# A Perspective on Graduate Education from the National Science Foundation

**Revitalizing Graduate STEM Education for the 21st Century**
**Board on Higher Education and Workforce**
**First Committee Meeting**
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# 10 Big Ideas for Future NSF Investments

**Navigating the New Arctic**
Improve Arctic observational tools to document rapid changes on multiple scales.


**Harnessing Data for 21st Century Science and Engineering**
Generate a world-wide data-enabled future for the U.S. through fundamental research and education in data science.

**Work at the Human-Technology Frontier: Shaping the Future**
Develop "smart" technologies and environments to enhance the human experience; assess their impact on human behavior and social systems.

## RESEARCH IDEAS

**Understanding the Rules of Life: Predicting Phenotype**
Bridge the biggest gap in biological science by determining how the environment influences an organism's unique characteristics.

**The Quantum Leap: Leading the Next Quantum Revolution**
Develop ways to access and manipulate the behavior of matter and energy at very small scales to make the next generation technology more accurate and efficient.

**Windows on the Universe: The Era of Multi-messenger Astrophysics**
Extend our understanding of the cosmos by building on NSF's unique observational assets.

## PROCESS IDEAS

**Growing Convergent Research at NSF**
Use ideas and technologies from widely diverse fields to bring about solutions to societal problems and profound questions.

**NSF-Includes: Enhancing Science and Engineering through Diversity**
Tap the innovation inherent in America's diversity to strengthen the U.S. science and engineering enterprise.

**Mid-scale Research Infrastructure**
Develop a nimble process to fund crucial scientific infrastructure projects that fall between traditional funding boundaries.

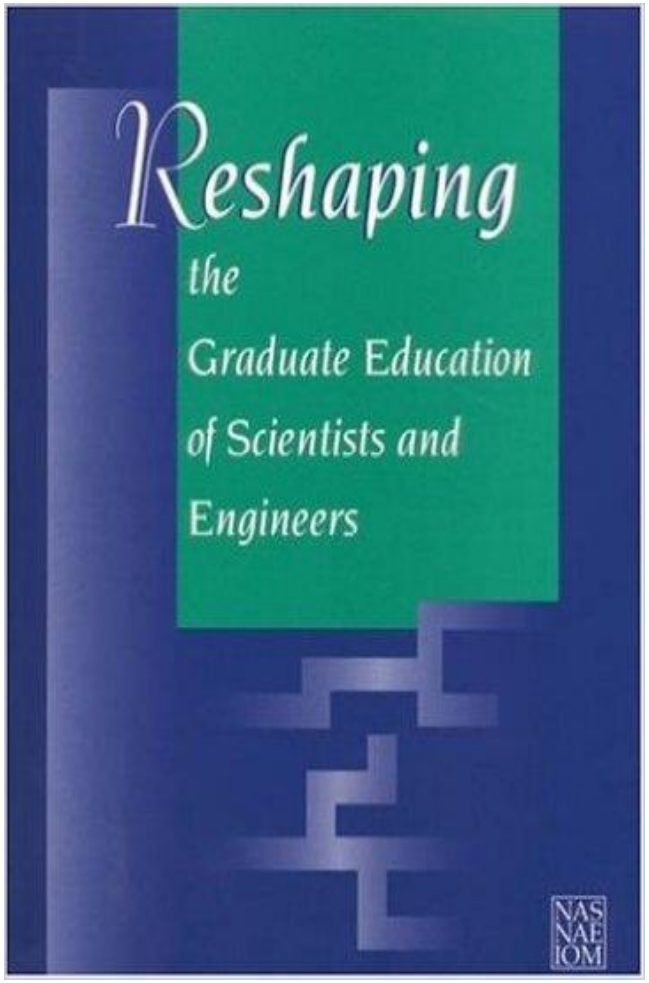

**NSF 2050**
Bold, forward-thinking research that transcends traditional approaches and pushes the frontiers of exploration.

# Trends in U.S. Graduate Education

- Greater interdisciplinary and team focus
- Dynamic pathways and careers - students more readily move across fields, institutions, sectors of the economy, and countries
- Greater racial/ethnic diversity, higher proportion of female students
- An increase in international students

These trends are important to understand to reach an important NSF's strategic objective: *Integrating education and research to produce a diverse STEM workforce with cutting-edge capabilities*

# Graduate Education and Workforce Development




**Key Recommendation:** ***Offer a Broader Range of Academic Options***

- To produce more versatile scientists and engineers, graduate programs should provide options that allow students to gain a wider variety of skills

- To foster versatility, government and other agents of financial assistance for graduate students should adjust their support mechanisms to include new education/training grants to institutions and departments.

**NAS 1995**

# Goals for NSF Investments in Graduate Education

## Strategic Framework for Investments in Graduate Education (FY2016-FY2020)

- **Advance Science and Engineering (S&E) Research:** Support graduate students and graduate education to enable long-term contributions of new knowledge at the frontiers of science and engineering.

- **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.

- **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.

# Considerations for the Committee

- **How can research about learning and about the nature and practice of science help to inform the design of graduate experiences in STEM?**

- **What is the current state of practice, and what innovations are in place in U.S. graduate education in STEM? What is their impact?**

- **How can we learn and disseminate to the appropriate constituents what we have learned from large-scale national training experiments such as NSF NRT, PSM, and NIH BEST programs, or initiatives such as NSF INCLUDES?**

# Scientific Drivers for Graduate Training


*The grand challenges of today -- protecting human health; understanding the food, energy, water nexus; exploring the universe at all scales -- will not be solved by one discipline alone. They require convergence: the merging of ideas, approaches and technologies from widely diverse fields of knowledge to stimulate innovation and discovery.*