

MAJOR INVESTMENTS IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM) GRADUATE STUDENTS AND GRADUATE EDUCATION

Overview

Maintaining U.S. preeminence in STEM will require that the U.S. continue to produce a workforce that includes a significant number of individuals with graduate-level preparation in STEM. The need for highly trained experts spans a broad range of disciplines, including high-priority fields such as cybersecurity, artificial intelligence, and microelectronics. Ensuring the Nation's ability to sustainably prepare STEM talent, in all disciplines and from all geographical locations across America, will require recruitment and retention of outstanding STEM teachers at all academic levels, including the professors and academic researchers that will prepare the Nation's future faculty.

STEM research increasingly demands collaborations spanning disciplines, institutions, and nations. STEM professionals must be adept at working in teams, communicating with peers and the public, and making use of sophisticated technologies. Computationally intensive and data-enabled investigations are enabling new discoveries at an increasingly rapid pace. Tomorrow's STEM researchers, leaders, and practitioners must be prepared for a world in which change will become increasingly frequent and adaptation and resilience are required for lifelong career success. Thus, the preparation of graduate students in STEM, including those who will become the nation's future STEM leaders, must continue to evolve to prepare highly capable individuals who also have the knowledge, skills, preparation, and habits of mind that will be needed to lead STEM innovation in academia and the private and public sectors in the future.

Aligned with Administration and Congressional priorities, NSF invests substantial resources to support the next generation of discoverers. This support is helping to create a diverse and talented pool of STEM researchers and professionals in fields that contribute to nearly every sector of the U.S. economy. NSF makes significant investments in the education of graduate students via research assistantships funded through research awards across the agency. The Division of Graduate Education (DGE) in the Directorate for STEM Education (EDU) also supports individual graduate students through mechanisms such as traineeships, scholarships, and fellowships, as well as institutions and organizations that are pursuing innovative strategies to improve the quality of education and enhance the preparation of the nation's future STEM workforce and leadership.

Goals

NSF envisions a nation that leads the world in science and engineering research and innovation, to the benefit of all, without barriers to participation. NSF's investments in STEM graduate education and STEM graduate students are intended to prepare a diverse workforce with advanced training that is equipped to transform STEM through leadership and innovation. DGE supports NSF's vision for the future by contributing to development of an inclusive, equitable, and globally competitive U.S. graduate education enterprise that advances STEM innovation, research, scholarship, diversity, and education. This vision for the future of graduate education is based on DGE's strategic plan,¹ which outlines the following goals for the division.

¹ U.S. National Science Foundation (2024). Division of Graduate Education 2023-2028 Strategic Plan. Retrieved from: www.nsf.gov/edu/dge/2023_DGE_Strategic_Plan.pdf.

1. Promote and empower STEM talent to participate in post-baccalaureate education and training throughout career stages to advance U.S. global leadership in STEM.
2. Contribute to STEM graduate student success by supporting the discovery and promotion of equitable practices and effective strategies to overcome barriers.
3. Serve as a source of support for discovery and dissemination of information about best practices in STEM graduate education.
4. Evaluate the impact of NSF's investments in graduate education and identify gaps in the agency's portfolio.
5. Cultivate sustainable partnerships that enable inclusive and equitable practices to inspire, support, and prepare current and future graduate students for diverse and globally competitive careers in STEM.
6. Excel in program operations and management by leveraging data and tools, increasing skill training, and fostering teamwork.

FY 2025 Investments

NSF's FY 2025 investments are guided, in part, by the CHIPS and Science Act of 2022.² As specified in the CHIPS Act and NSF's Proposal and Award Policies and Procedures Guide (PAPPG), all proposals submitted to NSF that include support for graduate students are required to include a graduate student mentoring plan. Additionally, annual reports submitted to the agency must include individual development plans for all graduate students receiving substantial support from NSF. These new requirements, implemented for proposals submitted on or after May 20, 2024, and which enact components of the CHIPS Act, will enhance the career progression of graduate students in FY 2025 and beyond.

In addition to graduate education research grants awarded by all NSF directorates, EDU hosts two major agency-wide programs that focus on graduate students and graduate education: the NSF Research Traineeship (**NRT**) program and the Graduate Research Fellowship Program (**GRFP**). EDU's Division of Graduate Education manages both programs with input from NSF-wide working groups. Both programs support recommendations from the National Academies³ for improving the quality of graduate education and to prepare graduate students for success in a range of careers. Ongoing evaluation and monitoring of these and other DGE programs, including NSF's Committee of Visitors process,⁴ are used to gain a better understanding of graduate students' experiences and interventions, and improve STEM graduate education and workforce development.

Several other NSF programs focus on developing sectors of the STEM workforce by supporting students and testing new models and approaches to graduate education. See descriptions of CyberCorps®: Scholarship for Service (**SFS**), the Robert Noyce Teacher Scholarship (**Noyce**) the Louis Stokes Alliances for Minority Participation's Bridge to the Doctorate (**LSAMP-BD**), and the NSF Scholarships in Science, Technology, Engineering, and Mathematics (**S-STEM**) programs below.

² www.congress.gov/bill/117th-congress/house-bill/4346

³ National Academy of Sciences, Engineering, and Medicine. 2018. Graduate STEM Education in the 21st Century. Washington, DC: The National Academies Press. Retrieved from: www.nap.edu/catalog/25038/graduate-stem-education-for-the-21st-century.

⁴ U.S. National Science Foundation Committee of Visitors Reports for the STEM Education Directorate. Retrieved from: www.nsf.gov/od/oia/activities/cov/covs.jsp#ehr

Major Investments in STEM Graduate Students and Graduate Education

NSF Research Traineeship

NRT addresses interdisciplinary graduate education through two approaches: traineeships and fundamental research into graduate education. Traineeships prepare diverse cohorts of STEM graduate students for a range of careers in high-priority interdisciplinary or convergent research areas. Traineeship programs supported by NRT are innovative, evidence-based, and aligned with changing workforce and research needs. These comprehensive models prepare STEM graduate students to contribute to high-priority interdisciplinary research areas. Training includes development of technical and professional skills for both research and research-related careers within and outside academia. NRT training components are made available to both NRT-funded students and other graduate students who may want to take advantage of these opportunities. NRT also seeks to support projects in diverse institution types.

NRT responds to Administration and Congressional priorities as they emerge. For example, in FY 2024, the program responded to the CHIPS and Science Act of 2022 by partnering with TIP on a solicitation for a pilot program that will be integrated into the regular NRT program in FY 2025. The pilot will enhance participation of non-R1 universities in the NRT program and will lead to partnerships among R1 and non-R1 universities and industry. These partnerships will expand NRT's positive influence on developing the future workforce in areas of national priority.

Fundamental education research is addressed through the Innovations in Graduate Education (IGE) component of NRT, which encourages development, implementation, and analysis of transformative approaches to STEM graduate education and training. IGE projects may focus on activities such as career preparation, mentoring, partnerships, or internships. In response to the CHIPS Act, in FY 2024, the IGE program solicitation communicated NSF's interest in considering project proposals investigating the impact that different strategies for supporting graduate students have on different types of students. Lessons learned from these and other IGE projects will help to inform national efforts to improve the quality of graduate education.

FY 2023	FY 2024	FY 2025
Base Plan	(TBD)	Request
\$59.13	-	\$60.00

Graduate Research Fellowship Program

GRFP supports outstanding graduate students as they prepare to serve as the Nation's future STEM scholars and leaders. In FY 2024, in response to the CHIPS and Science Act of 2022, the cost of education (COE) allowance provided to universities that host Fellows increased from \$12,000 to \$16,000 per year. Combined with the stipend of \$37,000, the total support provided to each Fellow is now \$53,000 per year. Administration and Congressional priorities are communicated to potential applicants each year via the GRFP solicitation. In FY 2023 and FY 2024, the GRFP program increased communication with the broader STEM community, including prospective applicants, current Fellows, and universities who work with prospective applicants and current Fellows. In FY 2025, the GRFP program staff intends to continue to grow outreach activities with a focus on reaching areas of the country and higher education that are underserved by the program at present. GRFP applications are welcomed from students in all disciplines supported by NSF, including interdisciplinary areas. In FY

2025, requested funding will support 2,300 new Fellows.

GRFP Funding
(Dollars in Millions)

	FY 2023 Base Plan	FY 2024 (TBD)	FY 2025 Request
	\$318.67	-	\$341.11
Number of New Fellows	2,500	TBD	2,300
Projected Fellows on Tenure ¹	6,196	TBD	6,550

¹ Fellowship tenure status is the period of time during which fellows actively use the fellowship award to pursue an advanced degree in a STEM or STEM education field.

CyberCorps®: Scholarship for Service

The CyberCorps® Scholarship for Service (SFS) program seeks to increase the number and diversity of qualified cybersecurity professionals prepared to serve the cybersecurity mission of the government. The program addresses cybersecurity education and workforce development by providing funding to institutions to develop cybersecurity educational projects and related activities, such as cyber camps, cohort building, and mentoring, and to support scholarships to both undergraduate and graduate students. In return for their scholarships, tuition, fees, health insurance, travel, and book allowances, recipients must complete a government-based internship and work after graduation for a Federal, state, local, or Tribal government organization in a cybersecurity-related position for a period equal to the length of the scholarship. The SFS program also supports research and development to improve cybersecurity education and workforce training, particularly in emerging areas such as the nexus between cybersecurity and AI, through the Secure and Trustworthy Cyberspace: Education program (SaTC-EDU). SaTC-EDU is designed to advance research that will contribute novel understanding and impact on cybersecurity learning, pedagogy, and equity and inclusion in educational settings.

As with other DGE programs, the SFS and SaTC-EDU programs respond to Administration and Congressional priorities on an ongoing basis. Of particular relevance is increased interest in AI. The CHIPS and Science Act of 2022 included language that encouraged NSF to conduct studies to help determine the need for a new SFS program specially designed to prepare the future government workforce in AI. These studies are expected to be completed in FY 2024.

SFS Funding
(Dollars in Millions)

FY 2023 Base Plan	FY 2024 (TBD)	FY 2025 Request
\$72.93	-	\$74.00

Additional Programs and Activities Supporting STEM Graduate Education and Workforce Development
Louis Stokes Alliances for Minority Participation-Bridge to the Doctorate (LSAMP-BD)

The LSAMP program assists universities and colleges in diversifying the STEM workforce by increasing the number of STEM baccalaureate and graduate degrees awarded to individuals from populations historically underrepresented in STEM disciplines: African Americans, Alaska Natives, American Indians, Hispanic Americans, Native Hawaiians, and Native Pacific Islanders. LSAMP funds alliances

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comprised of multiple degree-granting organizations that can implement comprehensive and sustained strategies that result in the graduation of well-prepared, highly qualified students from groups such as those above. LSAMP-BD is a targeted activity through which established alliances provide post-baccalaureate fellowships to support the transition and success of students in STEM master's and/or doctoral programs. In FY 2025, LSAMP expects to direct \$17.70 million toward the LSAMP-BD program.

NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM)

NSF established the S-STEM program in accordance with the American Competitiveness and Workforce Improvement Act (ACWIA) of 1998 (P.L. 105-277), as modified by the American Competitiveness in the Twenty-first Century Act of 2000 (P.L. 106-313), the Consolidated Appropriations Act, 2005 (P.L. 108-447), and the CHIPS and Science Act of 2022 (P.L. 117-167). The ACWIA reflected the national need to increase the number of American scientists and engineers. S-STEM is funded through H-1B Nonimmigrant Petitioner Account receipts. The program funds meritorious proposals from institutions to operate scholarship programs that provide scholarships to low-income, academically talented U.S. students with demonstrable financial need. These scholarships, together with additional support such as mentoring and internships, help these students earn an associate, baccalaureate, or graduate degree in a STEM field. These graduates are highly prepared to enter and contribute to the STEM workforce. S-STEM emphasizes the importance of recruiting students to pursue STEM disciplines, mentoring and supporting students through degree completion, and partnering with employers to facilitate student career placement in the STEM workforce. In addition to providing scholarship support, S-STEM projects also contribute to the knowledge base about effective STEM education by carrying out research on effective practices to recruit STEM students and to support them to earn STEM degrees. For graduate students, S-STEM offers individual scholarships of up to \$20,000 per year for up to five years, depending on cost of attendance and unmet financial need. In FY 2025, S-STEM expects to invest approximately \$10.0 million in awards to support scholarships for graduate students.

Robert Noyce Teacher Scholarships (Noyce)

The Noyce program responds to the increasing need for highly effective K-12 STEM teachers and teacher leaders. Noyce supports institutions of higher education to develop and sustain comprehensive programs of study that encourage and support undergraduate STEM majors and STEM professionals to become effective preK-12 STEM teachers in high-need school districts. It also supports experienced, exemplary preK-12 STEM teachers to become teacher leaders in high-need school districts and to engage their colleagues in communities of practice focused on continued professional development. In addition, the program funds research on the effectiveness and retention of preK-12 STEM teachers in high-need school districts. The table below summarizes Noyce's support for graduate education.

Categories of Noyce Support for Graduate Education

Track	Outcome	Eligible Individuals	Support	Commitment Length to Teach in High-need Schools
Scholarships and Stipends	Highly effective K-12 STEM teachers in high need schools/districts	STEM professionals	One-year scholarship to become certified/licensed teacher	2 years
Teaching Fellowship			One-year Scholarship to complete a master's degree in education and salary supplement* during teaching commitment	4 years
Master Teaching Fellowships	Highly effective K-12 teacher leaders in STEM education in high need schools/districts	K-12 STEM teachers without a master's degree	One-year Scholarship to complete a master's degree and salary supplement during teaching commitment	5 years**

*The salary supplements support participation in mentoring and professional development to increase the Fellow's effectiveness in the classroom and/or as teacher leaders.

**The Master Teaching Fellows continue teaching in a high need school and/or school district while they are pursuing their master's degree.

The Noyce Teaching Fellowships and Master Teaching Fellowships track expects to fund about 225 fellows in FY 2025.

Additional Programs Supporting STEM Graduate Education and Funding

Workforce Development

(Dollars in Millions)

	FY 2023 Base Plan	FY 2024 (TBD)	FY 2025 Request
LSAMP-BD	\$6.45	-	\$17.70
S-STEM	11.45	-	10.00
Noyce Teaching and Master Teaching Fellows (10A)	8.80	-	14.00
Total	\$26.70	-	\$41.70

