

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

Overview

Continued assurance of U.S. global competitiveness in STEM requires that academia, government, and industry have access to talent that can make contributions across the STEM disciplines and that also reflects the diversity of the US population. High-quality graduate education programs, across the Nation, are preparing future STEM leaders, researchers, and professionals to make revolutionary breakthroughs; to increase industrial competitiveness; to promote ethical decision-making; and contribute to the Nation's overall security, economic prosperity, and social wellbeing. Important resource allocations in graduate education are investments in the long-term viability of the U.S. STEM enterprise. Grand challenges related to salient national STEM priorities, such as cybersecurity, microelectronics, STEM teaching and learning, artificial intelligence, climate change, quantum computing, and many others will be successfully addressed by future STEM leaders, researchers, and professionals. There is growing awareness, as evidenced by the text of the CHIPS and Science Act of 2022, that investments in STEM graduate-level talent is critical for the future success of the Nation. As the STEM enterprise evolves, the preparation of graduate students in STEM will need to also adapt to ensure that students are equipped with the requisite knowledge, skills, and abilities to lead STEM innovation in academia and both the private and public sectors well into the future.

Aligned with current Administration and Congressional priorities, NSF invests substantial resources to support the next generation of STEM discoverers, researchers, and leaders. Such investments help to harness the needed diverse, domestic STEM talent in government, academia, and industry. Each year, NSF makes significant investments in graduate students through research assistantships funded through research awards across the agency. Other EDU investments, including those made by its Division of Graduate Education (DGE) and Division of Undergraduate Education, support individual graduate students through traineeships, scholarships, and fellowships. Additional investments promote innovations in graduate education that have the potential to enhance the graduate education experience for future STEM researchers and leaders.

Goals

The goal of NSF's investments in STEM graduate education and STEM graduate talent is to ensure that the Nation's graduate-level STEM education enterprise is prepared to produce a diverse workforce that will make transformational contributions at the frontiers of STEM; serve as leaders in STEM in academia, government, and industry; and innovate in STEM-intensive careers. This goal is based on an NSF strategic framework¹ that outlines the following specific aims:

1. *Advance Science and Engineering Research:* Support graduate students and graduate education to enable long-term contributions of new knowledge at the frontiers of science and engineering.
2. *Broaden Participation to Promote Excellence in Research and Build the Next Generation STEM Workforce:* Recruit graduate students from a variety of geographic, demographic, social, and educational backgrounds to promote the advancement of science and a highly qualified professional workforce.

¹ National Science Foundation (2016). NSF Strategic Framework for Investments in Graduate Education. National Science Foundation, Alexandria, VA. Retrieved from: www.nsf.gov/pubs/2016/nsf16074/nsf16074.pdf.

3. *Build Effective Models of Graduate Education and Workforce Development:* Support the development and use of innovative models and evidence-based approaches in graduate education, including education and research about promising practices and program effectiveness.

FY 2024 Investments

Across the agency, there are two major agency-wide programs focusing on graduate education: NSF Research Traineeship [NRT] and Graduate Research Fellowship Program [GRFP]). Both programs are under the auspices of EDU, and DGE leads management of them both, with the benefit of input from NSF-wide working groups. Both of the DGE programs support actions recommended in major national reports² as ways to better prepare graduates for a broad range of careers. Both programs also respond to legislative actions, such as the CHIPS and Science Act of 2022. NRT has two complementary components: (1) training grants that focus on developing researchers in high-priority interdisciplinary research areas; and (2) the Innovations in Graduate Education (IGE) research program that supports research on the development and implementation of bold, new, and potentially transformative approaches to STEM graduate education and training. GRFP identifies and supports the next generation of outstanding STEM researchers and scientists by providing them with stipend support as well as a contribution towards the costs of their education. Further, the NRT and GRFP programs provide professional development opportunities for graduate students, including internships and international research experiences. Ongoing evaluation and monitoring of the programs and students involved in NRT and GRFP provide rich data that will be used to inform future efforts to improve the graduate education experience for all students.

Several other NSF programs focus on developing sectors of the STEM workforce by supporting students and by testing new models and approaches to graduate education. For example, under DGE, the CyberCorps®: Scholarship for Service (SFS) program addresses the national cybersecurity workforce need. The Robert Noyce Teacher Scholarship program (Noyce), under EDU's Division of Undergraduate Education (DUE) provides fellowship support to members of the master teacher cohort at the graduate level and funds innovation in approaches to STEM teacher education and leadership development. Under EDU's Division of Excellence in Equity in STEM (EES), the Louis Stokes Alliances for Minority Participation's Bridge to the Doctorate (LSAMP-BD) track and DUE's NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) support the successful entry of underrepresented and underserved populations into STEM graduate education and the STEM workforce. This broad suite of programs contributes substantially to the NSF investment in the STEM research and education workforce of the future.

² 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; American Chemical Society Presidential Commission (2012). Advancing graduate education in the chemical sciences. American Chemical Society, Washington, DC. Retrieved from: www.acs.org/content/dam/acsorg/about/governance/acs-presidential-graduate-education-commission-full-report.pdf; Biomedical Research Workforce Working Group (2012). Biomedical Research Workforce Working Group Draft Report. National Institutes of Health, Bethesda. Retrieved from www.acd.od.nih.gov/documents/reports/bmw_report.pdf

NSF Research Traineeship

The goals of the NRT Program are to support highly effective training of STEM graduate students in convergent research areas of national priority, as well as to create, promote, and disseminate innovative, effective, and scalable models for effective STEM graduate student training. In FY 2024, NRT will continue to focus on providing traineeships to prepare students to lead in emerging industries.

NRT promotes interdisciplinary and convergent graduate education through two approaches: traineeships and fundamental research into graduate education. Traineeships utilize comprehensive training models that are innovative, evidence-based, and aligned with changing workforce and research needs. Such models aim to prepare STEM graduate students to contribute to high-priority interdisciplinary research areas. The 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 seeks to support projects at a diverse group of institution types.

Fundamental education research is addressed through the IGE component of NRT, which focuses on test-bed projects aimed at piloting, testing, and validating innovative and potentially transformative approaches to graduate education of students pursuing academic master’s, professional science master’s, and doctoral degrees. These approaches include activities such as career preparation, mentoring, partnerships, and internships. IGE will also support broader access to these advances for the graduate education community, including graduate faculty, staff, and graduate school administrators.

NRT Funding
(Dollars in Millions)

	FY 2023	Relief	FY 2023	
FY 2022	Estimate	Supplemental	Estimate	FY 2024
Actual	Base	CHIPS +	Total	Request
\$60.00	\$60.00	\$28.50	\$88.50	\$62.50

Graduate Research Fellowship Program

The goal of GRFP is to identify and nurture the STEM human capital necessary to ensure the Nation’s leadership in advancing STEM research innovations, with an emphasis on broadening participation. GRFP selects, recognizes, and financially supports graduate students with demonstrated high potential for excellence in STEM careers. In FY 2024, EDU will support at least 2,500 new fellowships, with a cost of education allowance of \$16,000, increased from a previous level of \$12,000, and a stipend of \$37,000 per fellow. Applications are welcome from students in all disciplines supported by NSF, including STEM education and interdisciplinary STEM areas. The GRFP program will continue to encourage applications in topical areas that align with NSF and Administration priorities.

Major Investments in STEM Graduate Students and Graduate Education

GRFP Funding

(Dollars in Millions)

	FY 2022 Actual	FY 2023 Estimate Base	Disaster Relief Supplemental Base	FY 2023 Estimate Total	FY 2024 Request
	\$290.01	\$230.00	\$92.00	\$322.00	\$380.32
Project Fellows on Tenure ¹	5870			6196	6742

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

CyberCorps®: Scholarship for Service

The SFS program addresses cybersecurity education and workforce development by providing funding to institutions to support development of cybersecurity educational programs and related activities such as cyber camps, cohort building and mentoring. SFS enables awards of scholarships to undergraduate and graduate students enrolled in these educational programs. In return for their scholarships, recipients must complete a government-based internship and then gain employment after graduation in a cybersecurity-related position in a Federal, state, local, or Tribal government organization for a period equal to the duration of the scholarship. The SFS program also supports research and development to improve cybersecurity education and workforce training, particularly in emerging areas such as AI, quantum computing, and aerospace, including through investments made via the Secure and Trustworthy Cyberspace: Education program (SaTC-EDU).

SFS Funding

(Dollars in Millions)

	FY 2022 Actual	FY 2023 Estimate Base	Disaster Relief Supplemental CHIPS + Science	FY 2023 Estimate Total	FY 2024 Request
	\$63.00	\$74.00	\$11.50	\$85.50	\$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. The LSAMP program provides funding to alliances 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. The LSAMP-BD is a targeted activity through which established alliances provide post-baccalaureate fellowships to support the transition into and success of students in STEM master's and/or doctoral programs, thus increasing their entry into the STEM workforce. In FY 2024, LSAMP expects to direct about \$22.5 million towards this activity.

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 of 1998 (P.L. 105-277), as modified by P.L. 106-313 and P.L. 108-447 in 2005. The Act reflected the national need to increase the number of American scientists and engineers. The S-STEM program provides institutions with funds for student scholarships to support low-income, academically talented U.S. students with demonstrable financial need.

Section 10393 of the CHIPS and Science Act of 2022 (Public Law. 117-167) removed language that limited the scholarship amount to \$10,000 per year and lengthened the maximum scholarship duration to five years. Thus, the maximum individual scholarship amounts were increased from \$10,000 to \$15,000 per year for undergraduate students and from \$10,000 to \$20,000 per year for graduate students for maximum duration of five years.

These scholarships, together with additional supports such as mentoring and internships, help these students earn an associate, baccalaureate, or graduate degree in STEM fields. These graduates will be highly prepared to enter and contribute to the STEM workforce. The S-STEM program 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. S-STEM provides individual scholarships of up to \$15,000 per year for undergraduate students and up to \$20,000 per year for graduate students for maximum duration of five years, depending on cost of attendance and unmet financial need. S-STEM expects to offer support for up to 250 Masters or PhD students in FY 2024. 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 support them to earn STEM degrees. S-STEM is funded through H-1B Nonimmigrant Petitioner Account receipts. In FY 2024, S-STEM expects to invest approximately \$49.06 million in awards to support scholarships for graduate students.

Robert Noyce Teacher Scholarship (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 K-12 STEM teachers in high-need school districts. It also supports experienced, exemplary K-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. Section 10320 of the CHIPS and Science Act of 2022 (Public Law. 117-167) waived the mandatory cost-sharing requirements for the Noyce program for 5 years for Noyce proposals submitted to Track 2 (NSF Teaching Fellowships [TF] Track), and Track 3 (NSF Master Teaching Fellowships [MTF] Track). The TF Track supports STEM professionals becoming certified or licensed elementary, middle, or high school teachers through the completion of a master's degree, as well as receiving a salary supplement every year for four years while teaching in a high-need school district. The MTF track supports experienced and exemplary STEM teachers (elementary, middle, and high school) with only a bachelor's degree to obtain a master's degree, as well as those with a master's degree to receive a salary supplement for up to five years as they continue to teach in a high-need school district. In addition, the Noyce program funds research on the effectiveness and retention of K-12 STEM teachers in high-need school districts.

Categories of Noyce Support for Graduate Education

Track	Outcome	Eligible Individuals	Support	Length of Commitment 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 160 fellows in FY 2024.

Funding Workforce Development

(Dollars in Millions)

	FY 2022 Actual	FY 2023 Estimate Base	FY 2023 Estimate Total	FY 2024 Request
LSAMP-BD	\$8.60	\$7.50	\$7.50	\$22.50
S-STEM	26.89	44.78	44.78	49.06
Noyce Teaching & Master Teaching Fellows (10A)	25.23	14.00	14.00	20.00
Total	\$60.72	\$66.28	\$66.28	\$91.56