics report results that confirm the tested hypothesis at a rate five times higher than published papers in space science (Fanelli 2010).<sup>2</sup> A recent paper by Robert M. Kaplan and Veronica L. Irvin (Kaplan and Irvin 2015) examined 55 large randomized controlled trials studying the effects (positive, negative, or null) of drugs or dietary supplements used to treat cardiovascular disease. They found that studies that did not pre-register the hypotheses under investigation were significantly less likely to report null results than the studies that did pre-register. Science watchdog sites like Retraction Watch<sup>3</sup> have sprung up to catalog retractions, withdrawals, and significant post-publication amendments of scientific papers. Cases of scientific retraction now regularly turn into major media events. These findings and others like them have led some to conclude that something is rotten at the core of twenty-first century research. "Science," they say, "is broken."

In June 2015, a group of prominent researchers took to the pages of *Science* magazine to rebut this charge. (Alberts, et al. 2015). Recent cases of high profile retractions, they argue, far from being evidence that science is broken, are in fact evidence that science is *working*. When scientific papers are discovered to be unreproducible or fraudulent, after all, the people who have done the discovering are invariably other scientists. Paper withdrawals and retractions are

- 1 Thanks are due to my colleagues Daniel Goroff, Josh Greenberg, and Nate Williams for very useful comments on an earlier draft of this letter.
- 2 This "confirmation bias"—the tendency to disproportionately publish only those studies that confirm the hypothesis under investigation—appears to be growing in many other scientific fields as well.
- 3 <http://www.retractionwatch.com>

instances not of the failure of the scientific process but of its proper functioning. They are the key mechanisms through which the scientific community polices itself.

I agree that the recent flurry of studies that raise questions about the credibility of results reported in important scientific papers should not lead to the conclusion that “science is broken.” However, this is not to say that there is no room for improvement.<sup>4</sup> Confirmation bias in academic journals is genuinely worrying. The publication of false results, however infrequent, is worrying. The publication of research that cannot be replicated is worrying. The integrity of scholarly research is essential if it is to achieve its full potential. Research must be perceived to be highly reliable by those who use it, by funding agencies, and by the public. “Reproducibility is essential for validating empirical research.” (Ioannidis and Doucouliagos 2013). The credibility of science is seriously undermined when other scientists find that they cannot reproduce research results that appear in the literature. Why are there seemingly so many published research papers whose empirical results cannot be readily reproduced by other scientists? Why do there seem to be so many high profile retractions of published research papers? How can we change scientific practice, institutions, incentives, or norms in ways that lead to more reproducible, more reliable research?

The Alfred P. Sloan Foundation has a keen interest in these questions. A large fraction of the Sloan Foundation’s grants support basic and applied research in science, technology, and economics. Because the Foundation does not itself publish any papers or reports drawn from the research we support, we expect our grantees to disseminate the results of their research in working papers, journal articles, books, and a variety of online media. The integrity and reliability of the academic literature is thus a topic of immense importance to us. Since 2008, the Foundation has committed nearly \$30 million to projects designed to help scientists conduct their work in ways conducive to greater reproducibility and transparency. In what follows I will discuss how the structure of scientific careers and the incentives facing scientists and journals create barriers to conducting fully reproducible research.

4 Alberts et al. (2015) concede as much and make many useful suggestions for how science might be improved in ways conducive to better reliability of published findings.

I will then discuss the opportunities grantmakers have to reduce or remove those barriers and what the Sloan Foundation is doing to make the published scientific literature more reproducible, reliable, and credible.

### What Is Reproducibility?

The concerns I wish to address fall under a wide array of rubrics. Some authors talk about *reproducibility*. Others talk about *replicability*. Still others talk about the *integrity* of research or its *reliability*, its *trustworthiness* or *dependability* or *robustness*. Still others talk about the need for research *transparency*. More recent entrants to the discussion have introduced new phrases influenced by Internet culture. They call for *open science*, or *open data*, or *open code* (and usually all three). Sometimes we talk about the reproducibility of *experiments*. Other times we talk about the reproducibility of *findings*.

The National Science Foundation’s Subcommittee on Replicability in Science has recently produced a report (Social, Behavioral and Economic Sciences Perspectives on Robust and Reliable Science 2015) that provides a helpful framework for discussing these issues, a framework I shall adopt in what follows. The report draws a distinction between three ways in which science may aspire to be robust, which it calls reproducibility, replicability, and generalizability. An experimental<sup>5</sup> finding is *reproducible* according to this framework if a researcher is able to duplicate the results of a prior study using the same methods, procedures, code, and data as the original author of the research. An experimental finding is *replicable* if a researcher is able to duplicate the results of a prior study by applying the same procedures and methods of the original experiment to newly collected data. Finally, an experimental finding is *generalizable* if a researcher is able to duplicate the results of a prior

5 I use the term “experiment” broadly in this letter to include laboratory experiments in controlled environments; randomized controlled trials (RCTs) applied to individuals, groups, or organizations; and hypothesis testing that relies on data drawn from non-randomized controlled trials, but where statistical modelling and other analytical methods are used to appropriately control for causal variables other than the variable of interest. Including the latter case as a type of “experiment” deviates somewhat from common usage in the physical sciences, but recent work in economics and econometrics has, in my opinion, made a persuasive case that in some situations a methodologically rigorous analysis of an appropriately large but non-random sample can yield insights comparable in breadth and power to those produced by controlled environments and RCTs. See Angrist (2009) and Angrist (2014).

study using an entirely different experimental design and associated data. If a given experimental finding is reproducible, replicable, and generalizable according to these definitions, we will call the finding *robust*. Ideally, we want scientists to produce robust research. Too often, they do not. The question I turn to now is why.

### Failures of Reproducibility, Replicability, and Generalizability

We should begin by cutting researchers some slack, if only a little. It is unreasonable to expect all empirical research to be robust. The conclusions of empirical science—that a particular treatment or causal variable is “significant,” whether its sign is positive or negative, the magnitude of the discovered effect, etc.—are probabilistic statements. For even the most rigorous, well-designed experiments, a replication study using the same experimental design, the same computational methods, but new data will yield exactly the same results only with some probability less than 100 percent. Accordingly, specific findings cannot be expected to be duplicated 100 percent of the time. Yet failures to reproduce experimental findings occur more frequently than would be predicted merely by the probabilistic nature of scientific findings. We need to understand why reproducibility failures arise more frequently than would be implied by the uncertainties inherent in empirical research.

In general, experimental findings fail to be reproducible (according to the definition above) for one of two reasons:

*Inadequate description of experimental design, experimental methods, and computational methods.* To perform a reproducibility study a researcher must have access to relevant information about the original experiment’s design, how it was implemented, and the computational and statistical methods used to analyze the data and draw conclusions. Absent this information, the reproducibility study may actually fail to be a *reproduction* at all, instead running a different experiment altogether or using different experimental or computational methods. Moreover, without certain methodological information it becomes impossible to interpret whether a failure to duplicate the original study’s result is due to flaws in the original experimental design, its implementation, or the computational methods used. In theory, this information is included in the traditional methodology section of a published paper. In practice, however, methodology sections of

papers are increasingly unhelpful to the would-be reproducer. Space constraints in scholarly journals rarely allow for adequate methodological detail for a subsequent researcher to accurately reproduce the original experiment. Yet even if more space were allotted to such discussions inside papers themselves, the complexity of modern research makes it difficult and time consuming to describe one’s methodology in a way that allows research results to be reproduced. Methodological information needed to reproduce a typical study involving the analysis of survey data (say) would include the sampling procedure, the survey instrument, the procedure used to field the survey, the type and version of the software used to collect responses, the methods used to code respondents’ answers, the techniques used to “scrub” respondent data, the information collected on respondents, the model used to analyze the data and the assumptions powering that model, the software platform and platforms (and their versions) used to perform analyses, the particular algorithms used, etc. Much of this information often does not appear in the paper itself but must be obtained in other ways. Yet, there is no standard practice governing how to store this information and make it available. Typically, one must go to the authors and request this information, with notoriously inconsistent responses to these requests.

*Unavailability of data.* Even the most complete information about methods is of little use in reproduction unless one has the data used in the original experiment. But like detailed information on methods, the data analyzed in a scholarly paper are not routinely made available to researchers. In some cases, the analyzed data *cannot* be shared, legally, because they belong to some private or corporate entity or because sharing the data would violate the privacy of the individuals whose information was used in the original research. Indeed, one of the paradoxes of the current era of science is that it increasingly utilizes datasets with information about individual attributes and behavior of a size, complexity, and usefulness dwarfing those available to researchers in the past. Yet the use of these datasets is often restricted to protect individual privacy or because the data are proprietary.<sup>6</sup>

These two factors—inadequate description of methods and the unavailability of data—are further

<sup>6</sup> For more on the challenges posed to science by the Big Data revolution and the corresponding opportunities for grant-makers, see my letter to the 2013 Alfred P. Sloan Foundation Annual Report.



complicated by the fact that reproducibility studies are often conducted years after the original experiment. The significance of any given finding is often not fully appreciated immediately upon publication and subsequent work either confirming or contradicting the finding may spur interest in reproducing the original study. In the intervening years, however, the original research team has often moved on to other pursuits. Researchers will have moved institutions or careers. Lab personnel will have changed. Memories will have faded. Data may be trapped in old, outdated formats or systems. To be useful, data, metadata, and methods must be stored in *durable, permanent* archives. Where those archives are to be hosted, how to make them easily discoverable, how to ensure their permanence, and how to pay for them are questions that have yet to be answered.

The two obstacles described above are barriers to reproducibility, to duplicating an experiment exactly as it was originally performed. There can also be failures of replicability and generalizability, failures to duplicate the *findings* of the original experiment either by running the original experiment on new data or in duplicating old findings through new experimental methods. Researchers are sometimes unable to duplicate the findings of previous research because the original finding is incorrect. The research reports a significant causal relationship between variables that is not, in fact, there. How do such results find their way into the published, peer-reviewed, academic literature? Any adequate analysis of the failures of replicability and generalizability in research will have to give some account of the sources of scientific error.

*Data errors and data "cleaning."* In a typical modern experimental study, data must be collected; transferred; aggregated; "cleaned" for obvious errors, missing entries, and outliers; converted into one or more formats suitable for analysis; and, finally, analyzed. Errors may creep in at any step in this process. The original data may have errors; there may be errors in transcription between the original source and the datasets used for analyses; and efforts to "clean" the data obtained from the original source may throw away relevant data, adjust data in questionable ways, or mischaracterize the data in some fashion. In addition, a replication study may make similar errors or fail to reproduce the original results due to errors of its own.

*Modelling and Statistical Deficiencies:* Most empirical research involves questions about causality (Angrist 2014) and the sign and magnitudes of the causal impacts of one "independent" variable on another "dependent" variable. Do variations in some variable  $x$  affect variations in another variable  $y$ ? What is the sign of the impact of variations in  $x$  on variations in  $y$ ? How large is the impact of variations in  $x$  on variations in  $y$ ? In an uncontrolled environment or a poorly designed controlled environment, however, there may be one or more other variables  $z$  that also affect variations in  $y$  or  $x$  or both. The failure to take the relationships between the variable  $z$  and the variables  $x$  and  $y$  into account can lead to incorrect conclusions about causality and biased estimates of key parameter values. The simplest case is one in which there is no causal relationship between  $x$  and  $y$  at all but a third variable  $z$  has a causal impact on both  $x$  and  $y$ . That is,  $z$  is correlated with  $x$  and  $y$  and, as a result,  $x$  and  $y$  happen to be correlated as well. A popular real life example of this scenario is a series of Dutch statistics showing a positive correlation between the number of storks nesting in springs around the city and the number of human babies born at that time. Of course, there was no causal connection, but a third variable, the weather nine months before the observations, caused both variables to comove. Absent a sound theory of why  $x$  and  $y$  should be causally related, we run the danger of drawing conclusions about causality when we are just measuring spurious correlations. Another very common situation is one in which there actually is a causal relationship between  $x$  and  $y$ , but there is a third variable  $z$  that is causally correlated with both  $x$  and  $y$ . In this case, using ordinary least squares regression methods to estimate the relationship between  $x$  and  $y$  while leaving the variable  $z$  out of the regression will lead to a biased estimate of the coefficient of  $x$ . This occurs because, by leaving the variable  $z$  out of the regression, the estimate of the coefficient of  $x$  now captures both the "direct effect" of  $x$  on  $y$  plus the "indirect effect" of  $z$  on  $y$  through  $x$ , making the identification of the isolated causal effect of  $x$  on  $y$ , our primary objective, impossible. In such cases, the production of reliable findings requires resorting to more sophisticated solutions, for example, a more complete modelling of the full system of relationships between causal variables that demonstrates that the parameter of interest can be identified, or the application of appropriate statistical methods that take account of the endogeneity of one or more in-

dependent variables. Other common statistical issues that often arise include sample selection bias, measurement error, and inadequate sample sizes required to correctly reject (in a binary hypothesis test) the null hypothesis when the alternative hypothesis is true with a sufficiently high probability (the power of the statistical test).

Data analysis practices can also lead to results that are not replicable or generalizable. Repeated empirical analysis of the same dataset using variations on the causal model and then reporting only the results that the researcher “likes” (overfitting or data mining) makes standard statistical tests meaningless, especially in relatively small samples where out-of-sample verification of the results is not feasible. Other bad practices include the failure to identify and exclude outliers (e.g. one observation drives the results) or, at the other extreme, the unmotivated exclusion of some observations whose inclusion would lead to results that are inconsistent with the hypothesis being tested.

*Fraud:* People will disagree about how exactly to define fraud in research. Whatever its proper definition, there will be borderline cases, those where reasonable people will disagree about whether the experimental design, implementation, or analysis of some study are so obviously flawed as to constitute willful scientific malpractice. Perhaps it is one of those cases where “you know it when you see it.” But not every case is near the border. If data are fabricated or consciously doctored to yield particular conclusions, if the experiments described in a paper have not actually been conducted, or if the computational and statistical analyses described were never performed, we have a clear case of research fraud. Research that is fraudulent will fail replication tests<sup>7</sup>, though, of course, research that cannot be replicated does not imply fraud and may be due to one or more of the factors I have already described. While cases of real or alleged research fraud garner much media attention and can, therefore, seem to be common, in my more than forty years of experience doing empirical research in economics, I must conclude that such cases of obvious fraud are rare. Reading through the reports on Retraction Watch, however, it is clear that fraudulent research does get published. How often such research is eventually identified, corrected, or retracted is unknown, but it would be surprising if all cases of fraud have

7 Unless, that is, the fraudster got *very* lucky and happened to have manufactured evidence for a replicable hypothesis.

been or will be identified. While the number of paper retractions appear to be growing, it is not at all clear whether this is due to an increasing incidence of flawed or fraudulent research or merely an artifact of the increased attention being paid to these issues. In any case, adoption of standards that foster reproduction and replication will deter the publication of fraudulent research since it increases the likelihood of detection.

### Incentives<sup>8</sup>

Research findings fail to be reproducible or replicable either because the original methods and data are unavailable or because flaws in the experimental design, implementation, or analysis led a researcher to reach a conclusion that was not supported by the evidence (including cases of fraudulent evidence). Minimizing the publication of such research requires not just understanding how it happens, but also understanding the underlying incentives faced by researchers and academic publishers which facilitate the barriers to reproducibility that I have discussed here.

*Researcher Incentives.* The academic incentive environment is partially responsible for the barriers to reproducibility and replicability. There are few incentives for researchers to perform replication studies.<sup>9</sup> Funding for replication is hard to find—funders tend to want to fund original, not duplicative, research—replication studies tend to be difficult to publish in the most highly respected journals and garner lower citation counts<sup>10</sup> than

8 Come on, I'm an economist. You think there wasn't going to be a section on incentives?

9 As a professor, I often gave students replication assignments to help them to learn how to do research. And they often had difficulty replicating published research, often due to their own mistakes rather than mistakes in the original research. (I frequently asked students to try to replicate the results of a very famous study published in a respected economics journal where the methods and data sources were especially clear. They could rarely replicate the econometric results exactly, but also never found a significant change in the most important result in the paper. Years later an experienced economist, armed with the actual data used in the original study, also tried to replicate it and found a very significant mistake in the data (and it was clearly simply a careless mistake). Correcting the mistake changed the magnitude of the coefficient of interest quite significantly and in turn changed the interpretation of the paper's most important result.

10 In my experience, the primary factor that affects tenure and promotion decisions at top research universities is the faculty member's research. And, in my experience, the evaluation of the quality and impact of the scholar's research is evaluated by colleagues and external experts who read the candidate's papers, and not by simply counting the *number* of publications

papers reporting original research. As one scholar said to me “nobody ever got tenure based on the replication studies she performed.”

The pressure to publish and the ticking of the tenure clock make time a very scarce resource. Labor-intensive activities are very costly in such an environment. Carefully documenting one’s experimental design and how it was implemented and then assembling, annotating, and archiving the data, code, and statistical methods used in an experiment takes a lot of time<sup>11</sup>, time that is poorly rewarded, if at all. Little credit is given to those who create well-documented and easily-accessible datasets or who follow best practice by carefully documenting every component of the research that underlies their published work.

*Publisher Incentives.* In theory, the editors and referees at scholarly journals are the “guardians at the gate” who safeguard research quality by deciding whether a paper should be published and identifying changes that are necessary to make a paper publishable. In practice, however, there is only so much that can be expected from editors and referees. Academic journal editors typically take those positions as a service to their profession with little in the way of financial or scholarly reward and with continuing academic responsibilities. At high quality journals where the submission rate is high and the acceptance rate low, the task of triaging papers, selecting referees, badgering referees to get their reports in, producing “revise and resubmit letters,” and ultimately deciding what gets published is very burdensome. Like editors, referees typically accept assignments as a service to their profession. Honoraria, when they exist at all, are modest, and referees are expected to continue to meet their teaching, research, and professional service obliga-

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or citations. However, some departments and universities apparently do count publications and citations, either because they lack the internal expertise in the scholar’s research area and/or because they cannot get external reviewers to accept the tedious task of reading a scholar’s papers and writing a letter about their quality and impact. The threat that evaluation letters may become public, further diminishes incentives to provide frank appraisals. Unfortunately, some universities have bureaucratic procedures for promotion and tenure that do include crude counts of publications and citations. In these situations, powerful incentives are created to get as many publications out as quickly as possible, with predictably deleterious consequences for the quality and reproducibility of this research.

11 In the short term, at least. Some argue that keeping a tidy scientific house, like keeping a tidy regular house, is a time saver in the long run.

tions. Because they do not receive detailed methodological information or data, referees rarely have the resources to turn the refereeing process into a replication process. Nor would they have the time to do so even if proper documentation were available. The best they can do is determine whether the research question makes sense, whether the experiment appears to be designed in a way that yields defensible results, and whether the data look sensible based on their own experience.

Academic journals are subject to many of the same pressures that plague individual researchers. The pressure to be a “high impact journal,” one that publishes papers that go on to be influential and highly cited, is immense. Maximizing the chances that one’s published pieces will be influential means maximizing, as far as is economically feasible, the number of articles published. Because print journals are space constrained—there’s an upper bound on how many pages a print journal can reasonably contain—there’s pressure to shorten average paper length, publishing more papers in the same number of pages<sup>12</sup>. This leads to pressures to make published papers shorter and shorter and to include fewer and fewer details about the experiments, data, and code in the paper itself. This “extra” (though in fact, crucial) information is then included in separate documents “available from the authors” or posted on their web pages. This increasingly common practice, however, is a barrier to reproducibility and replicability. Authors may not post information on their data and methods, data that does get posted is not standardized or controlled for quality, journals do not verify that information has been made available, web pages where material is posted often change, and data can be removed at any time by the author without consequence. While the journals could remedy these problems by creating standards and hosting an archive of this “residual” material themselves, this would require valuable time and resources, with little benefit accruing to the journal itself. The bottom line is that reproducibility and replicability are public goods that yield few if any private returns to the journals, the editors, or the scholars that produce them. (See, for example, Nosek, et al. 2015)

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12 Though digital journals are not similarly space-constrained, print norms have tended to carry over into the online publishing environment.

Journals, it is true, could require researchers to “pre-register” their hypotheses, the experimental design and methods, the expected outcomes, the models to be used and relationships to be tested, etc. This would counteract many of the practices that make replication difficult. But journals are poorly positioned to make such demands. To be effective, pre-registration must occur *before* an experiment begins, which is also before an author knows which journal she will submit her findings to or even whether she will seek to publish them at all. Since journals have the most leverage over researchers at the time of publication, pre-registration occurs too early in the research cycle for individual journal policies to hold much sway.

Journals are understandingly hesitant to place burdensome transparency requirements on their authors for fear that talented scientists will simply publish elsewhere. Why submit yourself to pain-in-the-neck transparency requirements from Journal X when Journal Y will publish your paper without the hassle? Without altering the incentives to both journals and researchers alike, we find ourselves in a bad equilibrium. The current system is non-ideal, but no individual actor in the system has reason to make things better.

### Opportunities for Grantmakers

Grantmakers and other funders of research can lead the way to a better equilibrium. Here I will discuss what the Sloan Foundation is doing, recognizing that some other private foundations and government funders of research are also making efforts to respond to the issues that I have discussed. The Foundation’s Digital Information Technology Program, led by program director Josh Greenberg, and the Economic Institutions, Behavior & Performance program, led by Vice President Daniel Goroff, have invested significant resources in changing the ways we conduct and publish research. What follows are some areas in which funders might “move the needle” in ways that change incentives and help move academic publishing in a direction more conducive to reproducibility and replicability.

#### 1. Insist on high methodological standards

Funders have the most influence before a project gets funded, when researchers, eager to acquire funding, are willing to make commitments they might not otherwise make. Funders can increase transparency and replicability by insisting on the

highest standards before agreeing to fund research. The Alfred P. Sloan Foundation, expanding on federal data management plan requirements, has adopted grant proposal guidelines<sup>13</sup> that require potential grantees to specify clearly and completely, in a separate Information Products Appendix, the anticipated products of their research, including working papers, publications, data, and code, and to specify whether and how those products will be made available to other researchers and to the public. We strongly encourage grantees to adhere to the principle that “making research products freely and openly accessible can increase the reach and value of what we fund.” The requirement that prospective grantees produce an Information Products Appendix as part of the grant application process begins an often-fruitful dialogue, making it possible for Foundation staff and external reviewers to work with potential grantees to increase the accessibility of their work product. Funders who wish to include similar requirements in their application process should proceed with caution however. First, as I’ve already noted, properly making the results of one’s work accessible is not costless; funders must be willing to increase grant budgets accordingly. Second, requirements should be sensitive to the fact that norms, standards, and research practices differ widely between fields and institutions.<sup>14</sup> Third, research products themselves differ widely and may require different treatments. Data and patents, for example, are governed by widely varying sets of intellectual property laws, institutional regulations, and professional norms. Fourth, funders should be mindful that requiring open access to data or methods may limit the journals authors may publish in or the data sources they may use.

In our case, the Sloan Foundation has opted for a very flexible Information Products policy. We ask prospective grantees to provide some plan laying out how research products will be made available, and to be mindful of certain principles when constructing it, but do not otherwise mandate specific forms of access. This gives us the flexibility

13 See [www.sloan.org/fileadmin/media/files/application\\_documents/proposal\\_guidelines\\_research\\_trustee\\_grants.pdf](http://www.sloan.org/fileadmin/media/files/application_documents/proposal_guidelines_research_trustee_grants.pdf)

14 The Foundation has supported efforts by UCLA professor Christine Borgman to compile detailed scientific ethnographies focusing on how data is impacting scientific practice across different disciplines. Her recent book, *Big Data, Little Data, No Data: Scholarship in the Networked World* (MIT Press, 2015), reports some of this research. The Foundation has supported similar research, focused on scholarly work with big data, by Eric Meyer at the Oxford Internet Institute.

to work with grantees on a case-by-case basis and craft a policy that makes sense for each particular researcher and project.

Insisting on the highest standards for reproducibility and replicability means not merely asking grantees to commit to making their data and methods available, but to ensuring that their research findings can be replicated if other scientists seek to try to replicate them. Funders of scientific research can make an impact by insisting that prospective grantees make explicit their empirical methodology and by subjecting that methodology to independent expert scrutiny. All empirical research grant applications to the Sloan Foundation must include an Empirical Research Methods appendix that specifies relevant theoretical and empirical models, experimental designs, data sources and attributes, sampling methods, identification of key parameters, estimation techniques, power calculations, and robustness tests. This information helps our staff and outside reviewers determine whether the proposed research will employ appropriate empirical methods, whether conclusions reached are likely to be robust given the data collected and analyses deployed, and how to improve the experimental design.

Lastly, funders can support the increased generalizability of scientific research by funding multiple experimental approaches to the same scientific question. For instance, a recent grant by the Foundation to the Environmental Defense Fund (EDF) supported the study of the magnitude of methane gas leaks associated with the extraction of shale gas. Rather than fund a single measurement approach, EDF commissioned 14 studies, conducted by independent research teams using different measurement and estimation methods.<sup>15</sup> This diversity of approaches permits a confidence in the studies' findings that a single study could not match.

## **2. Support the development of new tools that lower the costs of making data and methods available**

Software packages, computing platforms, and digital archiving infrastructure have the potential to significantly lower the costs to researchers of making their data and methods available. These new technologies also have beneficial knock-on effects. If documenting, archiving, and sharing one's data

and methods ceases to be burdensome, journals should be more willing to require such activities as a condition of publication.

The Foundation has made several major grants towards developing these new technologies. A \$1 million grant to Gary King at Harvard University is supporting the expansion of the Dataverse repository<sup>16</sup>. King and his team have linked the Dataverse with the popular Open Journal System and the Open Monograph Press, two digital workflow platforms used by numerous academic journals. The new linkage allows authors to upload their data to the Dataverse repository as part of the standard article submission process. This, in turn, allows editors and referees to view the data a paper is based on when making publication decisions. The Foundation is also supporting the development of the Jupyter notebook<sup>17</sup>, an exciting new computing platform designed to bring the traditional lab notebook into the digital age. At present, much scientific analysis requires using multiple computing package and programming languages: one to clean data, another for analysis, yet another to turn data into charts, graphs, and other visualizations. Developed by a team led by scholars Brian Granger and Fernando Perez, the Jupyter Notebook allows researchers to document their computational work *in situ*, combining narrative text, computational formulas from multiple languages, visualizations, and data into a single, useful research log that can be shared and collaboratively edited by others.

Other Foundation grants include support for the development of standardized modules for accessing commonly used scientific databases using the R programming language; and several grants to open source software developer Max Ogden for development of the DAT data versioning software, which helps researchers properly *version* datasets, allowing them to cite which version of a frequently updated dataset they used in their research. The Foundation has also supported the expansion of the University of California's Data Management Plan Tool, an online platform that helps researchers craft data management plans that comply with the requirements of funding agencies. A Sloan-supported collaboration between Sayeed Choudhury of The Johns Hopkins University and the Institute of Electrical and Electronics Engineers is crafting a software system that will link publications with

<sup>15</sup> See (Johnson 2015)

<sup>16</sup> <https://dataverse.harvard.edu/>

<sup>17</sup> <https://jupyter.org/>

the data on which they are based. In addition, the Foundation was an early supporter of the Open Science Framework, a new online platform being developed by the Center for Open Science that aspires to provide end-to-end research support in a single online interface, allowing scholars to use one system to document every part of their scientific process from data collection, to analysis, to archiving. In these cases and others, we seek opportunities to fund the development and dissemination of platforms that offer immediate, tangible value to researchers while nudging them towards more reproducible and replicable research practices.

### 3. Fund replication projects

Scientific funders are under many of the same pressures that fall on academic journals. Federal agencies are under pressure to maximize value to the taxpayer. Private foundations have an obligation to be prudent stewards of the funds left in their trust. Funding replication studies may thus seem to be a waste of scarce time and resources. Yet if we think reproducibility and replicability are important, then we have some obligation to fund it. The Sloan Foundation is currently supporting an innovative replication study by Colin Camerer at the California Institute of Technology, who has initiated a project to replicate some of the most famous findings in experimental economics with the cooperation of the original authors. The study is innovative because Camerer is surveying a group of economists to collect their predictions about what the replication studies will find, and confirming the experimental design and implementation with them. The project is the best of both worlds – a first class replication study of important experiments in economics and original research that will teach us something new. A complementary replication project by the University of Chicago’s Devin Pope is also receiving Sloan support.

### 4. Foster the development and adoption of norms and institutions devoted to good replication practices

Scientists’ work is supported by a host of interrelated institutions and norms. If scientific practice is to include efforts to increase its reproducibility, there must be norms and institutional infrastructure supporting those efforts. The Foundation is supporting a number of initiatives in this area. We have partnered with the National Academy of Sciences on a project to spearhead the creation of new

norms for data citation. Such standards streamline the process whereby researchers can acknowledge which datasets underlie their work and reward the creators and curators of useful scientific data. Other foundation grants support research on data archives and storage infrastructure. With Sloan support, Kristen Eschenfelder at the University of Wisconsin, Madison is compiling a set of case studies on the sustainability strategies, successful or not, of data archives, helping us understand which roads are promising avenues to archival permanence. The Foundation is also supporting a project by Phoenix Bioinformatics to experiment with a flexible paywall service for TAIR, a popular repository of molecular and biological data. The pilot, if successful, could serve as a potential model for other data archives.

Other Foundation efforts in this area include a focus on fostering institutions and norms that encourage the pre-registration of research. Pre-registration of hypotheses to be tested and methods to be deployed in experiments have been shown to be an effective deterrent against hypothesis fishing and data mining, practices where researchers hunt through data in search of statistically significant connections between variables. Since roughly one in twenty statistically significant correlations will be an artifact of the data, data mining is widely seen to contribute toward the confirmation bias that has been observed in the scientific literature. With Sloan support the American Economic Association launched a public registry of randomized controlled trials in economics, asking researchers who are using RCTs to publicly register their methods and the hypotheses they will be testing. Since 2014, more than 400 randomized controlled trials have been registered on the site. Success could serve as a model for other disciplines in the social sciences. Sloan is also supporting research on new mathematical techniques for designing and analyzing randomized controlled trials that can achieve a given level of statistical power with smaller sample sizes and at less cost.

### 5. Train scientists directly

The Internet Age is changing the skills scientists need to do their jobs well. Datasets are often too large to be manually searched, cleaned, manipulated, or analyzed. Working with data often means working with computers capable of handling millions of records and that means programming them to do what you need them to do. In addition, the

increased power of computers has opened up new channels for scientific analysis, allowing researchers to probe large datasets using complex statistical methods that would have been impractical only a generation ago. The twenty-first century scientist increasingly needs to understand statistics; computational methods; and data organization, manipulation, and curation techniques. But these skills are not yet a standard part of scientific training in some disciplines. Better science means training a new generation of working scientists in the best practices of software development and statistical methods. The Foundation is funding a number of training initiatives aimed at helping scientists master the increasingly complex skills required by modern science. Sloan grants to the Mozilla Foundation supported the growth of Software Carpentry, an organization of science-minded coders who provide software development boot camps for scientists, helping train them in the best practices of iterative software development and versioning. The Foundation is also supporting a project at Haverford College to experiment with early interventions with advanced undergraduates, incorporating best practices in experimental integrity, transparency, and reproducibility into the basic scientific curriculum. The Berkeley Initiative for Transparent Social Science (BITSS) actively promotes reproducible research, too, with funding from the Sloan, Templeton, and Arnold Foundations.

## 6. Support data science professionals

Taking scientific reproducibility and replicability seriously means taking data seriously, and that means cultivating a cadre of professionals whose job it is to work with data, to collaborate with disciplinary-scientists on data-intensive projects, to adapt existing data management tools for scientific use, and to develop new tools to aid scientists in data-driven discovery. We need institutions that value those researchers who do the important work of documenting, curating, and archiving data and we need to develop compelling and secure career paths for them to pursue. The Foundation is currently supporting several initiatives to support data professionals. Partnering with the Andrew W. Mellon Foundation, the Foundation is supporting an innovative fellowship program created by the Council on Library and Information Resources. Hosted at university libraries, supported fellows work to make data accessible and durable by advising scholars on how best to handle their data-intensive projects at every stage of the research process.

The fellowships have been strikingly popular and many of the host institutions have committed to supporting the positions after external funding lapses. The Foundation is also working with the Research Data Alliance on creating fellowships for doctoral students who want to work on projects in effective data management and access in connection with scientific research.

Last, but most importantly, the Foundation has launched a five-year, \$37.8 million initiative with the Gordon and Betty Moore Foundation to help empower data scientists and accelerate data-intensive, replicable scientific research. Partnering with New York University, the University of Washington, and the University of California, Berkeley, Sloan is helping create new data science centers focused, in part, on building durable, fulfilling career paths for data scientists, and in fostering their interaction with disciplinary scientists across the university. In addition to their other activities, the centers have convened a cross-university working group on Reproducibility and Open Science, with leadership provided by computer scientist Juliana Freire (NYU), mathematician Randy LeVeque (UW) and statistician Philip Stark (Berkeley). The result will be data-intensive research projects that are better conceived, better managed, more open, and more accessible to the scholarly world and the public.

## 7. Explore ways to facilitate the repeated scientific analysis of private and proprietary data

In an increasingly large number of cases, studies are not reproducible because the data the original study is based upon cannot be shared due to privacy restrictions or because the data are proprietary. Interesting opportunities abound for funders to facilitate the scientific use of such data. Recent Sloan grants support efforts by mathematicians and computer scientists to develop ways to query sensitive datasets that are both mathematically rigorous and protect the anonymity of the data they are analyzing. “Differentially private” techniques, for example, allow researchers to make aggregate statistical queries about a dataset while provably protecting the privacy of individuals’ information contained in that dataset. Grants in this area have supported pioneers like Cynthia Dwork as well as implementers based at Harvard and at the MIT Libraries. Other Foundation work funds further development of the mathematical theory behind fully homomorphic encryption, a method of

reliably analyzing data without having to decrypt them. Sloan supported work also includes a project led by George Alter at the University of Michigan's Interuniversity Consortium for Political and Social Research (ICPSR). In addition to exploring "secure multiparty computation," he is collecting samples of non-disclosure agreements (NDAs) signed by scientists in exchange for access to the company's proprietary data. Standardizing such agreements, so that businesses could safely rely on one of a few standard NDA templates, would make getting access to proprietary data much easier and would facilitate replication and reproduction. Cornell economist John Abowd is also being funded to examine the economics of privacy, cataloging the most popular privacy-preserving algorithms and evaluating their tradeoffs between accuracy and privacy. Abowd and others are also developing novel new ways to measure how much people value privacy, a topic that will be of significant interest should it turn out that some scientifically important datasets contain "private" information that no one actually wants to keep private. With Sloan support, computer scientists Adam Smith and Aaron Roth are investigating how techniques originally designed to protect privacy can also prevent false discovery and enhance reproducibility regardless of whether the data under study contains confidential information.

### **Conclusions**

The Alfred P. Sloan Foundation is fully committed to supporting efforts to facilitate access to all components of the process that characterizes modern scholarly empirical research and its dissemination. We believe that these efforts can improve the quality of research in the long run, lower the costs of adopting better research practices, reduce mistakes that find their way into the published literature, facilitate reproducibility, deter both honest mistakes and fraud, and ultimately enhance the integrity of scientific research.



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# 2014 Grants by Program

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## About the Grants Listing

Grants listed in this report are divided into three types.

**TRUSTEE GRANTS** are grants for amounts greater than \$125,000. All trustee grants are reviewed by an independent panel of experts and are presented quarterly to the Board of Trustees for approval.

**GRANTS MADE AGAINST PRIOR AUTHORIZATIONS** are grants in any amount made from funds set aside by the Board of Trustees to be used for specific purposes. Depending on the amount or subject matter of the grant, grants made against prior authorizations may or may not have been subject to external review by an independent panel of experts. For each authorization, the Foundation reports once yearly to the Board of Trustees about grants made against the authorized funds.

**OFFICER GRANTS** are grants for amounts less than or equal to \$125,000. 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 listed herein 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.

# Sloan Research Fellowships

**Program Director: Daniel L. Goroff**

First established in 1955 by Alfred P. Sloan Jr., these \$50,000 awards aim to accelerate scientific breakthroughs by providing support and recognition to outstanding early-career researchers in eight fields. Selected for their research accomplishments by an independent panel of senior scholars, the Sloan Research Fellows represent the next generation of leaders in the natural sciences, mathematics, and economics. Since the beginnings of the program nearly sixty years ago, some \$385 million (2014\$) has been awarded to more than 5,000 fellows, many of whom have gone on to esteemed careers. 43 Sloan Research Fellows have become Nobel Laureates; 16 have received the Fields Medal in mathematics; 15 Fellows have won the John Bates Clark Medal in economics; and 65 have been awarded the National Medal of Science. Hundreds of others have received notable prizes, awards, and honors in recognition of their major research accomplishments.

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## 2014 FELLOWS

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### **Boston College**

Maksym Fedorchuk, MATHEMATICS

### **Boston University**

Sharon Goldberg, COMPUTER SCIENCE  
Jared Weinstein, MATHEMATICS

### **Brown University**

Wesley Bernskoetter, CHEMISTRY  
Paul Valiant, COMPUTER SCIENCE

### **California Institute of Technology**

Clifford Cheung, PHYSICS  
Philip Hopkins, PHYSICS  
David Hsieh, PHYSICS

### **University of California, Berkeley**

Tapan Parikh, COMPUTER SCIENCE

### **University of California, Davis**

Justin Siegel, COMPUTATIONAL & EVOLUTIONARY  
MOLECULAR BIOLOGY

### **University of California, Irvine**

Animashree Anandkumar, COMPUTER SCIENCE

### **University of California, Los Angeles**

Kirk Lohmueller, COMPUTATIONAL &  
EVOLUTIONARY MOLECULAR BIOLOGY  
Alexander Sherstov, COMPUTER SCIENCE

### **University of California, San Francisco**

Zachary Knight, NEUROSCIENCE

### **University of California, Santa Cruz**

Ian Garrick-Bethell, PHYSICS

### **Carnegie Mellon University**

Jeffrey Bigham, COMPUTER SCIENCE



French economist Jean Tirole received the 2014 Nobel Prize in economics for his groundbreaking analyzes of market power and regulation. Tirole was awarded a Sloan Research Fellowship in 1985. Since the program began in 1955, 43 fellows have won the Nobel Prize, including six in economics. (PHOTO COURTESY OF THE INTERNATIONAL MONETARY FUND, CC BY-NC-ND 2.0.)

### **The University of Chicago**

Maureen Coleman, OCEAN SCIENCES  
 Daniel Fabrycky, PHYSICS  
 Zhiguo He, ECONOMICS  
 Maryanthe Malliaris, MATHEMATICS  
 Brent Neiman, ECONOMICS  
 Eric Weyl, ECONOMICS

### **Claremont McKenna College**

Deanna Needell, MATHEMATICS

### **University of Colorado, Boulder**

Gordana Dukovic, CHEMISTRY

### **Columbia University**

Ilyana Kuziemko, ECONOMICS  
 Brian Metzger, PHYSICS  
 Emi Nakamura, ECONOMICS

### **Cornell University**

Lionel Levine, MATHEMATICS  
 David Steurer, COMPUTER SCIENCE

### **Dartmouth College**

Ryan Hickox, PHYSICS

### **University of Delaware**

Nayantara Bhatnagar, MATHEMATICS  
 Joel Rosenthal, CHEMISTRY

### **Duke University**

Phillip Barbeau, PHYSICS  
 Lawrence David, COMPUTATIONAL &  
 EVOLUTIONARY MOLECULAR BIOLOGY  
 Raluca Gordan, COMPUTATIONAL &  
 EVOLUTIONARY MOLECULAR BIOLOGY  
 Court Hull, NEUROSCIENCE  
 Jeremy Kay, NEUROSCIENCE

### **University of Florida**

Rebecca Butcher, CHEMISTRY

### **Georgia Institute of Technology**

Maria Balcan, COMPUTER SCIENCE  
 Patrick Traynor, COMPUTER SCIENCE

**University of Georgia**

Brian Hopkinson, OCEAN SCIENCES

**Harvard University**

Emily Balskus, CHEMISTRY  
 Stephen Chong, COMPUTER SCIENCE  
 Benjamin de Bivort, NEUROSCIENCE  
 John Friedman, ECONOMICS  
 Richard Hornbeck, ECONOMICS  
 Daniel Jafferis, PHYSICS  
 Karin Oberg, PHYSICS

**University of Hawaii**

Christoph Baranec, PHYSICS

**University of Illinois, Urbana-Champaign**

Philip Godfrey, COMPUTER SCIENCE  
 Prashant Jain, CHEMISTRY  
 Shinsei Ryu, PHYSICS

**Indiana University**

Douglas Edmonds, OCEAN SCIENCES

**Johns Hopkins University**

Jared Kaplan, PHYSICS  
 Benjamin Langmead, COMPUTATIONAL &  
 EVOLUTIONARY MOLECULAR BIOLOGY  
 Tyrel McQueen, CHEMISTRY

**Lehigh University**

Jeetain Mittal, CHEMISTRY

**University of Maryland, College Park**

Elaine Shi, COMPUTER SCIENCE

**Massachusetts Institute of Technology**

Gloria Choi, NEUROSCIENCE  
 Mircea Dinca, CHEMISTRY  
 Mehrdad Jazayeri, NEUROSCIENCE  
 Jeremiah Johnson, CHEMISTRY  
 Bradley Olsen, CHEMISTRY  
 Charles Smart, MATHEMATICS  
 Jared Speck, MATHEMATICS  
 Kay Tye, NEUROSCIENCE

**McGill University**

Simon Gravel, COMPUTATIONAL &  
 EVOLUTIONARY MOLECULAR BIOLOGY

**University of Michigan**

Emanuel Gull, PHYSICS

**University of Michigan**

Pavel Nagorny, CHEMISTRY  
 Nathaniel Szymczak, CHEMISTRY

**University of Minnesota**

Jake Bailey, OCEAN SCIENCES  
 Kai-Wen Lan, MATHEMATICS

**New York University**

Roozbeh Kiani, NEUROSCIENCE  
 Nicholas Stavropoulos, NEUROSCIENCE

**North Carolina State University**

Jonathan Hauenstein, MATHEMATICS

**North Dakota State University**

Svetlana Kilina, CHEMISTRY

**Northeastern University**

Ivan Loseu, MATHEMATICS

**Northwestern University**

Nir Avni, MATHEMATICS  
 Aaron Naber, MATHEMATICS

**Ohio State University**

Julie Golomb, NEUROSCIENCE

**The Pennsylvania State University**

Alexander Radosevich, CHEMISTRY

**University of Pennsylvania**

Danielle Bassett, NEUROSCIENCE

**University of Pennsylvania**

Chris Callison-Burch, COMPUTER SCIENCE  
 Alison Sweeney, OCEAN SCIENCES

**University of Pittsburgh**

Marlene Cohen, NEUROSCIENCE  
 Sergey Frolov, PHYSICS  
 Michael Neilan, MATHEMATICS

**Princeton University**

Waseem Bakr, PHYSICS  
 Clifford Brangwynne, COMPUTATIONAL &  
 EVOLUTIONARY MOLECULAR BIOLOGY  
 Robert Knowles, CHEMISTRY  
 Benoit Pausader, MATHEMATICS  
 Rodney Priestley, CHEMISTRY

**Rice University**

Matthew Foster, PHYSICS  
Junrong Zheng, CHEMISTRY

**Rockefeller University**

Sebastian Klinge, COMPUTATIONAL &  
EVOLUTIONARY MOLECULAR BIOLOGY

**Rutgers University**

John Chou, PHYSICS  
Malin Pinsky, OCEAN SCIENCES

**Scripps Research Institute**

Ryan Shenvi, CHEMISTRY

**University of Southern California**

Jernej Barbic, COMPUTER SCIENCE  
Dion Dickman, NEUROSCIENCE  
Jennifer Garrison, NEUROSCIENCE  
Christoph Haselwandter, PHYSICS

**Stanford University**

Maria Barna, COMPUTATIONAL & EVOLUTIONARY  
MOLECULAR BIOLOGY  
Liang Feng, NEUROSCIENCE  
Jakub Kastl, ECONOMICS  
Anshul Kundaje, COMPUTATIONAL &  
EVOLUTIONARY MOLECULAR BIOLOGY  
Thomas Markland, CHEMISTRY  
Julia Salzman, COMPUTATIONAL &  
EVOLUTIONARY MOLECULAR BIOLOGY  
Monika Schleier-Smith, PHYSICS

**Stony Brook University**

Song Sun, MATHEMATICS

**Syracuse University**

M. Manning, PHYSICS

**University of Texas, Austin**

Guangbin Dong, CHEMISTRY  
Amir Mohammadi, MATHEMATICS  
Pradeep Ravikumar, COMPUTER SCIENCE

**University of Toronto**

Martin Krkosek, OCEAN SCIENCES

**University of Utah**

Adam Douglass, NEUROSCIENCE

**University of Virginia**

Benjamin Webster, MATHEMATICS

**Washington University in St. Louis**

Gary Patti, CHEMISTRY

**University of Washington**

Matthew Bush, CHEMISTRY

**University of Waterloo**

Dmitry Abanin, PHYSICS

**University of Wisconsin, Madison**

Shan Lu, COMPUTER SCIENCE  
Sushmita Roy, COMPUTATIONAL &  
EVOLUTIONARY MOLECULAR BIOLOGY  
Samuel Stechmann, MATHEMATICS  
Jun Yin, MATHEMATICS

**Woods Hole Oceanographic Institution**

Kristopher Karnauskas, OCEAN SCIENCES

**Yale University**

Reina Maruyama, PHYSICS



## STEM Research

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## Deep Carbon Observatory

**Program Director: Paula J. Olsiewski**

This ten-year program, begun in 2009, aims to revolutionize our understanding of the carbon deep in Earth, including its connections to the origins of life and to the origins, distribution, and abundance of fossil fuels. Through a multidisciplinary international network of scientists and technologists, the Deep Carbon Observatory (DCO) develops and deploys new instrumentation, collects observations, and performs analyses.

Initial activities of the Deep Carbon Observatory focused on the tremendous challenges posed by any large scale coordinated scientific enterprise: building institutional and technical infrastructure, engaging a net-

work of scholars, setting priorities, securing funds from stakeholders, benchmarking the state of deep Earth knowledge, and developing instruments to meet the severe technical challenges associated with probing the high-pressure, high-temperature processes in Earth's deep interior. The DCO's research agenda is being carried out through four research communities, one focused on the deep biosphere, another on deep energy, a third on carbon reservoirs and the flux of carbon between mantle and surface, and a fourth focused on the extreme physics and chemistry of carbon in high-pressure, high-temperature environments.



The University of Texas (Austin), which houses one of the world's best repositories of rock samples, agreed in 2014 to guide the sample preservation strategy of the Deep Carbon Observatory. (PHOTO COURTESY OF JESSE H. AUSUBEL.)

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## TRUSTEE GRANTS

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### Carnegie Institution of Washington

WASHINGTON, DISTRICT OF COLUMBIA

*\$2,250,000 over 24 months to continue supporting the Deep Carbon Observatory international secretariat.*

**Project Director: Robert M. Hazen, Executive Director, Deep Carbon Observatory**

Funds from this grant provide two years of continued support to the international secretariat of the Deep Carbon Observatory (DCO) as it pursues its 10-year mission to transform our understanding of the sources, forms, and properties of deep Earth carbon and its relation to hydrocarbons and the origins of life. As the governing body of the DCO, the international secretariat coordinates and oversees the activities of the DCO's four scientific communities, keeps the larger project on track, sets priorities and standards, helps allocate resources, and aids in project fund raising. Grant funds provide general support for these activities for the next two years.

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### Columbia University

NEW YORK, NEW YORK

*\$650,000 over 36 months to support seven field studies integral to the success of the Deep Carbon Observatory.*

**Project Director: Peter B. Kelemen, Vice Chair of Earth & Environmental Sciences**

This grant to the Deep Carbon Observatory (DCO) supports seven field studies, including the extraction and analysis of deep Earth drilling cores, at seven sites around the globe. Sample types and locations include:

- Hydrocarbons and microbes from fluids, Canadian Shield (Ontario, Canada);
- Surface-collected, carbon-bearing sediments and carbonate reefs, North Pole Dome (Western Australia);
- Hydrocarbons and deep microbes recovered from drilling, Songliao Basin (Northeastern China);
- High-pressure metamorphic rocks, graphite, and carbonates, Alpine Corsica (France);
- Possibly abiogenic hydrocarbons recovered from drilling, Romashkino oil field (Tatarstan, Russia);

- (Sub)seafloor methane hydrates (clathrates), water-column methane, Eastern Siberian Arctic Ocean Seafloor;
- Altered ocean crust and mantle, Samail ophiolite (Oman).

Sites were selected through a year-long collaborative process involving the entire DCO community. Together with cores already in repositories, new samples from these sites will complement the two dozen other locations where researchers are already working (such as volcanoes) in a way that DCO leaders believe will allow the program to achieve its decadal goals.

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### Rensselaer Polytechnic Institute

TROY, NEW YORK

*\$750,000 over 24 months to continue to lead the data science and management dimensions of the Deep Carbon Observatory.*

**Project Director: Peter A. Fox, Tetherless World Constellation Chair**

This grant provides continued support to a team led by Peter Fox at the Rensselaer Polytechnic Institute to provide computational and data management services to the Deep Carbon Observatory. Grant funds support the continued operation and development of deepcarbon.net, which is used to manage the project as a whole, coordinate member activities, and disseminate results both within the DCO and with the wider public. In addition, the RPI team maintains a state-of-the-art computing cluster used to store and analyze data collected by DCO scientists and to run complicated and data-rich model simulations. Grant funds provide continued support for these activities as well as additional work designed to lay the groundwork for a “deep carbon virtual observatory” that would exist as a continuing legacy after the DCO has completed its decadal research goals.

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### Smithsonian Institution

WASHINGTON, DISTRICT OF COLUMBIA

*\$599,862 over 24 months to advance jointly the modeling and visualization of deep carbon.*

**Project Director: Elizabeth Cottrell, Director of the Global Volcanism Program**

Funds from this grant support efforts to integrate the various diverse research projects and initia-



Professor Wendy Mao (Stanford University), co-leader of the Extreme Physics and Chemistry community of the Deep Carbon Observatory, demonstrates hi-tech imaging at the Jet Propulsion Laboratory, another DCO partner institution. (PHOTO COURTESY OF JESSE H. AUSUBEL.)

tives of the Deep Carbon Observatory (DCO) through the development of new numerical models and visualizations. Geologist Elizabeth Cottrell of the Smithsonian Institution's National Museum of Natural History will lead a multidisciplinary team of researchers, technologists, and representatives from each of the DCO's four scientific directorates to spearhead the collaborative development of new models and visualizations that incorporate the data collected and theoretical insights developed by DCO researchers in the field. Cottrell and her team will convene a workshop of DCO stakeholders to set modeling and visualization priorities, create an introductory visualization of the history of terrestrial vulcanism, and oversee the distribution of a small number of seed grants to stimulate modeling work on projects identified as high priority. The project promises several benefits, including forcing consistency upon diverse DCO research efforts, revealing gaps in measurement and functional understanding within the DCO community, and spurring new insights and projections.

## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

In March 2014, the Board of Trustees authorized the expenditure of up to \$750,000 for efforts to improve communications and networking within the Deep Carbon Observatory community and to strengthen its engagement with the public. The following grant was made against this previously authorized fund.

### University of Rhode Island

KINGSTON, RHODE ISLAND

*\$750,000 over 24 months to continue building the Deep Carbon Observatory as a model program in its internal community networking and external engagement.*

**Project Director: Sara C. Hickox, Director, Office of Marine Programs**

## OFFICER GRANTS

### American Geosciences Institute

ALEXANDRIA, VIRGINIA

*\$101,375 over 25 months to increase participation of underrepresented minority geoscientists in the Deep Carbon Observatory.*

**Project Director: Heather R. Houlton, Workforce Development Specialist**

### University of California, Berkeley

BERKELEY, CALIFORNIA

*\$78,172 over 12 months to conduct a workshop on one of the decadal questions of the Deep Carbon Observatory, "Is the net flux of carbon into or out of Earth?"*

**Project Director: Barbara Romanowicz, Professor**

### Rutgers, The State University of New Jersey

PISCATAWAY, NEW JERSEY

*\$75,000 over 14 months to organize and conduct the second international workshop of early career scientists involved in the Deep Carbon Observatory.*

**Project Director: Donato Giovannelli, Post Doctoral Associate**

### University of Texas, Austin

AUSTIN, TEXAS

*\$75,000 over 12 months to advance use of existing scientific collections for Deep Carbon Observatory projects and curation of samples.*

**Project Director: Beverly Blackeney DeJarnett, Research Science Associate IV**

# Microbiology of the Built Environment

**Program Director: Paula J. Olsiewski**

Americans spend the vast majority of their time indoors where they come into contact with trillions of microorganisms—tiny life forms invisible to the naked eye. Human beings ourselves are composed of ten times as many microbial cells as human cells and we are constantly shedding, acquiring, and sharing microbes. Environmental research and policy, however, have historically focused on natural or outdoor environments. Until recently, little was known about the complex microbial ecosystems that thrive in the built environment. Recent findings from Sloan grantees show that building ecosystems are influenced by building design, operation, and occupancy. The goal of the Microbiology of the Built Environment program is to grow a new multidisciplinary field of scientific inquiry that brings together biologists, architects, engineers and data specialists to expand our knowledge of the invisible microbial communities that live in our homes and workplaces, hospitals and schools, airplanes and subway systems.

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## TRUSTEE GRANTS

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### **University of California, Berkeley**

BERKELEY, CALIFORNIA

*\$1,445,238 over 24 months to understand the microbiology of the built environment through interdisciplinary research that combines microbial ecology, particle transport physics, chemistry, and architecture.*

**Project Director: Thomas D. Bruns, Professor**

This grant provides renewed support to the Berkeley Indoor Microbial Ecology Consortium (BI-MERC), a multidisciplinary group of mycologists, microbiologists, chemists, architects, and engineers who are working together to better understand the sources, factors, and processes involved in the assembly of microbial communities indoors.

Grant funds support a number of planned scientific studies by the BIMERC team, including an investigation into which microbial volatile organic compounds are indicators of microbial population growth; a study of how environment, building characteristics, and human behavior affect airborne microbes; a project to measure and model living particles using a laser-based ultraviolet spectrometer; and an analysis of microbial reproduction using gene transcripts. Additional funds support the purchase of a state-of-the-art mass spectrometer, a Proton Transfer Reaction-Time of Flight-Mass Spectrometer (PTR-ToF-MS), which will permit the team to conduct real-time chemical analysis.

The team will share their findings through peer-reviewed scientific publications, presentations at meetings and workshops, and through web-based blogs.

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## University of California, Davis

DAVIS, CALIFORNIA

*\$307,443 over 24 months to examine the seasonal nature of the built environment microbiota in wine- and cheese-making facilities.*

**Project Director: David A. Mills, Professor**

Funds from this grant support efforts by David A. Mills, Peter J. Shields Endowed Chair in the Department of Food Science, to examine the seasonal nature of the built environment microbiota in two types of food and beverage fermentation settings: dairies and wineries. The study aims to determine what microbial communities reside in these facilities during normal operation during all four seasons of the year; examine how these microbial communities migrate throughout the facilities; and make a series of building science measurements to evaluate how the built environment impacts these microbial communities.

In the wine study, Mills and his team will examine how regional microbiota on Chardonnay grapes from four different regions—Napa, Sonoma, Central Coast, and Northern San Joaquin Valley—influence winery-associated microbiota and how room traffic, occupancy, air flows, and room surfaces affect microbial composition. In the dairy study, the team will examine how three different types of milk—goat, cheese, and cow—drive the dairy-associated microbiota at three artisanal cheese-making facilities. In both studies, the team will examine seasonal changes to indoor microbiota and their correlations with environmental parameters.

The project will train at least one postdoctoral fellow and two undergraduates. Findings will be shared with the scientific community through peer-reviewed publications and talks at scientific meetings and disseminated to the wine and dairy industry through trade publications.

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## University of Colorado, Boulder

BOULDER, COLORADO

*\$446,000 over 24 months to provide renewed support to organize and convene two conferences on the Microbiology of the Built Environment.*

**Project Director: Mark T. Hernandez, Professor**

Building a vibrant, multidisciplinary community of researchers working on the microbiology of the built environment requires bringing together a wide range of life scientists (microbiologists,

ecologists, mycologists, bioinformaticians, etc.) and building scientists (engineers, architects, aerosol scientists, indoor air quality specialists, etc.) Funds from this grant support the administrative and organizational costs for two annual meetings of the microbiology of the built environment research community, to be held in 2015 and 2016. In addition to paper presentations, panels, and plenaries, the conferences will include significant outreach activities targeting younger researchers in an attempt to engage the next generation of researchers in microbial ecology. Additional grant funds will support a feasibility study to examine ways to make the conference self-sustaining going forward.

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## University of Colorado, Boulder

BOULDER, COLORADO

*\$199,888 over 24 months to provide improved tools for data analysis, including better user interfaces, protocols, and standards.*

**Project Director: Robin D. Knight, Professor**

Researchers working in indoor microbial ecology have no easy way to share data. Though the community is adopting state-of-the-art gene sequencing techniques, use of these new methods makes it difficult to compare newly collected data with older data collected using alternative methods. What's needed is an easy-to-use data platform that will facilitate data sharing by integrating sample handling, sequencing, analysis, and data release. Funds from this grant support a project by Rob Knight of the University of Colorado and Mitch Sogin of the Marine Biological Laboratory to develop just such an integrated data platform.

Over the next two years, Knight and Sogin will attempt to merge two data platforms used by microbial ecologists: QIIME (Quantitative Insights into Molecular Ecology) and VAMPS (Visualization and Analysis of Microbial Population Structures). VAMPS is very user-friendly and nimble; QIIME is more powerful but harder to use. The aim is to develop a new system that combines the best of both platforms, tying the user-friendly tools in VAMPS to the powerful analytical capacity of QIIME. They will also develop a series of protocols and standards for the collection and analysis of microbial data using the new system.

The project will result in new standard operating procedures, better software tools, and improved methods for depositing and sharing data in indoor



Microbiologist Maria Dominguez-Bello takes measurements inside a structure in Puerto Almendra, Peru. Dominguez-Bello was part of a Sloan-supported team of researchers who sampled microbial populations in third world structures as part of a study of how indoor microbial populations differ across cultures. (PHOTO BY HUMBERTO CAVALLIN.)

microbial ecology. The team expects the new tools and procedures to be adopted by at least 75 to 100 researchers, with at least 100 students and post-docs will be trained through annual workshops.

### University of California, Berkeley

BERKELEY, CALIFORNIA

*\$330,476 over 18 months to understand the microbial community response to water damage in residential buildings.*

**Project Director: Rachel I. Adams, Project Scientist**

Funds from this grant support efforts by Rachel Adams at the University of California, Berkeley and Michael Waring, assistant professor of civil, architectural, and environmental engineering at Drexel University, who propose to examine the microbial community response to water damage in residential buildings. Adams and Waring have three objectives: to apply molecular ecological approaches to better understand any changes in microbial biomass and composition that accompany water intrusion into residences; to inform microbial sampling strategies in residential buildings; and

to determine community-level patterns for how building conditions/characteristics and microbial community composition are associated.

Adams, Waring, and their team will conduct well-replicated surveys of 60 residential units in order to achieve these objectives, studying buildings in Red Hook, Brooklyn that experienced water damage during Superstorm Sandy in October 2012, as well as similar, though undamaged buildings, on Manhattan's Upper West Side. Over a period of three to four weeks, they plan to make continuous measurements of indoor and outdoor temperature, relative and absolute humidity, light intensity, HVAC system activity, and integrated PM2.5 and PM10 measurements. They will then characterize the microbial community composition in both time-integrated and discrete-time-period samples. Data collected will permit the team to analyze the variation in microbial community composition associated with building characteristics and operation, geographic location, and the extent of water damage. Findings will be shared through peer-reviewed publications, presentations at scientific conferences, articles in trade journals, and blog posts. The team also plans to write one article for a lay audience.

### National Academy of Sciences

WASHINGTON, DISTRICT OF COLUMBIA

*\$500,000 over 20 months to provide partial support for a consensus study of the microbiology of the built environment.*

**Project Director: Katherine Bowman, Senior Program Officer**

This grant provides partial support for a consensus study and subsequent report by the National Academy of Sciences on the microbiology of the built environment. An ad hoc committee of approximately 12 to 14 experts representing various disciplinary and sectoral perspectives will oversee this 20-month project that will include staff from the National Research Council (NRC), the Institute of Medicine (IOM), and National Academy of Engineering (NAE). The consensus study will begin with a fact-finding workshop that will bring together key stakeholder communities. The committee will use the information from the workshop as well as from the published literature and other sources to develop their report. They will meet four or five times to gather information and to deliberate about the knowledge gaps identified and the development of a prioritized research plan to address these gaps.

The result of the study will be a consensus report that documents the state of knowledge on the microbiome/built environment interface, identifies knowledge gaps, and sets out a list of prioritized areas for future research to address these gaps. The report will be available at no cost as a PDF file on the National Academies' website. The National Academies plan to disseminate the report's findings through briefings to the public, sponsors, and professional societies as well as through commentaries, op-ed pieces, and podcasts.

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### University of Ottawa

OTTAWA, CANADA

*\$586,500 over 24 months to provide renewed support to increase knowledge of fungi in the built environment.*

**Project Director: Keith Seifert, Professor**

This grant provides two years of continuing support to fungal taxonomists Keith Seifert and Rob Samson for their taxonomy studies of fungi isolated from indoor dust samples from homes on six continents.

Over the next two years, Seifert and Samson will complete taxonomic studies of up to 200 new species of fungi isolated from house dust, isolate xerophilic fungi from newly collected samples, and consolidate their data into an openly accessible online database. The team will share their findings and reference materials through peer-reviewed publications, including a special issue of the leading mycology journal *Studies in Mycology*, presentations at scholarly meetings, and through the open access database. At least two postdoctoral fellows, one graduate student, and four undergraduate students will be trained under the grant.

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### University of Texas, Austin

AUSTIN, TEXAS

*\$169,929 over 16 months to determine how the microbiome and air quality inside portable classroom buildings are affected by ventilation conditions and building design.*

**Project Director: Kerry A. Kinney, Professor**

Nearly one in five Americans spends time in school buildings each school day. Despite troubling findings that poor indoor air quality can reduce cognitive performance in students, schools are often not well maintained. There are nearly 600,000 portable classrooms, also known as trailers, across the country and, unfortunately, these spaces are

plagued with poor ventilation, water intrusion, and high levels of formaldehyde.

Funds from this grant support a project by Professor of Engineering Kerry Kinney and colleagues Richard Corsi, Atila Novoselac, and Ying Xu at the University of Texas at Austin to determine how the microbiome and air quality inside portable classroom buildings are affected by ventilation conditions and building design. The proposed project will examine the relationship between the microorganisms and pollutants found inside the actual classroom spaces to those found in the "hidden spaces" (e.g., wall cavities, crawl spaces) within portable classroom buildings, aiming to identify where microbes and other contaminants come from and where they go within the actual classroom and hidden spaces. The research team will also investigate how positive and negative pressurization from the ventilation systems affects the microbiota and other contaminants in various parts of the portable classroom.

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### University of Toronto

TORONTO, CANADA

*\$249,550 over 24 months to determine the impact of moisture on fungal growth on common indoor surfaces.*

**Project Director: Jeffrey A. Siegel, Associate Professor**

While it is well known that moisture in buildings is bad for both the structure and the occupants, no one has systematically investigated building material wetness and the associated response of fungal and bacterial communities. This grant supports efforts by Jeffrey Siegel, associate professor of civil engineering at the University of Toronto, in collaboration with J. Gregory Caporaso, assistant professor of biological sciences at Northern Arizona University, to determine the impact of moisture on fungal growth on common indoor surfaces. Sampling microbial community composition on gypsum drywall on three different test scales, Siegel and Caporaso will address how moisture affects microbial growth on common building materials, how different sensors respond to moisture changes in common building materials, which moisture measurements best correlate with changes in microbial communities under various conditions, and which building/materials/moisture factors have the biggest impact on fungal growth and community makeup?

The researchers will share their findings through publications in building and life science journals, trade journals, and blog posts and through presentations at national and international meetings.

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### University of Tulsa

TULSA, OKLAHOMA

*\$390,000 over 30 months to determine how ventilation and cleaning influence the microbial communities in indoor air and on surfaces.*

**Project Director: Richard Shaughnessy, Director, Indoor Air Program**

Funds from this grant provide partial support for a study examining Native American students' exposure to environmental asthma triggers at home and at school and will examine whether cleaning and ventilation interventions will result in fewer asthma symptoms and a decrease in school absences for the students. Sponsored by the U.S. Environmental Protection Agency (EPA), the study will conduct microbial sampling of homes and schools in the Cherokee Nation in pursuit of three primary objectives:

- Determine the impact of building ventilation on the airborne and surface concentrations and community structure of bacteria and fungi;
- Estimate the impact of cleaning on the microbial profiles present in floor dust samples;
- Study associations between in-depth microbial measurements based on DNA and the adenosine triphosphate (ATP) measurements, for assessing the effectiveness of surface cleaning. ATP measurements are the "gold standard" for evaluating cleaning in schools, health care settings, and food production facilities.

Sloan funds will enable project leader Richard J. Shaughnessy of the University of Tulsa to augment his efforts by adding building science measurements and modern microbial measurements to the research protocols.

The study proposes to develop new findings about the impact of ventilation and cleaning on the microbial profiles found in indoor air, surfaces, and floors. The team will share their results through peer-reviewed journal publications, presentations at national and international conferences, and publications in trade journals aimed at the cleaning and ventilation industries.

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### Virginia Polytechnic Institute and State University

BLACKSBURG, VIRGINIA

*\$250,000 over 24 months to develop new knowledge about how design, operational parameters, and engineering interventions shape the building plumbing microbiome in conventional and green buildings.*

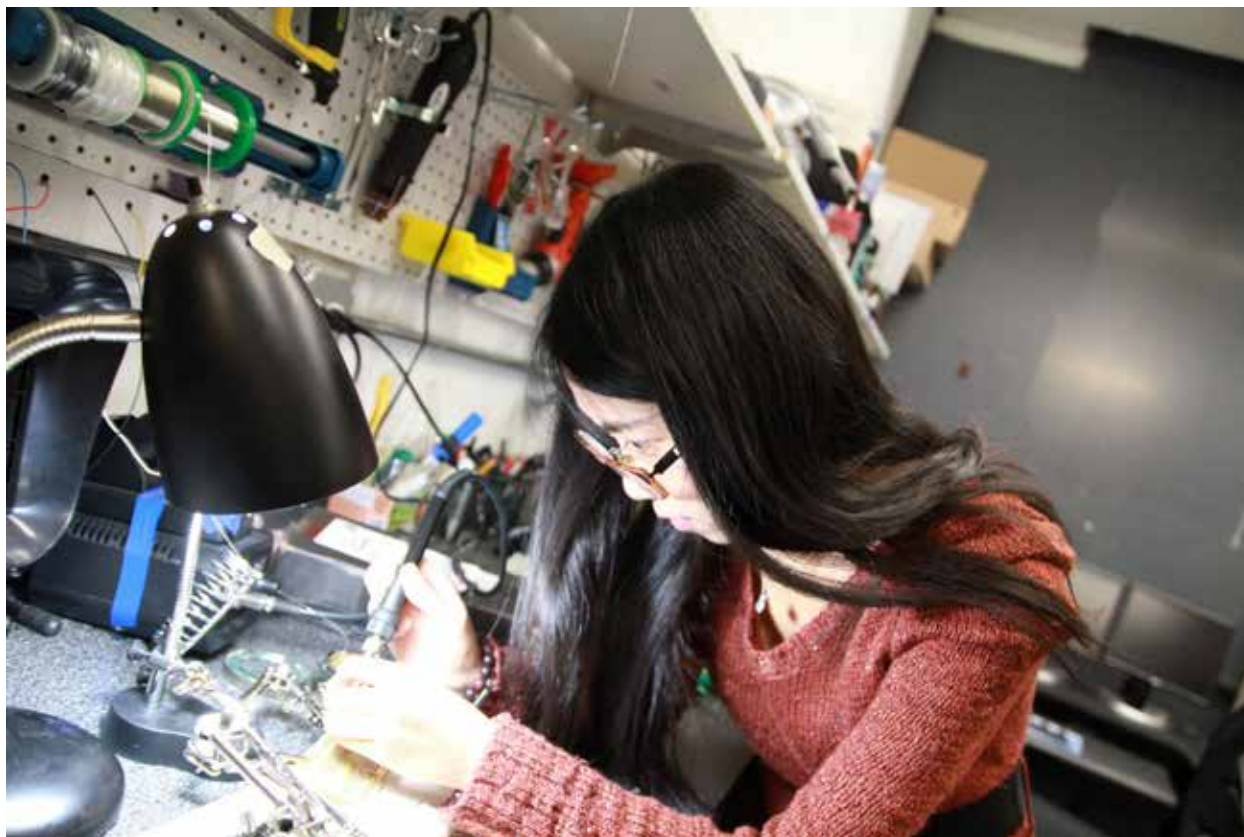
**Project Director: Amy Pruden, Professor**

Drinking water regulations focus on the water coming out of the water treatment plant, not on the water that comes out of the taps in your home or office. Building (i.e., in-premise) plumbing systems deliver potable water to the tap, shower, and other fixtures. These plumbing systems are a critical component of the built environment because they represent front line human exposure to water-borne microbes, whether harmless or harmful, which can occur via aerosol inhalation, aspiration, skin contact, or ingestion. Funds from this grant support a series of studies by Amy Pruden and Marc Edwards to develop new knowledge about how design, operational parameters, and engineering interventions shape the premise plumbing microbiome in conventional and green buildings. Pruden and Edwards have four objectives:

- Evaluate the role of water stagnation time in shaping the premise plumbing microbiome and propensity for opportunistic premise plumbing pathogens to colonize;
- Characterize the resilience of the microbiome to heat shock or heat interruption and quantify the response of opportunistic premise plumbing pathogens (OPPPs);
- Resolve the effect of copper and chloramine disinfectants; and
- Identify key microbial ecological relationships among OPPPs and the broader premise plumbing microbiome, when subject to a range of engineering design and control measures.

Pruden and Edwards plan to share their findings through peer-reviewed papers and presentations at national and international conferences, as well as through a webinar for building and water professionals. Additional grant funds support training for at least three graduate students.





An engineering student works on a sensor at the Open Source Building Science Sensors project. Based at the Illinois Institute of Technology, the project develops protocols for the design and construction of inexpensive, open source sensors for use in studying indoor microbial environments. (PHOTO BY AKRAM SYED ALI.)

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## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

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In October 2013, the Board of Trustees authorized the expenditure of up to \$250,000 for small grants in support of workshops, meetings and other engagement activities that build community and advance the goals of the Microbiology of the Built Environment program. The following grants were made against this previously authorized fund.

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### **American Association for the Advancement of Science**

WASHINGTON, DISTRICT OF COLUMBIA

*\$16,284 over 3 months to provide supplemental support for a one-day symposium on Microbiology of the Built Environment that was postponed due to the October 2013 federal government shutdown.*

**Project Director: Mark Milutinovich, RCP Program Director**

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### **University of California, Berkeley**

BERKELEY, CALIFORNIA

*\$66,269 over 15 months to support an October 2014 workshop “Fungi in the Built Environment: Next Steps.”*

**Project Director: Rachel I. Adams, Project Scientist**

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### **Illinois Institute of Technology**

CHICAGO, ILLINOIS

*\$25,447 over 10 months to support a May 2014 workshop: Building Science to Advance Research in the Microbiology of the Built Environment Program.*

**Project Director: Brent Stephens, Assistant Professor**

In October 2014, the Board of Trustees authorized the expenditure of up to \$140,000 for grants to projects that showcase the work of researchers in the Microbiology of the Built Environment program and inform the Foundation’s exploration of launching a new program on the chemistry of human habitats. The following grant was made against this previously authorized fund.

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### International Society for Indoor Air Quality and Climate

SANTA CRUZ, CALIFORNIA

*\$70,000 over 11 months to support the Sloan Symposium at Healthy Buildings 2015 Europe.*

**Project Director: Hal Levin, Research Architect**

In March 2013, the Board of Trustee authorized the expenditure of up to \$960,000 to provide fellowships to eight outstanding scientists and engineers who are studying the microbiology of the built environment. The following grants were made against this previously authorized fund.

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### University of California, Davis

DAVIS, CALIFORNIA

*\$120,000 over 24 months to examine the role of the built environment as a venue for microbial cross inoculation between infants.*

**Project Director: Zachery Lewis, Graduate Student**

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### The Forsyth Institute

CAMBRIDGE, MASSACHUSETTS

*\$120,000 over 24 months to examine the microbiomes of indoor track facilities and the runners who train indoors versus outdoors.*

**Project Director: Brian Klein, Postdoctoral Fellow**

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### University of Michigan

ANN ARBOR, MICHIGAN

*\$120,000 over 24 months to examine the regulation of the microbial community structures in drinking water, from source to tap.*

**Project Director: Sarah Jane Haig, Research Fellow**

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### Syracuse University

SYRACUSE, NEW YORK

*\$120,000 over 24 months to understand and control biofilms in the built environment.*

**Project Director: Huan Gu, MoBE Postdoctoral Fellow**

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## OFFICER GRANTS

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### Cold Spring Harbor Laboratory

COLD SPRING HARBOR, NEW YORK

*\$15,500 over 5 months to provide partial support for a workshop on enabling undergraduate research at the interface between high performance computing and genomics, genetics, and other areas of “big data” biology.*

**Project Director: David Micklos, Executive Director**

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### National Academy of Sciences

WASHINGTON, DISTRICT OF COLUMBIA

*\$75,000 over 22 months to provide partial support for a study on the effects of disasters on biomedical academic research that will include preparedness guidance for researchers, institutions, and sponsors.*

**Project Director: Bruce Altevogt, Senior Program Officer, Board on Health Sciences Policy, Institute of Medicine**

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### University of Maryland, Baltimore

BALTIMORE, MARYLAND

*\$44,942 over 24 months to foster metadata collection and analysis across the Microbiology of the Built Environment program.*

**Project Director: Lynn M. Schriml, Assistant Professor**

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### J. Craig Venter Institute

ROCKVILLE, MARYLAND

*\$20,000 over 12 months to provide partial support for a training course in microbial ecology for early-career scientists.*

**Project Director: Barbara A. Methé, Professor**

## Sloan Digital Sky Survey

**Program Officer: Evan S. Michelson**

The Sloan Digital Sky Survey (SDSS) is one of the largest, most detailed, and most often cited astronomical surveys, with the goal of expanding our understanding of the large-scale evolution and structure of the universe, the formation of stars and galaxies, the history of the Milky Way, and the science behind dark energy. By comprehensively mapping and cataloguing over a third of the night sky, SDSS represents one of the major quests of contemporary physics and has spurred advancement on answering a range of fundamental questions about the origins of the universe.

In cooperation with the Astrophysical Research Consortium, the Foundation has helped build and operate a pioneering, specially designed telescope and associated experiments to observe and archive information on millions of stars, galaxies, quasars, and other cosmological phenomena. SDSS is distinctive within the astronomical community for its participatory, bottom-up scientific research planning process, and it currently involves over 50 contributing institutional members in the collaboration. For the first time in the collaboration's history, the current fourth phase of SDSS



SDSS technician Diana Holder at the Apache Point Observatory hand connecting optical fibers into metal plug plates to capture light during observations. (PHOTO COURTESY OF THE SDSS COLLABORATION. [WWW.SDSS.ORG](http://WWW.SDSS.ORG))

(SDSS-IV) will continue the survey's rich tradition of cutting-edge data collection by partnering with a sister telescope located 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.

All SDSS data is released to the public under open principles. Participating scientists have written over 1,000 papers using SDSS data, and a total of over 6,300 papers with over 280,000 citations have been produced when the use of public data releases is considered. The most recent public Data Release 12 contains data on the properties and spectra of close to a half billion stars

and galaxies. As the only astronomy project supported by the Foundation, SDSS is currently the Foundation's longest running scientific research program.

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## TRUSTEE GRANTS

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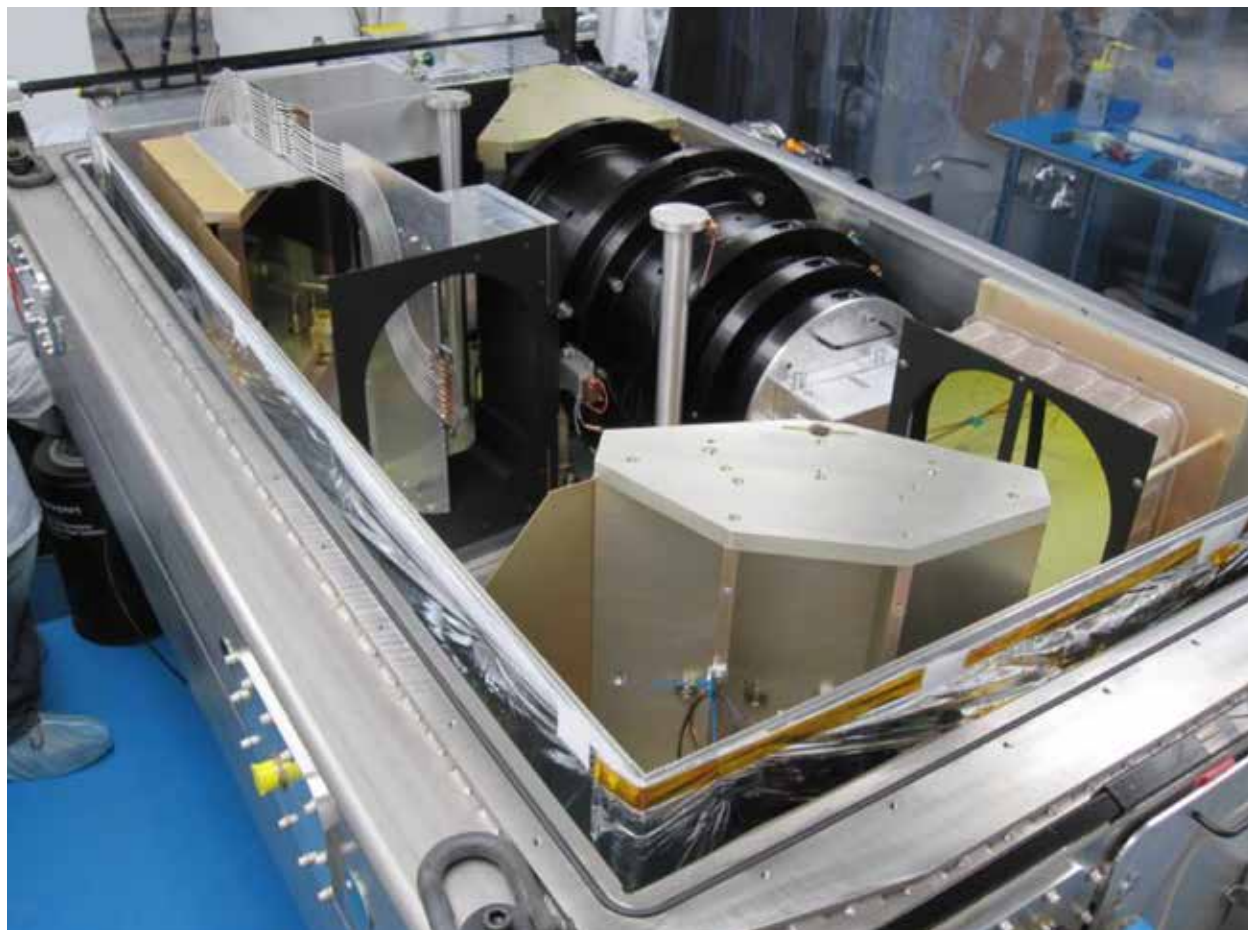
### Astrophysical Research Consortium

SEATTLE, WASHINGTON

*\$3,500,000 over 38 months to support the Sloan Digital Sky Survey IV to design, build, and install an infrared astronomical spectrograph for the Apache Point Observatory Galactic Evolution Experiment 2 (APOGEE-2) at the du Pont Telescope in Las Campanas, Chile in order to study the history and formation of the Milky Way galaxy.*

**Project Director: Michael Blanton, SDSS-IV Director**

This grant provides support for the construction, installation, and deployment of an infrared spectrograph for use by the Sloan Digital Sky Survey (SDSS) to study star formation in the Milky Way. The instrument, to be installed on the du Pont Telescope in Las Campanas, Chile, is identical to one already constructed and installed on the Sloan Telescope at Apache Point Observatory in New Mexico, the SDSS's primary observational instrument. The new spectrograph, installed in the southern hemisphere, will allow SDSS researchers, working in collaboration with their Chilean colleagues, to make parallel observations both north and south of the equator, quadrupling the number of observable stars and exposing sections of the inner Milky Way unviewable from the north. The project also promises to be a productive collaboration between American and Chilean astronomers, with nearly 20 Chilean scientists and engineers from multiple institutions directly involved in the installation and operation of the instrument.



Internal components of the spectrograph detector used for the APO Galactic Evolution Experiment (APOGEE). The Sloan Foundation is supporting the building and installation of a second APOGEE detector for observation in the Southern hemisphere. (PHOTO COURTESY OF THE SDSS COLLABORATION. WWW.SDSS.ORG)

## Synthetic Biology

**Program Director: Paula J. Olsiewski**

Established in 2005, The Alfred P. Sloan Foundation's Synthetic Biology program is credited with laying the groundwork for a robust examination of, and a sustainable approach to, a rapidly advancing field with transformative potential for both science and industry.

Through its strategic grantmaking the Foundation supported the scholarly community and provided a framework within which the synthetic biology field could identify risks, articulate societal and ethical implications, and provide options for governance. The program invested nearly \$10 million over the course of a decade to address the complexities of synthetic biology.

Grantmaking concluded in 2014.

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## TRUSTEE GRANTS

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### **National Academy of Sciences**

WASHINGTON, DISTRICT OF COLUMBIA

*\$170,000 over 18 months to provide partial support for an ad hoc committee to examine the issues of publication of dual-use research of concern.*

**Project Director: Anne-Marie Mazza, Director**

In 2011 researchers in the United States and Rotterdam, while conducting federally funded research on the H5N1 influenza virus, also known as bird flu, created a lethal human pathogen. This research has generated much controversy and has been the subject of numerous articles in the popular and scientific press. The response of the scientific community included a voluntary 60-day moratorium on H5N1 research and a meeting hosted by the World Health Organization, and a workshop convened by the National Academy of Sciences on the dangers of dual-use research. Funds from this grant continue that conversation through providing partial support for an ad hoc committee of the National Academy of Sciences (NAS) to examine the issues of publication of dual-use research of concern. The NAS will assemble a multidisciplinary committee that will meet, listen to briefings from a range of stakeholders, and commission papers to identify new approaches or mechanisms to mitigate the dangers associated with the publication of dual-use research.

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### Woodrow Wilson International Center for Scholars

WASHINGTON, DISTRICT OF COLUMBIA

*\$500,000 over 21 months to transition the activities of the Synthetic Biology Project either to successful closure or to sustainability.*

**Project Director: Todd Kuiken, Senior Scientist**

The Synthetic Biology Project at the Woodrow Wilson International Center for Scholars (WWIC) has been the center of the Foundation's activities to identify and address risk in synthetic biology. The WWIC team conducts forward-looking analyses, policy research, and public engagement on synthetic biology risks. As Sloan grantmaking in the Synthetic Biology program comes to a planned end in 2014, the Foundation will make several grants to existing grantees to secure the legacy of Sloan grantmaking in this area. Accordingly, this grant provides funds to help the Synthetic Biology Project bring high-value projects to a successful close or to secure long-term sustainability through other means. Over the next 21 months, the WWIC team will conduct a series of activities to ensure that their research reports, website, and other relevant outputs remain accessible after the project closes while maintaining a flexible posture to deal with new issues or opportunities that arise in synthetic biology. They will also develop long-term sustainability strategies for certain key initiatives, such as the Ask-a-Biosafety Expert program for the Do-It-Yourself biology (DIYbio) community. Other grant funds will help WWIC develop a compelling research agenda to address environmental risks in synthetic biology, to be ultimately funded by the U.S. government.

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## OFFICER GRANTS

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### International Council for the Life Sciences

MCLEAN, VIRGINIA

*\$65,000 over 12 months to review and discuss international regulations governing environmental release of organisms produced by synthetic biology.*

**Project Director: Terence Taylor, President**

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### National Academy of Sciences

WASHINGTON, DISTRICT OF COLUMBIA

*\$9,558 over 5 months to provide partial support for a symposium "Risks and Benefits of Gain-of-Function Research."*

**Project Director: Frances E. Sharples, Director, Board of Life Sciences, National Research Council**

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### J. Craig Venter Institute

ROCKVILLE, MARYLAND

*\$125,000 over 20 months to assess and apply lessons learned from DNA screening guidelines.*

**Project Director: Sarah R. Carter, Policy Analyst**

## Other STEM Research Grants

The Foundation occasionally makes research grants outside its normal grantmaking programs when a unique opportunity is presented to benefit society or advance the state of scientific knowledge. The following grants made in 2013 do not fall under the Sloan Foundation's active grantmaking programs.

### TRUSTEE GRANTS

#### University of California, Irvine

IRVINE, CALIFORNIA

*\$793,006 over 36 months to engage mathematicians and cryptographers in developing efficient and secure methods of computing on encrypted data.*

**Project Director: Alice Silverberg, Professor of Mathematics and Computer Science**

This grant funds work by Alice Silverberg of the University of California, Irvine to bring together mathematicians, cryptologists, and computer scientists in a concerted research effort to build on recent breakthroughs in fully homomorphic encryption (FHE). FHE is a promising new encryption technique that allows accurate computation on encrypted data, allowing third parties to perform calculations on datasets without the need to decrypt them first. Recent mathematical breakthroughs in FHE have shown it to be theoretically possible, though extant techniques are too slow and unwieldy for practical use. Silverstein's project will bring attention and intellectual firepower to the issue, in the hopes of eventually crafting more feasible FHE approaches, with consequent benefits for the conduct of privacy-preserving research by allowing scientific analysis of private, proprietary, and otherwise sensitive data.

### GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

In October 2011, the Board of Trustees authorized the expenditure of up to \$500,000 for exploratory grants in mathematics that relate to the Foundation's other grantmaking priorities. The following grant was made against this previously authorized fund.

#### Mathematical Sciences Research Institute

BERKELEY, CALIFORNIA

*\$100,000 over 11 months to support a national festival that increases the appreciation of mathematics and mathematical research.*

**Project Director: David Eisenbud, Director**

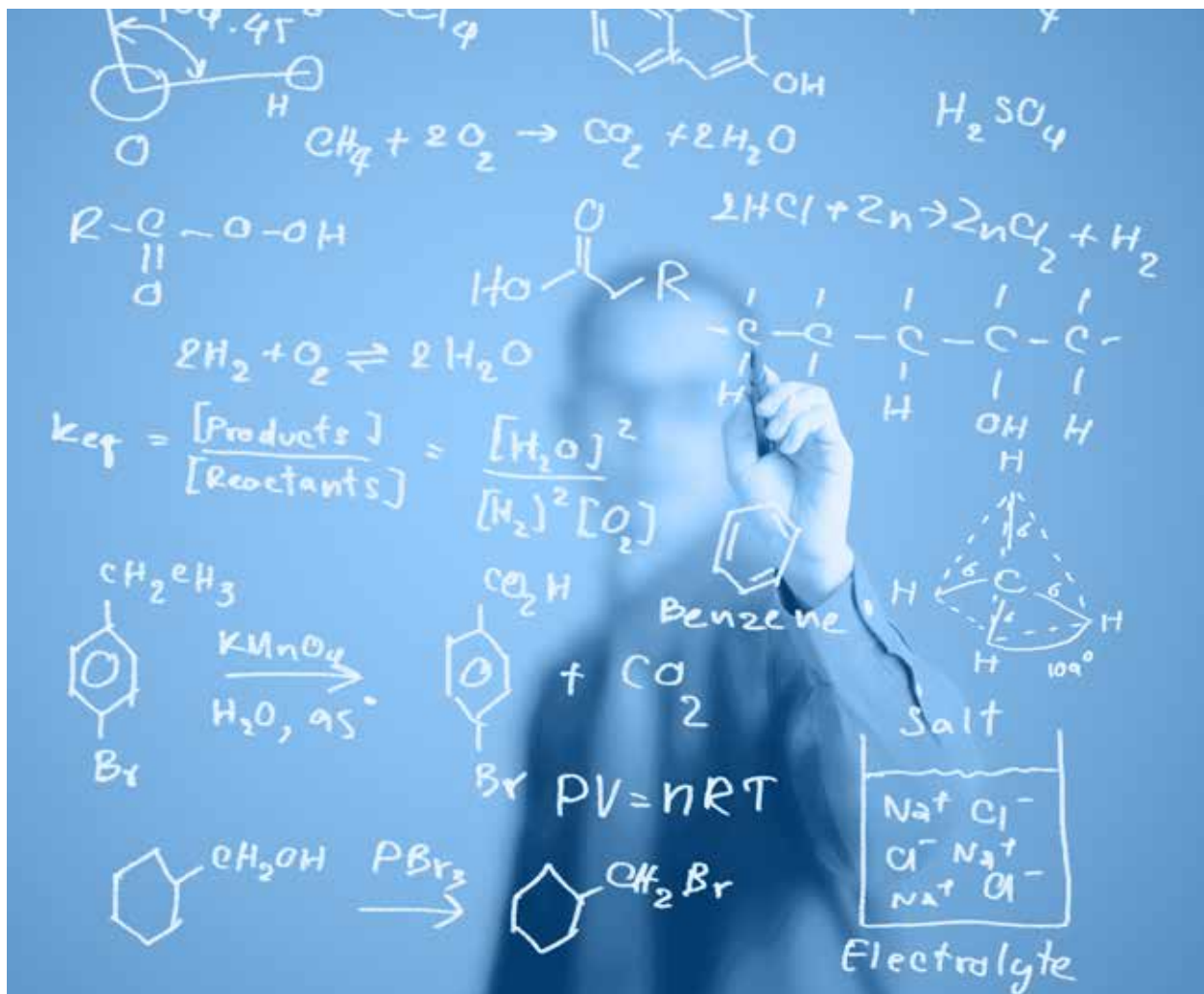
In October 2014, the Board of Trustees authorized the expenditure of up to \$140,000 for grants to projects that showcase the work of researchers in the Microbiology of the Built Environment program and inform the Foundation's exploration of launching a new program on the chemistry of human habitats. The following grant was made against this previously authorized fund.

#### Missouri University of Science and Technology

ROLLA, MISSOURI

*\$34,388 over 9 months to provide partial support for a workshop on indoor chemistry.*

**Project Director: Glenn Morrison, Professor**



## STEM Higher Education

Education and Professional Advancement  
for Underrepresented Groups

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The Science of Learning STEM

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## Education and Professional Advancement for Underrepresented Groups

**Program Director: Elizabeth S. Boylan**

This program aims to increase the diversity of higher education institutions and the work force in STEM fields through college and university initiatives that support the education and professional advancement of high-achieving individuals from underrepresented groups.

The program is divided into two major initiatives: The Minority PhD program and the Sloan Indigenous Graduate Partnership.

The **Minority Ph.D. program (MPHD)** aims to increase the number of underrepresented minorities who graduate from Ph.D. programs in STEM fields through the support of eight **University Centers of Exemplary Mentoring (UCEMs)**. UCEMs are campus-based initiatives that provide scholarships, mentoring, and other professional support to minority graduate students in STEM.

In addition to UCEMs, the Foundation also supports 10 **Programs of Exemplary Mentoring (PEMs)**. Drawn from departments that were traditional participants in the Minority Ph.D. program, PEMs receive grants for recruitment and professional development activities for minority doctoral students.



Dr. Elizabeth Boylan, Program Director at the Alfred P. Sloan Foundation, accepts an award from Robert Belle, Director of the SREB-AGEP Doctoral Scholars Program, recognizing the Foundation's 15-year partnership with the Institute on Teaching and Mentoring to provide support and opportunities to Sloan scholars and directors. (PHOTO COURTESY OF SOUTHERN REGIONAL EDUCATION BOARD.)

Students eligible for scholarships through the MPHD program must self-identify as African American/black, Hispanic/Latino(a), American Indian, or Alaska Native, and must be U.S. citizens.

The **Sloan Indigenous Graduate Partnership (SIGP)** aims to increase the number of American Indian and Alaska Native students who successfully complete master's or Ph.D. programs in STEM fields through the support of four regional centers. Each of the centers provides scholarships, mentoring, and other professional support to its students, and works cooperatively with the other centers to raise awareness of the opportunities that American



Program directors and Scholars of the Sloan Indigenous Graduate Partnership convene in Tampa, FL for the American Indian Science and Engineering Society meeting. (PHOTO COURTESY OF DENISE ELLIS.)

Indian and Alaska Native students have for financial support and professional development, all enhancing their aims to succeed in STEM graduate programs.

Management operations of the Minority Ph.D. program and the SIGP are conducted by the National Action Council for Minorities in Engineering (NACME).

In addition to the above, the Foundation makes a number of grants focused on initiatives that promote the professional advancement of women and underrepresented minorities who hold post-doctoral and faculty appointments in academic institutions.

## TRUSTEE GRANTS

### **National Action Council for Minorities in Engineering, Inc.**

WHITE PLAINS, NEW YORK

*\$2,071,038 over 36 months to provide scholarship funds for the Sloan Indigenous Graduate Partnership (SIGP) for three years, to be managed by the National Action Council for Minorities in Engineering.*

**Project Director: Aileen Walter, Vice President, Scholarship Management**

This grant provides scholarship funds for an anticipated 59 master's and 20 Ph.D. students to be recruited and enrolled over the next three years by the four institutional partners in the Sloan Indigenous Graduate Partnership, a national network of four educational institutions that aim to increase the number of American Indians and Alaska Natives that obtain postgraduate degrees in STEM fields. The following is the expected breakdown of scholarships by campus: \$385,200 to the University of Alaska (Anchorage and Fairbanks); \$712,500 to the University of Arizona; \$620,000 to the Montana University system; and \$353,338 to Purdue University.

Scholarships in the Sloan Indigenous Graduate Partnership are administered and disbursed by the National Action Council for Minorities in Engineering.

## National Action Council for Minorities in Engineering, Inc.

WHITE PLAINS, NEW YORK

*\$674,737 over 36 months to continue managing the Sloan Foundation's Minority Graduate Scholarship Programs for an additional three years.*

**Project Director: Aileen Walter, Vice President, Scholarship Management**

This grant provides three years of continuing support to the National Action Council for Minorities in Engineering to administer scholarships for graduate students supported through the Foundation's Minority Ph.D. program and the Sloan Indigenous Graduate Partnership. Funded activities include the timely execution of scholarship payments, accurate accounting of scholarship disbursements and balances, data collection on supported students, filing regular reports to the Foundation on scholarship disbursements, maintenance of the program's website and associated forms, and the production of a series of webinars aimed at supported scholars.

## Purdue University

WEST LAFAYETTE, INDIANA

*\$328,961 over 36 months to increase the number of indigenous Americans obtaining advanced degrees in STEM disciplines and to develop the Sloan Indigenous Graduate Partnership (SIGP) as a national network.*

**Project Director: Kevin D. Gibson, Associate Professor**

This grant provides support to Purdue University for its administrative, organizational, and infrastructure costs associated with the continued operation of the Sloan Indigenous Graduate Partnership (SIGP), a national network of four universities and university systems that aim to increase the number of indigenous Americans and Alaska Natives that obtain postgraduate degrees in STEM fields. Over the next three years the SIGP institutions—Purdue University, University of Arizona, the University of Alaska (Anchorage and Fairbanks), and the University of Montana system (University of Montana, Montana Tech, and Montana State University)—plan to recruit 59 talented American Indian or Native Alaska students into STEM master's programs and 20 students into STEM Ph.D. programs. Grant funds will support SIGP partner institutions as they engage in various administrative and infrastructure-building activities over the next three years, including community-building; collection, sharing, and analysis of data



Dr. Edwin Barea-Rodriguez, biologist and director of the Sloan-supported Program of Exemplary Mentoring at the University of Texas, San Antonio, was the recipient of the 2014 Faculty Mentor of the Year Award in recognition of his extraordinary success in mentoring minority graduate students. (PHOTO COURTESY OF SOUTHERN REGIONAL EDUCATION BOARD.)

on student outcomes and programmatic effectiveness; and the launch of a new intercampus student exchange program. Scholarship funds for students supported through the SIGP program are provided through a separate grant to the National Action Council for Minorities in Engineering.

## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

In December 2013, the Board of Trustees authorized the expenditure of up to \$750,000 to provide support for a number of University Centers of Exemplary Mentoring and Programs of Exemplary Mentoring committed to diversity and equity in STEM higher education. The following grant was made against this previously authorized fund.

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### National Action Council for Minorities in Engineering, Inc.

WHITE PLAINS, NEW YORK

*\$750,000 over 60 months to support the Sloan Minority Ph.D. program for Phase 2 transition awards for new University Centers of Exemplary Mentoring (UCEMs) and Programs in Exemplary Mentoring (PEMs).*

**Project Director: Aileen Walter, Vice President, Scholarship Management**

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## OFFICER GRANTS

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### Association of American Colleges and Universities

WASHINGTON, DISTRICT OF COLUMBIA

*\$50,000 over 19 months to use AAC&U's Centennial to shine a light on the current deep quality divides and the urgent equity imperative in American higher education—with special attention to the essential learning outcomes and evidence-based high impact teaching and learning practices that work in STEM education.*

**Project Director: Bethany Zecher Sutton, Chief of Staff**

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### Computing Research Association

WASHINGTON, DISTRICT OF COLUMBIA

*\$33,840 over 17 months to gain insight into the representation of women in the computing field through an in-depth analysis of available data from key national surveys, with emphasis on trends in women's representation at different educational levels and different areas.*

**Project Director: Stuart H. Zweben, Professor Emeritus**

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### Computing Research Association

WASHINGTON, DISTRICT OF COLUMBIA

*\$20,000 over 6 months to provide support enabling approximately 16 PhD graduate students to attend the 2015 CRA-Women Grad Cohort in San Francisco, CA on April 10-11, 2015.*

**Project Director: Kathryn McKinley, Principal Researcher**

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### Georgia Institute of Technology

ATLANTA, GEORGIA

*\$23,386 over 12 months to identify and analyze existing data and trends on women faculty in computing; 2) identify and analyze the relevant research literature; and 3) identify and characterize the organizations that support women as faculty in computing.*

**Project Director: Mary Frank Fox, ADVANCE Professor**

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### University of Kansas

LAWRENCE, KANSAS

*\$124,999 over 21 months to examine the data and literature on under-representation of women in Computer Science (CS) degrees and Information Technology (IT) careers.*

**Project Director: Donna K. Ginther, Professor of Economics**

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### University of Minnesota

MINNEAPOLIS, MINNESOTA

*\$115,000 over 18 months to document a notable time period in the participation of women and computing through oral histories of middle-rank professional women employed by three major U.S. corporations.*

**Project Director: Thomas J. Misa, Professor**

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### Social Science Research Council

NEW YORK, NEW YORK

*\$125,000 over 18 months to develop plans for a MPhD Alumni Mentoring Network and pilot a limited number of activities and professional development opportunities for graduates of the Minority Ph.D. (MPhD) Program with an initial focus on those who have positions in higher education.*

**Project Director: Mary Byrne McDonnell, Executive Director**

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### University of Texas, Austin

AUSTIN, TEXAS

*\$124,949 over 17 months to better understand the historical development of IT education in the United States and its role in creating a diverse workforce.*

**Project Director: William Aspray, Bill and Lewis Suit Professor of Information Technologies**

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### University of Washington

SEATTLE, WASHINGTON

*\$45,987 over 13 months to write a review paper that identifies the reasons for women's underrepresentation in computing and provides recommendations for the most promising ways to remedy this underrepresentation.*

**Project Director: Sapna Cheryan, Assistant Professor**

# The Science of Learning STEM

**Program Director: Elizabeth S. Boylan**

Grantmaking in this program aims to enhance the persistence and success of students in STEM majors and other undergraduate programs through the improvement of STEM pedagogies that incorporate evidence-based principles of how people learn and account for differences in achievement among student groups, e.g., race/ethnicity and gender.

Grants in this program support hypothesis-driven projects that are sensitive to the heterogeneity of STEM disciplines, attentive to differences in student demographics and motivations, and concerned with the dissemination of findings and the portability of lessons learned to other institutions.

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## TRUSTEE GRANTS

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### **National Academy of Sciences**

WASHINGTON, DISTRICT OF COLUMBIA

*\$150,000 over 24 months to report on the science and practice of learning by revising and extending the book *How People Learn*.*

**Project Director: Barbara Wanchisen, Director**

For those interested in the “science of learning,” the book called *How People Learn* has been a bible. This report is one of the most successful ever produced by the National Academies Press, selling nearly 150,000 hard copies on top of many free downloads. A distinguished National Research Council committee of cognitive neuroscientists, developmental psychologists, and educational experts succeeded in distilling and documenting key research findings, a series of practical applications of these findings, and an agenda for further research. Funds from this grant support a project by the National Academy of Science to publish an updated second edition of *How People Learn*, fifteen years after its original publication. The new edition will cover the latest research in fields such as cognitive neuroscience, behavioral economics, developmental psychology, and learning technologies. Though the updated report will address the full spectrum of learning from “K to gray,” Sloan funding will specifically support work on topics related to postsecondary education in science, technology, engineering, and mathematics.

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## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

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In June 2012, the Board of Trustees authorized the expenditure of up to \$500,000 for small grants to support innovation in and evaluation of curricular and teaching practices in STEM undergraduate education. In October 2014, the Board of Trustees authorized the expenditure of an additional \$350,000 for this same purpose. The following grants were made against these previously authorized funds.

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### Texas A&M University

COLLEGE STATION, TEXAS

*\$10,000 over 5 months to plan workshops on implementing, evaluating, and disseminating techniques for active and inquiry-based mathematics learning in higher education.*

**Project Director: Ronald G. Douglas, Distinguished Professor**

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### Association of Public and Land-Grant Universities

WASHINGTON, DISTRICT OF COLUMBIA

*\$20,000 over 12 months to explore innovative and effective ways to engage senior tenure-line faculty in physics and chemistry in pedagogical reform of upper division courses at research high or research very high universities.*

**Project Director: Kacy Redd, Director, Science & Mathematics Education Policy**

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### Barnard College

NEW YORK, NEW YORK

*\$115,888 over 14 months to update the existing content and plan for an extensive renovation of the website, [www.reducingstereotypethreat.org](http://www.reducingstereotypethreat.org), to increase its effectiveness in reducing the experience and consequences of stereotype threat.*

**Project Director: Steven J. Stroessner, Professor of Psychology**

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### University of Michigan

ANN ARBOR, MICHIGAN

*\$69,246 over 12 months to provide the impetus for a committed group of researchers to complete an analysis of STEM teaching, learning, and student outcomes, particularly as they are affected by the design of undergraduate courses and student research opportunities.*

**Project Director: Margaret Levenstein, Research Scientist**

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### National Academy of Sciences

WASHINGTON, DISTRICT OF COLUMBIA

*\$92,319 over 24 months to provide partial support for a convocation and dissemination activities on the evidence, models, and implications of replacing standard laboratory courses with discovery-based research courses in the STEM undergraduate curriculum.*

**Project Director: Jay Labov, Senior Advisor for Education & Communication**

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### National Bureau of Economic Research, Inc.

CAMBRIDGE, MASSACHUSETTS

*\$120,557 over 37 months to study the persistence of high-achieving underrepresented minority students in STEM majors at highly-ranked colleges and universities after participation in summer enrichment programs for rising high school seniors and to test novel and cost-effective data collection techniques and a randomized control design.*

**Project Director: Joshua Angrist, Ford Professor**

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## OFFICER GRANTS

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### Business-Higher Education Forum

WASHINGTON, DISTRICT OF COLUMBIA

*\$20,000 over 8 months to develop the goals, organizational structure, membership, and activities for a New York City Data Science Task Force focused on understanding the regional workforce requirements in data science, and creating or expanding undergraduate educational and research opportunities aligned to these requirements.*

**Project Director: Isabel Cardenas-Navia, Director, Emerging Workforce**



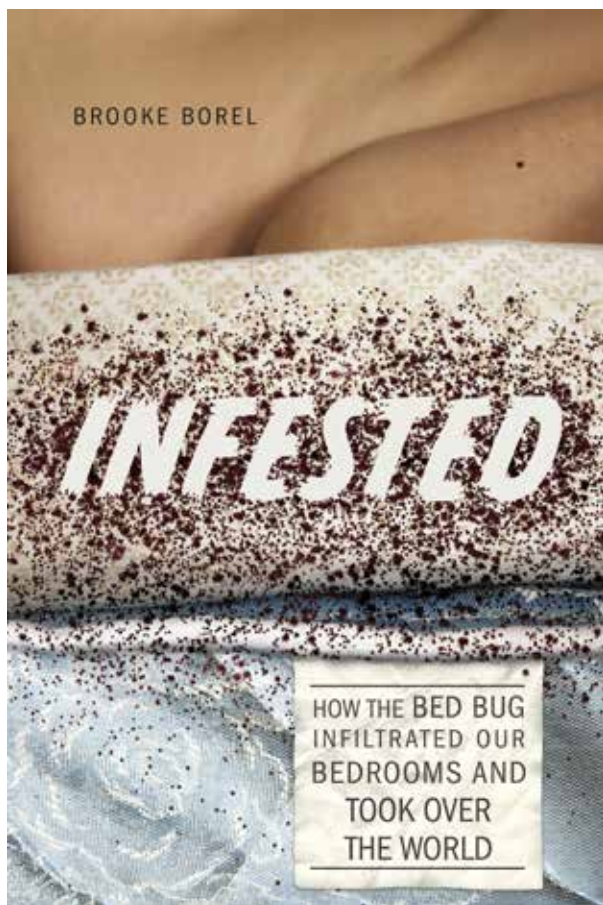
## Public Understanding of Science, Technology, & Economics

<b>Books</b>	<b>31</b>
<b>Film</b>	<b>33</b>
<b>Radio</b>	<b>36</b>
<b>Television</b>	<b>38</b>
<b>Theater</b>	<b>41</b>
<b>New Media</b>	<b>43</b>

## 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 re-



mains 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.

The current book program began in 1996 and has supported over 100 authors. For the prior two decades, the Foundation supported the Sloan Series of Scientific Autobiographies in the 1980s and the Sloan Technology Series, begun in 1994, which was continued under the current program. Books such as Kai Bird and Martin Sherwin's *American Prometheus*, Richard Rhodes's *The Making of the Atomic Bomb*, 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 Amir Aczel's *Finding Zero*, Catherine Price's *Vitamina*, Benny Shilo's *Life's Blueprint*, and Tom Shachtman's *Gentlemen Scientists and Revolutionaries*.

Brooke Borel's *Infested*, about the unusual history and cultural significance of bed bugs, was supported by a small books grant and published on May 15, 2015 by The University of Chicago Press. (PHOTO COURTESY OF THE UNIVERSITY OF CHICAGO PRESS.)



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## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

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In December 2013, the Board of Trustees authorized the expenditure of up to \$400,000 to provide small grants for promising new books on science, technology, engineering, and mathematics. The following grants were made against this previously authorized fund.

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### Kevin Davis

CHICAGO, ILLINOIS

*\$10,250 over 12 months to support the research and writing of a book on the intersection of criminal law and neuroscience for a general audience.*

**Project Director: Kevin Davis, Author**

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### Maura R. O'Connor

BROOKLYN, NEW YORK

*\$13,000 over 9 months to support a book on the science and ethics of conservation biology with a focus on extinction and de-extinction.*

**Project Director: Maura R. O'Connor, Writer**

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### Margot Lee Shetterly

HAMPTON, VIRGINIA

*\$50,000 over 12 months to support the research and writing of a book on the female African American mathematicians who worked at NASA over six decades.*

**Project Director: Margot Lee Shetterly, Project Director**

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### Julie Wosk

NEW YORK, NEW YORK

*\$4,525 over 4 months to support enhanced illustrations in a print and electronic book about how our changing representation of artificial women reflect both changing technologies and our changing attitudes toward women.*

**Project Director: Julie Wosk, Professor**

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### Yale University

NEW HAVEN, CONNECTICUT

*\$25,000 over 12 months as support for supplementary images, drawings and video in an interdisciplinary course book on physics and dance.*

**Project Director: Emily Coates, Lecturer**

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### David Baron

BOULDER, COLORADO

*\$50,000 over 14 months to support the research and writing of a book on the 1878 solar eclipse and how it helped create a culture of science in America.*

**Project Director: David Baron, Author**

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## OFFICER GRANTS

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### Richard Rhodes

HALF MOON BAY, CALIFORNIA

*\$125,000 over 12 months to support the research and writing of a book on the history of energy transitions for a general audience to be published by Simon & Schuster.*

**Project Director: Richard Rhodes, Writer**

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## 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 500 film projects from some of the nation's most innovative filmmakers, and has created a film development pipeline of multiple program partners through which Sloan nurtures and develops individual projects. The goals of this program are 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 develop new scripts about science and technology that can be produced and released theatrically. Over the past 15 years the Foundation has partnered with six of the top film schools in the

country and established annual awards in screenwriting and film production, along with an annual best-of-the-best Student Grand Jury Prize. The Foundation also supports screenplay development programs at the Sundance Film Institute, the Tribeca Film Institute, the Hamptons International Film Festival, and Film Independent's Producer's Lab and has developed such film projects as Morten Tyldum's *The Imitation Game*, Michael Almereyda's *Experimenter*, Rob Meyer's *A Birder's Guide to Everything*, Musa Syeed's *Valley of Saints*, and Andrew Bujalski's *Computer Chess*. In an effort to gain distribution for Sloan films, the Foundation has expanded Coolidge Corner Theater's *Science on Screen* effort into a nationwide program that has to date awarded 71 grants to 38 independent cinemas, each of which shows at least one Sloan-supported film a year. The Foundation has also partnered with Film Independent to launch a new annual initiative for an outstanding science film entering its distribution phase.

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## TRUSTEE GRANTS

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### Columbia University

NEW YORK, NEW YORK

*\$266,939 over 29 months to encourage the next generation of filmmakers to write screenplays and produce short films about science and technology.*

**Project Director: Trey Ellis, Associate Professor**

This grant provides continuing support to Columbia University, one of the Foundation's six film school partners, for twenty-eight months of activities designed to encourage top film students to develop screenplays and produce short films about science and technology. Activities supported through this grant include the provision of faculty mentors and science advisors for students working on science-themed film projects, two annual awards for production of short films on science and technology, one annual award to develop promising feature film scripts with science content, an annual science information seminar for film students, and networking events with select film industry producers, agents, and managers.

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### Film Independent, Inc.

LOS ANGELES, CALIFORNIA

*\$665,995 over 36 months to provide direct support to develop science and technology scripts through a Producer's Lab and Fast Track film financing and to start a fund to incentivize distribution of completed Sloan films and other science-worthy features.*

**Project Director: Jennifer Kushner, Director of Artist Development**

Funds from this grant support a continuing partnership with Film Independent in its efforts to develop high-quality, science-themed screenplays and support producing teams that can get these films completed. Grant funds will support a series of incentive awards administered by Film Independent toward this purpose, including a yearly \$30,000 award to a producer to develop a science-themed script in FIND's Producing Lab; a Sloan Fast Track Fellowship to be awarded annually to a producer or producing team and which includes a \$20,000 cash grant and participation in the Fast Track film financing market; and an annual \$50,000 distribution grant awarded to one exceptional science-themed film a year to incentivize buyers to acquire it for distribution. Additional grant funds defray the administrative costs of the

program and support outreach and publicity efforts aimed at promoting winning projects.

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### Film Independent, Inc.

LOS ANGELES, CALIFORNIA

*\$381,053 over 5 months to support the triennial Sloan Film Summit, a three-day event of screenings, panels, staged readings, project updates, and networking opportunities and community building for Sloan film grantees.*

**Project Director: Jennifer Kushner, Director of Artist Development**

Funds from this grant will allow Film Independent (FIND) to host the 2014 Sloan Film Summit, a major convening of all of the Foundation's film grantees held every three years, from film schools to film festivals, and from film development to film distribution partners. Supported activities at the summit include screenings of short films produced by Sloan-supported student filmmakers, screenplay readings, scientist-filmmaker panels on a variety of topics related to the incorporation of high-quality science into narrative film, updates on the progress of Sloan-supported projects, and networking events with industry insiders. In addition to events for participants in the Sloan Film program, the summit will also feature three public-facing events: a full day of screenings of completed Sloan feature films followed by Q&A with the filmmakers, the staged readings of select Sloan-winning screenplays, and a high-profile "conversation" that focuses on science and storytelling.

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### Hamptons International Film Festival

EAST HAMPTON, NEW YORK

*\$186,467 over 12 months to provide final support toward a program to develop qualifying screenplays towards production and spotlight feature films with science and technology themes and characters at the Hamptons International Film Festival.*

**Project Director: Anne Chaisson, Executive Director**

This grant provides one year of continuing support to the Hamptons International Film Festival (HIFF) for a series of activities designed to develop and spotlight high-quality films and film scripts that explore science as a theme or that feature scientists, mathematicians, or engineers as major characters. Supported activities include a feature film prize for the best science-themed film submitted, a high-profile reception celebrating the

The Sloan Retrospective screening of *Good Will Hunting* at the 2015 Tribeca Film Festival featured a talkback with Director Gus Van Sant, actors Minnie Driver and Stellan Skarsgard, physicist Brian Greene, and psychiatrist Paul Browde. (PHOTO COURTESY OF THE TRIBECA FILM INSTITUTE.)



winning film and filmmaker, a panel discussion featuring filmmakers and working scientists, and a screenwriting workshop to develop two science-themed scripts that will result in a staged reading of those scripts with well-known actors during the festival. HIFF will also continue its intensive three-week filmmaking workshop at Stony Brook and will also host a tastemaker event in New York City in the weeks following the festival to promote the Sloan-winning film among prominent industry and press.

### National Academy of Sciences

WASHINGTON, DISTRICT OF COLUMBIA

*\$600,000 over 36 months to sustain and strengthen the Science & Entertainment Exchange and the role of science in Hollywood and provide support and exposure for the Sloan Film Program.*

**Project Director: Ann Merchant, Deputy Executive Director**

Launched in 2008 by the National Academy of Sciences, the Science & Entertainment Exchange pairs scientists with members of the entertainment industry, giving Hollywood producers, directors, writers, and other filmmaking professionals access to scientific expertise. Through hundreds of film and TV consultations, high-profile events, and “behind-the-scenes” access to scientific venues, the Exchange has successfully worked to enhance and improve the scientific content of many Hollywood productions, from science fiction to action to dramas. The Exchange has conducted over 800 consul-

tations to date on blockbuster films such as *Thor* and *The Avengers* and on TV series such as *The Good Wife* and *The Big Bang Theory*. The Exchange works to ensure accuracy when science is used in film, seeds new ideas within the film and television industry, and gives professional science advice. Funds from this grant provide operating support for The Exchange’s core activities. Additional funds support the enhancement of The Exchange’s web presence and a planned “signature” networking event to take place in late 2014.

## OFFICER GRANTS

### Barnard College

NEW YORK, NEW YORK

*\$25,000 over 11 months to screen *Decoding Annie Parker* and hold a panel discussion as a way of highlighting women in STEM fields at the Athena Film Festival.*

**Project Director: Kathryn Kolbert, Constance Hess Williams Director**

## 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 on National Public Radio and on Public Radio International's *The World*, and 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 award-winning show *Radiolab*, two-time Peabody-winner *Studio 360*, *Science Friday*, the *Public Radio Exchange (PRX)*, Kavli Award for Science Journalism winner *BURN: An Energy Journal*, and Emmy-winning *Planet Money*. The Foundation also supports *LA Theatre Works* to record full-length science plays as part of a series called *Relativity*, broadcast on public radio. The recordings include over twenty plays originally commissioned by the Foundation's theater program.

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## TRUSTEE GRANTS

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### American Museum of Natural History

NEW YORK, NEW YORK

*\$354,000 over 12 months to support a popular science talk show StarTalk hosted by Neil deGrasse Tyson.*

**Project Director: Neil deGrasse Tyson, Executive Producer**

Neil deGrasse Tyson, an astrophysicist and director of the Hayden Planetarium at the American Museum of Natural History, is also creator and host of an innovative radio show called StarTalk, a program that uses comedy and celebrity star power to demystify science for the public. Tyson's guests are a mix of distinguished scientists—Bill Nye, Brian Greene, Buzz Aldrin—and interesting nonscientists and celebrities such as Jon Stewart, Morgan Freeman, and GZA. Increasingly the show has been videotaped and posted on YouTube and other video channels where it has attracted a sizeable audience and significant advertising.

This grant provides basic operating support for the continued production of StarTalk during a one-year contractual blackout imposed by Tyson's decision to host the upcoming 13-part mini-series COSMOS, to air in primetime on FOX in the spring of 2014. Contractually forbidden to appear on a "competing" video program, Tyson is seeking bridge funding to keep StarTalk funded until he can reappear on the program in 2015. This grant provides these funds, ensuring that an innovative show devoted to advancing the public understanding of science can stay on the air.

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### New York Public Radio

NEW YORK, NEW YORK

*\$400,000 over 24 months to support a health care reporting unit at WNYC, Appointment with Reform, focusing on the economics and policy of our health-*

*care system and the impact of the Affordable Care Act on consumers in New York.*

**Project Director: Jim Schachter, Vice President of News**

Funds from this grant provide support for a project by WNYC to produce a series of radio segments focusing on health care policy and the economics of the health care system in New York as viewed through the lens of the Affordable Care Act (ACA). Using a mix of personal stories, stakeholder interviews, data news, enterprise reporting, and in-depth conversations on the impact of the ACA, WNYC hopes to make the health care system more transparent to consumers. The idea is to use this historic, confusing, and still controversial health care Act as a teaching moment for the public and to get at the underlying economics and health care policy that few understand well. Additional focus will be on advances in medical science and methods that motivate behavior change for healthier living.

WNYC will produce 100 short news reports about the ACA, health care, and health care policy in the New York region for broadcast on programs like Morning Edition and All Things Considered and for follow-up discussion in segments on WNYC signature programs. They will also produce two one-hour series each year that delve more deeply into topics such as how health care reform is affecting the city's most vulnerable populations. In addition, WNYC will launch a new, weekly podcast aimed at prompting healthier consumer behavior and choices, create interactive graphics and charts to make complex health and economic data more accessible, and hold two public events that will allow members of the public to engage with WNYC and policymakers, practitioners, and other experts.

### **PRX Incorporated**

CAMBRIDGE, MASSACHUSETTS

*\$300,000 over 12 months to support a three-pronged approach to developing and disseminating new science and technology content for a new generation of radio producers and listeners via nontraditional broadcast, digital, and mobile platforms.*

**Project Director: Jake Shapiro, CEO**

Funds from this grant support a project by PRX, an open content marketplace for independently produced radio programs, to develop new voices and fresh radio content about science and technology (S&T). Using grant funds, PRX will issue an open call for story driven audio content on S&T

Microbiologist Christina Agapakis, neuroscientist Wendy Suzuki, and astrophysicist Michelle Thaller host PRX's new *Transistor* podcast. (PHOTO COURTESY OF PRX.)



themes and will produce S&T content for their existing portfolio of signature shows and podcasts, including a one-hour S&T-themed production for the The Moth Radio Hour, three science-themed S&T episodes for 99% Invisible, three technology-themed episodes for Theory of Everything, and three video segments showcasing interviews with leaders of S&T for Blank on Blank. PRX will also develop a new science-based podcast focused on women in science.

### **SoundVision Productions**

BERKELEY, CALIFORNIA

*\$789,044 over 17 months to support the radio broadcast of BURN: An Energy Journal to enhance understanding of energy and energy-related issues through public radio specials, podcasts, features for national news shows, and infographics and multimedia online content.*

**Project Director: Bari Scott, Executive Director**

This grant provides support to Bari Scott and SoundVision Productions for the continued production of their popular and ambitious multimedia radio series on energy, BURN: An Energy Journal. Using grant funds, SoundVision will produce an in-depth one-hour special The Adaptors about energy innovators, entrepreneurs, and average citizens and their creative adaptations to our energy future; a series of at least 12 five- to eight-minute features on energy to air on Marketplace, The World, and All Things Considered; 52 eight- to 15-minute podcasts about energy, distributed via iTunes and Soundcloud; a multimedia website with enhanced information, blogs, maps, infographics, and video science explainers; and 50 to 100 two- to three-minute videos on Soundcloud that will also be posted to YouTube, Vimeo, Facebook, and Tumblr.

# 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, where most of Sloan Public Understanding funding goes, 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, technology and engineering in the country's narrative. The Foundation also supports *American Masters*, National Geographic Television, programs on NOVA, and economics coverage on *The Newshour*. PBS received support for a new scripted drama set during the Civil War called *Mercy Street*,

which will be broadcast on public television in 2015. 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 Lise Meitner, Marie Curie, Rosalind Franklin, and Hedy Lamarr. The Foundation also supports television programs based on projects it has sponsored in other media.

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## TRUSTEE GRANTS

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### CUNY TV Foundation

NEW YORK, NEW YORK

*\$457,200 over 12 months to pilot a 13-part TV series co-hosted by a journalist and a scientist that reviews the latest movies and television shows, with an emphasis on the science angle.*

**Project Director: Robert Isaacson, President**

Funds from this grant provide partial support for the pilot season of a new series, *Science at the Movies*, which will review the scientific content and characters of the films, television, and other entertainment media. To be produced by CUNY TV and co-hosted by a team of one scientist and one journalist, the 13-episode, half-hour series aims to attract the general film-loving audience while casting a fun and friendly light on the scientific and technological content or the scientific implications, violations, or validations of popular entertainment. Topics will include how the lives and work of real scientists differ from on-screen portrayals on screen, and how elements of science and technology underlie both everyday events and the most dramatic or comedic activities. The show will air on CUNY TV and be offered for national distribution to PBS affiliates.

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### **Greater Washington Educational Telecommunications Association Inc.**

ARLINGTON, VIRGINIA

*\$1,000,000 over 19 months to support the production of a six-hour PBS documentary with Ken Burns on the past, present, and future of cancer science based on the award-winning book Emperor of All Maladies, and associated outreach.*

**Project Director: Dalton Delan, Executive Vice President & Chief Operating Officer**

This grant provides support for the production of a six-hour television series, to be produced by documentarian Ken Burns and broadcast on PBS, on the past, present, and future of cancer science. Based on Siddhartha Mukherjee's Pulitzer Prize-winning bestseller: *The Emperor of All Maladies. The Story of Cancer*, the series will offer cinema-verité style stories about patients and their caregivers and will delve into the latest scientific advances in cancer re-

search, including how the sequencing of the human genome, has transformed our understanding of the genetic, cellular, and molecular basis of cancer. The series will focus on three specific types of cancer—leukemia, breast, and lung—in an effort to give a broad overview of the complexity of this disease.

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### **Greater Washington Educational Telecommunications Association Inc.**

ARLINGTON, VIRGINIA

*\$500,000 over 15 months to increase coverage of the NewsHour's Making Sen\$e program by one-third and make it a weekly broadcast with a designated regular time slot.*

**Project Director: Sara Just, Executive Producer**

This grant provides continued support to the Greater Washington Educational Telecommunications Association, producer of the PBS NewsHour,



*The American Experience's* documentary *The Big Burn* is the dramatic story of the massive wildfire in the North Rockies that shaped the U.S. Forest Service and national fire policies. (PHOTO COURTESY OF THE UNITED STATES FOREST SERVICE.)



for the production and broadcast of a recurring series of high-quality segments on economic and financial topics. Funds support the production of 52 segments per year, to be produced by NewsHour reporter Paul Solman and broadcast weekly on a regular schedule. Additional funds support the creation of supplementary economic materials for the NewsHour website.

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### **WGBH Educational Foundation**

BOSTON, MASSACHUSETTS

*\$1,000,000 over 33 months to support a two-hour NOVA special about black holes hosted by astrophysicist Janna Levin, and ancillary outreach activities and a free mobile app.*

**Project Director: Paula S. Apsell, Senior Executive Producer**

This grant provides support for a new two-hour documentary, to be produced and broadcast for the PBS series NOVA, on the science of black holes. Hosted by Columbia astrophysicist Janna Levin, the film will document how recent improvements in instrumentation have led to significant advances in our understanding of black holes and are shedding light on fundamental questions about the universe. The show will include state-of-the-art animations as well as a free black hole app for mobile devices. Grant funds will provide production support for the documentary along with funds for app development, animation, and educational outreach campaigns targeting students, teachers, and the lay public.

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### **WNET**

NEW YORK, NEW YORK

*\$1,000,000 over 15 months to produce ten hour-long episodes on “Brain Science and Society” co-hosted by Charlie Rose and Eric Kandel, to be broadcast on PBS and Bloomberg and made available online.*

**Project Director: Charlie Rose, Host & Executive Producer**

This grant provides funds for a new series, to be broadcast on PBS and Bloomberg Television, that will focus on the relationship between brain science and society. To be hosted by award-winning journalist Charlie Rose and Nobel-winning biologist Eric Kandel, the new series will focus on a wide range of social issues connected with brain science, showing how much or how little the latest advances in neuroscience can help us understand

our behavior. Topics will include aggression and the social amplification of violence; gender identity and gender-related differences in cognitive function; psychiatric disorders such as autism, schizophrenia, and eating disorders; the inheritance of acquired traits and the impact of growing up in adverse circumstances; the consequences of sports-induced head trauma; brain science and criminal justice; erasing traumatic memories; aging populations and brain function; and genetic counseling for neurological and psychiatric disorders. The series will consist of 10, hour-long episodes with each episode featuring a panel of four-to-five experts in roundtable discussion.

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## OFFICER GRANTS

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### **University of Texas, Austin**

AUSTIN, TEXAS

*\$50,000 over 6 months to produce a 5- to 7-minute demo reel and revised treatment for a 6-part PBS series “Energy at the Movies.”*

**Project Director: Michael E. Webber, Deputy Director, Energy Institute**

# 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 fifteen 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 Tony and Pulitzer-Prize winning works as *Proof* and *Copenhagen*, and is recognized as the leading supporter of science plays in the country.

In addition to its two main partners, the Foundation 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 Nell Benjamin's *The Explorer's Club*, Sharr White's *The Other Place*, Lucas Hnath's *Isaac's Eye*, Anna Ziegler's *Photograph 51*, and Nick Payne's *Constellations*. To date the theater program has received over 2000 submissions for new plays, and of those it

has commissioned more than 220 works, and staged more than 60 plays in New York City alone, with dozens more travelling to theaters across the country.

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## TRUSTEE GRANTS

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### L.A. Theatre Works

VENICE, CALIFORNIA

*\$500,000 over 24 months to record four new science-themed Sloan plays for public radio broadcast and online streaming, to develop new digital products based on previous play recordings and to maximize visibility and access to all science plays for the public, for libraries and for schools.*

**Project Director: Susan Albert Loewenberg, Producing Director**

This grant provides renewed support to L.A. Theatre Works (LATW) for its ongoing efforts to record and disseminate high-quality science plays nationally and internationally. The LATW features leading actors reading well-produced versions of new and established science-themed plays, including many originally commissioned and produced through the Foundation's Theater program. Sixteen Foundation-supported plays have been broadcast on public radio and streamed online, with supplementary educational material provided, and then have been disseminated widely to schools and libraries. The current grant will support the recording and dissemination of an additional four Sloan-supported plays. Each will be broadcast nationally on public radio and streamed online along with previous titles. Individual titles will also be licensed via the Public Radio Exchange (PRX), reaching an estimated 2.5 million people during the grant period. Additional grant funds will support the expansion of LATW's mobile app to further engage younger listeners.



*Constellations*, supported by the MTC-Sloan Science Theatre Initiative, tells the story of a beekeeper and a quantum physicist who fall in love in multiple dimensions. (PHOTO COURTESY OF MANHATTAN THEATRE CLUB.)

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## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

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In December 2012, the Board of Trustees authorized the expenditure of up to \$425,000 for grants that aim to incentivize the production of more science and technology plays at the Manhattan Theatre Club by offering production support for qualifying plays. The following grants were made against this previously authorized fund

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### **Manhattan Theatre Club**

NEW YORK, NEW YORK

*\$125,000 over 5 months to provide production support for Manhattan Theatre Club's science-themed Broadway play *Constellations* featuring a theoretical physicist as a main character.*

**Project Director: Elizabeth Rothman, Director of Play Development**

## 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. 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 supported 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, and 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.

ChemCrafter is a free educational virtual chemistry set that has been downloaded in more than 127 countries. (PHOTO COURTESY OF THE CHEMICAL HERITAGE FOUNDATION.)

## OFFICER GRANTS

### Library Foundation of Los Angeles

LOS ANGELES, CALIFORNIA

*\$20,000 over 4 months to support a science essay, panels with scientists, and other programs exploring the scientific underpinnings of Homer's The Odyssey, part of a month-long series of programs, lectures, and events using libraries to bring the two cultures of science and the arts together around great works of literature.*

**Project Director: Kenneth Brecher, President**

### The Phillips Collection

WASHINGTON, DISTRICT OF COLUMBIA

*\$75,000 over 12 months to support an exhibition, public programs, and a book about the mathematical significance of the artist Man Ray's work.*

**Project Director: Wendy Grossman, Associate Curator**

### Women Make Movies, Inc.

NEW YORK, NEW YORK

*\$50,000 over 10 months to support two animated short films about current scientific research that will be distributed on the web.*

**Project Director: Flora Lichtman, Co-Director**





## Economic Performance & Quality of Life

<b>Economic Institutions, Behavior &amp; Performance</b>	<b>45</b>
<b>Working Longer</b>	<b>53</b>

# Economic Institutions, Behavior & Performance

**Program Director: Daniel L. Goroff**

The Foundation's program on Economic Institutions, Behavior, and Performance supports rigorous and objective 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 four subprograms:

- **Financial and Institutional Modeling in Macroeconomics**

Projects in this sub-program study interactions between the financial sector and the real economy, specifically the

role of banks, regulators, and other institutions. Research topics include financial frictions; heterogeneous agents; intermediation; transaction costs; asymmetric information; regulatory coordination; risk measurement, capital requirements; credit ratings; interbank markets; microeconomic foundations; liquidity and default; maturity transformation; asset valuation; etc.

- **Behavioral and Regulatory Effects on Decision-making**

Projects in this sub-program study households and individuals, specifi-

Sloan-sponsored fellowship winner Emil Siriwardane of NYU presents his research at a meeting of the Macro-Financial Modeling Initiative. (PHOTO PROVIDED COURTESY OF THE BECKER FRIEDMAN INSTITUTE. PHOTOGRAPHY BY JASON SMITH AT JASONSMITH.COM.)



cally the of role “choice architecture” on their economic decision-making. Research topics include 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; behavioral welfare economics; obfuscated markets; consumer finance; probabilities and perceptions of extreme events; etc. Behavioral and Regulatory Effects on Decision-making

- **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 labor markets for scientists and engineers; high-skilled immigration; patterns of scientific publication, collaboration, and intellectual property protection; the economics of digitization; 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 legal entity identifiers; data citation standards;

identification and tracking systems for scholars; federal statistics; smart disclosure platforms for obfuscated markets; data and metadata management protocols; privacy and access to social science datasets; the replicability of empirical research; and the economics of knowledge contribution and distribution.

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## TRUSTEE GRANTS

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### **The Australian National University**

CANBERRA, AUSTRALIA

*\$583,646 over 18 months to improve teaching and research in quantitative economics through the development of compelling, open, and reproducible models using Python.*

**Project Director: John Stachurski, Professor**

In contrast with academics in other fields, economists and other social scientists have been slow to adopt new open source programming languages, instead sticking with expensive proprietary applications like Matlab and STATA when doing modeling or running complex analyses on data. Because such programs cannot be used without a license, their popularity hampers reproducibility, hampers archiving, and hinders reuse of research that employs them.

This grant funds efforts by Nobel Prize-winner Tom Sargent of New York University and computational economist John Stachurski of Australian National University to speed the adoption of Python—a compact, powerful open source programming and computation platform—among economists and social scientists. Funds from this grant will bring Stachurski to NYU for a year to work with Sargent on expanding and promoting the usefulness of Python to economists everywhere. They will develop free Python modules and teaching materials, publicize the capabilities of the new iPython notebook, give presentations, publish a textbook, and further develop the materials and resources freely available on their website, [quant-econ.net](http://quant-econ.net).

Professor Andrew Metrick (center), Director of the Sloan-supported Yale Program on Financial Stability, talks with Summer School participants from the Bank of England and the International Monetary Fund. (Photo by Ben Mattison, Yale School of Management.)



### The Brookings Institution

WASHINGTON, DISTRICT OF COLUMBIA

*\$600,000 over 36 months to present accessible, reliable, and influential research through the Brookings Papers on Economic Activity.*

**Project Director: Justin Wolfers, Visiting Fellows, Economic Studies**

This grant provides continued support for the Brookings Papers on Economic Activity (BPEA) a series of conferences and journals that serve as premier outlets for impartial, nonpartisan, policy-relevant economic research. Over the next three years, grant funds will support organizational and administrative costs associated with the BPEA, including biannual meetings, commissioned papers, and a “Living Papers” series that allows research results to be updated in real time as new data becomes available. Potential topics to be covered include household finance, macroeconomic dynamics, quantitative easing, and macroprudential regulation.

### The Conversation

WEST NEWTON, MASSACHUSETTS

*\$400,000 over 24 months to inform conversations about economics by editing and publishing publicly accessible articles by academics about their research.*

**Project Director: Andrew Jaspan, Treasurer**

Funds from this grant provide two years of administrative and operational support for the business and economics desk of the Conversation U.S., an experimental new platform in journalism. Based on similar efforts already successfully launched in the

United Kingdom and Australia, the Conversation U.S. is an experiment in direct journalism, providing a platform where researchers and experts write public-facing news and analysis pieces themselves, published under their own bylines, which are then edited in collaboration with experienced journalists for clarity and objectivity. Content produced by the Conversation is released to the public free of intellectual property restrictions and it encourages other sites—even “competitor” news sites—to reuse and repurpose its content. The project represents a promising response to changing economic prospects in the news industry and facilitates more direct communication between researchers and the public.

### Harvard University

CAMBRIDGE, MASSACHUSETTS

*\$992,018 over 36 months to promote interdepartmental, intergovernmental, and international cooperation on policy-relevant research by behavioral scientists.*

**Project Director: Max H. Bazerman, Jesse Isidor Straus Professor of Business Administration**

Behavioral economics should have many implications for government policy. With this motivation, the Prime Minister’s Office in the U.K. established a Behavioral Insights Team (BIT) in 2010 to help bring insights from behavioral economics to the design and evaluation of government policy. The BIT’s successes in a wide variety of areas—from tax collection to energy efficiency to organ donation—have inspired other countries to launch similar initiatives, including Australia, the Netherlands, Israel, and the United States.



The academics and government officials leading such efforts have much to gain by comparing notes with one another. This grant funds a joint effort by David Halpern, head of the BIT in the U.K., and Max Bazerman, head of the Behavioral Insights Group (BIG) at Harvard, to organize a series of meetings, international conferences, and advanced courses that will bring together researchers from all over the globe to exchange the latest insights on the intersection of behavioral research and public policy.

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### **Massachusetts Institute of Technology**

CAMBRIDGE, MASSACHUSETTS

*\$868,954 over 30 months to develop tools that are computationally, administratively, and legally practical for conducting privacy preserving research on social science datasets.*

**Project Director: Micah Altman, Director of Research**

This grant funds efforts by Micah Altman of MIT and Salil Vadhan of Harvard to develop practical tools that researchers and repositories can use to process private and proprietary data. The goal of the project is to provide workable procedures that improve the accessibility, reproducibility, and confidentiality of “big data” produced from a variety of sources. Potential outputs include templates for legal agreements as well as software for depositing and accessing sensitive information. In addition, Altman, Vadhan, and their team plan to analyze the incentives and constraints on players throughout the system—from research funders to university administrators, and from potential data providers to academic publishers.

For social scientists, working with personally identifiable data poses significant technical, administrative, and legal challenges. Though the big data era has made these challenges increasingly ubiquitous, there is hardly anywhere to turn for reliable standards, precedents, or guidance. This project aims to help rectify that pressing problem.

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### **University of Michigan**

ANN ARBOR, MICHIGAN

*\$999,785 over 36 months to establish an independent, scientific, and comprehensive source of detailed information about the results of public and private investments in science.*

**Project Director: Jason Owen-Smith, Professor**

If those who discover new ideas could appropriate

all the benefits, then, at least in principle, market mechanisms could efficiently determine investments in science. But private and collective incentives diverge in the presence of externalities. We just do not know in advance where, when, or for whom research results will become valuable. Because predicting or charging for such applications can be difficult, markets tend to underallocate and misallocate support for basic research.

This grant funds research by a team led by Jason Owen-Smith to examine the return to investments in basic science by tracking how research grants eventually do and do not result in gainful applications. To collect, process, and study the detailed data necessary for carrying this out, Owen-Smith and his colleagues will establish an Institute for Research on Innovation and Science (IRIS) based at the University of Michigan. Foundation funds will support data infrastructure at the University of Michigan, as well as infrastructure at the University of Chicago and Ohio State.

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### **National Bureau of Economic Research, Inc.**

CAMBRIDGE, MASSACHUSETTS

*\$667,316 over 36 months to organize and support research on the economics of digitization.*

**Project Director: Shane Greenstein, Kellogg Prof of Information Technology**

Funds from this grant provide three years of support to the National Bureau of Economic Research for expenses associated with the continued operation of the Economics of Digitization Working Group. Led by Shane Greenstein of Northwestern, Josh Lerner of Harvard, and Scott Stern of MIT, the Economics of Digitization working group brings together a diverse group of economists to examine issues related to the digital revolution, including the structure and features of markets that deal in digital goods and services, copyright and intellectual property issues, privacy in the digital age, the role of prices in digital markets, and capturing digital work and productivity in economic statistics like GDP.

Grant funds will support working group conferences at the NBER Summer Institute and at Stanford. They will also support one postdoctoral fellow and four research sub-awards per year.

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### National Bureau of Economic Research, Inc.

CAMBRIDGE, MASSACHUSETTS

*\$534,750 over 48 months to study interventions for increasing the number of undergraduate women majoring in economics.*

**Project Director: Claudia Goldin, Henry Lee Professor of Economics**

The ratio of men to women earning undergraduate degrees in economics is three to one. This grant funds a project by Harvard economist Claudia Goldin to try to understand why. Over the next four years, Goldin will pursue three interconnected activities. The first is analysis of administrative data to better understand gender differences in selecting courses and majors. The second is convening researchers to coordinate similar research efforts by other scholars and to design interventions aimed at testing hypotheses suggested by the data. And the third is to run a kind of “randomized controlled trial” by matching baseline economics departments with those that receive financial in-



Federal Reserve System Vice-Chair Stanley Fischer addresses the Summer Institute of the National Bureau for Economic Research. (PHOTO COURTESY OF JIM POTERBA/NBER.)

centives to use an intervention. These experiments will provide evidence about whether and to what extent departmental interventions can effectively raise the number of women who major in economics, and may suggest ways to effectively address gender imbalances in other fields.

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### New York University

NEW YORK, NEW YORK

*\$588,205 over 43 months to model how the capitalization and regulation of financial institutions interact with the macroeconomy.*

**Project Director: Robert Engle, Michael Armellino Professor of Finance**

Traditionally, macroeconomics and finance have been surprisingly separate subjects. Yet if the Great Recession taught us anything, it is that macroeconomic models should not ignore the financial sector. We now know that financial considerations such as risk, regulation, leverage, liquidity, and default can affect the “real economy.” Funds from this grant support the work of a team led by Robert Engle at New York University to build, test, and refine macro-economic models that incorporate these financial factors. Engle’s team will pay particular attention to modeling how undercapitalization relative to regulatory requirements affects macroeconomic dynamics.

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### University of Pennsylvania

PHILADELPHIA, PENNSYLVANIA

*\$275,527 over 22 months to study how knowledge generated by research and development spills over through innovation networks.*

**Project Director: Ufuk Akcigit, Assistant Professor**

If those who discover new ideas could appropriate all the benefits, then, at least in principle, market mechanisms could efficiently determine investments in science. But private and collective incentives diverge in the presence of externalities. We just do not know in advance where, when, or for whom research results will become valuable. Because predicting or charging for such applications can be difficult, markets tend to underallocate and misallocate support for basic research.

This grant supports efforts by economists Ufuk Akcigit of the University of Pennsylvania and Daron Acemoglu of Harvard University to study economic spillover effects associated with technological

progress through the examination and modeling of innovation networks. Using patent, citation, and other data, the team will construct new theoretical models of innovation spillovers, conduct detailed empirical analyses, and evaluate the counterfactual effects of various innovation policies. Additional topics to be studied include the role of innovation policy in an open economy; the roots of major real-world innovations that led to significant spillovers; and the role networks play among inventors and financial institutions in generating spillovers.

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### Princeton University

PRINCETON, NEW JERSEY

*\$577,544 over 36 months to study how the psychology of scarcity and slack has implications for behavioral and traditional economics.*

**Project Director: Eldar Shafir, William Stewart Tod Professor of Psychology and Public Affairs**

Funds from this grant support a series of surveys, tests, and experiments by Princeton behavioral psychologist Eldar Shafir that examine scarcity and its implications for the social and behavioral sciences. Findings to date suggest that how closely people's behavior complies with standard economic models of rationality depends interestingly on the constraints they face when making decisions. Shafir has found that those who are poor (or put into an experimental situation of scarcity) often act more like the rational "homo economicus" posited by normative economic theorists. In contrast, those who are rich (or who are put into an experimental situation of plenty) often exhibit curious biases and behavioral anomalies that deviate from what standard economic models predict. Abundance, Shafir's research suggests, makes inconsistency and irrationality more affordable. The findings stand in stark contrast to the widespread belief that those in poverty make poor economic decisions. The truth may be exactly the reverse. This grant will fund the continuation and expansion of Shafir's research over the next three years, allowing deeper investigation of what factors explain behavioral deviation from traditional economic models and the implication for the design and implementation of policy interventions.

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### Stanford University

STANFORD, CALIFORNIA

*\$617,665 over 27 months to develop two new surveys of subjective business expectations and conduct research on the sources and consequences of business uncertainty.*

**Project Director: Nicholas Bloom, Professor of Economics**

This grant funds a project led by Nicholas Bloom (Stanford University) and Steven Davis (University of Chicago) to examine the relationship between uncertainty in the business community and economic performance. Partnering with the U.S. Census Bureau, Bloom and Davis will survey the nearly 45,000 U.S. business establishments in the 2016 Annual Survey of Manufacturing, asking respondents to provide forecasts about the coming year, including expected demand for products, prices, cost increases, employment, planned investment, and both industry- and economy-wide performance outcomes. The resulting will be a powerful new dataset that will provide the first direct measure of uncertainty in the business community.

In a related effort, Bloom and Davis will partner with the Federal Reserve Bank of Atlanta to survey a smaller sample of 1,000 businesses on a monthly basis, providing a complementary dataset that will be able to measure how business uncertainty changes over time and in response to new information.

Bloom and Davis plan to use these datasets to construct new measures of economic uncertainty and address a variety of questions, including the impact of uncertainty on business and aggregate economic performance; whether firm-level uncertainty reduces investment, hiring, and R&D; whether firm forecasts of business conditions and outcomes exhibit cognitive biases, and if so, whether these biases vary by firm age, size, performance, management experience, or external conditions.

## Stevens Institute of Technology

HOBOKEN, NEW JERSEY

*\$433,647 over 12 months to develop both a viable set of open source algorithms that describe financial contract types, as well as a community that will develop, fund, use, and maintain an even more comprehensive set.*

**Project Director: Khaldoun Khashanah, Director, Financial Engineering**

Financial contracts range from stocks, options, and futures to loans, annuities, and swaps. Each has its own rules governing who pays whom under what circumstances. Understanding the obligations imposed by these real world contracts under various hypothetical future scenarios is essential to evaluating the risks posed by the financial system to the global macroeconomy. What will happen if oil prices drop precipitously? What will happen if Chinese growth slows far faster than expected? What happens if there is another recession in the Eurozone?

Project ACTUS (Algorithmic Contract Types Unified Standards), based at the Stevens Institute of Technology, seeks to answer these questions by simplifying the analysis of financial transactions.

In theory, every financial agreement can be modeled algorithmically in terms of just 30 basic paradigms called “contract types.” Each contract type’s algorithm accepts as inputs both the parameters of the original agreement as well as information about the subsequent state of the world. It then outputs the payments dictated by the contract to and from its counterparties. In other words, the algorithm calculates “state dependent cash flows.” Banks and consultants already have their own proprietary systems that accomplish this, of course, but ACTUS is developing a system that would be comprehensive, standardized, open source, and compatible across organizations. It would allow the calculation of state dependent cash flows not just within a company, but across entire industries and economies, with potential applications in everything from risk management to regulatory reporting.

A 2012 planning grant from the Sloan Foundation supported ACTUS in the development and testing of the first six contract types. Funds from this grant will expand the project, allowing the development and testing of six additional types, enough to cover most routine bank transactions.



Richard Herring from The Wharton School discusses contingent capital requirements at the international summer school for financial regulators run by the Yale Program on Financial Stability. (PHOTO BY BEN MATTISON, YALE SCHOOL OF MANAGEMENT.)

## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

In June 2013 the Board of Trustees authorized the expenditure of up to \$750,000 to fund joint or exploratory small research projects in economics, particularly projects resulting from a joint initiative with the Russell Sage Foundation to identify unique research opportunities in behavioral economics. The following grants were made against this previously authorized fund.

### University of California, Berkeley

BERKELEY, CALIFORNIA

*\$124,992 over 22 months to apply behavioral insights to labor economics, particularly through the design of unemployment insurance schemes.*

**Project Director: Stefano DellaVigna, Professor of Economics**

### Princeton University

PRINCETON, NEW JERSEY

*\$115,000 over 24 months to connect and train graduate students from around the world who are beginning dissertation research on macro-financial models.*

**Project Director: Markus K. Brunnermeier, Edward S. Sanford Professor of Economics**

### Stanford University

STANFORD, CALIFORNIA

*\$20,000 over 12 months to develop and workshop a multidisciplinary research agenda on rethinking regulatory economics.*

**Project Director: Margaret Levi, Director at CASBS**

### The United States Studies Centre

SYDNEY, AUSTRALIA

*\$54,870 over 2 months to help launch the first international conference on applying behavioral insights to public policy.*

**Project Director: Bates Gill, CEO & Head of Thought Leadership**

## OFFICER GRANTS

### Haverford College

Haverford, Pennsylvania

*\$98,486 over 30 months to teach undergraduate social scientists about integrity, transparency, and reproducibility in empirical research.*

**Project Director: Richard J. Ball, Associate Professor of Economics**

### Industrial Organizational Society, Inc.

EAST LANSING, MICHIGAN

*\$20,000 over 24 months to support graduate student presentations at the International Industrial Organization Conference.*

**Project Director: Joseph Harrington, Professor**

### Massachusetts Institute of Technology

CAMBRIDGE, MASSACHUSETTS

*\$80,000 over 10 months to organize and run a workshop on technical, practical, and research questions about big data privacy.*

**Project Director: Daniel Weitzner, Research Scientist**

### University of Michigan

ANN ARBOR, MICHIGAN

*\$115,204 over 12 months to plan the design and testing of secure multi-party computing systems for the statistical analysis of private data.*

**Project Director: George Alter, Director of Interuniversity Consortium for Political and Social Research**

### National Bureau of Economic Research, Inc.

CAMBRIDGE, MASSACHUSETTS

*\$93,150 over 27 months to study productivity in higher education through the analysis of institutions and markets.*

**Project Director: Caroline M. Hoxby, Scott & Donya Bommer Professor of Economics**

### University of North Carolina, Chapel Hill

CHAPEL HILL, NORTH CAROLINA

*\$49,975 over 24 months to study the motivation and impact of science philanthropy as practiced by high-net-worth individuals.*

**Project Director: Maryann Feldman, Distinguished Professor**

## 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 the labor market activities of older Americans. The program also supports projects to identify ways in which institutional adjustments may facilitate employment of older Americans who need or want to work beyond conventional retirement ages. Grants support high quality research in specific areas of economics, including labor economics, public finance, and behavioral economics, as well as in related and complementary disciplines including demography, psychology and political science. Topics of interest include:

- **Human Capital:** *Occupation, Education, Cognition, and Health*  
How do the particular work history, occupation, cognitive abilities, and health of the individual impact employment for men and women after age 55?
- **Household Structure:** *Marriage, Divorce, Children, and Grandchildren*  
How do changes in the family at older ages alter labor force activities due to intergenerational transfers of money or in-kind resources, such as housing and care?

- **Finances:** *Resources, Pensions, and Financial Literacy*  
What roles do financial security, macro-economic factors, and individual financial literacy play in work and retirement decisions?
- **Institutions:** *Social Security, Pension, Disability, and Health Insurance Regulations*  
How do the important and changing regulatory aspects of the Social Security system and other institutions relate to decisions to work longer and to retire?
- **Personnel Practices:** *Incentives, Sorting, Compensation, Job Design, and HR Practices*  
How can employers identify and implement practices that sustain or improve employee productivity as people age?

In addition to research, this program supports efforts to build and sustain a vital community of scholars focused on older workers and to effectively marshal resources in journalism and social media to advance the public understanding and engagement with issues related to the aging of the U.S. workforce.

## TRUSTEE GRANTS

### Boston College

CHESTNUT HILL, MASSACHUSETTS

*\$498,556 over 24 months to inform decisions that affect the labor force activity, employment opportunities, and retirement security of older Americans, accounting for differences in socio-economic status.*

**Project Director: Alicia H. Munnell, Director**

This grant to Alicia Munnell and her colleagues at the Center for Retirement Research at Boston College supports research on the aging work force through the lens of workers' socio-economic status (SES). Munnell and her team will launch five integrated projects related to retirement, financial security, and employment opportunities that address the following questions.

- How long do people need to work to achieve a financially secure retirement?
- How would retirement ages vary if they reflected differential mortality by socio-economic status?
- How does job-changing affect the ability to retire securely?
- How do job opportunities narrow with age?
- How much would reducing the price of older workers' labor increase their attractiveness to employers?
- The project promises fill significant gaps in our understanding of the older work force.

### Columbia University

NEW YORK, NEW YORK

*\$663,141 over 18 months to enhance and expand the scope of the Age Smart Employer Awards.*

**Project Director: Ruth Finkelstein, Associate Director, CAC-ILC**

This grant provides continued support for the second year of the Age Smart Employer Awards, which honor local New York City employers who have demonstrated an extraordinary commitment to leveraging older workers' talent while meeting the goals of both the business and its employees. Grant funds will support the administration of the awards, the selection process, and outreach activities. Particular emphasis will be placed on expanding the circle of businesses that know about and ap-

ply for the awards as well as increasing the visibility for winning employers and the innovative practices for which they are being honored. Outreach strategy will particularly target small businesses (those employing fewer than 100 workers) and employers in New York City's growing health care sector.

### Cornell University

ITHACA, NEW YORK

*\$307,604 over 24 months to identify the effect of public policies that promote extended employment on the health of older Americans.*

**Project Director: Maria D. Fitzpatrick, Assistant Professor**

As the health of the U.S. population improves and the sources of retirement income become potentially more unstable, older Americans are expected to continue their current trend of both needing and wanting to work longer. The health impacts of longer working lives, however, are inadequately understood, particularly when work is induced by policy changes such as increasing the age of full retirement for Social Security benefits.

This grant supports research by Maria Fitzpatrick of Cornell University and Timothy Moore of George Washington University that examines this issue by studying the changes made in 1983 to the statutory retirement ages for Social Security benefits. Combining administrative with data and detailed data on health behaviors and expenditures, Fitzpatrick and Moore will examine how and whether differences in the length of working lives change health outcomes such as mortality and morbidity.

### University of Michigan

ANN ARBOR, MICHIGAN

*\$620,292 over 24 months to advance measurement of income, work activity, spending, assets, and debt by producing and analyzing a new data infrastructure based on the transactions and balances of individuals and use this infrastructure to study economic behavior and economic well-being of older Americans.*

**Project Director: Matthew Shapiro, Research Professor**

Matthew Shapiro and a research team at the University of Michigan and the University of California, Berkeley have successfully completed an innovative, two-year data infrastructure pilot that lays the groundwork for providing invaluable data regarding the real-time financial activities of older Americans as they work, transition into, and complete retire-

ment. The Michigan/Berkeley team relied on data from a mobile payments application, Check (previously known as Pageonce) that integrates individuals' bank accounts, credit cards, and asset accounts. With this data, the research team developed a data infrastructure that can be used to study individual income paths, consumption patterns, wealth levels, and financial portfolio choices of Americans, with a specific focus in this study on older Americans, more than 40,000 of which are Check users.

Funds from this grant provide continued support for the project, allowing the team to move from pilot to production of the data infrastructure and maintain a panel dataset of the work, income, spending, and balance sheet of a population of approximately one million users. Subsequent analyses will allow the research team to examine behavior of older Americans as they face labor market transitions, health shocks, and the take up of Social Security; produce time series estimates of income and spending for novel aggregates including, for example, spending and income by age and type; and study the quality of financial decisions among older populations and of behavioral reactions to discrete financial events like income tax refunds.

The team has instituted numerous safeguards to ensure the confidentiality and privacy of individual consumer data are strictly protected.

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### **National Academy of Social Insurance**

WASHINGTON, DISTRICT OF COLUMBIA

*\$375,000 over 15 months to help Americans understand how they can enhance their long-term retirement security by delaying Social Security benefits, when feasible.*

**Project Director: Virginia P. Reno, Vice President for Income Security Policy**

Recent Sloan-funded work by economist John Shoven of Stanford University demonstrates that, under a wide range of circumstances, healthy Americans would benefit from delaying the age at which they begin taking Social Security benefits. This grant funds a wide-ranging education campaign by the National Academy of Social Insurance (NASI) to effectively communicate Shoven's research to the public. Building on its successful, user-friendly toolkit of materials, "Social Security: It Pays to Wait," NASI will engage in an ambitious campaign to disseminate the toolkit through a multipronged media strategy that will utilize a grass-

roots outreach campaign composed of a number of well-connected partner organizations, including the Center for Rural Strategies, the National Women's Law Center, the National Council of La Raza, and the National Urban League. Grant funds will be used for dissemination, for efforts to deepen NASI's connections with organizations well positioned to reach older workers, and for improvements to the toolkit based on user feedback.

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### **National Bureau of Economic Research, Inc.**

CAMBRIDGE, MASSACHUSETTS

*\$373,750 over 24 months to continue research on facilitating work at older ages, building on a set of studies already completed under a previous grant.*

**Project Director: David A. Wise, Area Director, Health & Retirement Programs**

Funds from this grant provide continued support to the National Bureau of Economic Research (NBER) in its efforts to lead a network of top economists in the examination of issues related to aging and work and to the barriers to working longer. Led by economist David Wise, this network of scholars has substantial past and ongoing research expertise on health and health trends at older ages, population aging and its implications, the determinants of work and retirement, the incentives in public and employer policies, and the psychosocial factors that influence behavior.

Grant funds will help NBER extend the network collaboration by producing at least nine papers focused on how to facilitate work at older ages. Additional topic areas to be addressed include work capacity at older ages; how public and employer benefit policies affect work and retirement; and factors that facilitate work by seniors, such as work environments and job flexibility.



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## National Opinion Research Center

CHICAGO, ILLINOIS

*\$987,258 over 37 months to increase the amount and quality of news coverage on the economics of working longer, by extending the AP-NORC Center's education, research, and public outreach for two additional cycles.*

**Project Director: Trevor Tompson, Principal Research Scientist & Director**

This grant provides two years of continued support for a partnership between National Opinion Research Center (NORC) and the Associated Press (AP) to marry NORC's research expertise with AP's media reach to create a vehicle for promoting public understanding of critical social issues. Funds from this grant will provide two years of salary support to a NORC-AP fellow who will cover the older work force beat, producing thoughtful, scientifically informed, high-quality articles on a variety of issues, including aging and work, retirement, flexible work arrangements for older workers, productivity, and the economic impact of an aging work force on businesses, pensions, and government programs like Social Security. In addition, NORC will field a high-quality, nationally representative survey of older adults about issues facing older workers with the results distributed nationwide through the AP. Survey reporting will be supplemented with reporting on new economic research on the older work force and survey data will be made freely available to researchers in a public-use dataset.

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## RAND Corporation

SANTA MONICA, CALIFORNIA

*\$378,666 over 24 months to investigate the role of psychological factors in individuals' planning and subsequent decisions about the timing and staging of their transition from work to retirement.*

**Project Director: Andrew M Parker, Senior Behavioral/Social Scientist**

This grant funds a project by economist Susan Rohwedder of the RAND Corporation to examine the psychological factors in individuals' planning and subsequent decisions about the timing and staging of their decisions to work beyond conventional retirement age and how and when to transition from work to retirement. Rohwedder and her team will investigate whether and to what extent psychological factors such as cognitive abilities, beliefs about the future, and personality explain differences in individuals' staging and tim-

ing of late-in-life work decisions and subsequent retirement. While psychological factors have been shown to play an important role in various domains of individual decision-making, they have received little attention so far in the context of the complex decisions involved in late-in-life work choices and retirement transitions. Bringing together a cross-disciplinary team with expertise in cognitive psychology and classical and behavioral economics, they hope to fill this gap.

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## Stanford University

STANFORD, CALIFORNIA

*\$862,416 over 36 months to foster more research and policy discussion about changing labor market institutions to accommodate increased longevity through a conference series and a post-doc/first sabbatical program.*

**Project Director: John B. Shoven, Director, SIEPR**

This grant supports three, two-day, annual conferences exploring the latest economic research related to changing labor market institutions and regulatory policy in ways that accommodate the increasing lifespans of the American worker. Hosted by economist John Shoven, director of the Stanford Institute for Economic Policy Research (SIEPR), the conferences will serve as an annual event where the growing community of new and established economists working on these issues can gather to network, share ideas, and learn about the latest research. Topics to be discussed at the conferences will cover a wide range of issues, including retirement security, how existing regulatory regimes affect worker incentives, retirement strategies, pensions, the likely effects of proposed alternative regulatory regimes, and systematic differences between labor markets for older workers and those for younger cohorts. Additional funds will support a small postdoc/first sabbatical fellowship program that will support the work of two researchers interested in conducting original, high-quality economic research in this area.

## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

In December 2013, the Board of Trustees authorized the expenditure of up to \$350,000 to support small projects aimed at extending our understanding of the demand and supply sides of the labor market for older workers. The following grants were made against this previously authorized fund.

### **Boston College**

CHESTNUT HILL, MASSACHUSETTS

*\$124,950 over 13 months to determine the feasibility of creating a sustainable multidisciplinary aging and work research network.*

**Project Director:** Jacquelyn Boone James, Director of Research, Center on Aging and Work

### **Colorado State University**

FORT COLLINS, COLORADO

*\$20,000 over 15 months to analyze data from the Health and Retirement Study and the Occupational Information Network to study novel research questions regarding workers' perceptions of their work ability or job-related capacity and labor force participation among older workers.*

**Project Director:** Gwenith G. Fisher, Assistant Professor

### **The Graduate Center of The City University of New York**

NEW YORK, NEW YORK

*\$112,928 over 16 months to create a profile of older workers in critical unionized industries in New York City and an inventory of the current policies and practices of the unions representing them, in order to assess the extent to which the collective bargaining is—or could become—an effective mechanism for addressing the challenges of the aging workforce.*

**Project Director:** Ruth Milkman, Academic Director

### **University of Michigan**

ANN ARBOR, MICHIGAN

*\$74,444 over 15 months to understand the trend of health and socioeconomic position of early retirees by examining a nationally representative survey of older adults over a 15-year period.*

**Project Director:** Hwajung Choi, Research Investigator

## OFFICER GRANTS

### **National Opinion Research Center**

CHICAGO, ILLINOIS

*\$108,880 over 6 months to assess the demand among potential audiences for a Working Longer Resource Center that would catalog, synthesize, and disseminate the body of research on the economics of working longer and the aging work force, making it accessible to those people who are in a position to use the information to assess outcomes for older Americans.*

**Project Director:** Trevor Tompson, Principal Research Scientist & Director

### **University of Massachusetts Medical School**

WORCESTER, MASSACHUSETTS

*\$97,750 over 24 months to conduct a national conference to identify and disseminate generalizable principles, strategies, interventions, and tools that can be used to advance faculty career flexibility in medical schools throughout the career lifecycle from recruitment through retirement.*

**Project Director:** Luanne E. Thorndyke, Vice Provost for Faculty Affairs

### **Yale University**

NEW HAVEN, CONNECTICUT

*\$15,383 over 12 months to understand low and variable levels of female political representation in the United States.*

**Project Director:** Frances Rosenbluth, Professor

*The following officer grant was made to help secure the continuing legacy of the Foundation's now closed Workplace, Work Force and Working Families program.*

### **Center for American Progress**

WASHINGTON, DISTRICT OF COLUMBIA

*\$125,000 over 3 months to advance the state of public dialogue on the challenges facing working women and their families.*

**Project Director:** Jocelyn Frye, Senior Fellow



## Digital Information Technology

<b>Data &amp; Computational Research</b>	<b>59</b>
<b>Scholarly Communication</b>	<b>64</b>
<b>Universal Access to Knowledge</b>	<b>69</b>

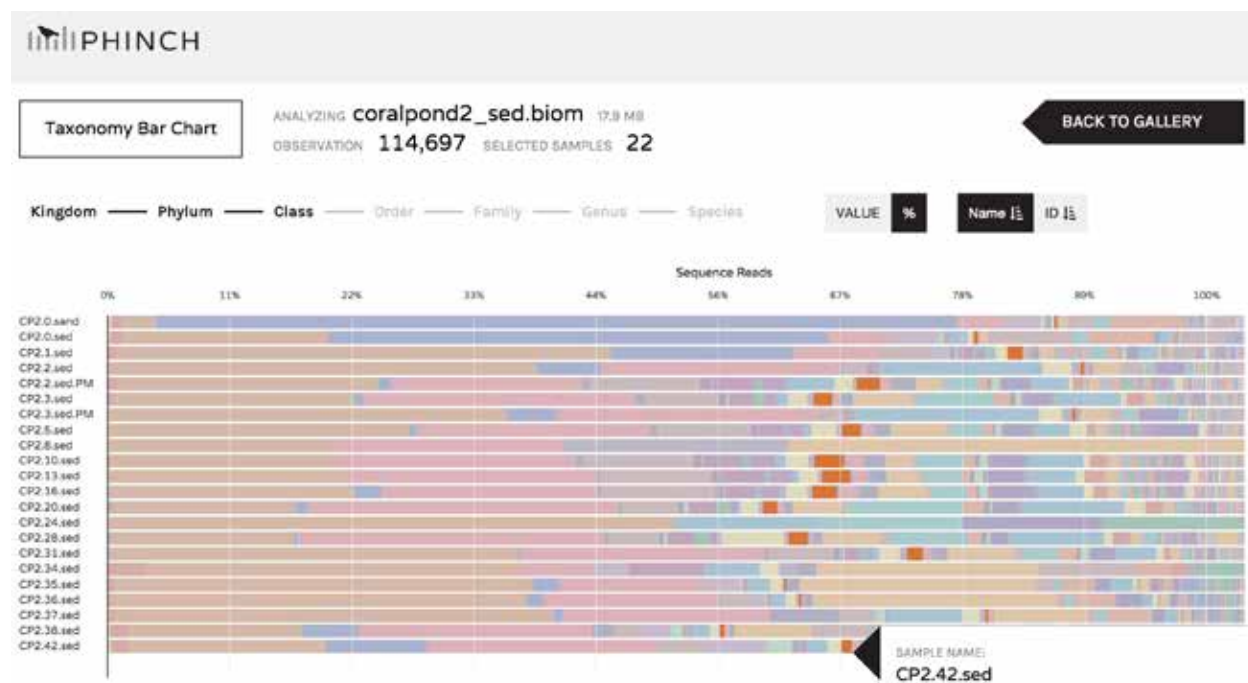
## Data & Computational Research

**Program Director: Joshua M. Greenberg**

The goal of this program is to accelerate scientific discovery by helping researchers fully exploit the opportunities created by recent advances in our ability to collect, transmit, analyze, store, and manipulate data. Grantmaking aims to support the efficient management and sharing of research data and code at every point in the scientific pipeline—from acquisition through analysis to archiving—and to grow the current and future scientific data workforce.

Grants in this program fall into four broad categories:

- **Software grants** support technology development projects ranging from building of prototypes, to iterative redevelopment, to providing resources for scaling;
- **Training grants** support workforce training and curricular initiatives as well as targeted efforts to speed adoption of new technologies by research communities;



Sloan is supporting the development of Phinch, a new tool that helps researchers probe large biological datasets by providing compelling visualizations, like this bar chart which displays the concentration over time of various microbial taxa in an aquarium. The chart reveals patterns in how certain marine microbes bloom and then die during the nitrogen-cycle of the aquarium. (Phinch image generated by Holly Bik.)

- **Research grants** bring historical, ethnographic, and economic research methods to bear on our understanding of how scholars use technology and how technology is changing scholarship;
- **Community grants** build networks for knowledge exchange across research disciplines and help strengthen institutions that incubate sustainable research and software projects.

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## TRUSTEE GRANTS

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### Adler Planetarium

CHICAGO, ILLINOIS

*\$707,648 over 18 months to support a sustainable future for the rapidly expanding Zooniverse platform through an engaged and empowered community of citizen scientists.*

**Project Director: Christopher Lintott, Project Lead**

Raw data needs preparation to be useful for research. In some cases, what is needed is cleanup and normalization; in others, tagging or categorization of dataset elements. Depending on the domain and kind of data, computers can do much of the necessary work, but some tasks, due to fuzziness or complexity in the data, are currently beyond the bounds of computation. Much data prep requires human eyes, human minds, human judgment, and human labor, a daunting demand when the size of many modern scientific datasets is measured in terabytes.

The Zooniverse project, an international effort initially based at Oxford University and now housed primarily at the Adler Planetarium in Chicago, offers a straightforward solution to this problem: divide the work into very granular tasks, gather a large crowd of science enthusiasts, and let them loose on the data. The result has been remarkably successful. Over the past few years the project has launched more than 20 citizen science research projects across meteorology, ecology, astrophysics, history, zoology, pathology, and geology and has attracted more than 1.5 million registered and anonymous users, including a core group of 15,000 dedicated volunteers who contribute at least monthly.

Funds from this grant support the next phase in Zooniverse's evolution: enabling faster growth to meet the explosive demand for Zooniverse projects. The Zooniverse team plans to decentralize their governance model, expanding their online platform to allow community volunteers to take part in core management functions while still maintaining peer review and oversight by the research community to ensure that the project's high scientific standards are met. The result will be a more self-sustaining and scalable model, which the Adler Planetarium is committed to maintain as a national leader in using citizen science to serve its research and educational missions.

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### University of California, Berkeley

BERKELEY, CALIFORNIA

*\$301,383 over 18 months to develop open source R software and training to support various parts of the research process including data publication, data integration, and reproducibility.*

**Project Director: Karthik Ram, Assistant Researcher**

In 2013, the Foundation approved a one-year grant to rOpenSci, a collective of data scientists, to build and promote a suite of "packages" for R, a powerful programming language and software environment for statistical computing and graphics. The packages aimed to greatly simplify the process of gathering data from various archives and services commonly used by researchers. Such software modules dramatically lower the barriers to R use, freeing researchers from having to write their own idiosyncratic code when parsing data from commonly used repositories like Dryad, the Global Biodiversity Information Facility, or the Biodiversity Heritage Library.

This grant provides continued support for this project. The project team will continue software development, shifting their focus to several generic needs like spatial data analysis and the submission of data to repositories for publication, as well as supporting R interoperability with popular emerging tools for data management like Dat. To further lower barriers to R use in data-driven research, rOpenSci will also develop openly licensed curricular "modules" that could be incorporated into graduate seminars or informal workshops. In speed adoption, rOpenSci will cultivate an initial cohort of a dozen "ambassadors" from across the natural and social sciences who will develop domain-specific R packages and lead various outreach and community-building efforts in their home disciplines.

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## The University of Chicago

CHICAGO, ILLINOIS

*\$499,156 over 12 months to facilitate more efficient movement, management, and sharing of research data.*

**Project Director: Ian Foster, Director, Computation Institute**

One of the more surprising difficulties of working with big data—more than a few hundred gigabytes—is the sheer difficulty of moving it from place to place. Though the price of cloud and local computing has dropped and the availability of bandwidth has increased, the standard protocols for transferring data over the Internet (http and ftp) simply start to break down at that scale. Errors multiply, requiring laborious file integrity checking and repetitive restarting of transfer operations. There is, as yet, no satisfactory solution to the simple yet thorny issue of moving meso—and larger scale data from one computer to another.

Globus, a data management tool developed by a team at the University of Chicago's Computation Institute, offers a promising solution to these problems, allowing the seamless transfer of large datasets with none of the drawbacks of existing methods. The project is currently pivoting from support by grant funding to a sustainable nonprofit business model based on both individual and institutional subscriptions (and has already signed up six major universities as charter members). However, it is facing a catch-22: The team needs robust marketing and customer support capacity to build up a customer base, but without a customer base they will not have the funds to provide marketing and customer support. Funds from this grant provide temporary bridge funding to the Globus platform, enabling the project to provide top quality service while it builds a customer base and moves towards independent sustainability.

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## Indiana University

BLOOMINGTON, INDIANA

*\$748,000 over 36 months to fund early career fellowships that support work with the Research Data Alliance on projects that promote data sharing.*

**Project Director: Beth A. Plale, Director, Data to Insight Ctr & Professor**

Funds from this grant provide three years of support for the expansion of a fellowship program hosted by the Research Data Alliance (RDA), an in-

ternational community organization of researchers and innovators who have come together to build the social and technical infrastructure need to enable the open sharing of data. These fellowships offer summer funding and travel support to graduate students and postdocs with data science skills or training who will assist RDA's various working groups on one or more specific projects. To ensure that projects are aligned with each fellow's primary work, the application process requires nomination by a candidate's advisor or supervisor. Sloan Foundation funds will support 30 fellows over the next three years.

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## The Miami Foundation Inc

MIAMI, FLORIDA

*\$260,000 over 12 months to grow Dat, a system for real-time replication, transformation, and versioning of large tabular data sets, into a vibrant, healthy open source project.*

**Project Director: Max Ogden, Computer Programmer**

Github, the collaborative software development and versioning platform, has become so essential to the software development ecosystem that scientists have begun experimenting with using it for the collaborative versioning and sharing of datasets. Though the potential value is immense, Github was designed to handle software code containing thousands of lines per file, not tabular datasets containing millions of entries. Large datasets of the kind regularly used by scientists grinds the system to a halt. Moreover, tabular data, unlike textual software code, might exist in any one of myriad data formats ranging from comma-separated to Excel to SQL. Funds from this grant provide support for the development of a solution to this problem, a Git-esque platform called "Dat." Created by open source developer Max Ogden, Dat borrows heavily from Github's syntax and mechanics, but is optimized for large-scale tabular data and has been programmed to be able to translate seamlessly between the wide variety of formats commonly used to store data. Grant funds will support the hiring of two developers: one focused on core development and one focused on providing interfaces useful to researchers and on ensuring the system's interoperability with existing scientific data repositories. Additional funds will support outreach and partnership building with stakeholders in the scientific community.

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## Mozilla Foundation

MOUNTAIN VIEW, CALIFORNIA

*\$819,480 over 15 months to build educational resources, prototype tools, and foster an ongoing dialogue between the open web community and researchers in order to make science more open, collaborative, and efficient.*

**Project Director: Kaitlin Thaney, Director of the Mozilla Science Lab**

Since 2011, the Mozilla Foundation, developer of the popular Firefox web browser, has hosted a series of “Software Carpentry” boot camps developed by computer scientist Greg Wilson to teach basic software engineering practices to researchers who in a professional capacity were writing code to manage data but had never received any formal software development training. The project has been a success. Interest in the boot camps has been robust both in the U.S. and Europe and Mozilla has expanded their effort into a larger project, called the Open Science Lab, aimed at collaborating with the scientific community to develop open source tools and other resources to aid in scientific research and collaboration. Funds from this grant provide continued operational support to Mozilla for this project.

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## University of Wisconsin, Madison

MADISON, WISCONSIN

*\$180,535 over 36 months to conduct a set of case studies on the sustainability of social science data archives.*

**Project Director: Kristen Eschenfelder, Director**

Funds from this grant support efforts by an international team of researchers including Kristin Eschenfelder and Greg Downey of the University of Wisconsin, Madison School of Library and Information Studies and Kalpana Shankar at the University College Dublin School of Information and Library Studies to develop a set of case studies of social science data archives. Beginning with a pilot case study already underway of the University of Michigan’s Interuniversity Consortium for Political and Social Research, the team will select a cohort of up to five data archives for study that meet specific criteria, including longevity, collections that are contributed by others, and funding models that do not rely on direct government support. The researchers will draw on interviews and archival research to develop detailed histories of these archives with a particular focus on how they

evolved their current access policies and business models. The ensuing case studies will help provide a more robust foundation for discussions about how data archives might be made sustainable over the long term.

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## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

In October 2013, the Board of Trustees authorized the expenditure of up to \$375,000 for grants in support of the expansion of data science activities at Columbia University, Johns Hopkins University, and the University of Michigan as part of a collaboration with the Gordon and Betty Moore Foundation to advance scientific capabilities for data-driven discovery. The following grants were made against this previously authorized fund.

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### Columbia University

NEW YORK, NEW YORK

*\$125,000 over 18 months to demonstrate the effectiveness of supporting collaborative teams of data-driven researchers within a university.*

**Project Director: Kathleen McKeown, Director, IDSE & Professor of Computer Science**

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### Johns Hopkins University

BALTIMORE, MARYLAND

*\$125,000 over 18 months to amplify and accelerate data-driven research across Johns Hopkins University.*

**Project Director: Sandor Alexander Szalay, Alumni Centennial Professor of Physics & Astronomy**

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### University of Michigan

ANN ARBOR, MICHIGAN

*\$125,000 over 18 months to build institutional capacity in support of data science at the University of Michigan, and to increase understanding of the barriers to success of interdisciplinary data-centric research projects.*

**Project Director: Carl Lagoze, Associate Professor of Information**

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## OFFICER GRANTS

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### Columbia University

NEW YORK, NEW YORK

*\$19,385 over 6 months to support a workshop on the history of data science and the use of data in the history of science more broadly.*

**Project Director: Matthew Jones, James R. Barker**  
**Professor of Contemporary Civilization**

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### Creative Commons

MOUNTAIN VIEW, CALIFORNIA

*\$63,250 over 7 months to survey and evaluate open hardware licensing options, with an emphasis on distributed sensing hardware.*

**Project Director: Puneet Kishor, Manager**

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### Data & Society Research Institute

NEW YORK, NEW YORK

*\$10,000 over 2 months to organize and run a workshop on the social, cultural, and ethical dimensions of big data.*

**Project Director: Danah Boyd, President**

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### Drexel University

PHILADELPHIA, PENNSYLVANIA

*\$11,500 over 4 months to Support a workshop on data remediation and taxonomy strategies for cross-platform, citizen science inventory interoperability and geospatial and badging integrations.*

**Project Director: Youngmoo E. Kim, Director**

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### University of Maryland, College Park

COLLEGE PARK, MARYLAND

*\$19,858 over 7 months to partially support a meeting to share best practices and opportunities in scholarly crowdsourcing across the sciences and humanities.*

**Project Director: Neil Fraistat, Director**

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### New York Public Library

NEW YORK, NEW YORK

*\$41,568 over 7 months to set an agenda to expand historical geodata production and determine a research and development plan for the next five years.*

**Project Director: Matthew A. Knutzen, Geospatial Librarian**

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### New York University

NEW YORK, NEW YORK

*\$15,000 over 5 months to support a workshop and hackathon on crowdfunding and scientific projects.*

**Project Director: Nancy Hechinger, Faculty**

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### New York University

NEW YORK, NEW YORK

*\$15,000 over 6 months to run a workshop and associated hack day on strategies and tools for cross-platform identity and contribution management in citizen science.*

**Project Director: François Grey, Professor**

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### Northwestern University

EVANSTON, ILLINOIS

*\$15,000 over 6 months to partially support the 2015 Computational Sociology Summit.*

**Project Director: Brian Uzzi, Faculty Director, Kellogg Architectures of Collaboration Initiative**

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### NumFOCUS

AUSTIN, TEXAS

*\$10,000 over 6 months to partially support a summit of grassroots organizations that foster diversity in the technology sector.*

**Project Director: Gregory V. Wilson,**

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## Scholarly Communication

### Program Director: Joshua M. Greenberg

The goal of this program is to empower researchers by supporting the development and adoption of new resources for managing the increasingly diverse array of digital communication channels, enabling scientists to more effectively locate relevant research, network with other researchers, and disseminate their work to the scientific community and the public. Grantmaking aims to improve the discovery and review of diverse scholarly materials and establish new forms of publication connecting data, code, and analysis—particularly to support the reproducibility of research.

Grants in this program fall into four broad categories:

- **Software grants** support technology development projects ranging from building of prototypes, to iterative redevelopment, to providing resources for scaling;
- **Training grants** support workforce training and curricular initiatives as well as targeted efforts to speed adoption of new technologies by research communities;
- **Research grants** bring historical, ethnographic, and economic research methods to bear on our understanding of how scholars use technology and how technology is changing scholarship;
- **Community grants** build networks for knowledge exchange across research disciplines and help strengthen institutions that incubate sustainable research and software projects.

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## TRUSTEE GRANTS

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### American Mathematical Society

PROVIDENCE, RHODE ISLAND

*\$139,688 over 12 months to develop semantic capabilities for open source systems that display mathematics on the World Wide Web.*

**Project Director: Donald E. McClure, Executive Director**

The meaning of mathematical formulae depends on how they are represented and displayed. Mathematical symbols have to be arranged and ordered precisely, lest the meaning of formulae change completely. A poorly placed line break can render a mathematical expression incoherent. The rise of the internet has made this problem acute. Major browsers developed by Apple, Google, and Microsoft do not support mathematical content. As more and more content is accessed on screens, tablet computers, and smart phones, mathematicians need a tool that can rearrange mathematical expressions dynamically without distortion of meaning. This grant funds efforts by a consortium led by the American Mathematical Society (AMS) to “semantically enrich” MathML, a markup language used by the popular, open source MathJax platform. The AMS team aims to further develop the MathML language, allowing it to encode information about the meaning of mathematical expressions and how

to display them. If successful, the project would eventually allow browsers to treat mathematical expressions not as uninterpreted strings of symbols, but as contentful expressions whose meaning must be preserved across changes in display.

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### Association of Research Libraries

WASHINGTON, DISTRICT OF COLUMBIA

*\$500,000 over 18 months to support the initial development and launch of the SHARE Notification System, a structured way to report and notify parties of research release events.*

**Project Director: Elliott Shore, Executive Director**

In 2013, a White House Office of Science & Technology Policy directive outlined new open-access expectations for research products funded by the federal government. One question left open by the directive, however, is how exactly those materials should be managed and made discoverable, particularly for the long term. Funds from this grant support a project by the Association of Research Libraries (ARL) to facilitate compliance with the OSTP directive by developing a platform for reporting and notifying parties of events related to the release of publicly and privately funded research.

Partnering with the Association of American Universities and the Association of Public and Land-Grant Universities, the ARL will create a multi-institutional platform, the SHared Access Research Ecosystem (SHARE), that will tie together existing university-based institutional repositories into a coherent discovery and compliance tracking system. When completed, SHARE will function as connective tissue that will enable others to build user-facing services that build on the multi-institutional architecture, leveraging university investments in their own institutional repositories and providing a valuable resource to help university offices of sponsored research meet their reporting and compliance-tracking obligations.

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### University of California, Office of the President

OAKLAND, CALIFORNIA

*\$266,958 over 12 months to promote research data sharing by enhancing the usability (design, functionality, and user experience) of existing community repositories.*

**Project Director: Stephen Abrams, Associate Director, University of California Curation Center**

Developed by the California Digital Library (CDL), which serves the entire University of California system, the Data Management Plan (DMP) tool is an open source software platform that allows UC researchers to create and implement data management plans, which are an increasingly ubiquitous requirement of government and private funding for scientific research. The existence of such platforms reduces the barriers to data sharing, allowing scientists to make their data permanently available in accordance with funder requirements without having to invest significant time, effort, or other resources in the process. Funds from this grant will allow the CDL, which operates out of the Office of the President, to launch and implement a redesign of the user interface of the Data Management Plan tool. Using detailed user feedback that is the norm in much for-profit software development, the CDL team will redesign its primary interface using detailed user-experience testing, letting the needs and competencies of actual users drive how the interface works. The result will be a lightweight open source software application that would be accessible initially to the thousands of scientists and researchers employed throughout the University of California system, but which will be generalized enough that it could, in principle, sit in-between users and any data repository.

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### George Mason University

FAIRFAX, VIRGINIA

*\$481,340 over 14 months to support extensive outreach in conjunction with continued refinement of the PressForward software platform in order to produce curated overlay publications for scientific communities.*

**Project Director: Sean Takats, Director, Research Projects/Associate Professor**

This grant provides continued support to George Mason University's Roy Rosenzweig Center for History and New Media for the continued development of PressForward, a software platform that fa-

cilitates the creation of “overlay journals,” curated collections of scholarly materials whose contents are drawn not from original submissions, but from existing academic sources. PressForward journals have the ability to draw material not only from existing online journals, but from the rich landscape of reputable working paper repositories like SSRN, rapid publication venues like PLoS ONE, preprint repositories like arXiv, and the untidy world of blogs, posters, and other gray literature. Previous Sloan grants supported the initial development of PressForward and its deployment to a handful of pilot sites. Funds from this grant support the expansion of the platform, the hiring of an outreach specialist to give presentations and handle online engagement, increased help desk capacity, a summer institute to train potential users, and additional software development as determined through user needs.

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### Harvard University

CAMBRIDGE, MASSACHUSETTS

*\$845,000 over 24 months to make empirical research more reliable and replicable by helping academic journals process, publish, and preserve datasets accompanying article submissions.*

**Project Director: Gary King, University Professor, Director**

When researchers share data, their empirical results become more reproducible and more reusable. This, in turn, can accelerate progress while enhancing accountability and transparency. This grant supports efforts by Gary King and Mercè Crosas of the Institute for Quantitative Social Science (IQSS) at Harvard University to facilitate data sharing through continued development of the Dataverse Network (DVN), a leading Harvard-based data repository. Working with scientists, technologists, and academic publishers, King and Crosas have launched an ambitious project to help academic journals make data submission a fully integrated part of the paper submission process, using the Dataverse infrastructure to store and manipulate data submitted by authors. Grant funds will support several activities aimed at expanding and improving Dataverse, including convening workshops and conferences with stakeholders to develop uniform standards and protocols, crafting an application programming interface, and developing several “data widgets” that allow real-time manipulation of data uploaded to the system.

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### Hypothesis Project

SAN FRANCISCO, CALIFORNIA

*\$683,000 over 18 months to support further development and pilot adoption of the *hypothes.is* web annotation platform.*

**Project Director: Dan Whaley, President**

This grant provides 14 months of support for the Hypothes.is Project, a web annotation platform that aims to bring granular annotation of online scholarly materials to users through the development of an easy-to-use interface that makes web annotation fully collaborative, shareable, and searchable. Grant funds will support continued development of the Hypothes.is platform as well as three pilot implementations, one at the American Geophysical Union, one at the arXiv preprint repository, and one at eLife, an influential online journal sponsored by the Wellcome Trust and the Howard Hughes Medical Institute. Additional funds support a 2014 summit for Hypothes.is stakeholders to ensure compliance with current and forthcoming standards set by the World Wide Web Consortium.

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### Johns Hopkins University

BALTIMORE, MARYLAND

*\$602,039 over 24 months to design and launch a data curation infrastructure that provides a graph-based view of the relationships between publications and data.*

**Project Director: G. Sayeed Choudhury, Associate Dean for Research Data Management**

Though the Sloan Foundation has funded several initiatives to make the citation of data a regular, established practice in science, data citation is itself unidirectional. In a properly cited scientific article, the reader will know what datasets are being referenced and used, but the creator or curator of those cited datasets may have no way to know his or her data is being cited. Yet knowing how a dataset is being used and by whom can be a crucial factor in making decisions about its value, how to extend it, and how to increase its usefulness.

This grant supports work by Sayeed Choudhury, associate dean for research data management at Johns Hopkins University, to develop a third-party service called “Matchmaker” that would independently map the relationships between articles and data, linking between existing publishing platforms and data repositories. These relationships could be

created by a number of different stakeholders in the scholarly communication process: by a publisher, by a data archive, by an individual researcher, or even by a library. When fully developed, these relationships would then form a “graph” that could be queried without having to repeatedly poll every repository and publisher, a complement to more traditional citation services like ISI or Google Scholar.

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### University of Montreal

MONTREAL, CANADA

*\$359,991 over 24 months to support greater understanding of social media in scholarly communication and the actual meaning of various altmetrics.*

**Project Director: Vincent Larivière, Canada**

**Research Chair on the Transformations of Scholarly Communication**

The rise of the Internet and digitally enabled means of disseminating scholarly research has led to a burgeoning interest in “altmetrics,” alternative measures of the impact and importance of scholarship that extend beyond traditional measures like citation counts.

Funds from this grant support efforts by Vincent Larivière and Stefanie Haustein of the University of Montreal and their colleague Cassidy Sugimoto of Indiana propose to dig deeper into the relative value and meaning of two specific altmetric indicators: social media tweets and “saves” by popular bibliographic reference manager platforms. The researcher team will match bibliographic and citation data from the Web of Science (linked with the same articles as they appear in PubMed and arXiv) with these forms of altmetric activity in order to answer a set of questions about the relationship between altmetric signals and the ultimate impact of a given work as traditionally measured in citation. Particular focus will be given to the relationship, if any, between initial attention paid to preprints or working papers and the subsequent citation of formally published versions of those same papers.

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### University of Oklahoma

NORMAN, OKLAHOMA

*\$351,844 over 24 months to build an open-access, digital research platform for the global history of science community centered on data from the Isis Bibliography of the History of Science.*

**Project Director: Stephen P. Weldon, Assistant Professor**

Funds from this grant support a series of projects to increase the usefulness of the Isis Bibliography of the History of Science, the oldest and largest bibliography in its field and an invaluable resource to historians of science worldwide. Using grant funds, Isis Bibliographer Stephen Weldon and his team will spearhead a series of initiatives designed to bring the ISIS Bibliography more fully into the digital era, including retrospective digitization, data extraction, and cleanup of the existing bibliography; the development of new researcher-facing tools and interfaces; “community-sourced” mechanisms for maintaining the bibliography going forward; and a mini-grant program to incentivize novel or innovative ways of utilizing the bibliography as a scholarly resource.

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## GRANTS MADE AGAINST PRIOR AUTHORIZATIONS

In June 2014, the Board of Trustees authorized the expenditure of up to \$500,000 to support the implementation of innovative scholarly communication platforms by professional scholarly organizations. The following grant was made against this previously authorized fund.

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### Foundation for Earth Science

RALEIGH, NORTH CAROLINA

*\$124,995 over 15 months to explore adoption of RFID tracking at professional society meetings in order to improve the network connections among attendees.*

**Project Director: Erin Robinson, Executive Director**

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## OFFICER GRANTS

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### **Adler Planetarium**

CHICAGO, ILLINOIS

*\$16,380 over 6 months to support the dotAstronomy workshop and to explore the extension of its model into other fields.*

**Project Director: Robert Simpson, Communications Lead, Zooniverse**

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### **American Anthropological Association**

ARLINGTON, VIRGINIA

*\$79,986 over 12 months to develop an open source platform to manage scholarly book reviews.*

**Project Director: Oona Schmid, Director, Publishing**

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### **FORCE11**

SAN DIEGO, CALIFORNIA

*\$15,000 over 3 months to partially support the 2015 Future of Research Communication and e-Scholarship conference.*

**Project Director: Maryann Martone, President**

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### **Foundation for Earth Science**

RALEIGH, NORTH CAROLINA

*\$20,000 over 3 months to partially support a workshop on software citation.*

**Project Director: Erin Robinson, Executive Director**

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### **Hypothesis Project**

SAN FRANCISCO, CALIFORNIA

*\$20,000 over 6 months to partially support the 2015 IAnnotate workshop on current and future directions for web annotation.*

**Project Director: Dan Whaley, President**

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# Universal Access to Knowledge

## Program Director: Doron Weber

The goal of the Universal Access to Knowledge program is to facilitate the openness and accessibility of all knowledge in the digital age for the widest public benefit under reasonable financial terms and conditions, including the digitization of scientific and cultural knowledge under best practices and standards. Current grantmaking focuses on identifying and crafting solutions to the economic, legal, and institutional barriers to universal access to knowledge and on supporting efforts of 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. Since 2008, major support has also gone to Wikipedia, available in 289 languages, now the largest encyclopedia in human history and the fifth largest website in the world, and a model of open, collaborative text production.

## TRUSTEE GRANTS

### New York Botanical Garden

BRONX, NEW YORK

*\$1,155,244 over 20 months to support the New York Botanical Garden's efforts to digitize 20,000 plant species records and to become a major Content Hub for the Digital Public Library of America (DPLA) while co-heading World Flora Online, the first complete online scientific resource for all Earth's 350,000 plant species.*

**Project Director: William Wayt Thomas, Elizabeth G. Britton Curator of Botany**

Though plants have enormous value for society in terms of food, medicine, the environment, and economics, and hold significant social and cultural value, no single site provides accurate, comprehensive, and open access data on the known species of flowering plants. This grant to the New York Botanical Garden (NYBG) supports its efforts become one of four lead international institutions spearheading the creation of World Flora Online (WFO), the first open access, online resource for accurate and comprehensive information for all of Earth's 350,000 known plant species. NYBG will also become one of a dozen major content hubs for the Digital Public Library of America (DPLA), making available not only its first 20,000 plant species records and all 85,000 records when completed, but also depositing over a million existing plant specimen records in DPLA's index, a 15 percent increase in DPLA's current holdings.



The second annual DPLAfest, held in Indianapolis in 2015, celebrated the thriving Digital Public Library of America that now has over 10 million digitized items from 1,600 contributing institutions from all 50 states. (PHOTO COURTESY THE DIGITAL PUBLIC LIBRARY OF AMERICA.)

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## Wikimedia Foundation

SAN FRANCISCO, CALIFORNIA

*\$3,000,000 over 60 months to bolster Wikipedia's readership and editors, including more women, expand its mobile presence, and strengthen its technical infrastructure as it moves to self-sustainability.*

**Project Director: Lisa Gruwell, Executive Director**

This grant to the Wikimedia Foundation provides continued administrative and operational support for Wikipedia, the fifth largest website in the world and the largest encyclopedia in history. Over the next five years, grant funds will be used in a series of projects to bolster Wikipedia's technical infrastructure, improve editor engagement, increase the number of women editors, increase the number of contributions via mobile devices, better integrate multimedia offerings such as video, audio, and photography into Wikipedia pages, and help Wikipedia improve and monitor article quality while moving toward self-sustainability.



## Select Issues

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## Energy & Environment

**Program Officer: Evan S. Michelson**

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.

Formalized in 2014, this 10 year program will make progress toward achieving this overarching goal by providing support across the following five core outcome areas:

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

- **Educate Stakeholders and Disseminate Information for Decision-Making:** High quality grantees will be engaged to apply impartial research findings to inform the development of 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.

Due to the significant amount of 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 advocacy. Using the energy system as a guiding framework, the Foundation will investigate previously underexplored and targeted research questions in select areas related to energy sources (supply), energy transmission and distribution, and energy use (demand), along with other cross-cutting systemic opportunities.

## TRUSTEE GRANTS

### American Academy of Arts and Sciences

CAMBRIDGE, MASSACHUSETTS

*\$200,000 over 30 months to research the durability and adaptability of energy and environmental policy regulation through five case studies focused on the Clean Air Act.*

**Project Director: Ann Carlson, Professor, Faculty Co-Director, Vice Dean**

The Clean Air Act (CAA) serves as one of the main statutes under which the Environmental Protection Agency oversees a broad range of challenges, such as mobile source emissions, air quality, acid rain, and hazardous air pollution. Better understanding how the CAA can be applied in new contexts is increasingly important given how central this statute has become to the implementation of greenhouse gas control strategies in the United States.

This grant provides funds to the American Academy of Arts and Sciences to undertake an in-depth, two-year study looking at the CAA as a model for creating “durable yet flexible” energy and environmental policy. The first year of the project will involve interdisciplinary research on five different case study applications of the CAA. The purpose will be to identify and confirm the individual elements that have made the CAA both durable and adaptable since enacted into law nearly 45 years ago. The second year of the proposed project will then compare these analyses to tease out common

“design characteristics” emerging from the case studies. The research will culminate in a capstone workshop and a companion public event where the results would be widely shared. In addition, the researchers will produce a set of working papers and articles in peer-reviewed energy and environment journals and make several presentations on their findings to key stakeholders.

### Carnegie Endowment for International Peace

WASHINGTON, DISTRICT OF COLUMBIA

*\$149,997 over 12 months to tie off ongoing efforts to develop an objective assessment methodology for distinguishing between legitimate peaceful nuclear activity and illegitimate nuclear weapons activities.*

**Project Director: George Perkovich, Vice President for Studies**

The foundational treaty of the global nuclear order, the Nuclear Non-Proliferation Treaty (NPT), does not define what constitutes a nuclear weapon and therefore what activities, technologies, and materials should be regarded as evidence that a state is seeking to acquire nuclear weapons. This lack of definition exacerbates the nonproliferation challenge of distinguishing between legitimate nuclear activities (be they peaceful or military applications such as naval propulsion) and illegitimate ones (namely, those oriented toward nuclear weapons). This challenge, in turn, exacerbates the difficulty of promoting the peaceful spread of nuclear energy while preventing weapons proliferation.

Kenneth B. Medlock, the James A. Baker, III, and Susan G. Baker Fellow in Energy and Resource Economics and senior director of the Baker Institute Center for Energy Studies, welcomes guests to a Sloan-supported conference on “The Shale Revolution.” (© 2015 MICHAEL STRAVATO)



This grant provides continued support to an initiative by the Carnegie Endowment for International Peace to build an international, science-based, de-politicized consensus around how to distinguish legitimate from illegitimate nuclear activity as defined by the NPT. Funds will support preparation for an international meeting of stakeholders in Beijing in 2014, finalization of technical documentation, the identification of use-cases and potential applications of the new identification regime, and outreach and communication efforts aimed at garnering broad international support.

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### Duke University

DURHAM, NORTH CAROLINA

*\$249,951 over 19 months to continue public finance research to understand comprehensively the key fiscal issues faced by local governments experiencing new or increased shale oil and shale gas development.*

**Project Director: Richard Newell, Professor**

This grant to Richard Newell at the Duke University Energy Initiative supports the second phase of research focused on documenting and understanding local economic responses to managing shale gas and oil revenues. Newell's previous research analyzed the extent to which increased tax receipts are able to cover growing expenditures for municipal services in several municipalities and counties across eight states. This grant will allow Newell to expand his efforts in the states already surveyed and to expand his research to eight additional states, covering every major shale energy producing region in the country.

Newell and his team will conduct over 75 on-the-ground structured interviews with local municipal managers, industry stakeholders, and other experts in these states. They will also collect financial data from local governments and produce a robust economic analysis comparing tax collection and revenue distribution practices. The expansion of state coverage will also allow the research team to write a set of synthesis reports that compare experiences across the United States. Finally, Newell and his team also propose to disseminate their research findings broadly in academic and policy settings.

---

### Environmental Defense Fund Incorporated

NEW YORK, NEW YORK

*\$627,125 over 10 months to conduct two scientific research projects on the environmental impacts of shale gas and shale oil exploration by studying wastewater characterization and treatment and examining methane losses from natural gas end users.*

**Project Director: Steven Hamburg, Chief Scientist**

Funds from this grant support a project led by Steven Hamburg of the Environmental Defense Fund (EDF) to spearhead the study of two critical topics related to shale oil and gas exploration. The first is the characterization and treatment of wastewater ("flowback" fluids) resulting from shale gas and shale oil exploration. The second is the examination of methane emissions from natural gas end users in the industrial, commercial, residential, and transportation sectors. EDF will organize a several emerging issue workshops that will engage leading researchers in the design of a detailed set of scientific research projects related to wastewater issues and methane emissions from end users resulting in a detailed set of research questions, sampling strategies, project management plans, collaboration agreements, and deliverable expectations. Additional grant funds will support a set of quick turnaround, small-scale, proof of concept projects to rapidly test the suggested technologies and methodologies that emerge from the workshops.

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## OFFICER GRANTS

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### University of California, Berkeley

BERKELEY, CALIFORNIA

*\$29,800 over 20 months to bring together world-renowned energy economists to discuss and explore new research ideas on energy markets.*

**Project Director: Lucas Davis, Associate Professor**

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### University of Colorado, Denver

DENVER, COLORADO

*\$106,943 over 18 months to map the political landscape of national politics on hydraulic fracturing in the United States and draw lessons between North America and Europe about the politics of hydraulic fracturing and the research methods for studying political systems.*

**Project Director: Tanya Heikkila, Associate Professor**



The four finalists in the Environmental Defense Fund's Methane Detectors Challenge show off their inventions. The nationwide competition challenged scientists and engineers to develop novel, effective, and low-cost methane monitors that could help reduce emissions. (PHOTO COURTESY OF THE ENVIRONMENTAL DEFENSE FUND.)

### Columbia University

NEW YORK, NEW YORK

*\$50,000 over 12 months to continue support for the Center on Global Energy Policy's external speaker series to inform public debate about critical energy issues.*

**Project Director: Jason Bordoff, Founding Director**

### Harvard University

CAMBRIDGE, MASSACHUSETTS

*\$60,000 over 11 months to improve processes for the assessment of social science research related to climate change and communicate the results of assessments effectively to policymakers.*

**Project Director: Robert Stavins, Albert Pratt Professor of Business & Government**

### International Energy Policy and Programme Evaluation Conference

BIRMINGHAM, UNITED KINGDOM

*\$20,000 over 8 months to accelerate and advance the profession of energy evaluation through instilling an interest in and connections to professional evaluation of energy programs and policies by enabling graduate students to attend the IEPPEC Conference at no charge.*

**Project Director: Charles Michaelis, President**

### Massachusetts Institute of Technology

CAMBRIDGE, MASSACHUSETTS

*\$60,000 over 12 months to provide final support for the International Nuclear Leadership Education Program (INLEP) to train private and public sector executives from emerging nuclear countries and to become financially self-sustaining over the next year.*

**Project Director: Richard K. Lester, Department Head**

---

**University of Minnesota Foundation**

MINNEAPOLIS, MINNESOTA

*\$55,000 over 4 months to organize a conference by the Heller-Hurwicz Economics Institute to develop the next generation of economic models of climate change.*

**Project Director: Varadarajan V Chari, Director**

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**University of Texas, Austin**

AUSTIN, TEXAS

*\$75,000 over 8 months to enhance analysis of the Marcellus Shale productivity outlook by reducing ranges of uncertainty for geologic mapping and gas production profiles.*

**Project Director: Svetlana Ikonnikova, Researcher**

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**National Academy of Sciences**

WASHINGTON, DISTRICT OF COLUMBIA

*\$50,000 over 27 months to provide partial support for a consensus study to evaluate the Advanced Research Projects Agency – Energy (ARPA-E) Program.*

**Project Director: Paul Beaton, Program Officer**

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**University of Texas, Austin**

AUSTIN, TEXAS

*\$50,000 over 14 months to provide partial support to examine the national potential for using flared natural gas to treat wastewater at shale oil production sites.*

**Project Director: Michael E. Webber, Deputy Director, Energy Institute**

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**New York University**

NEW YORK, NEW YORK

*\$12,500 over 6 months to organize a roundtable workshop by the Guarini Center on Environmental, Energy & Land Use Law at NYU School of Law to fill a knowledge gap in the United States as to the design, implementation and performance of the United Kingdom's innovative approach to electricity regulation.*

**Project Director: Richard B. Stewart, University Professor & John E. Sexton Prof. of Law**

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**Stanford University**

STANFORD, CALIFORNIA

*\$45,000 over 9 months to support the Program on Energy and Sustainable Development in the organization of a conference titled "The Financialization of Energy and Environmental Markets."*

**Project Director: Frank Wolak, Professor**

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**Stanford University**

STANFORD, CALIFORNIA

*\$10,500 over 6 months to support the Precourt Energy Efficiency Center to provide stipends to junior faculty and post-doctoral fellows to attend the 2014 Behavior, Energy, and Climate Change (BECC) Conference in Washington, DC.*

**Project Director: James L. Sweeney, Director & Professor**

## International Science Engagement

**Program Director: Doron Weber**

The International Science Engagement program is an early stage program currently focused on South Asia that seeks to bring scientists and engineers in conflict regions together to collaborate on subjects and projects of mutual interest.

The program, begun in 2011, is focusing primarily on efforts to create a South Asia Science Center based in Singapore and a select number of opportunistic projects that draw on science as a nonideological community of shared interests and values.

### TRUSTEE GRANTS

#### **Institute of International Education**

NEW YORK, NEW YORK

*\$750,000 over 36 months to provide life-saving fellowships and academic placements for persecuted scholars from around the world.*

**Project Director: Daniela Kaisth, Vice President**

The Institute of International Education's Scholar Rescue Fund (SRF), begun in 2002, provides persecuted scholars from around the world with one- to two-year fellowships that allow threatened scholars to pursue their academic and scientific studies in the safety of one of the Fund's partner institutions. This grant provides three years of continued support to the Scholar Rescue Fund for these activities. Grant funds will provide life-saving fellowships for an estimated eight to ten persecuted scholars per year and help defray administrative costs associated with identifying, rescuing, and finding appropriate host institutions for endangered scholars world-wide.



Representative scientists from eight South Asian countries convene to discuss rice science at the Lee Kuan Yew School of Public Policy in 2012. (PHOTO COURTESY OF THE LEE KUAN YEW SCHOOL OF PUBLIC POLICY.)



# Civic Initiatives

## Civic Initiatives

**Program Director: Paula J. Olsiewski**

Since its founding in 1934, the Alfred P. Sloan Foundation has been proud to call New York City home. With its Civic Initiatives 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 science, technology, and economic performance.

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.
- **InsideSchools.org:** Not-for-profit website that provides independent information on each of NYC's 1,800 public schools.

- **The DNA Learning Lab:** A new, Manhattan branch of Cold Spring Harbor Laboratory's DNA Learning Center, 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 Civic Initiatives 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. Many of the grants in our other programs go to New York institutions. Approximately one out of every four Foundation grant dollars goes to an institution based in New York.



## TRUSTEE GRANTS

### Research Foundation of the City University of New York

NEW YORK, NEW YORK

*\$1,126,925 over 36 months to provide renewed support to encourage promising early career scientists at both student and faculty levels through two awards programs: a Summer Undergraduate Research program and a Junior Faculty Research Award program.*

**Project Director: Gillian Small, Vice Chancellor for Research**

Funds from this grant provide three years of continued support for two programs at the City University of New York aimed at supporting faculty and students in STEM disciplines. The first, CUNY's Summer Undergraduate Research Program (C-SURP), provides talented undergraduates with the opportunity to engage in hands-on, in-the-lab research, assisting CUNY science faculty with ongoing research projects during the summer. Grant funds will support 10 students in each of 2015, 2016, and 2017, providing a \$4,000 housing allowance and a \$4,000 living stipend to each



Staten Island science teacher Theresa Dunlap Kutza was one of seven extraordinary NYC public high school teachers honored in 2014 with a Sloan Award for Excellence in Teaching Science and Mathematics. Kutza was recognized for her passionate teaching and the imaginative ways she brings science into the classroom. Her students are raising their own clutch of oysters in Great Kills Harbor, have studied colony collapse disorder in bee hives, and have witnessed a live thoracic surgery. (PHOTO BY SARAH SHATZ.)

student. The second supported program under this grant is CUNY's Junior Faculty Research Award in Science and Engineering (J-FRASE) program, which supports promising early-career STEM faculty at CUNY with a \$50,000 fellowship for use in research. Over the course of the next three years, 12 faculty will receive fellowships through this grant.

### Columbia University

NEW YORK, NEW YORK

*\$250,000 over 24 months to determine the microflora of mice in proximity to densely populated and high-traffic areas in New York City.*

**Project Director: W. Ian Lipkin, John Snow Professor of Epidemiology & Director**

Infectious disease expert Ian Lipkin, M.D., the John Snow Professor of Epidemiology and Director of the Center for Infection and Immunity at the Mailman School of Public Health at Columbia University studied the microbial profiles of 133 rats in lower Manhattan and determined that they harbor multiple human pathogens. This grant supports Lipkin as he expands this study to mice. Lipkin will examine the microflora of 100 mice from each of 16 densely populated areas of New York City in order to determine what bacteria, fungi, and viruses are present in native NYC mice and whether the distribution of these microorganisms differ by borough, season, or socioeconomic status of the surrounding human population.

The project has the potential to identify both known and novel pathogens in rodent vectors, provide insights into otherwise unexplained diseases by revealing links to infection with rodent-borne pathogens, and build support for rodent control. The new knowledge will be shared through peer-reviewed publications and presentations at scientific and medical meetings.

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**New York University**

NEW YORK, NEW YORK

*\$709,654 over 36 months to identify, motivate, and nurture mathematical talent through after-school activities in New York City's underserved neighborhoods.*

**Project Director: Selin Kalaycioglu, Clinical Associate Professor of Mathematics**

The Center for Mathematical Talent (CMT) was established in 2010 at New York University's prestigious Courant Institute for Mathematics. Its mission is to identify, motivate, and nurture those underserved and underrepresented students in New York City schools who could excel in mathematics. This grant provides three years of continued support for the activities of the CMT, including partnering with other educational organizations to set up satellite programs for students unable or unwilling to travel to Manhattan, training public school teachers and others to run extracurricular programs like "math circles," and developing educational materials, like math games, designed to present mathematics in ways that are challenging, fun, and engaging. In addition, CMT plans over the next three years to double the numbers of students and instructors reached; diversify its sources of support; restructure its website to better serve its core audiences, and refine its data collection procedures so as to better measure program impact.

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**GRANTS MADE AGAINST  
PRIOR AUTHORIZATIONS**

In March 2012, the Board of Trustees authorized the expenditure of up to \$210,000 for small grants to groups that provide services to the wider philanthropic community. In December of 2013, the Board of Trustees authorized the expenditure of an additional \$300,000 for this same purpose. The following grants were made against these previously authorized funds.

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**Council on Foundations, Inc.**

ARLINGTON, VIRGINIA

*\$45,000 over 12 months to support work on behalf of the nonprofit and charitable community.*

**Project Director: Vikki N. Spruill, President and CEO**

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**GuideStar USA, Inc.**

WILLIAMSBURG, VIRGINIA

*\$7,500 over 12 months to support work on behalf of the nonprofit and charitable community.*

**Project Director: James Lum, CFO**

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**Philanthropy New York**

NEW YORK, NEW YORK

*\$100,000 over 12 months to fund a new initiative to meet the philanthropic community's needs for the decade to come with enhanced meeting facilities, improved communications and technological capacity, increased programming, deeper public policy engagement, and strengthened fiscal stability in a new era of increased visibility and expectations for the philanthropic sector.*

**Project Director: Kathryn O'Neal-Dunham, Chief Operating Officer**

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**Technology Affinity Group**

WAYNE, PENNSYLVANIA

*\$5,000 over 4 months for 2014 Membership Dues.*

**Project Director: Lisa Dill Pool, Executive Director**

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## OFFICER GRANTS

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### American Regions Mathematics League

NEW YORK, NEW YORK

*\$10,000 over 6 months to support the participation of New York City Math Team students in the American Regions Mathematics League annual competition.*

**Project Director: Linda Berman, Treasurer**

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### Habitat for Humanity of Collier County

NAPLES, FLORIDA

*\$5,000 over 12 months for a memorial gift in memory of William E. Hoglund, a former Alfred P. Sloan Foundation Trustee.*

**Project Director: Sam Durso, President & CEO**

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### National Kidney Foundation of Michigan

ANN ARBOR, MICHIGAN

*\$5,000 over 12 months for a memorial gift in memory of William E. Hoglund, a former Alfred P. Sloan Foundation Trustee.*

**Project Director: Daniel Carney, President & CEO**

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### New York Hall of Science

CORONA, NEW YORK

*\$75,000 over 12 months to establish the new Alan J. Friedman Center for the development of young scientists.*

**Project Director: Priya Mohabir, Deputy Director**

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### New York University

NEW YORK, NEW YORK

*\$125,000 over 14 months to provide renewed support for a cyber security lecture series in New York City.*

**Project Director: Robert N. Ubell, VP/Dean of Technology Based Learning**

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### New York University

NEW YORK, NEW YORK

*\$20,000 over 12 months to provide partial support for the Cyber Security Program for High School Women.*

**Project Director: Nasir Memon, Department Head**

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### Northwest Michigan Habitat for Humanity

HARBOR SPRINGS, MICHIGAN

*\$5,000 over 12 months for a memorial gift in memory of William E. Hoglund, a former Alfred P. Sloan Foundation Trustee.*

**Project Director: Lani G. Laporte, Executive Director**

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### Open Space Institute

NEW YORK, NEW YORK

*\$20,000 over 10 months to identify and employ the most appropriate technology to equip the performance space at Riverbank State Park to better serve the Harlem community.*

**Project Director: Erik Kulleseid, Senior Vice President**

## 2014 Financial Review

The financial statements and schedules of the Foundation for 2014 and 2013 have been audited by Grant Thornton LLP. They include the balance sheets, statements of activities and cash flows, and schedules of management and investment expenses.

Investment income for 2014 was \$13,531,531, a decrease of \$7,186,936 from \$20,718,467 in 2013. After the deduction of investment expenses and provision for taxes, net investment income was \$198,583 in 2014 as compared to \$9,428,208 for the prior year. Investment expenses for 2014 consisted of \$4,169,677 of direct investment expenses and \$4,388,271 for investment management fees. Total investment expenses and provision for taxes of \$4,775,000 equaled \$13,332,948 versus \$11,290,259 in 2013. Total investment gains for 2014 were \$81,585,038 as compared with \$232,096,280 in 2013.

Grants authorized (net of grant refunds) and management expenses during 2014 totaled \$83,912,727 as compared to \$96,207,011 for the prior year. Of this total, grants authorized (net of refunds) amounted to \$71,464,219, while management expenses were \$12,448,508. For the prior year, grants authorized (net of grant refunds) were \$86,382,161 and management expenses were \$9,824,850.

Grant payments in 2014 were \$81,296,447 compared to \$82,100,316 for the prior year. Together with management expenses, investment expenses, and provision for taxes, the total of cash expenditures net of grant refunds in 2014 was \$107,077,903 while in 2013 the amount was \$103,215,425.

Grants authorized and payments made during the year ended December 31, 2014 are summarized in the following table:

Grants unpaid at December 31, 2013	\$ 62,454,443
Authorized during 2014	71,464,219
Payments during 2014	<u>(81,296,447)</u>
Grants unpaid at December 31, 2014	\$ 52,622,215

The fair value of the Foundation's total assets was \$1,875,962,450 at December 31, 2014 including investments valued at \$1,854,276,175 as compared with total assets of \$1,888,720,791 at December 31, 2013.

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

**ALFRED P. SLOAN FOUNDATION**

December 31, 2014 and 2013

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# Audited Financial Statements and Schedules

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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, 2014 and 2013, and the related consolidated statements of activities 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 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 financial statements. The procedures selected depend on the auditor’s judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity’s preparation and fair presentation of the 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 entity’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 financial statements.

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

**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, 2014 and 2013, 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.

**Supplementary information**

Our audit was conducted for the purpose of forming an opinion on the basic 2014 consolidated financial statements as a whole. The schedule of management and investment expenses for the years ended December 31, 2014 and 2013 on page 104 and the schedule of grants and appropriations for the year ended December 31, 2014 on pages 105 through 111 are presented for purposes of additional analysis and are not a required part of the basic 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 basic consolidated financial statements. The information has been subjected to the auditing procedures applied in the audit of the basic 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 established by the American Institute of Certified Public Accountants. In our opinion, the supplementary information is fairly stated, in all material respects, in relation to the consolidated financial statements as a whole.



New York, New York  
June 18, 2015



# Alfred P. Sloan Foundation

## Consolidated Statements of Financial Position

As of December 31, 2014 and 2013

	<u>2014</u>	<u>2013</u>
<b>ASSETS</b>		
Cash	\$ 1,356,562	\$ 1,244,519
Receivables	20,329,713	—
Investments (Note 3):		
Direct investments — equities	180,434,633	145,512,350
Direct investments — fixed income	91,210,296	104,982,138
Direct investments — mutual & exchange traded funds	171,446,255	209,304,270
Alternative investments	1,411,184,991	1,427,677,514
Total investments	<u>1,854,276,175</u>	<u>1,887,476,272</u>
Total assets	<u>\$ 1,875,962,450</u>	<u>\$ 1,888,720,791</u>
<b>LIABILITIES AND NET ASSETS</b>		
<b>LIABILITIES</b>		
Grants payable (Note 8)	\$ 52,622,215	\$ 62,454,443
Federal excise tax payable (Note 5)	12,326,912	12,980,634
Deferred compensation arrangements	139,350	928,555
Accrued postretirement health benefit obligation (Note 7)	7,162,185	6,270,079
Other liabilities	126,881	113,235
Total liabilities	<u>72,377,543</u>	<u>82,746,946</u>
Commitments (Notes 3, 4, and 9)		
NET ASSETS — unrestricted	<u>1,803,584,907</u>	<u>1,805,973,845</u>
Total liabilities and net assets	<u>\$ 1,875,962,450</u>	<u>\$ 1,888,720,791</u>

*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, 2014 and 2013

	<u>2014</u>	<u>2013</u>
INVESTMENT INCOME		
Interest and dividends	\$ 13,531,531	\$ 20,718,467
Less:		
Investment expenses	(8,557,948)	(9,790,259)
Provision for taxes (Note 5)	(4,775,000)	(1,500,000)
	<u>(13,332,948)</u>	<u>(11,290,259)</u>
Net investment income	<u>198,583</u>	<u>9,428,208</u>
EXPENSES		
Grants (net of refunds of \$208,571 in 2014 and \$181,303 in 2013)	71,464,219	86,382,161
Management expenses	<u>12,448,508</u>	<u>9,824,850</u>
	<u>83,912,727</u>	<u>96,207,011</u>
Excess of expenses over net investment income	<u>(83,714,144)</u>	<u>(86,778,803)</u>
INVESTMENT GAINS		
Net realized gain on disposal of investments	103,400,852	80,747,979
Unrealized (loss) gain on investments, net of deferred federal excise tax expense of \$11,769,232 and \$12,214,453 in 2014 and 2013, respectively	<u>(21,815,814)</u>	<u>151,348,301</u>
	<u>81,585,038</u>	<u>232,096,280</u>
(Decrease) increase in net assets before postretirement benefit adjustments"	(2,129,106)	145,317,477
Amounts not yet recognized as a component of net periodic benefit cost	<u>(259,832)</u>	<u>(697,515)</u>
(Decrease) increase in net assets	(2,388,938)	144,619,962
Net assets at beginning of year	<u>1,805,973,845</u>	<u>1,661,353,883</u>
Net assets at end of year	<u>\$ 1,803,584,907</u>	<u>\$ 1,805,973,845</u>

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, 2014 and 2013

	<u>2014</u>	<u>2013</u>
<b>CASH FLOWS FROM OPERATING ACTIVITIES</b>		
Increase in net assets	\$ (2,388,938)	\$ 144,619,962
Adjustments to reconcile (decrease) increase in net assets to		
Net realized gain on disposal of investments	(103,400,852)	(80,747,979)
Unrealized loss (gain) on investments	22,261,034	(154,437,042)
Increase in other assets	(20,329,713)	—
(Decrease) increase in federal excise tax payable	(653,722)	4,201,255
(Decrease) increase in grants payable	(9,832,228)	4,463,149
Increase in accrued postretirement health benefit obligation	892,106	1,387,226
Decrease in deferred compensation arrangements	(789,205)	(164,833)
Increase (decrease) in other liabilities	13,646	(24,346)
Net cash used in operating activities	<u>(114,227,872)</u>	<u>(80,702,608)</u>
<b>CASH FLOWS FROM INVESTING ACTIVITIES</b>		
Proceeds from sales of investments	127,870,315	101,785,986
Purchases of investments	<u>(13,530,400)</u>	<u>(20,717,619)</u>
Net cash provided by investing activities	<u>114,339,915</u>	<u>81,068,367</u>
Net increase (decrease) in cash	112,043	365,759
Cash at beginning of year	<u>1,244,519</u>	<u>878,760</u>
Cash at end of year	<u>\$ 1,356,562</u>	<u>\$ 1,244,519</u>

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

# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

### 1. ORGANIZATION

The Alfred P. Sloan Foundation is a philanthropic private foundation which makes grants to support original research and broad-based education related to science, technology, and economics that aim to improve the quality of American life. The Foundation is unique in its focus on science, technology, and economic institutions. It believes the scholars and educators who work in these fields are chief drivers of the nation's health and prosperity. The Foundation also believes that broad-based education of the public about science, technology and economics, and the scholars who do research in these areas, is an essential complement to research and practice in these areas. In each grant program, the Foundation seeks proposals for original projects led by outstanding individuals or teams that will advance these goals. The Alfred P. Sloan Foundation is interested in projects that it expects will result in significant benefits to society, and for which funding from the private sector, the government, or other foundations is not widely available. The Alfred P. Sloan 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 achieving superior returns.

In June 2009, Sloan Projects LLC was established under the Delaware Limited Liability Company Act. The Alfred P. Sloan 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 Alfred P. Sloan Foundation. Sloan Projects LLC is consolidated with Alfred P. Sloan Foundation for financial statement and tax purposes.

### 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

Alfred P. Sloan 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.

#### 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

# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

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. Also included in Level 2 are investments measured using a net asset value ("NAV") per share, or its equivalent, that may be redeemed at that NAV as of the date of the statement of financial position or in the near term, which the Foundation has generally considered to be within one-year.
- 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. Also included in Level 3 are investments measured using a NAV per share, or its equivalent, that can never be redeemed at NAV in the near term or for which redemption at NAV is uncertain due to lockup periods or other investment restrictions.

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.

### 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.

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# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

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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.

Most investments classified in Levels 2 and 3 consist of shares or units in investment funds as opposed to direct interests in the funds’ underlying holdings, which may be marketable. Because the net asset value reported by each fund is used as a practical expedient to estimate fair value of the Foundation’s interest therein, its classification in Level 2 or 3 is based on the Foundation’s ability to redeem its interest at or near December 31st. If the interest can be redeemed in the near term, which the Foundation has determined to be within one-year, the investment is classified as Level 2.

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

### **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.

### **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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# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

### Subsequent Events

The Foundation evaluated its December 31, 2014 consolidated financial statements for subsequent events through June 18, 2015, the date the consolidated financial statements were available to be issued. The Foundation is unaware of any events that would require disclosure in the accompanying consolidated financial statements.

### 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, 2014 and 2013:

	Fair value measurements at December 31, 2014			
	Total	Level 1	Level 2	Level 3
Direct investments:				
Equities:				
Domestic	\$ 126,382,586	\$ 126,382,586	\$ —	—
International	54,052,047	54,052,047	—	—
	<u>180,434,633</u>	<u>180,434,633</u>	<u>—</u>	<u>—</u>
Fixed income:				
U.S. government	91,210,296	91,210,296	—	—
Mutual & exchange-traded funds:				
Equities	80,302,836	80,302,836	—	—
Independent return	49,858,296	49,858,296	—	—
Fixed income	41,285,123	41,285,123	—	—
	<u>171,446,255</u>	<u>171,446,255</u>	<u>—</u>	<u>—</u>
Alternative investments:				
Equities:				
Domestic	159,479,551	—	159,479,551	—
Long/short	164,175,833	20,403,003	105,989,443	37,783,387
International	263,389,331	—	225,119,156	38,270,175
Fixed income:				
Global sovereign bonds	58,125,827	—	58,125,827	—
High yield	50,483,311	—	50,483,311	—
Independent return	486,384,616	3,985,578	180,051,920	302,347,118
Real estate	17,659,701	—	—	17,659,701
Private equity	211,486,821	—	—	211,486,821
	<u>1,411,184,991</u>	<u>24,388,581</u>	<u>779,249,208</u>	<u>607,547,202</u>
	<u>\$ 1,854,276,175</u>	<u>\$ 467,479,765</u>	<u>\$ 779,249,208</u>	<u>\$ 607,547,202</u>

# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

### Fair Value Measurements at December 31, 2013

	Total	Level 1	Level 2	Level 3
Direct investments:				
Equities:				
Domestic	\$ 123,229,849	\$ 123,229,849	\$ —	—
International	22,282,501	22,282,501	—	—
	145,512,350	145,512,350	—	—
Fixed income:				
U.S. government	104,982,138	104,982,138	—	—
Mutual & exchange-traded funds:				
Equities	83,005,768	83,005,768	—	—
Independent return	55,661,105	55,661,105	—	—
Fixed income	70,637,397	70,637,397	—	—
	209,304,270	209,304,270	—	—
Alternative investments:				
Equities:				
Domestic	129,038,930	—	129,038,930	—
Long/short	159,387,038	—	86,860,877	72,526,161
International	240,745,909	—	215,983,482	24,762,427
Fixed income:				
Global sovereign bonds	58,269,841	—	58,269,841	—
High yield	55,327,905	—	55,327,905	—
Independent return	468,687,617	21,169,228	186,897,683	260,620,706
Real estate	61,575,745	—	—	61,575,745
Private equity	254,644,529	—	—	254,644,529
	1,427,677,514	21,169,228	732,378,718	674,129,568
	\$ 1,887,476,272	\$ 480,967,986	\$ 732,378,718	\$ 674,129,568



# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

The following table presents a reconciliation for all Level 3 assets measured at fair value at December 31, 2014:

	<u>Beginning Balance</u>	<u>Purchases</u>	<u>Settlements/ Redemptions</u>	<u>Total Net Realized and Unrealized Gains</u>	<u>Transfers In/ (Out) *</u>	<u>Ending Balance</u>
Alternative Investments:						
Equities:						
Long/short	\$ 72,526,161	\$ 20,000,000	\$ (40,582,034)	\$ 1,371,775	\$ (15,532,515)	\$ 37,783,387
International	24,762,427	10,000,000	—	3,507,748	—	38,270,175
Independent return	260,620,706	79,109,226	(49,313,940)	12,929,949	(998,823)	302,347,118
Real estate	61,575,745	332,583	(48,224,038)	3,975,411	—	17,659,701
Private equity	254,644,529	26,332,766	(82,031,420)	8,004,070	4,536,876	211,486,821
	<u>\$ 674,129,568</u>	<u>\$ 135,774,575</u>	<u>\$ (220,151,432)</u>	<u>\$ 29,788,953</u>	<u>\$ (11,994,462)</u>	<u>\$ 607,547,202</u>

\* Certain alternative investments were reclassified from Level 3 to Level 2 during 2014 due to changes in liquidity terms. Other certain investments were reclassified from Level 2 to Level 3 as the Foundation redeemed from the main fund and residual balances remained in liquidating side pockets. The Foundation recognizes transfers at the date of the consolidated statement of financial position.

The following table presents the reconciliation for all Level 3 assets measured at fair value at December 31, 2013:

	<u>Beginning Balance</u>	<u>Purchases</u>	<u>Settlements/ Redemptions</u>	<u>Total Net Realized and Unrealized Gains</u>	<u>Transfers In/ (Out) **</u>	<u>Ending Balance</u>
Alternative Investments:						
Equities:						
Domestic	\$ 98,384,780	\$ —	\$ —	\$ 30,654,150	\$ (129,038,930)	\$ —
Long/short	67,607,916	—	(2,864,000)	7,782,245	—	72,526,161
International	21,064,287	—	—	3,698,140	—	24,762,427
Independent return	261,996,388	71,724,916	(43,413,400)	25,640,707	(55,327,905)	260,620,706
Real estate	64,605,245	2,261,790	(14,390,433)	9,099,143	—	61,575,745
Private equity	285,979,816	19,305,634	(84,287,166)	33,646,245	—	254,644,529
	<u>\$ 799,638,432</u>	<u>\$ 93,292,340</u>	<u>\$ (144,954,999)</u>	<u>\$ 110,520,630</u>	<u>\$ (184,366,835)</u>	<u>\$ 674,129,568</u>

\*\* Certain alternative investments were reclassified from Level 3 to Level 2 during 2013 due to changes in liquidity terms. Other certain investments were reclassified from Level 2 to Level 3 as the Foundation redeemed from the main fund and residual balances remained in liquidating side pockets. The Foundation recognizes transfers at the date of the consolidated statement of financial position.

# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

The following table lists the redemption terms and unfunded commitments for the alternative investments as of December 31, 2014 and 2013:

<b>2014</b>						
	<b># of Funds</b>	<b>Fair Value</b>	<b>Unfunded Commitments (\$ in millions)</b>	<b>Redemption Frequency</b>	<b>Redemption Notice Period</b>	<b>Lock-up Period</b>
Alternative investments:						
Equities:						
Domestic	2	\$ 159,479,551	\$ —	monthly, quarterly	30-60 days	None
Long/short	7	164,175,833	—	monthly, quarterly, other	30-90 days	none, 1-year
International	4	263,389,331	—	monthly, quarterly, other	10-60 days	none, 1-year
Fixed income:						
Global sovereign bonds	1	58,125,827	—	monthly	10 days	None
High Yield	1	50,483,311	—	semi-annually	90 days	None
Independent return	21	486,384,616	17	daily, monthly, quarterly, annually, other	30-180 days	none, 1-year, rolling 2-year
Real estate	5	17,659,701	3	None	N/A	N/A
Private equity	43	211,486,821	51	None	N/A	N/A
Total		<u>\$ 1,411,184,991</u>	<u>\$ 71</u>			
<b>2013</b>						
	<b># of Funds</b>	<b>Fair Value</b>	<b>Unfunded Commitments (\$ in millions)</b>	<b>Redemption Frequency</b>	<b>Redemption Notice Period</b>	<b>Lock-up Period</b>
Alternative investments:						
Equities:						
Domestic	1	\$ 129,038,930	\$ —	quarterly, other	30 days	None
Long/short	6	159,387,038	—	quarterly, semi- annually, other	30-90 days	none, rolling 3-year
International	4	240,745,909	—	monthly, quarterly, other	6-60 days	none, 2-year
Fixed income:						
Global sovereign bonds	1	58,269,841	—	monthly	10 days	None
High Yield	1	55,327,905	—	semi-annually	90 days	None
Independent return	21	468,687,617	36	daily, monthly, quarterly, annually, other	30-180 days	none, 1-year, rolling 2-year
Real estate	9	61,575,745	5	None	N/A	N/A
Private equity	49	254,644,529	72	None	N/A	N/A
Total		<u>\$ 1,427,677,514</u>	<u>\$ 113</u>			

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# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

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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. Equity funds range from no lock-up provisions to no more than 3 years.

**Fixed Income:** Alternative investments in this category invest in domestic and international fixed income securities, benchmarked against Composite of Barclays Capital U.S. Intermediate Government Credit Index and Citigroup Broad index.

**Independent Return:** Independent return funds include investments such as low net exposure equity hedge funds, distressed credit, and merger arbitrage. Such strategies are expected to have equity-like long-term returns but with less correlation to the equity markets. \$52.6 million is invested in draw-down structures with no predetermined redemption date.

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

**Private Equity:** Includes private equity and venture capital, all of which are illiquid investments.

Private foundations are required by the Internal Revenue Service 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 2014, the Foundation sold options contracts. S&P 500 Index put options sold were valued at approximately \$4 million at December 31, 2014 and to \$21.2 million at December 31, 2013. In addition, the Foundation bought and sold S&P 500 Futures contracts valued at \$20.4 million at December 31, 2014. The Foundation does not anticipate that losses, if any, resulting from its market or credit risks would materially affect its consolidated financial statements.

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# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

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### 5. TAXES

The Foundation is liable for a federal excise tax of 2% of its net investment income, which includes realized capital gains. However, this tax is reduced to 1% if certain conditions are met. The Foundation did not meet the requirements for the 1% tax for the year ended December 31, 2014, but met the requirements for the year ended December 31, 2013. Therefore, current taxes are estimated at 2% of net investment income for 2014 and 1% for 2013. Additionally, certain of the Foundation's investments give rise to unrelated business income tax liabilities. Such tax liabilities for 2014 and 2013 are not material to the accompanying consolidated financial statements; however, the provision for taxes, as of December 31, 2014 and 2013, includes an estimate of tax liabilities for unrelated business income.

Deferred taxes principally arise from differences between the cost value and fair value of investments. Since the qualification for the 1% tax is not determinable until the fiscal year in which net gains are realized, deferred taxes represent 2% of unrealized gains at December 31, 2014 and 2013.

### 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 and Fidelity Investments. Retirement plan expense was \$824,656 and \$803,288 in 2014 and 2013, 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.

# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

The following table sets forth the financial information for the plan for 2014 and 2013:

	<u>2014</u>	<u>2013</u>
Change in accrued postretirement benefit obligation:		
<b>Benefit obligation at beginning of year</b>	\$ 6,270,079	\$ 4,882,853
Service cost	160,020	299,108
Interest cost	297,709	186,625
Actuarial loss	735,893	1,173,576
Benefits paid	(301,516)	(272,083)
<b>Benefit obligation at end of year</b>	<u>\$7,162,185</u>	<u>\$6,270,079</u>
Components of net periodic postretirement benefit cost reported:		
Service cost	\$160,020	\$299,108
Interest cost	297,709	186,625
Amortization of transition obligation	476,061	476,061
Amortization of gain	(170,878)	(359,198)
Net periodic postretirement benefit cost	<u>\$ 762,912</u>	<u>\$ 602,596</u>
Benefit obligation weighted average assumptions at December 31, 2014 and 2013:		
Discount rate	3.88%	4.86%
Periodic benefit cost weighted average assumptions for the years ended December 31, 2014 and 2013:		
Discount rate	4.86%	3.91%

The medical trend and inflation rate is 8% in 2015 grading down to 5.75% in 2018 and 5% ultimately.

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:

	<u>2014</u>		<u>2013</u>	
	<u>1% Increase</u>	<u>1% Decrease</u>	<u>1% Increase</u>	<u>1% Decrease</u>
Effect on total service and interest cost	\$ 75,976	\$ (67,104)	\$ 46,879	\$ (49,879)
Effect on postretirement benefit obligation	1,140,635	(907,623)	922,043	(745,160)

# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

Projected premium payments for each of the next five fiscal years and thereafter are as follows:

**Year ending December 31:**

2015	\$	303,229
2016		321,602
2017		322,885
2018		334,700
2019		331,414
Thereafter through 2024		1,658,243
	\$	<u>3,272,073</u>

The accumulated amount not yet recognized as a component of net periodic benefit cost was \$(305,988) and \$(667,842) at December 31, 2014 and 2013, respectively. The components are as follows:

	<u>2014</u>	<u>2013</u>
Transition obligation	\$ 2,463,223	\$ 2,939,284
Net actuarial gain	(2,769,211)	(3,607,126)
	<u>\$ (305,988)</u>	<u>\$ (667,842)</u>

The transition obligation and actuarial gain that will be amortized into net periodic benefit cost in 2015 will be \$476,061 and \$170,878, respectively.

### 8. GRANTS PAYABLE

The Foundation estimates that the grants payable balance as of December 31, 2014 will be paid as follows:

**Year:**

2015	\$	36,546,100
2016		12,566,115
2017		3,260,000
2018		250,000
	\$	<u>52,622,215</u>

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. Such conditional grant commitments total approximately \$1.5 million at December 31, 2014.

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# Alfred P. Sloan Foundation

## Notes to Consolidated Financial Statements

December 31, 2014 and 2013

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### 9. LEASE

Rent expense for 2014 and 2013, including escalations, was \$1,433,273 and \$1,923,254, respectively. On November 21, 2013, the Foundation modified the original lease to provide for the leasing of a portion of the 22nd floor as substitute premises and to surrender the original premises on the 25th floor. Prior to the surrender of the original premises, the Foundation leased the original premises upon all of the terms of the original lease. The substitute premises were delivered on February 27, 2014. The Foundation vacated the original premises and provided written notice that the surrender date of the original premises was September 16, 2014, on which date the term of the original lease expired and the original lease was deemed modified. As a result of the lease modification, rent commencement on the substitute premises will occur 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 and (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. LINE OF CREDIT

The Foundation established a \$40,000,000 line of credit with Bank of New York Mellon to provide bridge funding of grants and to finance short-term working capital needs of the Foundation. To date, the Foundation has not yet used the line of credit. The interest rate is calculated using the Mellon Monthly LIBOR plus 75 basis points, with a fallback rate of Wall Street Journal Prime minus 125 basis points. The interest rate was 2% at December 31, 2014 and 2013. If the line is used, interest will be payable monthly on the 15th of each month and principal will be due on demand. If payment is not made within 15 days following the payment date, a \$25 late fee will be assessed.

## **SUPPLEMENTARY INFORMATION**



# Alfred P. Sloan Foundation

## Schedule of Management and Investment Expenses

For the years ended December 31, 2014 and 2013

	<u>2014</u>	<u>2013</u>
Management expenses:		
Salaries and employees' benefits:		
Salaries	\$ 6,242,611	\$ 6,574,515
Employees' retirement plan and other benefits	2,780,403	2,990,154
Total	9,023,014	9,564,669
Rent	1,433,273	1,923,253
Program expenses	917,644	1,124,169
Office expenses	4,168,162	911,183
Website and publications	86,754	61,143
Professional fees	989,338	970,755
Total management expenses	16,618,185	14,555,172
Less direct investment and other management expenses allocated to investments	(4,169,677)	(4,730,322)
Management expenses	<u>\$ 12,448,508</u>	<u>\$ 9,824,850</u>
Investment expenses:		
Investment management fees	\$ 4,388,271	\$ 5,059,937
Direct investment and other management expenses allocated to investments	4,169,677	4,730,322
Investment expenses	<u>\$ 8,557,948</u>	<u>\$ 9,790,259</u>

*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, 2014

Grantee	Unpaid December 31, 2013	2014		Unpaid December 31, 2014
		Authorized	Payments	
Adler Planetarium	\$ —	\$ 724,028	\$ 416,380	\$ 307,648
American Academy of Arts and Sciences	20,872	200,000	120,872	100,000
American Anthropological Association	—	79,986	79,986	—
American Association for the Advancement of Science	308,426	16,284	186,284	138,426
American Council on Education	337,318	—	337,318	—
American Economic Association	62,401	—	62,401	—
American Film Institute	96,000	—	96,000	—
American Geosciences Institute	—	101,375	101,375	—
American Institutes for Research	436,312	—	436,312	—
American Museum of Natural History	—	354,000	354,000	—
American Mathematical Society	—	139,688	139,688	—
American Regions Mathematics League	—	10,000	10,000	—
Arius Association	105,000	—	75,000	30,000
Association of American Colleges and Universities	—	50,000	50,000	—
Association of Public and Land-Grant Universities	—	20,000	20,000	—
Association of Research Libraries	—	500,000	500,000	—
Astrophysical Research Consortium	9,500,000	3,500,000	5,875,000	7,125,000
Australian National University	—	583,646	389,098	194,548
Barnard College	—	140,888	140,888	—
Baron, David	—	50,000	35,000	15,000
Baylor University	193,250	—	100,000	93,250
Behavioral Science And Policy Association	12,000	—	12,000	—
Bipartisan Policy Center	116,765	—	116,765	—
Borel, Brooke	40,000	—	40,000	—
Boston College	—	673,506	487,208	186,298
Boston University	—	100,000	100,000	—
British Columbia, University of	298,299	—	132,112	166,187
Brown University	—	100,000	100,000	—
Business-Higher Education Forum	138,859	20,000	158,859	—
California Institute of Technology	—	150,000	150,000	—
California, University of, Berkeley	1,698,681	2,476,330	3,079,773	1,095,238
California, University of, Davis	548,796	477,443	517,443	508,796
California, University of, Irvine	109,964	843,006	559,964	393,006
California, University of, Los Angeles	847,400	366,958	1,214,358	—
California, University of, Santa Cruz	—	50,000	50,000	—

# Alfred P. Sloan Foundation

## Schedule of Grants and Appropriations

For the year ended December 31, 2014

Grantee	Unpaid December 31, 2013	2014		Unpaid December 31, 2014
		Authorized	Payments	
California, University of, San Diego	\$ —	\$ 6,245	\$ 6,245	\$ —
California, University of, San Francisco	125,000	50,000	175,000	—
Carnegie Endowment for International Peace	—	149,997	125,000	24,997
Carnegie Institution of Washington	266,000	2,250,000	933,000	1,583,000
Carnegie Mellon University	330,631	100,000	430,631	—
Catticus Corporation	500,000	—	—	500,000
Center for American Progress	—	125,000	125,000	—
Center for Open Science	168,600	—	168,600	—
Claremont McKenna College	—	50,000	50,000	—
Chicago, University of	106,900	849,156	956,056	—
Chemical Heritage Foundation	125,000	—	125,000	—
Cold Spring Harbor Laboratory	1,000,000	15,500	1,015,500	—
Colorado State University	—	20,000	20,000	—
Colorado, University of, at Boulder	629,471	1,496,000	1,092,210	1,033,261
Colorado, University of, Denver	55,309	106,943	162,252	—
Columbia University	—	2,174,465	1,889,465	285,000
Computing Research Association	—	53,840	33,840	20,000
Conference Board, Inc.	125,000	—	125,000	—
Coolidge Corner Theater Foundation	230,000	—	230,000	—
Cornell University	—	457,604	357,604	100,000
Council for Economic Education	75,000	—	75,000	—
Council of Graduate Schools	125,000	—	125,000	—
Council on Foreign Relations	714,059	—	—	714,059
Council on Foundations, Inc.	—	45,000	45,000	—
Council on Library and Information Resources	879,373	—	640,281	239,092
Council of Professional Associations on Federal Statistics	45,000	—	45,000	—
Creative Commons	—	63,250	63,250	—
CUNY TV Foundation	—	457,200	75,000	382,200
Data & Society Research Institute	—	10,000	10,000	—
Dartmouth College	605,433	50,000	348,270	307,163
Davis, Kevin	—	10,250	10,250	—
Digital Public Library of America, Inc.	300,000	—	300,000	—
Delaware, University of	—	100,000	100,000	—
Drexel University	349,627	11,500	123,230	237,897
Duke University	—	499,951	400,000	99,951

# Alfred P. Sloan Foundation

## Schedule of Grants and Appropriations

For the year ended December 31, 2014

Grantee	Unpaid	2014		Unpaid
	December 31, 2013	Authorized	Payments	December 31, 2014
Ensemble Studio Theatre, Inc.	\$ 1,194,000	\$ —	\$ 597,000	\$ 597,000
Environmental Defense Fund Incorporated	—	627,125	500,000	127,125
Film Independent, Inc.	—	1,047,048	511,420	535,628
Financial Stability Board	125,000	—	125,000	—
Finkelstein, Katherine Eban	50,000	—	50,000	—
Firestein, Stuart	40,000	—	40,000	—
Florida, University of	—	100,000	100,000	—
FORCE11	—	15,000	15,000	—
Forsyth Institute	—	120,000	—	120,000
Foundation for Earth Science	—	144,995	144,995	—
Fund for the City of New York	1,140,000	—	285,000	855,000
Georgia Institute of Technology	—	23,386	23,386	—
Georgia, University of	—	50,000	50,000	—
George Mason University	—	481,340	481,340	—
George Washington University	109,000	—	109,000	—
Greater Washington Educational Telecommunications Association Inc.	720,000	1,500,000	1,520,000	700,000
GuideStar USA, Inc.	—	7,500	7,500	—
Habitat for Humanity of Collier County	—	5,000	5,000	—
Hamptons International Film Festival	—	186,467	186,467	—
Haverford College	—	98,486	98,486	—
Harvard University	136,988	2,247,018	1,513,988	870,018
Hawaii, University of	—	50,000	50,000	—
Hypothesis Project	—	703,000	683,000	20,000
Illinois Institute of Technology	120,000	25,447	85,447	60,000
Illinois, University at Chicago	—	42,237	42,237	—
Illinois, University of, Urbana-Champaign	—	150,000	150,000	—
ImpactStory	250,000	—	250,000	—
Indiana, University of	—	798,000	498,000	300,000
Industrial Organizational Society, Inc.	—	20,000	20,000	—
Institute of International Education Inc.	—	750,000	250,000	500,000
International Energy Policy and Programme Evaluation Conference	—	20,000	20,000	—
International Council for the Life Sciences	—	65,000	65,000	—
International Society for Indoor Air Quality and Climate	—	70,000	70,000	—
J. Craig Venter Institute	—	145,000	145,000	—

# Alfred P. Sloan Foundation

## Schedule of Grants and Appropriations

For the year ended December 31, 2014

Grantee	Unpaid	2014		Unpaid
	December 31, 2013	Authorized	Payments	December 31, 2014
Johns Hopkins University	\$ —	\$ 877,039	\$ 627,039	\$ 250,000
Kanigel, Robert	30,000	—	30,000	—
Kansas, University of	—	124,999	124,999	—
Keck Graduate Institute	75,000	—	75,000	—
L.A. Theatre Works	138,000	500,000	388,000	250,000
Lehigh University	—	50,000	50,000	—
Library Foundation of Los Angeles	—	20,000	20,000	—
Manhattan Theatre Club	186,521	125,000	311,521	—
Marine Biological Laboratory	650,000	—	250,000	400,000
Maryland, University of, Baltimore	—	44,942	44,942	—
Maryland, University of, College Park	62,845	69,858	69,858	62,845
Massachusetts Institute of Technology	2,499,130	1,358,954	2,321,286	1,536,798
Massachusetts, University of, Medical School	—	97,750	97,750	—
Mathematical Sciences Research Institute	—	100,000	100,000	—
McGill University	—	50,000	50,000	—
Miami Foundation Inc.	—	260,000	260,000	—
Michigan State University	—	35,476	35,476	—
Michigan, University of	1,499,875	2,079,527	2,409,484	1,169,918
Michigan, University of, Ann Arbor	—	194,444	134,444	60,000
Mindell, David	50,000	—	50,000	—
Minnesota Foundation, University of	—	55,000	55,000	—
Minnesota, University of	—	255,891	255,891	—
Missouri University of Science and Technology	—	34,388	34,388	—
Montreal, University of	—	359,991	359,991	—
Mozilla Foundation	—	819,480	409,740	409,740
Museum of the Moving Image	150,000	—	75,000	75,000
National Academy of Sciences	465,000	1,646,877	1,266,877	845,000
National Academy of Social Insurance	—	375,000	310,031	64,969
National Action Council for Minorities in Engineering, Inc.	4,897,332	3,495,775	4,675,032	3,718,075
National Bureau of Economic Research, Inc.	1,347,147	1,789,523	1,986,029	1,150,641
National Kidney Foundation of Michigan	—	5,000	5,000	—
National Information Standards Organization	102,219	—	102,219	—
National Opinion Research Center	—	1,096,138	536,423	559,715
National Public Radio, Inc.	350,000	—	350,000	—
New York Botanical Garden	—	1,155,244	600,000	555,244

# Alfred P. Sloan Foundation

## Schedule of Grants and Appropriations

For the year ended December 31, 2014

Grantee	Unpaid	2014		Unpaid
	December 31, 2013	Authorized	Payments	December 31, 2014
New York Genome Center, Inc.	\$ 1,000,000	\$ —	\$ 1,000,000	\$ —
New York Hall of Science	—	75,000	75,000	—
New York Public Library	—	41,568	41,568	—
New York Public Radio	850,000	400,000	250,000	1,000,000
New York University	1,889,575	1,794,690	2,141,262	1,543,003
North Carolina State University	421,982	—	274,821	147,161
North Carolina, University of, Chapel Hill	—	49,975	49,975	—
North Dakota State University	—	50,000	50,000	—
Northwest Michigan Habitat for Humanity	—	5,000	5,000	—
Northwestern University	—	115,000	100,000	15,000
Northeastern University	—	50,000	50,000	—
Notre Dame, University of	—	50,000	50,000	—
NumFOCUS	—	10,000	—	10,000
O'Connor, Maura R	—	13,000	13,000	—
Oklahoma, University of	—	351,844	351,844	—
Ohio State University	500,000	50,000	550,000	—
Open Space Institute	—	20,000	20,000	—
Oregon, University of	625,000	22,112	647,112	—
Ottawa, University of	—	586,500	286,500	300,000
Oxford University	312,958	—	312,958	—
PBS Foundation	—	1,000,000	700,000	300,000
Pennsylvania State University	—	50,000	50,000	—
Pennsylvania, University of	15,000	425,527	340,527	100,000
Philanthropy New York	30,000	100,000	130,000	—
Phillips Collection	—	75,000	75,000	—
Pittsburgh, University of	—	150,000	150,000	—
Pittsburgh, University of, Medical Center	200,000	—	200,000	—
Polytechnic Institute of New York University	20,000	—	20,000	—
Princeton University	—	942,544	480,809	461,735
Project HOPE	20,000	—	20,000	—
Puerto Rico, University of	210,856	(209,330)	1,525	—
Purdue University	—	328,961	110,000	218,961
PRX Incorporated	—	300,000	150,000	150,000
RAND Corporation	836,359	378,666	816,050	398,975
Rice University	—	100,000	100,000	—

# Alfred P. Sloan Foundation

## Schedule of Grants and Appropriations

For the year ended December 31, 2014

Grantee	Unpaid	2014		Unpaid
	December 31, 2013	Authorized	Payments	December 31, 2014
Richard Rhodes	\$ —	\$ 125,000	\$ 65,000	\$ 60,000
Rensselaer Polytechnic Institute	—	750,000	450,000	300,000
Research Foundation of the City University of New York	—	1,126,925	375,000	751,925
Resources for the Future, Inc.	384,397	—	115,807	268,590
Rhode Island, University of	—	750,000	400,000	350,000
Rockefeller University	332,667	50,000	382,667	—
Rutgers, The State University of, New Jersey	153,607	210,867	364,474	—
Segre, Gino	16,100	—	16,100	—
Science Festival Foundation	600,000	—	600,000	—
Science Friday Initiative, Inc.	450,000	—	225,000	225,000
Scripps Research Institute	—	50,000	50,000	—
Shetterly, Margot Lee	—	50,000	35,000	15,000
Smithsonian Institution	30,000	599,862	430,000	199,862
Social Science Research Network	20,000	125,000	145,000	—
Society for Human Resources Management Foundation	459,650	—	350,000	109,650
SoundVision Productions	—	789,044	500,000	289,044
Southern California, University of	119,450	200,000	200,000	119,450
Southern Regional Education Board	325,000	—	325,000	—
Stanford University	140,669	1,905,581	1,333,834	712,416
Stevens Institute of Technology	—	433,647	433,647	—
Stony Brook University	—	50,000	50,000	—
Sundance Institute	250,000	—	250,000	—
Syracuse University	—	170,000	110,000	60,000
Technology Affinity Group	—	5,000	5,000	—
Texas A&M University	—	10,000	10,000	—
Texas, University of, Austin	1,024,012	694,878	1,613,384	105,506
The Brookings Institution	292,622	600,000	592,622	300,000
The Conversation	—	400,000	250,000	150,000
The Graduate Center of The City University of New York	—	112,928	112,928	—
The United States Studies Centre	—	54,870	54,870	—
Tribeca Film Institute	375,000	—	375,000	—
Toronto, University of	100,000	299,550	299,550	100,000
Tulsa, University of	—	390,000	250,000	140,000
Utah, University of	—	66,199	66,199	—
Virginia, University of	—	50,000	50,000	—

# Alfred P. Sloan Foundation

## Schedule of Grants and Appropriations

For the year ended December 31, 2014

Grantee	Unpaid	2014		Unpaid
	December 31, 2013	Authorized	Payments	December 31, 2014
Virginia Polytechnic Institute and State University	\$ 60,000	\$ 250,000	\$ 210,000	\$ 100,000
Washington, University of	750,000	95,987	595,987	250,000
Washington, University in St. Louis	—	50,000	50,000	—
Waterloo, University of	—	50,000	50,000	—
WGBH Educational Foundation	1,250,000	1,000,000	1,225,000	1,025,000
Wikimedia Foundation	—	3,000,000	1,250,000	1,750,000
Wilcox, Christie	25,000	—	25,000	—
Wisconsin, University of, Madison	892,602	330,535	881,543	341,594
WNET.ORG	45,000	1,000,000	645,000	400,000
Women Make Movies, Inc.	247,546	50,000	297,546	—
Wosk, Julie	—	4,525	4,525	—
Woods Hole Oceanographic Institution	—	50,000	50,000	—
Woodrow Wilson International Center for Scholars	283,999	500,000	608,999	175,000
Yale University	1,591,331	90,383	839,490	842,224
<b>TOTAL</b>	<b>55,164,185</b>	<b>71,314,220</b>	<b>81,020,576</b>	<b>45,457,829</b>
Sloan research fellowships to be granted in ensuing year	6,300,000	—	—	6,300,000
Other appropriations authorized but not committed	990,258	607,596	733,468	864,386
	62,454,443	71,921,816	81,754,044	52,622,215
Reduction for grant transfers	—	(457,597)	(457,597)	—
	<b>\$ 62,454,443</b>	<b>\$ 71,464,219</b>	<b>\$ 81,296,447</b>	<b>\$ 52,622,215</b>

*This schedule should be read in conjunction with the accompanying consolidated financial statements and notes thereto.*



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