U.S. National Science Foundation
Office of the Director

September 10, 2026

FROM: Brian Stone, Performing the Duties of the Director

TO: The Science and Technology Community

SUBJECT: NSF Leadership in a New Golden Age of Science

The U.S. National Science Foundation (NSF), first envisioned in Vannevar Bush's report *Science: The Endless Frontier*, was created in 1950 to advance the frontiers of knowledge and to sustain the broad foundations of American scientific leadership.

Our core mission has not changed. We are redoubling our commitment to foundational research, which lays the foundation for the next generation of technologies that will strengthen economic competitiveness, enhance national security, and improve quality of life for all Americans.

At the same time, the U.S. science and technology (S&T) enterprise has changed and America has entered a period of extraordinary scientific possibility. New instruments of discovery are enabling new lines of inquiry across every field of science and engineering, and the frontiers of research are advancing in laboratories of every kind, in every part of the country. Industry and philanthropy play a growing role in both basic and applied research. The greatest periods of American scientific progress have depended on institutions capable of recognizing new possibilities, empowering exceptional researchers, and adapting as the practice of science has changed.

NSF is taking decisive action to meet this moment, introducing new and ambitious ideas that capitalize on the changes in the scientific ecosystem to advance our core mission. We are embracing a portfolio approach that delivers the highest return on our investments; strengthening the agency's ability to measure, learn from, and improve how we evaluate and support science; enabling ambitious, multidisciplinary inquiry at the scientific frontiers; harnessing AI to accelerate discovery; and investing in exceptional students and early-career researchers to support as much scientific creativity as possible.

Many of these changes at NSF have already begun. In the coming weeks and months, we will roll out a series of Dear Colleague Letters and announcements that build on these themes. We know none of this succeeds without you, our staff, reviewers, awardees, students, and partners across academia and industry. NSF's role is to create conditions for exceptional science to happen more often and more frequently, and this remains our priority.

Our direction is consistent with the ambitious vision articulated in *Science: A New Golden Age* and the Fiscal Year 2028 OMB-OSTP R&D Budget Priorities Memorandum, the first comprehensive rethinking of the U.S. S&T enterprise since Vannevar Bush's 1945 *Science: The Endless Frontier*. We are proud to take a leading role and work with federal research agencies across the government to continue to push the American scientific frontier.

A Portfolio-Based Approach to Supporting Science

For over 75 years, NSF has supported research and related activities to further its mission to promote the progress of science, including curiosity-driven and use-inspired foundational research, translational efforts, research infrastructure, and STEM talent development. NSF will combine its merit-based approach with an enhanced deliberateness to its portfolio-based grant-making along two dimensions: how the foundation supports its research and related activities, and how it supports different forms of scientific inquiry.

First, funding opportunities are being consolidated, simplified, and purpose-built to more intentionally advance a specific aspect of NSF's mission. Discovery-focused research funding opportunities will advance fundamental understanding within a given directorate's disciplines without the need to address later-stage development. Translational programs will address the barriers between discovery and application, leveraging industry cost-share where appropriate. Infrastructure investments will create capabilities that no individual researcher or institution could build alone and enable more researchers to conduct cutting-edge science. NSF's STEM talent development programs will constitute a dedicated portfolio focused on the challenge of preparing a robust domestic STEM workforce. Talent development funding opportunities may be coordinated with discovery, translation, and infrastructure-focused activities, as appropriate, but will be distinct and goal-oriented efforts. NSF's programs and their funding opportunities will aim to improve delineation and enable researchers and agency staff to focus on specific, well-suited goals as part of a larger, complementary portfolio.

Second, the same principles apply to how NSF supports different forms of scientific inquiry conducted by our communities. Different scientific opportunities require different time horizons, degrees of specification, and funding mechanisms, and may even require new kinds of institutions altogether. To empower NSF-funded researchers and maximize scientific output, NSF will intentionally match the mechanism of support to the nature of the work, considering its research field and modality, its stage, and its risk profile, while making full use of existing authorities and partnerships.

Time Horizons. Some research activities require long-horizon support, which lowers administrative burden and provides investigators with the certainty of support that is needed to pursue ambitious research directions that may not have a clear path to incremental research outputs. NSF will expand funding opportunities that provide exceptional researchers with the ability to request award durations of five years or longer to give sufficient time and autonomy to pursue transformative questions. This flexibility is

built into the over $1.5 billion dollars of core discovery research funding opportunities released on August 17, 2026.

Likewise, true curiosity-driven, blue-sky research is more exploratory and can often be de-risked quickly and inexpensively. Building on existing mechanisms such as EAGER awards for high-risk, high-reward exploratory research and RAPID awards for time-sensitive science, NSF is expanding the use of short-duration grant pathways featuring applications of only a few pages and rapid funding decisions.

Degrees of Specification. NSF's portfolio approach to grantmaking will balance funding opportunities focused on exploration by the scientist ("investigator-driven inquiry") and NSF-directed opportunities in areas of special emphasis or need. Investigator-driven funding opportunities provide researchers with the freedom to pursue bold ideas shaped by their own curiosity, with the goal of advancing scientific progress without regard to practical application or ancillary objectives. NSF-directed opportunities will take many forms, from milestone-based funding tied to demonstrated progress towards defined technical objectives, to prizes and challenges where NSF specifies a goal in advance aligned with national missions and strategic technology priorities. When NSF provides direction, we will specify the objective, never the method scientists must use to achieve it.

There is an opportunity to increase our use of prizes, challenges, and milestone-based support where an ambitious objective can be clearly specified but many paths to achieve it exist or interdisciplinary teams must be formed, and where substantial non-federal participation can be leveraged. In the coming weeks and months, NSF will announce a series of Grand Research Challenges to take thesis-driven bets that stand to unlock new frontiers of S&T.

Funding Mechanisms. The NSF merit review process remains the gold standard of grant-making, but other models exist that may be better suited to identify particular types of meritorious research activities, such as projects that span disciplinary boundaries.[1] NSF will experiment with various proposal review mechanisms, such as providing "Golden Tickets" that empower individual reviewers to champion exceptional proposals that may not survive panel consensus; employing distributed review to reduce administrative burden and speed time to decision; and developing new measures to identify and support novel research.[2] Our goal in this experimentation is to surface high-potential ideas that may be too divisive for committee consensus and to attract higher-quality reviewers by empowering them to exercise independent scientific judgment, while ensuring every funded proposal meets a level of scientific rigor appropriate for Gold Standard Science.

[1] A growing body of literature has studied the efficacy of peer review in identifying risky or unconventional projects. See, for example, Azoulay and Greenblatt (2025). A 2012 study by the National Science Board described the difficulty faced by review panels and program officers in evaluating larger-than-typical unsolicited NSF proposals.
[2] *Science*, "How a novel research paper competition to quantify a concept crowns a winner."

Institutional Models. Universities and investigator-led laboratories remain indispensable to the American S&T ecosystem, but some scientific goals require new forms of institutions that support a mix of full-time interdisciplinary teams, engineering capacity, local and active management, or sustained coordination around a specific technological bottleneck. Our X-Labs initiative that we announced in May 2026 provides one new model for filling this institutional gap through agile, time-bound organizations that pursue a defined scientific or technological objective. We will also expand support for other emerging institutional forms, such as joint university-industry centers and research institutes that drive greater integration of foundational and applied research. These organizations will complement, not replace, the extraordinary strengths of America's universities, industry, and federal laboratories.

Portfolio-based grant-making is ultimately a model for the entire federal R&D enterprise, and NSF intends to be the first agency to demonstrate it at scale. Our unique and indispensable contribution to the overall federal R&D portfolio is foundational research, spanning both curiosity-driven and use-inspired discovery. By pursuing excellence and deliberateness in our part of the national portfolio, and by leveraging partnerships with other agencies, philanthropy, and industry, NSF will deliver maximum return on federal research dollars.

Building a Self-Improving National Science Foundation

Since its inception, NSF has leveraged taxpayer investments to deliver groundbreaking discoveries, cutting-edge infrastructure, and a world-class scientific workforce. Yet, we must continuously adapt and improve the agency to operate with maximal efficiency and impact. NSF's merit review system rightly expects researchers to formulate hypotheses, test them against evidence, and apply a high degree of rigor and self-skepticism. We will apply the same experimental thinking and discipline to the ways we evaluate and support science.

To institutionalize NSF's long-standing commitment to active experimentation, self-skepticism, and continuous operational improvement, we will establish an Office of Metascience (OMS) within the Office of the Director. The OMS will develop and rigorously evaluate new approaches to funding, merit review, program management, and the adoption of emerging tools. It will identify what practices produce better outcomes, scale what works, and discontinue what does not. The OMS will be staffed by metascience experts and data scientists who will build the data infrastructure needed to evaluate outcomes and will work closely with the wider leadership team to ensure its recommendations are rapidly and thoughtfully implemented throughout the agency.

Metascience will improve NSF's ability to understand its portfolio as a whole, tracking measures such as grant turnaround time and identifying gaps, complementarities, unnecessary duplication, and emerging opportunities within NSF and across the nation's S&T enterprise. The OMS will work across directorates to run rigorous experiments, identify

consequential results, and operationalize practical improvements. The OMS will operate with full transparency, publicly reporting the effectiveness of various funding mechanisms and publishing postmortems for both positive and negative results.

The Office of Metascience will work across directorates to run rigorous experiments that advance directorate goals and inform consequential design choices. OMS' experiments will test questions whose findings can inform broader NSF practices and priorities, such as: When do longer awards produce greater scientific ambition? Do rapid, exploratory awards surface valuable ideas that conventional processes miss? Which approaches give early-career researchers the most independence to produce novel, disruptive ideas? NSF will test such questions prospectively, share what is learned, and expand successful approaches across the agency.

Through the OMS, NSF will become a learning, self-improving institution that tries new approaches, measures their effects, admits candidly when they do not work, and scales them when they succeed. NSF intends for the OMS to serve as a model that can be applied to the broader federal research enterprise. These efforts ultimately serve a concrete ambition for NSF to double the scientific productivity and impact generated by each federal research dollar by 2036.

Pioneering at the Scientific Frontiers

Increasingly, the most consequential scientific questions emerge at the intersection of fields, where coordinated action across disciplines can produce transformative outcomes. NSF has a strong tradition of opening up new frontiers: the National Nanotechnology Initiative, launched in 2000, spanned NSF's Directorates for Biological Sciences (BIO), Computer and Information Science and Engineering (CISE), Engineering (ENG), Mathematical and Physical Sciences (MPS), and Social, Behavioral and Economic Sciences (SBE); the Materials Genome Initiative, launched in 2011, worked across CISE, ENG, and MPS; and the BRAIN Initiative, launched in 2013, brought together BIO, CISE, ENG, MPS, and SBE — all to achieve ambitious, multidisciplinary goals. NSF will formalize capacity for multi-directorate coordination by establishing Frontier Initiatives.

Frontier Initiatives will be charged with organizing thesis-driven efforts around major scientific opportunities that can only be reached through cooperation across disciplines and directorates. Each Frontier Initiative Lead will be seated in the Office of the Director and will be responsible for the questions no individual directorate or research community can answer alone: What are the consequential uncertainties shaping this field? What capabilities or enabling technologies would unlock otherwise inaccessible progress? Which connections among disciplines or sectors should be built? And where could focused NSF action produce a transformative scientific outcome?

Frontier Initiative Leads will draw on the expertise from across NSF and the research community to identify how individual areas of science can advance each initiative. They will

model NSF's portfolio-driven approach and make full use of the agency's funding mechanisms and institutional models to accelerate progress, including prizes and challenges. Frontier Initiative portfolios will balance thesis-driven conviction about where breakthroughs will emerge with room for serendipity in recognition of scientific uncertainty. The NSF Office of Metascience will regularly assess whether a Frontier Initiative continues to address a consequential and distinct frontier, and NSF leadership will strengthen, evolve, retire, and/or establish new Frontier Initiatives as the frontier develops.

NSF is announcing the inaugural set of Frontier Initiatives:

1. **Future of Intelligence** will advance our fundamental understanding of intelligence, aimed at breakthroughs in the architectures, hardware, and theories of learning that will define the next paradigm of AI. Just as neuroscience laid the groundwork for neural networks, the next paradigm will likely come from outside computer science and draw deliberately on physics, mathematics, biology, neuroscience, and engineering.

2. **Frontier of Quantum Phenomena** will advance foundational research in quantum information science and technology, building the physical understanding, materials, and theory needed to compute, sense, and communicate in ways that exceed the capabilities of classical systems. This initiative will also support the engineering and instrumentation breakthroughs required to realize the application of quantum to other frontiers.

3. **Advanced Materials and Matter** will advance the design, discovery, and manipulation of the materials that underpin nearly every other frontier, including quantum and computing, semiconductors, robotics, fusion, and biomanufacturing. This initiative will also advance early-stage research on advanced manufacturing methods that accelerate and close the loop between discovery, synthesis, and characterization.

4. **Foundations of Biological Design** will advance the broad measurement and intervention tools to read, write, and reliably control living systems in the physical world. A small number of such tools (e.g., gene editing, low-cost synthesis and sequencing, advanced microscopy) have driven much of modern biology, and the next generation of tools will also draw deliberately on engineering, mathematics, chemistry, and materials science.

Accelerating AI-Enabled Scientific Discovery

AI capabilities will transform the questions researchers can answer and the practice of science itself. As the cost to generate hypotheses, analyze evidence, and search large spaces of potential solutions falls, discovery will increasingly depend on whether researchers can connect AI tools to high-quality data, advanced compute, scientific

instrumentation, experimental facilities, and reliable verification methods. Realizing the promise of AI for science requires preparing the scientific enterprise to work differently, and NSF intends to lead the way.

NSF has a unique role in this transformation. The agency reaches across nearly every field of science and engineering and supports researchers at every career stage and in every kind of institution. NSF will use that reach to make AI a broadly available instrument of discovery, connecting researchers to the AI models, compute, datasets, software expertise, cloud labs, and infrastructure needed to apply these capabilities across every domain of the scientific enterprise.

Nowhere is NSF's role more important than in the Genesis Mission, a national effort to harness AI for scientific discovery and apply it to the most pressing national S&T challenges. Scientific advances previously thought impossible are now within reach, but only if the nation's research community lends its expertise, data, and effort to a coordinated national mission.

NSF is putting its trusted relationships across the scientific enterprise behind Genesis Mission coordination. The agency has issued a Dear Colleague Letter and incorporated language into core discovery funding opportunities encouraging proposals that leverage AI and other emerging technologies, where scientifically justified, to make new modes, methods, and scales of science possible. In parallel, NSF has also announced a series of investments in AI-accelerated discovery, including support for AI-ready datasets, next-generation scientific data infrastructure, and a new national network of programmable cloud laboratories.

NSF, both directly and through its grantees, is pursuing new and stronger partnerships with industry, which houses frontier general-purpose AI tools and increasingly performs its own foundational research using the largest and most capable AI models, computing systems, and engineering teams. Partnerships with the private sector and others who fund and perform R&D across our nation's S&T enterprise enable new science and accelerates the adoption of transformative capabilities across the research community.

Scientific discovery is constrained by the physical world, as new hypotheses must be tested, molecules synthesized, and materials fabricated. Supporting the scientific instrumentation and research infrastructure that closes the loop between reasoning and experimentation has long been part of NSF's mandate. The agency will extend that tradition to the AI era, investing in increasingly autonomous, high-throughput experimentation through programmable cloud laboratories and self-driving laboratories, and expanding access to compute, data, and AI for science training through the National AI Research Resource (NAIRR) and a set of State and Regional AI Infrastructure Hubs that the NAIRR will federate together. Researchers across the nation will move from hypothesis to design and experimentation at a speed and scale never before possible.

Investing in Exceptional American Talent

NSF's fellowships have launched many of the nation's most distinguished scientific careers, and cultivating a domestic STEM talent pipeline is a core part of NSF's mission. NSF will continue this tradition of excellence to identify, train, and empower the latent scientific and technical talent across our nation.

NSF will therefore renew its talent development around a clear objective: to open pathways for all Americans with technical aptitude and interest to translate their potential into STEM careers and, in particular, to make advanced STEM training and research a compelling choice for the best and brightest Americans. The agency will find and support talented individuals across the country and equip them with scientific and technical fundamentals through sustained hands-on experience. NSF programs will bring individuals into contact with the scientific frontier as early as possible and grant them independence while their research creativity is at its peak.

The growing integration between basic research and manufacturing R&D calls for federal investments that pair foundational research in the physical sciences and engineering with translational efforts including in advanced manufacturing, rebuilding domestic manufacturing capacity and laying the groundwork for an industrial renaissance. Where appropriate, NSF will co-locate, sequence, or jointly award workforce and education investments alongside federal R&D funding so that sector-specific R&D in a region's expertise is matched by the skilled technical workforce it needs. Through such place-based strategies, NSF will extend the benefits of federal science to American communities, enable partnerships across sectors, and facilitate complementary investments in a region.

Education and workforce development are by nature multi-stakeholder endeavors, and federal investment goes furthest when joined by committed partners. Across its talent programs, NSF will integrate academia, industry, philanthropy, and state and local governments to attract stronger applicants and deliver more impactful outcomes. Non-federal partners will provide co-funding, paid internship placements, access to research infrastructure, curriculum development, and expert mentorship, exposing students to technical environments across the nation's S&T ecosystem and aligning skills development with a region's future workforce opportunities.

Exceptional Students and Early-Career Talent. NSF education and workforce development programs will identify and support exceptional STEM talent nationwide through merit-based criteria anchored in demonstrated technical ability and other measures predictive of scientific success. These programs will engage in early talent identification and intensive enrichment to accelerate students with exceptional potential at every stage, including K-12, undergraduate, graduate, and continuing education.

NSF will likewise strengthen support and autonomy for early-career researchers, whose research creativity is high, but who also face the most acute constraints on inquiry. On

August 25, NSF renewed the Graduate Research Fellowship Program, which provides portable, sustained support for America's most talented graduate STEM students and gives them the freedom to choose the research questions, mentors, institutions, and environments in which they can do their most ambitious work.

Hands-On Technical Training. NSF will increase early and sustained exposure to real-world technical environments across academia, industry, and federal laboratories, giving students meaningful access to advanced instrumentation and datasets that enable frontier discovery. NSF will also expand makerspace access, machine shop classes, and other vocational training to develop a generation of experts and technicians skilled in advanced manufacturing R&D and laboratory techniques, skills that accelerate discovery and translate it into domestic manufacturing capacity and stronger regional industries. NSF will explore extending mechanisms such as Research Experiences for Undergraduates (REUs), Research Experiences for Teachers (RETs), and Non-Academic Research Internships for Graduate Students (INTERN), which already provide students and teachers with non-academic research experiences across a range of settings, to allow for further hands-on technical training across federal laboratories and industry.

Research is often bottlenecked by the number of people who have the ability to operate, maintain, troubleshoot, and improve sophisticated instrumentation. NSF will establish programs that give students substantial time on real equipment, including cleanrooms, cryogenic systems, advanced microscopes, autonomous laboratories, high-performance computing facilities, and robotics testbeds, sensors, and fabrication facilities, and will pair these programs with portable, industry-recognized credentials. Facilities across the nation's S&T ecosystem will gain a stronger pipeline of technical staff who will build the tacit, process knowledge that enables scientific discovery and technological innovation on sophisticated technical equipment.

Cross-Sector Pathways. NSF will enable the nation's top scientific talent to gain experience across research cultures and scientific environments throughout their education and career. Such mobility strengthens the scientist and provides exposure to the many ways they can leverage their training to support the nation's S&T enterprise. The agency is developing new programs to provide joint placements across industry, academia, and federal laboratories, as well as alternative paths for skilled technical workers to participate in academic training and scientific discovery. On July 29, NSF launched a $47 million pilot for four-year industry Ph.D.s, co-funded by three dozen universities and industry partners, that will support more than 250 doctoral students nationwide. The pilot will enable American students to earn a Ph.D. in a compressed timeframe while gaining hands-on experience in industry R&D as part of their graduate education.

The priorities and actions described here represent only the beginning of NSF's work to usher in a New Golden Age of American Science. In the months and years ahead, we will act with creativity and strategic focus to respond to the changes in the U.S. S&T enterprise and how frontier science is conducted today. I am confident we will rise to meet this moment

with the pioneering spirit, rigor, and sense of mission that have long defined both the agency and America's researchers. With your support and participation, NSF will continue to drive the scientific discoveries that underpin technological innovation, strengthen U.S. economic competitiveness and national security, and improve quality of life for all Americans for generations to come.