United States Court of Appeals

for the

First Circuit

Case Nos. 25-1236
and 25-1413

STATE OF NEW YORK; STATE OF CALIFORNIA; STATE OF ILLINOIS; STATE OF RHODE ISLAND; STATE OF NEW JERSEY; COMMONWEALTH OF MASSACHUSETTS; STATE OF ARIZONA; STATE OF COLORADO; STATE OF CONNECTICUT; STATE OF DELAWARE; DISTRICT OF COLUMBIA; STATE OF HAWAII; STATE OF MAINE; STATE OF MARYLAND; STATE OF MICHIGAN; STATE OF MINNESOTA; STATE OF NEVADA; STATE OF NORTH CAROLINA; STATE OF NEW MEXICO; STATE OF OREGON; STATE OF VERMONT;

(For Continuation of Caption See Inside Cover)

ON APPEAL FROM THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT COURT OF RHODE ISLAND,
PROVIDENCE, IN CASE NO. 1:25-CV-00039-JJM,
HONORABLE JOHN J. MCCONNELL, JR., U.S. DISTRICT JUDGE

BRIEF FOR *AMICUS CURIAE* DR. ARATI PRABHAKAR IN SUPPORT OF PLAINTIFFS-APPELLEES AND AFFIRMANCE

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STATE OF WASHINGTON; STATE OF WISCONSIN, OFFICE OF THE GOVERNOR OF KENTUCKY, ex rel. ANDREW BESHEAR, in their official capacity as Governor of the Commonwealth of Kentucky,

Plaintiffs-Appellees,

v.

DONALD J. TRUMP, in their official capacity as President of the United States; U.S. OFFICE OF MANAGEMENT AND BUDGET; RUSSELL THURLOW VOUGHT, in their official capacity as Director of the U.S. Office of Management and Budget; U.S. DEPARTMENT OF THE TREASURY; SCOTT BESSENT, in their official capacity as Secretary of the Treasury; PATRICIA COLLINS, in their official capacity as Treasurer of the U.S.; U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES; ROBERT F. KENNEDY, JR., in their official capacity as Secretary of the Department of Health and Human Services; U.S. DEPARTMENT OF EDUCATION; LINDA MCMAHON, in their official capacity as Secretary of Education; U.S. FEDERAL EMERGENCY MANAGEMENT AGENCY; CAMERON HAMILTON, in their official capacity as Acting Administrator of the U.S. Federal Emergency Management Agency; U.S. DEPARTMENT OF TRANSPORTATION; SEAN P. DUFFY, in their official capacity as Secretary of Transportation; U.S. DEPARTMENT OF LABOR; LORI CHAVEZ-DEREMER, in their official capacity as Secretary of Labor; U.S. DEPARTMENT OF ENERGY; CHRISTOPHER ALLEN WRIGHT, in their official capacity as Secretary of the U.S. Department of Energy; U.S. ENVIRONMENTAL PROTECTION AGENCY; LEE M. ZELDIN, in their official capacity as Administrator of the U.S. Environmental Protection Agency; U.S. DEPARTMENT OF THE INTERIOR; DOUGLAS BURGUM, in their official capacity as Secretary of the Interior; U.S. DEPARTMENT OF HOMELAND SECURITY; KRISTI NOEM, in their official capacity as Secretary of the U.S. Department of Homeland Security; U.S. DEPARTMENT OF JUSTICE; PAMELA J. BONDI, in their official capacity as Attorney General; NATIONAL SCIENCE FOUNDATION; DR. SETHURAMAN PANCHANATHAN, in their official capacity as Director of the National Science Foundation; U.S. DEPARTMENT OF AGRICULTURE; BROOKE ROLLINS, in their official capacity as Secretary of Agriculture; U.S. DEPARTMENT OF HOUSING & URBAN DEVELOPMENT; SCOTT TURNER, in their official capacity as Secretary of Housing and Urban Development; U.S. DEPARTMENT OF STATE; MARCO RUBIO, in their official capacities as Secretary of State and Acting Administrator of the United States Agency for International Development; US AGENCY FOR INTERNATIONAL DEVELOPMENT; U.S. DEPARTMENT OF DEFENSE; PETE HEGSETH, in their official capacity as Secretary of Defense; U.S. DEPARTMENT OF VETERANS AFFAIRS; DOUGLAS COLLINS, in their official capacity as Secretary of Veterans Affairs; U.S. DEPARTMENT OF COMMERCE; HOWARD LUTNICK, in their official capacity as Secretary of Commerce; NATIONAL AERONAUTICS AND SPACE ADMINISTRATION; JANET PETRO, in their official capacity as Acting Administrator of National Aeronautics and Space Administration; CORPORATION FOR NATIONAL AND COMMUNITY SERVICE; JENNIFER BASTRESS TAHMASEBI, in their official capacity as Interim Head

of the Corporation for National and Community Service; U.S. SOCIAL SECURITY ADMINISTRATION; LELAND DUDEK, in their official capacity as Acting Commissioner of United States Social Security Administration; U.S. SMALL BUSINESS ADMINISTRATION; KELLY LOEFFLER, in their official capacity as Acting Administrator of U.S. Small Business Administration,

Defendants-Appellants.

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STATEMENT OF INTEREST PURSUANT TO FED. R. APP. P. 29[1]

Dr. Arati Prabhakar is an American engineer and scientist who has been a public official and businessperson. From October 3, 2022 to January 20, 2025, she served as the Science and Technology Advisor to the President and the Director of the White House Office of Science and Technology Policy, which under President Biden was elevated to a Cabinet-level position. From 1993 to 1997, Dr. Prabhakar served as the Director of the National Institute of Standards and Technology ("NIST"). Dr. Prabhakar served as the Director of the Defense Advanced Research Projects Agency ("DARPA") from 2012 to 2017. In addition, Dr. Prabhakar worked in the private sector as a company executive and a venture capitalist from 1997 to 2011.

These roles have given her the opportunity to contribute to many different facets of American innovation, from funding scientific research to commercializing new technologies and building companies. She led the federal funding of scientific research that enabled new electronics for both military and commercial purposes, and that enabled new diagnostic instrumentation that has accelerated medicine. As

[1] No party or party's counsel has authored this brief, in whole or in part, or contributed financial support intended to fund the preparation or submission of this brief. No person or organization contributed financial support intended to fund the preparation or submission of this brief besides amicus curiae, Dr. Arati Prabhakar, or her counsel.

well, she has hands-on private sector experience working with technologists and entrepreneurs who were educated on federal research funds to use research results from federally funded projects to develop new products and companies. She therefore has an interest in seeing the continuation of federal funding for scientific research, which makes American technological advancement possible and which is now in question.

SUMMARY OF THE ARGUMENT

The government has a congressionally-directed responsibility to invest in research and development that supports public missions like national security, the health of Americans, and the nation's competitiveness on the global stage.[2] The government agencies charged with ensuring American scientific leadership and the private sector companies that build on foundational research to bring innovations like anticancer drugs and semiconductors to market and achieve that leadership depend on this federal funding to achieve their missions.[3]

But just one week after President Trump's inauguration, the Office of Management and Budget issued a memorandum ("OMB Directive") despite mandates to federal agencies to fund this critical and important research.[4] Specifically, that memorandum directed all federal agencies to "temporarily pause" billions of dollars in federal funding pending a review of that funding's alignment

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[2] *See OSTP Director Arati Prabhakar on a Pivotal Moment: Science and Technology for America's Future*, White House (Jan. 13, 2025), https://bidenwhitehouse.archives.gov/ostp/news-updates/2025/01/13/ostp-director-arati-prabhakar-on-a-pivotal-moment-science-and-technology-for-americas-future/ ("*Pivotal Moment*").

[3] *Id.*

[4] Off. of Mgmt. & Budget, Exec. Off. of the President, OMB Memorandum M-25-13, *Temporary Pause of Agency Grant, Loan, and Other Financial Assistance Programs* (Jan. 27, 2025), https://s3.documentcloud.org/documents/25506186/m-25-13-temporary-pause-to-review-agency-grant-loan-and-other-financial-assistance-programs.pdf.

with the Administration's policy preferences.[5] Those agencies subsequently complied, indefinitely suspending all payments on a sweeping range of government programs, including programs widely regarded as the crown jewels of American leadership in the sciences.[6] If allowed to go into effect, the OMB Directive and subsequent agency freezes will have staggering impacts on the nation's capacity for innovation—both immediately and in the long term.

Congress has directed multiple agencies to fund scientific research grants that enable innovation for the health, security, and prosperity of Americans.[7] Congress's appropriation of monies for long-term scientific research recognizes that the development of innovative technologies is not always linear or predictable, and it requires long-term public investment, as was the case with artificial intelligence, pharmaceuticals, aerospace, communications, and computing.[8]

Further, the OMB Directive is just one of several ways in which the Administration has cut funding or support for the sciences. As of June 2025, Grant Watch identified "more than 2,482 terminated NIH grants worth $8.7 billion and

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[5] *Id.*

[6] *See, e.g.*, Declaration of Jeni Kitchell, Ex. A, *New York v. Trump*, No. 1:25-cv-00039-JJM-PAS (D.R.I. Jan. 28, 2025), Dkt. No. 68-34 (NSF pausing "all payments under active awards" to comply with the OMB Directive).

[7] *See Pivotal Moment*.

[8] *See id.*

1,669 terminated National Science Foundation grants worth $1.5 billion."[9] These include cancer research grants (465 grants, totaling $1,087,114,107); HIV-related grants (349 grants, totaling $1,950,341,056); Alzheimer's disease grants (195 grants, totaling $410,049,134); and vaccine-related grants (173 grants, totaling $1,260,441,329).[10]

Beyond the institutions directly affected by the cuts in the short-term, these collective cuts—together with the OMB Directive's funding freeze—will significantly harm American citizens in the long-term due to the loss of American capacity to develop cutting-edge technology, American job opportunities, and future American prosperity and health. The cuts also underscore the lingering threat that, without this Court's protection, another freeze could categorically halt research funding.

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[9] Rachel Nuwer, *U.S. Budget Cuts Are Robbing Early-Career Scientists of Their Future*, Sci. Am. (July 3, 2025), https://www.scientificamerican.com/article/how-trumps-federal-funding-cuts-are-hurting-early-career-researchers-and/ ("*Budget Cuts*").

[10] *See NIH Grant Terminations in 2025*, Grant Watch, https://grant-watch.us/nih-data.html (last visited July 12, 2025).

ARGUMENT

I. The OMB Directive and Funding Freezes Significantly Harm American Innovation

The OMB Directive and funding freezes have already had, and will continue to have, a devastating effect on the efforts of the agencies that administer Congressional funding and the researchers who leverage that funding to support the nation's health, security, and economy. Americans will feel the effects of these harms for years to come: the OMB Directive and freezes have created lasting damage to America's status as a leader in scientific innovation, resulting in a weakened pipeline of scientists and engineers that will deprive Americans of future scientific advancements. They ignore the benefits of stable, long-term research funding and threaten to deprive the nation of future fruits of today's pursuits. Additional efforts to cut billions of dollars in congressionally authorized scientific research funding will only further amplify the harms imposed by the OMB Directive and subsequent freezes.

A. The Harm to Federal Agencies and Institutions That Conduct Scientific Research and Drive Innovation

The OMB Directive threatens federal agencies that power American innovation, including the National Institutes of Health ("NIH"), the National Science Foundation ("NSF"), the Centers for Disease Control and Prevention ("CDC"), the National Oceanic and Atmospheric Administration ("NOAA"), and the National Aeronautics and Space Administration ("NASA"). Congress created

these agencies to work on fundamental and foundational research that spurs the development of products, services, and companies that in turn allow America to lead economically, to compete globally, and to create American jobs;[11] lead to new advances in life-saving medical treatments;[12] produce critical safety information such as weather forecasts;[13] and secure America's defense with military technology and capabilities.[14] In addition, freezing funds disbursed by these agencies threatens innovation at public and private institutions that rely on federal funding to drive "advances in artificial intelligence, quantum computing, engineering

[11] *See, e.g.*, National Aeronautics and Space Act of 1958, Pub. L. No. 85-568, §§ 102(b)–(c), 103(1), 72 Stat. 426, 426–27 (1958) (establishing NASA to conduct "research into, and the solution of, problems of flight within and outside the earth's atmosphere").

[12] *See, e.g.*, 42 U.S.C. § 282(b) (authorizing NIH to assemble "information to better evaluate scientific opportunity, public health burdens, and progress in reducing health disparities"); 42 U.S.C. § 242c(b)(1) (authorizing CDC to "improve public health domestically and globally").

[13] *See, e.g.*, Reorganization Plan No. 4 of 1970, 35 C.F.R. 15,627 (1970) (establishing NOAA); President Richard Nixon, Message from the President of the United States Relative to Reorganization Plans Nos. 3 and 4 of 1970, H.R. Doc. 91-366, at 6 (1970) (noting establishment of NOAA "for better protection of life and property from natural hazards").

[14] *See, e.g.*, National Science Foundation Act of 1950, Pub. L. No. 81-507, § 3(a), 64 Stat. 149, 149–50 (1950) (authorizing NSF to provide grants for, "initiate and support specific scientific research activities in connection with matters relating to the national defense").

innovations, biological science and nanotechnology," as well as "support early-stage research that often leads to major scientific breakthroughs."[15]

These harms have already begun to materialize in the instant case. For example, the University of California received $3.84 billion in federal research awards in fiscal year 2023 including from NSF and NIH;[16] the University of Washington received over 3,500 active federal direct and passthrough awards, with an "economic impact from all forms of sponsored research activities exceeds $2.6 billion, supporting and sustaining 10,641 statewide jobs and generating more than $93 million in Washington state and local tax revenue";[17] and the University of Wisconsin-Madison received $129.7 million in fiscal year 2023 from NSF that "supports basic and applied research across all scientific and engineering disciplines."[18] The OMB Directive puts this funding in jeopardy. Without the

[15] *See* Declaration of Dorota Grejner-Brzezinska at 5, *New York v. Trump*, No. 1:25-cv-00039-JJM-PAS (D.R.I. Jan. 28, 2025), Dkt. No. 68-120.

[16] Suppl. App. 57; *see also* Declaration of Sally Morton at 2, *New York v. Trump*, No. 1:25-cv-00039-JJM-PAS (D.R.I. Jan. 28, 2025), Dkt. No. 68-21 (noting that in fiscal year 2023, Arizona State University "expended $510 million received from federal agencies," including NASA and NSF, "to conduct research work under approved grant agreements").

[17] Declaration of Sarah Norris Hall at 2, *New York v. Trump*, No. 1:25-cv-00039-JJM-PAS (D.R.I. Jan. 28, 2025), Dkt. No. 68-112.

[18] Declaration of Dorota Grejner-Brzezinska at 2, 5, *New York v. Trump*, No. 1:25-cv-00039-JJM-PAS (D.R.I. Jan. 28, 2025), Dkt. No. 68-120.

preliminary injunction currently in place to ward off uncertainty around the future of such funding, these and other similarly situated universities would have to fear that funding for their projects—and therefore the projects themselves—could grind to a halt at a moment's notice. Indeed, the OMB Directive and freezes "could have an existential effect on higher education in California and across the country" and prevent institutions that rely on federal funding from carrying out "critical missions, including research and development that supports critical government interests, such as health and safety and national security."[19]

The loss and abandonment of existing experiments and the chilling of future research will lead to a slowdown in innovation. Losing out on these research advances will also result in significant lost economic activity; past experience has proven that even research without obvious commercial application today can have a powerful effect in the future. For example, NIH-funded research is frequently the starting point for new drugs. In fact, NIH funding contributed to research for over 99 percent of the 356 new drugs approved by the U.S. Food and Drug Administration between 2010 and 2019.[20] But it takes on average between 17 and

[19] Declaration of Jeni Kitchell at 4–5, *New York v. Trump*, No. 1:25-cv-00039-JJM-PAS (D.R.I. Jan. 28, 2025), Dkt. No. 68-34.

[20] Ekaterina Galkina Cleary et al., *Comparison of Research Spending on New Drug Approvals by the National Institutes of Health vs the Pharmaceutical Industry,*

24 years between the original investment and the first application to the FDA for approval of a new drug before the downstream effects on nationwide health and economic prosperity start showing.[21] Thus, unilateral funding freezes affecting NIH research today will result in the loss of new-disease treatments years and even decades into the future.

These harms are made all the more likely by the Administration's broader cuts to investment in scientific research. Separate reductions at NIH have caused a widespread halt in biomedical research across the U.S., with labs unable to access existing grant money or apply for new awards.[22] Peer-review panels are suspended, experiments are paused midstream, and many research teams have been forced to furlough or lay off staff, jeopardizing years of work.[23] The terminations

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2010-2019, JAMA Health F. (Apr. 28, 2023), https://jamanetwork.com/journals/jama-health-forum/fullarticle/2804378.

[21] *See* Andrew A. Toole, *The Impact of Public Basic Research on Industrial Innovation: Evidence from the Pharmaceutical Industry*, 41 Res. Policy 1, 9 (2012) ("*Impact of Public Basic Research*").

[22] *See NIH Grant Terminations in 2025*, Grant Watch, https://grant-watch.us/nih-data.html (last visited July 12, 2025).

[23] *See* Jane Smith-Rogers, *The Damage to Federal Medical Research Is Already Done*, Wired (Jan. 31, 2025), https://www.wired.com/story/life-saving-research-risks-being-destroyed-by-the-federal-funding-freeze/; *see also* Letter from Am. Fed'n of Gov't Emps., Loc. 3403, AFL-CIO, to Rep. Zoe Lofgren (July 21, 2025), https://democrats-science.house.gov/imo/media/doc/AFGE_Local_3403_NSF_Letter_to_RM_Lofgren_REDACTED_Redacted.pdf.

disrupted clinical trials, emptied freezer stocks of biospecimens, and left scientists scrambling for alternative funding, forcing some to scrap projects or abandon them entirely.[24] More broadly, about 2,000 grants in the vaccine-related, HIV-related, cancer, and Alzheimer's research fields amounting to about $2 billion in NIH funding have been targeted for termination.[25] And the resulting funding deficit relative to past years has grown—from $2.3 billion at the end of April to at least $4.7 billion by mid-June—and will continue to grow.[26] Compared to average funding levels during the same months of the last nine years, this reflects a 29 percent drop in average funding levels.[27]

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[24] *See* Annie Waldman et al., *Shattered Science: The Research Lost as Trump Targets NIH Funding*, ProPublica (June 12, 2025), https://projects.propublica.org/nih-cuts-research-lost-trump/; Patrick Boyle, *What's at Stake When Clinical Trials Research Gets Cut*, AAMC (Apr. 24, 2025), https://www.aamc.org/news/whats-stake-when-clinical-trials-research-gets-cut; Darya Minovi et al., *Science and Democracy Under Siege,* Union of Concerned Scientists (July 21, 2025), https://www.ucs.org/resources/science-and-democracy-under-siege.

[25] *See NIH Grant Terminations in 2025*, Grant Watch, https://grant-watch.us/nih-data.html (last visited July 12, 2025).

[26] *See* Megan Molteni & J. Emory Parker, *Despite Resumption of NIH Grant Reviews, Research Funding Gap Grew*, STAT News, (June 27, 2025) https://www.statnews.com/2025/06/27/despite-resumption-of-nih-grant-reviews-research-funding-gap-grew/.

[27] *Id.*

B. The Harm to America's Leadership in Scientific Innovation

The consequences of the OMB Directive and other cuts are already emerging in ways that will have ripple effects for many years. For example, the OMB Directive and other freezes have profoundly impacted STEM education research grants that educate America's workforce to conduct research and development, such as the grants funding the McNair Scholars Program at California State University, Dominguez Hills ("CSUDH").[28] Such education-focused grants are nearly eliminated, cut by 80 percent compared to 2024, across all administrative actions.[29] This will result in a weakened U.S. pipeline of scientists and engineers in every field critical to national security, industrial innovation, and health.

In the wake of the OMB Directive, other funding cuts, and the resulting uncertainty, several universities announced reductions in graduate student

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[28] *See* Declaration of Jeni Kitchell at 7, *New York v. Trump*, No. 1:25-cv-00039-JJM-PAS (D.R.I. Jan. 28, 2025), Dkt. No. 68-34 ("The McNair Scholars at CSUDH . . . are students who are first-generation, low-income students interested in research-based education through the graduate level. . . . These students go on to highly productive careers that support the engine of the economy. . . . The university relies completely on grant funding to support this program.").

[29] Aatish Bhatia et al., *Trump Has Cut Science Funding to Its Lowest Level in Decades*, N.Y. Times: Upshot (May 22, 2025), https://www.nytimes.com/interactive/2025/05/22/upshot/nsf-grants-trump-cuts.html.

admissions into the sciences.[30] The inevitable "brain drain" and resulting generational gap in American scientists and engineers will result in a loss of pipeline talent for American industry and a significant slowdown in U.S. innovation over the coming decade or more.[31] This deprives U.S. institutions of scientific and technical talent, and hence deprives the American people of the benefits of their future work.[32] According to a poll by *Nature*, a leading scientific journal chronicling developments across multiple disciplines, 75% of responding scientists said they considered leaving the United States, and many of them were

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[30] *See, e.g.*, Danielle Gerhard, *US Universities Reduce PhD Admissions in Response to Federal Funding Cuts*, Scientist (Feb. 27, 2025), https://www.the-scientist.com/us-universities-reduce-phd-admissions-in-response-to-federal-funding-cuts-72734; Katherine Knott, *Colleges Restrict Graduate Student Admissions After NIH Proposes Rate Cut*, Inside Higher Ed (Feb. 25, 2025), https://www.insidehighered.com/news/government/science-research-policy/2025/02/25/facing-nih-cuts-colleges-restrict-grad-student.

[31] *See, e.g.*, Nina Lakhani, *Scientists Warn US Will Lose a Generation of Talent Because of Trump Cuts*, Guardian (July 3, 2025), https://www.theguardian.com/us-news/2025/jul/03/national-science-foundation-trump-cuts ("A generation of scientific talent is at the brink of being lost to overseas competitors by the Trump administration's dismantling of the National Science Foundation (NSF), with unprecedented political interference at the agency jeopardizing the future of US industries and economic growth . . . .").

[32] *See Budget Cuts*.

already looking for jobs in Europe and Canada.[33] And Europe and Canada have launched programs to attract impacted American researchers.[34]

These consequences endanger longstanding bipartisan priorities, including those identified by the current Administration. The Trump Administration has declared it a goal "to blaze a trail to the next frontiers of science[,] . . . cement America's global technological leadership and usher in the Golden Age of American Innovation . . . to make America greater than ever before."[35] These goals are being undermined, not advanced, by the continuation of the OMB Directive and other cuts.

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[33] Alexandra Witze, *75% of US Scientists Who Answered Nature Poll Consider Leaving*, Nature (Mar. 27, 2025), https://www.nature.com/articles/d41586-025-00938-y.

[34] *See, e.g.*, Noemie Bisserbe & Nidhi Subbaraman, *Europe Is Recruiting Academics Disenchanted with America*, Wall St. J. (June 28, 2025), https://www.wsj.com/world/europe/europe-is-recruiting-academics-disenchanted-with-america-c4bae422; Catherine Porter & Roger Cohen, *Europe Makes a Pitch to Attract Scientists Shunned by the U.S.*, N.Y. Times (May 5, 2025), https://www.nytimes.com/2025/05/05/world/europe/eu-us-scientists-trump.html; *Queen's Special U.S. Doctoral Recruitment Initiative*, Queen's Univ., https://www.queensu.ca/grad-postdoc/graduate-studies/international-students/queens-special-us-doctoral-recruitment-initiative (last visited July 24, 2025).

[35] *ICYMI: President Trump Outlines OSTP's Goals and Priorities*, White House (Mar. 27, 2025), https://www.whitehouse.gov/articles/2025/03/icymi-president-trump-outlines-ostps-goals-and-priorities/.

II. Congress's Authorization for Stable Long-Term Federal Funding of Scientific Research Underpins America's Leadership in Innovation

Stable, long-term funding is particularly important for research that lays the foundation for transformative advances. Such research often spans multiple sectors and disciplines, years ahead of any product, and goes on to support investments and discoveries across the American economy.[36] Examples of NSF-funded innovations that took years or decades to mature include:[37]

> **MRIs.** "MRI technology is built upon decades of NSF-funded research in nuclear magnetic resonance, electromagnetics, biophysics, biochemistry and computer engineering that began in the 1950s." *MRI: Imagine Living Tissue*, U.S. Nat'l Sci. Found., https://www.nsf.gov/impacts/mri (last visited July 24, 2025).
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> **Artificial Intelligence.** "Since the 1960s, [NSF] has funded research breakthroughs in artificial intelligence that built the foundation for technologies Americans use every day, such as digital assistants like Alexa and Siri, Face ID, image generators and chatbots like ChatGPT." *Building the Foundations of Artificial Intelligence*, U.S. Nat'l Sci. Found., https://www.nsf.gov/impacts/ai (last visited July 24, 2025).
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> **Semiconductors.** In the 1950s, NSF began supporting research that "lay[] the foundation for a semiconductor manufacturing revolution," and it continued funding researchers for decades, leading to the invention of, among other things "the 3D fin field-effect transistor (FinFET), now a key component in advanced microchips." *Semiconductors: Powering the Modern World*, U.S. Nat'l Sci. Found.,

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[36] *See Pivotal Moment* ("Federally funded research is what all these industries draw on for their product development."); *see also generally* Toole, *Impact of Public Basic Research*.

[37] *See NSF Impacts*, U.S. Nat'l Sci. Found., https://www.nsf.gov/impacts (last visited July 24, 2025).

> https://www.nsf.gov/impacts/semiconductors (last visited July 24, 2025).
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> **CRISPR and Gene Editing.** Although CRISPR was first discovered in 1987, CRISPR only "took the scientific world by storm" over two decades later, when "a research team that included a recipient of the [NSF]'s prestigious Alan T. Waterman Award" discovered how to leverage the technology to create one of "the world's most powerful gene-editing tools." *CRISPR: A Biotech Breakthrough*, U.S. Nat'l Sci. Found., https://www.nsf.gov/impacts/crispr (last visited July 24, 2025).

This work in turn supports foundational, bipartisan goals such as national security, economic prosperity, and medical progress.

The loss of continued, stable support for American sciences would further be devastating to our global economic competitiveness. The innovation and dynamism of American businesses rely on government-supported foundational research to create cutting-edge technologies like the ones identified above. But businesses do not fund a sufficient base of fundamental research on their own due to the scale, uncertain returns, and extended timelines involved.[38] Instead, multi-pronged, system-level government efforts that involve dedicated research funding are necessary to tackle the most pressing problems our nation faces, such as maintaining economic competitiveness and national security during tremendous

[38] Commerce Dems, *Roundtable Discussion on Importance of Federal Investment in Science*, at 12:54–13:15 (YouTube, May 20, 2025), https://www.youtube.com/watch?v=e7rwdTnYSkw.

geopolitical change, and improving the health of Americans.[39] Neither philanthropy nor the private sector is likely to take up that mantle.[40] Even if entities in the private sector were financially capable of shouldering the cost of foundational scientific research, they lack the broad expertise in public missions, coordinated vision, and economies of scale to realize it on their own.

Any response that federal money preempts private investment—so as to fill the gap left following a government retreat from the sector—is incorrect. Such an argument misunderstands the complementarity between private and public investment that makes American science and innovation work. In fact, federal funding for scientific research expands the opportunity for private sector investment[41] because innovative American technologies and companies build on

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[39] *See Pivotal Moment* ("doing the research with clinical trials to make it possible to prevent cervical cancers with tests simple enough to do at home" and "developing and validating new ways to make it easier and easier to detect cancer early, through blood or even saliva tests," as part of coordinated federal initiative to combat cancer); Berkeley School of Information, *The Stakes Are High: Science & Technology for Our Future — Dr. Arati Prabhakar*, at 19:55–22:22 (YouTube, June 9, 2025), https://www.youtube.com/watch?v=U7ENnHAVKpI (same).

[40] Commerce Dems, *Roundtable Discussion on Importance of Federal Investment in Science*, at 14:10–14:17 (YouTube, May 20, 2025), https://www.youtube.com/watch?v=e7rwdTnYSkw.

[41] *See, e.g.*, Andrew A. Toole, *Does Public Scientific Research Complement Private Investment in Research and Development in the Pharmaceutical Industry?*, 50 J.L. & Econ. 81, 95 (2007) (finding "public basic research is complementary to private pharmaceutical R&D investment and thereby stimulates additional private investment").

knowledge and talent pipelines first developed using congressionally-appropriated funding.[42]

Lastly, even if funding were to resume in full and without restriction tomorrow, the lingering uncertainty created by the prospect of another freeze would continue to chill investment, risking the consequences laid out above.

III. Stable, Reliable Investment in Scientific Research Is a Matter of Congressional Policy

The OMB Directive and freezes cut directly against decades of broadly shared, bipartisan congressional commitments to government funding of, and partnership with, science and technology.

The CHIPS and Science Act of 2022—which passed both houses of Congress with bipartisan support—built on the earlier and similarly bipartisan United States Innovation and Competition Act of 2021 ("USICA"), which was proposed by Democratic Senator Chuck Schumer and Republican Senator Todd Young. Like the later CHIPS and Science Act, the proposed USICA stated Congress's recognition that "[f]ederal agencies have carried out vital work supporting basic and applied research to create knowledge that is a key driver of

[42] *See Pivotal Moment* (emphasizing that federal R&D "started so many of our innovative industries: aerospace, pharmaceuticals, semiconductors, communications and computing, and now AI and renewable energy, with more to come").

the economy of the United States and a critical component of national security," "increasing research and technology transfer investments . . . will enhance the competitive advantage and leadership of the United States in the global economy," and "authorization and funding for investments in research, education, technology transfer, intellectual property, manufacturing, and other core strengths of the United States innovation ecosystem, including at the National Science Foundation and the Department of Energy, should be done on a bipartisan basis." S. 1260, 117th Cong. § 3 (2021); *see also* CHIPS and Science Act of 2022, Pub. L. No. 117-167, § 10301(1), 136 Stat. 1366, 1506 (2022).

In the CHIPS and Science Act, Congress also reaffirmed its commitment to "maintaining the Nation's scientific and economic leadership" by recognizing that "investments into State research" by NSF's Established Program to Stimulate Competitive Research "should be sustained." 42 U.S.C. § 19014(a)(1)(A).

One of the clearest testaments to Congress's unified stance on the importance of funding scientific research is the 21st Century Cures Act of 2016, which passed nearly unanimously in both the House (392-26)[43] and Senate (94-

[43] *Roll Call 592 | Bill Number: H. R. 34*, U.S. House of Representatives: Clerk, https://clerk.house.gov/Votes/2016592 (last visited July 24, 2025).

5).[44] The 21st Century Cures Act authorized for appropriation a decade's worth of funding for NIH to, among other things, pursue "research that has the potential to transform the scientific field" and "has inherently higher risk," the exact sort of research that could pay dividends by improving the nation's health, economic superiority, and security. *See* 21st Century Cures Act, Pub. L. No. 114-255 § 1001, 130 Stat. 1033, 1039–41 (2016).

This commitment is nothing new. Congress has repeatedly supported robust, long-term funding of scientific research,[45] reauthorized and made appropriations to the agencies responsible for the administration of such funding,[46] and spoken about the importance of continuing such funding to benefit the American people:

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[44] *Roll Call Vote 114th Congress - 2nd Session*, U.S. Senate, https://www.senate.gov/legislative/LIS/roll_call_votes/vote1142/vote_114_2_00157.htm (last visited July 24, 2025).

[45] *See, e.g.*, 42 U.S.C. § 1862s (2017) (American Innovation and Competitiveness Act, introduced by Republican Senator Cory Gardner and Democratic Senator Gary Peters, stating "[i]t is the sense of Congress that . . . sustained, predictable Federal funding of basic research is essential to United States leadership in science and technology"); *see also* 42 U.S.C. § 6603(a) (America COMPETES Act, enacted in 2007, stating Congress's intent that "each Federal research agency should strive to support and promote innovation in the United States through high-risk, high-reward basic research projects").

[46] *See, e.g.*, 42 U.S.C. § 282a (authorizing funds for appropriation to NIH); America COMPETES Reauthorization Act of 2010, Pub. L. No. 111-358, § 503, 124 Stat. 3982, 4005 (2011) (authorizing funds for appropriation to NSF); Further Consolidated Appropriations Act, 2024, Pub. L. No. 118-47, 138 Stat. 460, 653–56 (2024) (appropriating funds to CDC); 15 U.S.C. § 8519 (authorizing funds for appropriation to the Office of Oceanic Atmospheric Research within NOAA);

Rep. Brian Babin (R-TX), Chairman, House Committee on Science, Space, and Technology: "Federally funded research is the foundation on which major technological innovations are built . . . . It is critical for maintaining a healthy baseline over generations by supporting fundamental basic research, infrastructure, and facilities; creating new research disciplines; and training generations of scientists and engineers. . . . America's economic strength, national security, and quality of life all fundamentally depend on ongoing scientific progress and the strength of our S&T enterprise. While the United States continues to lead in the innovation race, we face fierce global competition." *The State of U.S. Science and Technology: Ensuring U.S. Global Leadership: Hearing Before the H. Comm. on Sci., Space, & Tech.*, 119th Cong. (Feb. 5, 2025)[47];

Rep. Zoe Lofgren (D-CA), Ranking Member, House Committee on Science, Space, and Technology: "For many decades there has been bipartisan consensus that the federal role in basic research is essential. That we cannot pull back, and that basic research funding needs to continue if we are [to] take the lead in science in the world." *Id.*[48];

Rep. Jay Obernolte (R-CA), Chairman, House Subcommittee on Research and Technology: "[W]e must invest in the fundamental research and development (R&D) that will drive the innovations of tomorrow. . . . Federal investments can be a force multiplier that reinvigorates our biotechnology research ecosystem and guarantees U.S. leadership for decades to come." *Pursuing the Golden Age of Innovation: Strategic Priorities in*

National Aeronautics and Space Administration Transition Authorization Act of 2017, Pub. L. No. 115-10, § 101, 131 Stat. 18, 20–21 (2017) (authorizing funds for appropriation to NASA).

[47] https://science.house.gov/2025/2/opening-statement-of-chairman-brian-babin-at-full-committee-hearing-the-state-of-u-s-science-and-technology-ensuring-u-s-global-leadership

[48] https://democrats-science.house.gov/imo/media/doc/2.5.25%20RM%20Lofgren%20OS%20State%20of%20Science.pdf

Biotechnology, Joint Hearing Before the H. Subcomm. on Rsch. & Techn. & H. Subcomm. on Energy, 119th Cong. (June 5, 2025)[49];

Sen. Cory Gardner (R-CO): "Unless we dedicate more support to our Nation's research and development enterprise, we will lose out to competitors like China, who are quickly working to displace the United States as the world's greatest innovator." *One Year Later: The American Innovation and Competitiveness Act: Hearing Before the S. Comm. on Com., Sci., & Transp.*, S. Hrg. 115-654, at 2 (Jan. 30, 2018);

Sen. Bill Nelson (D-FL): "The public interest, public health and national security are going to depend on advancements in science. . . . The advancement of science has depended on a healthy investment in research by the Federal Government." *Id.* at 3.

These statements, together with Congress's repeated dedication to securing long-term funding for scientific research, underscore Congress's vital role in legislating the nation's long-term scientific research priorities. *See* U.S. Const., art. I, § 9, cl. 7. For more than 80 years, American scientific research has flourished and served the nation thanks to federal funding and the stability and predictability created by the rule of law. The Court should do everything in its power to protect that vital relationship.

CONCLUSION

Amicus curiae urges this Court to affirm the District Court's judgment.

[49] https://science.house.gov/2025/6/opening-statement-of-research-and-technology-subcommittee-chairman-jay-obernolte-at

Dated: July 25, 2025

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CERTIFICATE OF COMPLIANCE

I certify that this brief (1) complies with the type-volume limitation of Federal Rules of Appellate Procedure 29(a)(5) and 32(a)(7)(B) because, excluding the parts of the document exempted by Federal Rule of Appellate Procedure 32(f), it contains 4,714 words; and (2) complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type-style requirements of Federal Rule of Appellate Procedure 32(a)(6). As permitted by Federal Rule of Appellate Procedure 32(g)(1), in preparing this certificate, the undersigned has relied upon the word-count feature of the word-processing system used to prepare this document.

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CERTIFICATE OF SERVICE

I hereby certify that on July 25, 2025, I electronically filed the foregoing document with the Clerk of the Court for the United States Court of Appeals for the First Circuit by using the CM/ECF system. For all participants that are registered CM/ECF users, service will be accomplished by the appellate CM/ECF system. The below non-CM/ECF participants will be served by their preferred method, U.S. Mail.

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