Strategic Initiatives in Graduate Education at the National Science Foundation

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Moderator: Brian Mitchell, CGS Dean-in-Residence

Annual Conference CGS

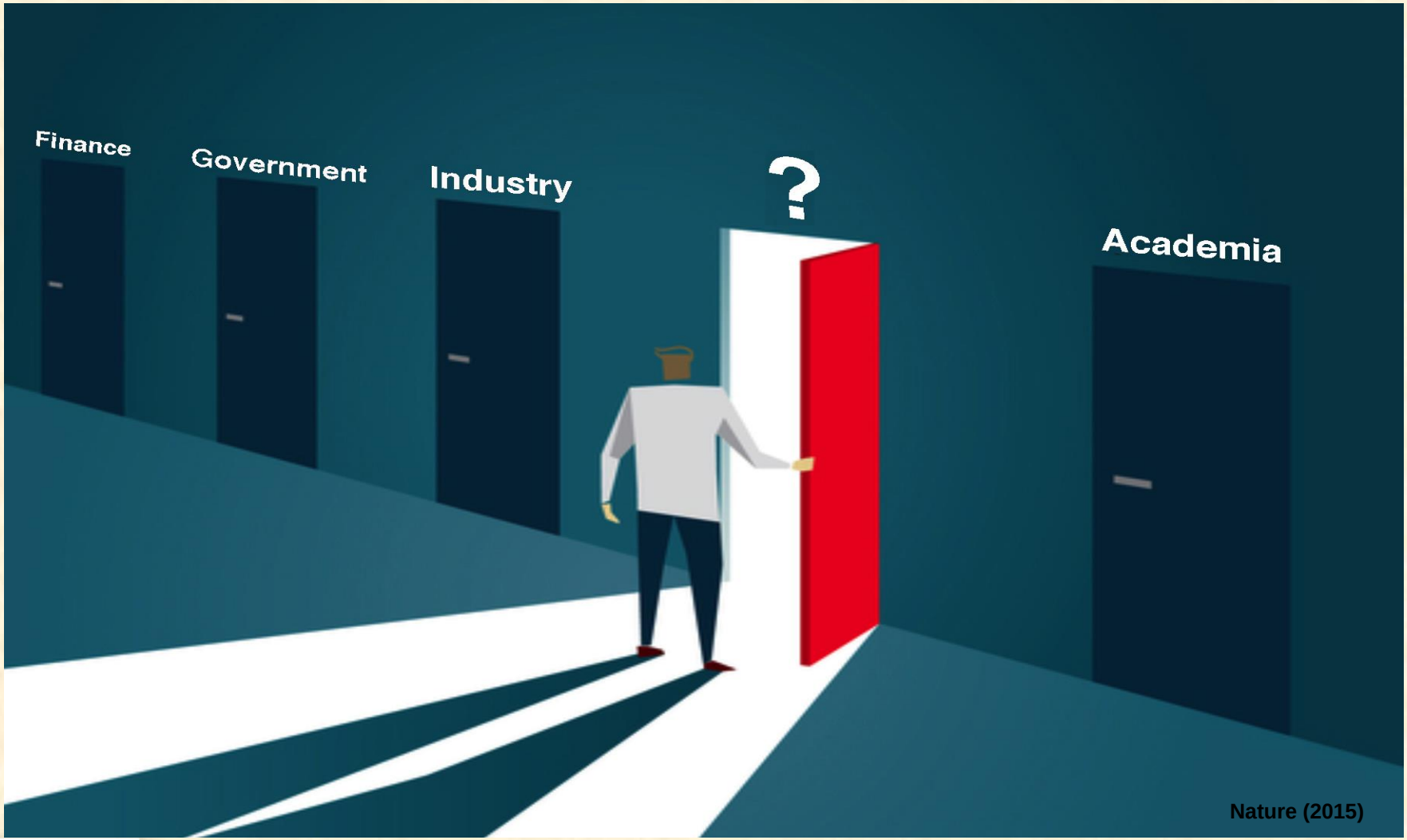
Goals of Session

I. **Provide an Overview** of NSF's current context for graduate education and preparation of the future workforce

II. **Highlight** how NSF (and DGE specifically) is addressing graduate preparedness through changes to its programs (GRFP, NRT)

III. **Gather Your Input:** what should NSF be thinking about as we develop new initiatives to support graduate education?

Improved Graduate Student Preparedness



Roger M. Wakimoto, Assistant Director
Directorate for Geosciences
National Science Foundation
December 4, 2015

National Science and Technology Council (NSTC) Committee on STEM Education Federal STEM Education 5-Year Strategic Plan

(https://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf)

- Enhance the undergraduate STEM experience of undergraduate students.

- Design graduate education for tomorrow's STEM workforce.

Science PhDs' First Jobs in 2013

Academia:	29%
Government:	9%
Industry:	55%
Nonprofit:	4%
Other:	3%

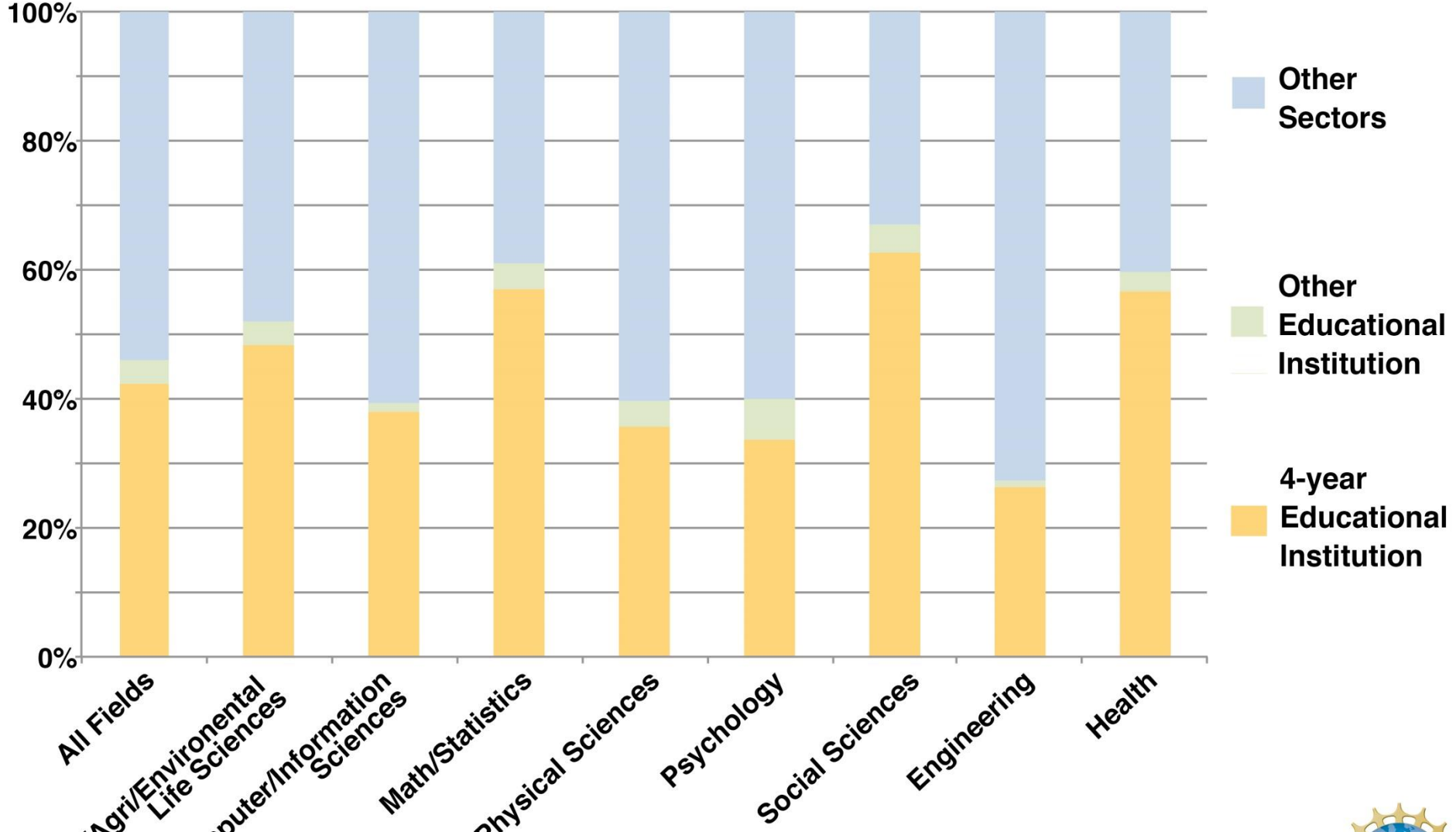
2013 NCSES
(National Center for Science and Engineering Statistics)

Primary Work Activity of Employed STEM Doctoral Scientists and Engineers (SDR 2013)

Primary Work Activity	Number (%)
Total Non-R&D	**430,100 (60%)**
Management, Sales, and Administration	137,100 (19%)
Teaching	140,800 (20%)
Other	152,200 (21%)
Research and Development (R&D)	**290,700 (40%)**
Basic Research	86,300 (12%)
Applied Research	135,700 (19%)
Design and Development	68,800 (9%)
All	720,800

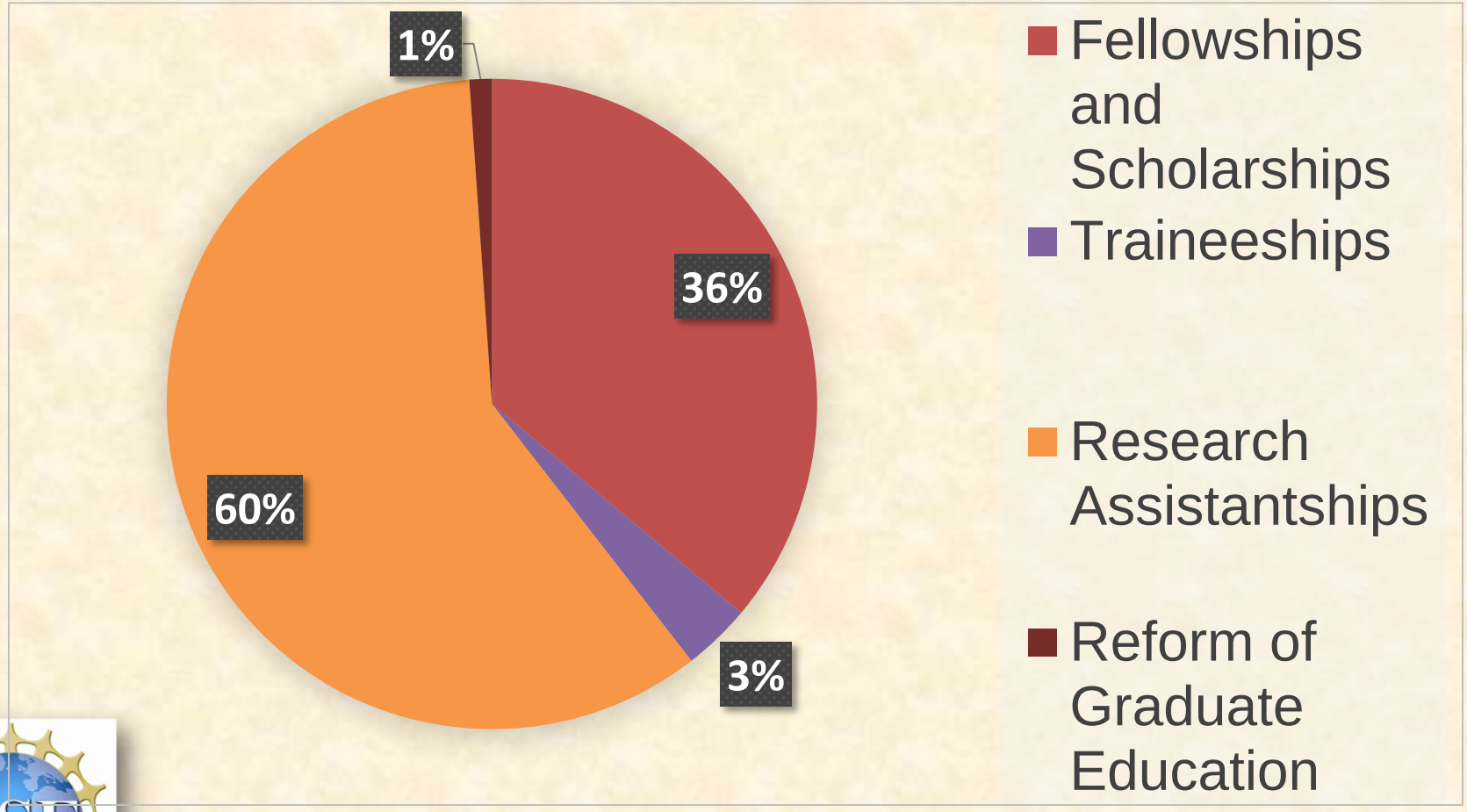
Source: Survey of Doctoral Recipients 2013, NCSES

Employed science, engineering and health doctorates, by field of doctorate and sector of employment: 2013



SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Doctorate Recipients, 2013.

NSF Graduate Education Investments
$985.68 million
(FY 2014 Estimates)

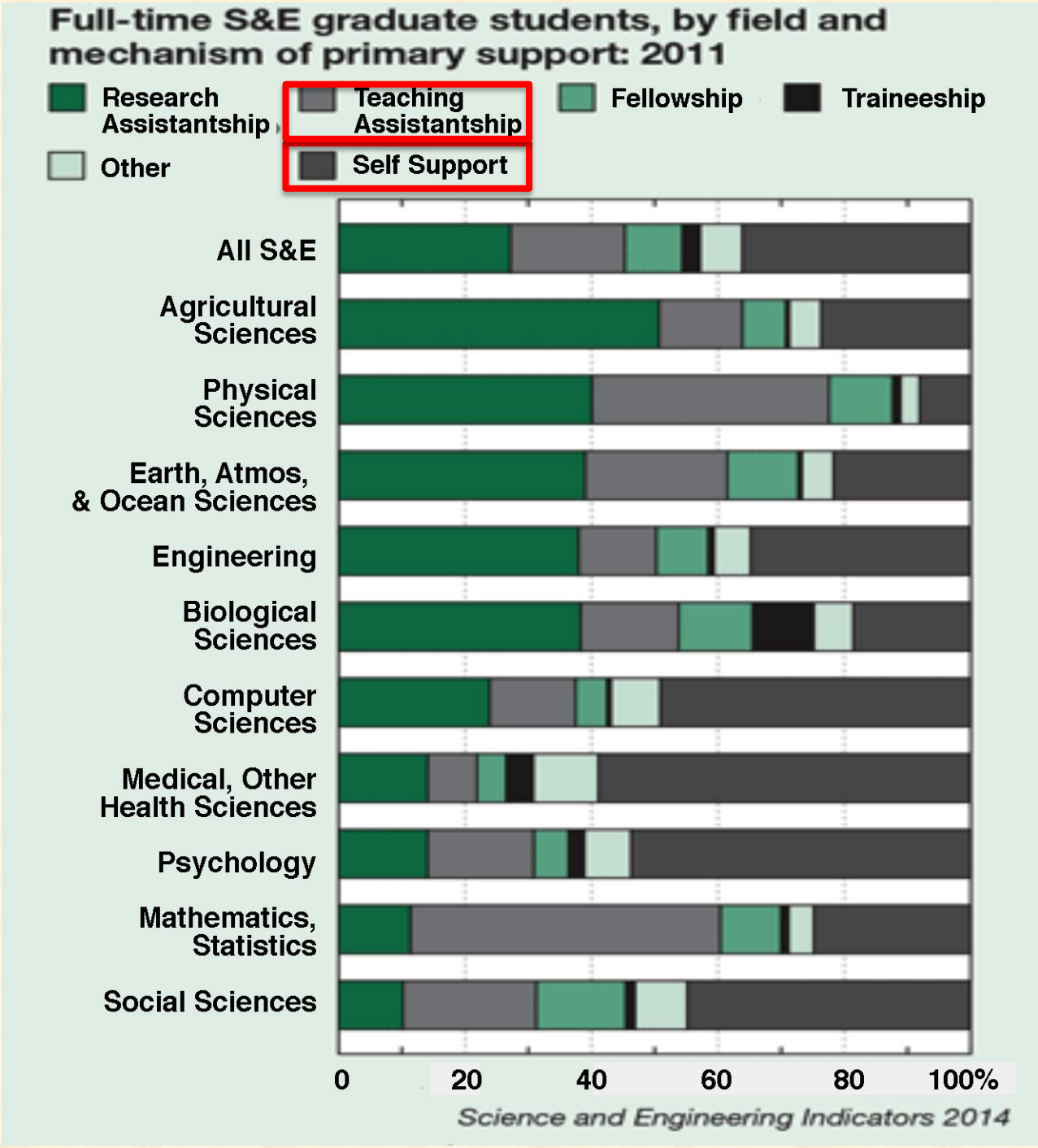


NSF

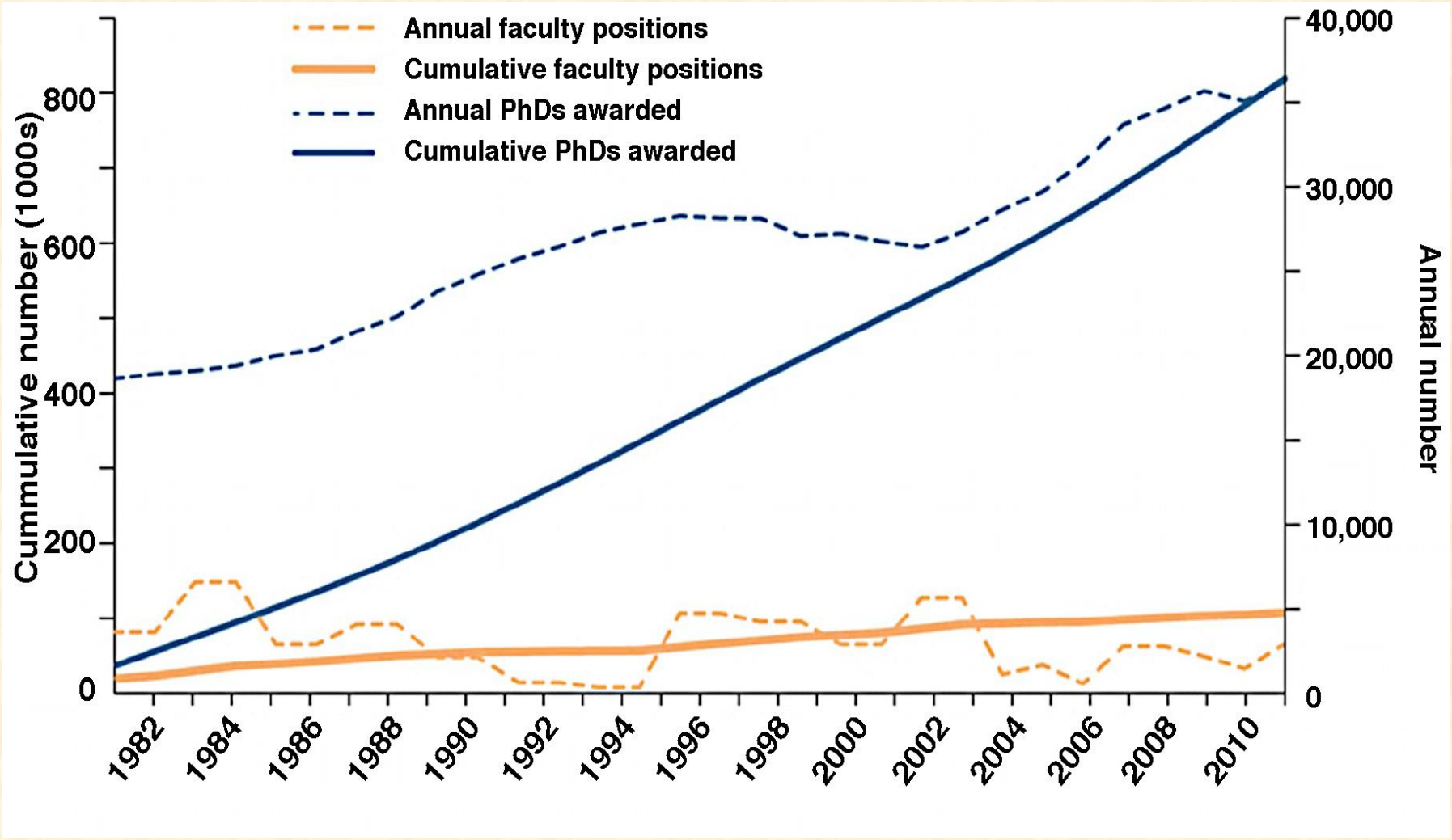
RAs – 60%

Scholarships/Fellowships – 36%

Traineeships – 3%



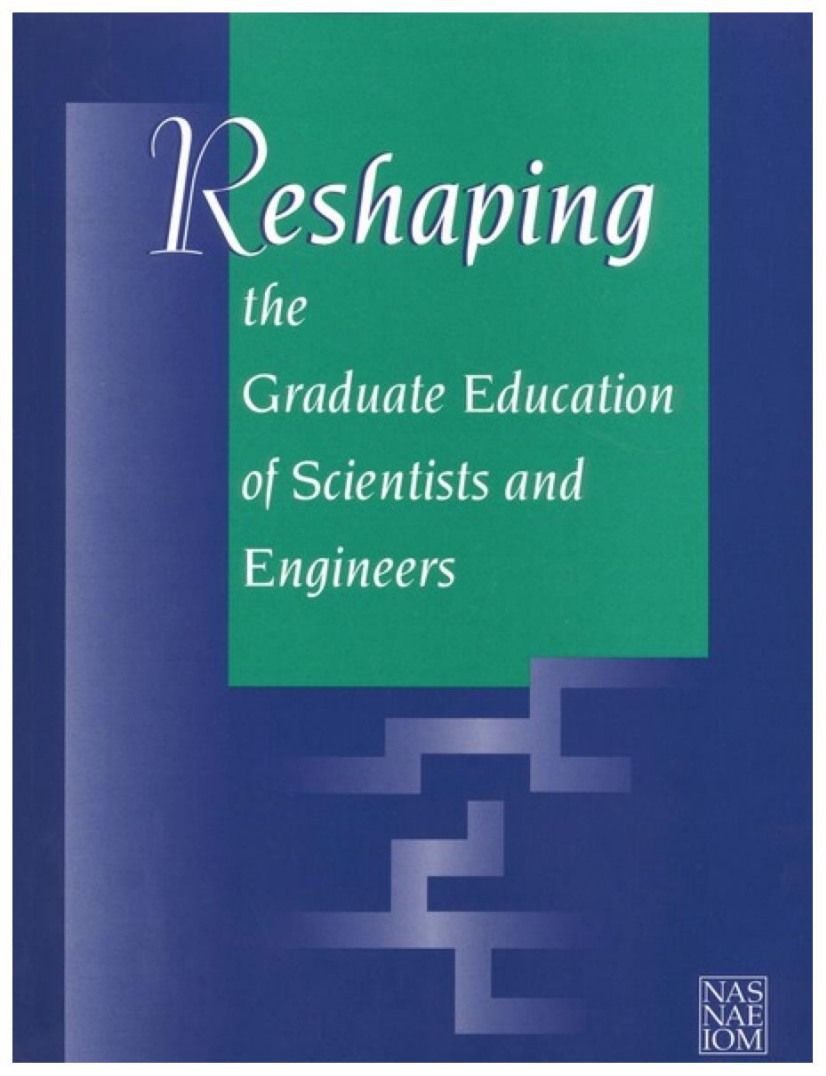
Available STEM Faculty Positions versus New STEM PhDs



Data source: NSF 2011, 2012

Schillebeeckx et al. 2013

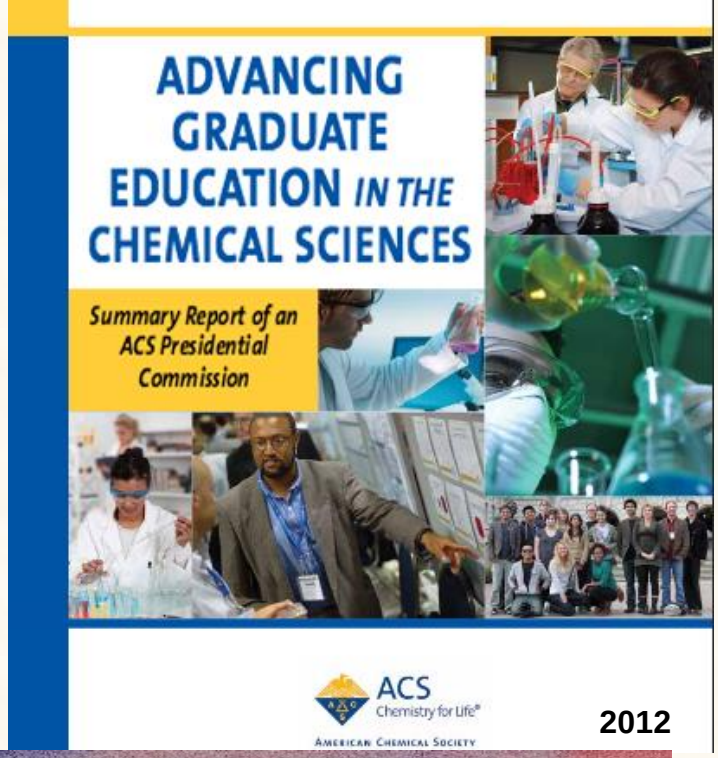
1995



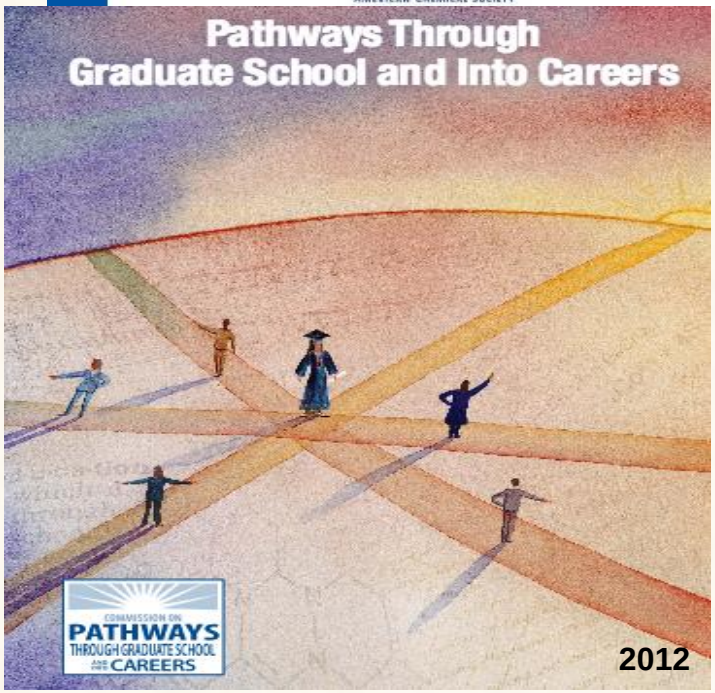
Committee on Science, Engineering and Public Policy (COSEPUP), 1995, National Academy Press

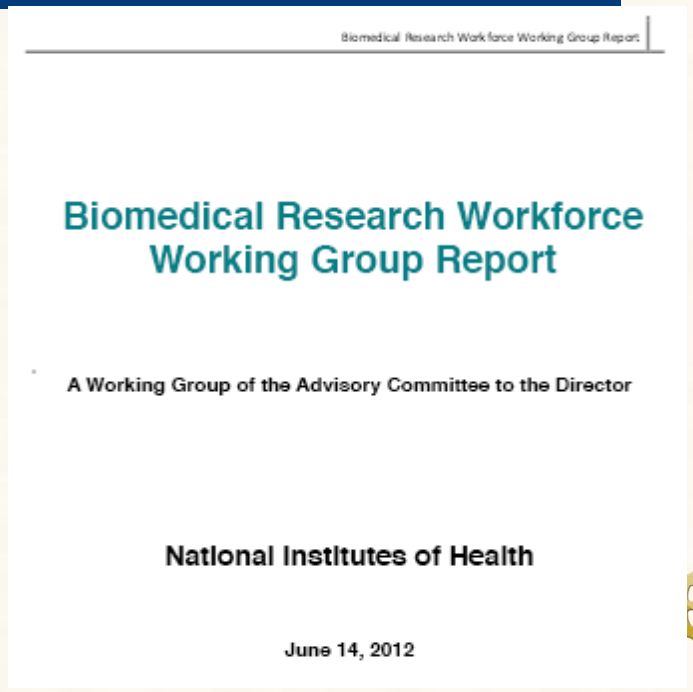
- Are we producing too many PhDs?
- Does the current graduate education system adequately prepare science and engineering students for today's marketplace?
- How do foreign students enter the picture?
- What should be the PhD of the future?

COSEPUP 1995


ADVANCING GRADUATE EDUCATION IN THE CHEMICAL SCIENCES
Summary Report of an ACS Presidential Commission
ACS Chemistry for Life®
American Chemical Society
2012


RESEARCH UNIVERSITIES AND THE FUTURE OF AMERICA
Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security
NATIONAL RESEARCH COUNCIL
2012


Pathways Through Graduate School and Into Careers
COMMISSION ON PATHWAYS THROUGH GRADUATE SCHOOL AND INTO CAREERS
2012

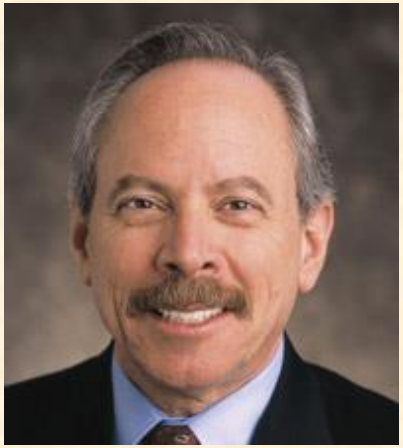

Biomedical Research Workforce Working Group Report
Biomedical Research Workforce Working Group Report
A Working Group of the Advisory Committee to the Director
National Institutes of Health
June 14, 2012

Deficiencies Identified in STEM Graduate Education

- PhD completion rates are low.
- Graduate education is not aligned with disciplinary, workforce, societal, and student needs.
- The master's degree is undervalued.
- Graduate students are narrowly trained and lack transferrable professional skills.
- Graduate student career mentoring is narrowly focused on academe, though the majority of graduate degree recipients will pursue and have non-academic careers.

Selection of Recommendations

- Enhance/expand professional skills training
- Prepare students for multiple career pathways
- Create incentives for university-industry partnerships, including internships
- Enhance interdisciplinary training/collaborations
- Apply evidence-based approaches to increase retention and reduce time to degree
- Give much greater attention to mentoring
- Link graduate programs with undergraduate research programs, particularly as a means of broadening participation



Alan Leshner, CEO Emeritus AAAS
Science (2015)

…..“graduate training in science has followed the same basic format for almost 100 years, heavily focused on producing academic researchers. Given that so many students will not join that community, the system is failing to meet the needs of the majority of its students”…..

…..“relatively new government programs and curriculum supplements are positive steps that are likely to give students greater career flexibility…. However, these efforts are limited in scope”…..

…..“what is needed is a fundamental system analysis and reconfiguration that results in graduate training programs that are better designed to meet the diverse career needs”…..

Agency Priority Goal: FY16-17

STEM Graduate Student Preparedness

Pramod Khargonekar (ENG)

Roger Wakimoto (GEO)

Alexandra Isern

Nirmala Kannankutty

Goal Statement

- To provide STEM doctoral students opportunities to expand their knowledge and skills and prepare for a range of careers and for entering the workforce

Priority Goals (cross-agency and single agency)

- a tool used by leadership to **accelerate progress** on a limited number of Presidential priority areas
- includes specific **metrics and milestones** that will be used to gauge progress
- using goals and measurements reinforces priorities, motivate action, and **illuminate paths** to improvement

Goals of this effort

To provide multiple opportunities for science and engineering doctoral students to acquire the knowledge, experience, and skills needed for highly productive careers, inside and outside of academe.

- Encourage enhanced mentoring of skills beyond those needed in academia;
- Encourage theory and/or evidence-based strategies to enhance and expand training in essential professional skills;
- Enhance interdisciplinary training and collaborations through development of activities that encourage graduate student preparedness for entering the workforce.

STEM graduate student preparedness

Current activities related to this Priority Goal:

- ***Graduate Research Opportunities Worldwide (GROW)***
- ***Graduate Research Internship Program (GRIP)***

An agency-wide effort directed at the specific goal of increased graduate student preparedness for the workforce is still needed.

STEM graduate student preparedness

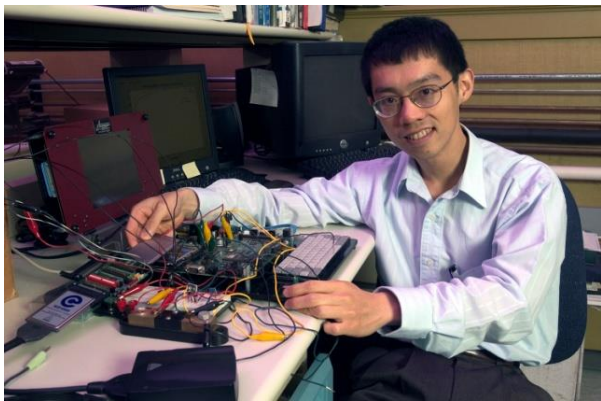
- ***Supplements*** to existing awards
  - ***Enhanced experience*** - single/collaborative awardees for existing graduate students to acquire professional development experience
  - ***Enhanced activities*** – available to larger "center-like" activities to support cohorts of graduate students with the goal of developing new "best practice activities" for enhancing graduate student preparedness.
- ***Summer institutes*** that propose convincing, theory or evidence-based strategies for providing students with professional development in areas that have been identified as being essential for workforce preparedness.

Dear Colleague Letter to solicit applications for supplements is planned for release early next year

A Solicitation for proposals to support summer institutes should be released soon after

II. Division of Graduate Education

- Supports U.S. graduate students and innovative graduate programs to prepare tomorrow's leaders in STEM.
- Provides leadership for the use and conduct of research to inform implementation of approaches, practices, and models for STEM professional workforce development



Division of Graduate Education Portfolio

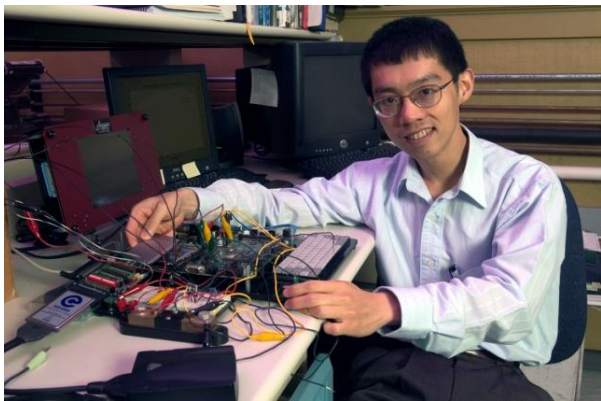
Graduate Research Fellowship Program

NSF Research Traineeship Program

CyberCorps Scholarship for Service

EHR Core Research: Workforce Development

Project and Program Evaluation



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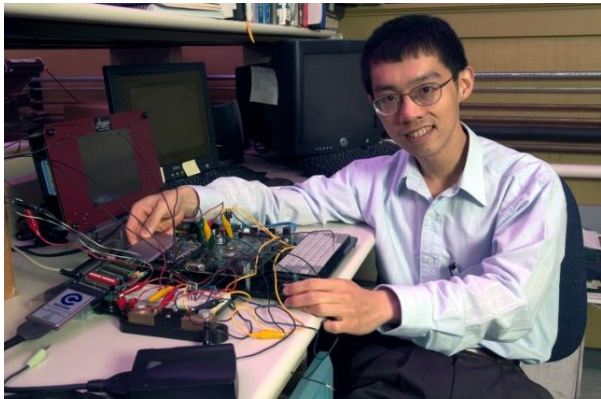
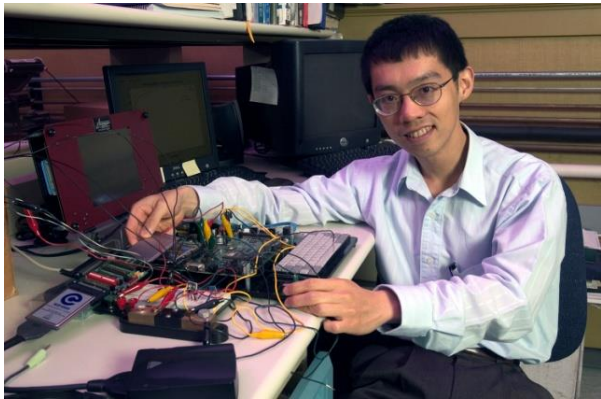


Graduate Research Fellowship Program

GRFP
NSF GRADUATE RESEARCH FELLOWSHIP PROGRAM

GOALS:

- To select, recognize, and financially support, **early in their careers**, individuals with the demonstrated potential to be high achieving scientists and engineers.
- To broaden participation in science and engineering of underrepresented groups, including women, minorities, persons with disabilities and veterans.



GRFP Update

Launch new longitudinal study of career outcomes of Fellows to assess program impact

- Develop and pilot a GRFP survey instrument and process
- Census survey of six cohorts of recent Fellows in 2016 and 2017

GOALS

- Implement a permanent monitoring system for NSF to follow cohorts of Fellows over time.
- Use the data as part of a larger evaluation of the GRFP

Update on Professional Development Opportunities

- **GRIP (Graduate Research Internship Program)**
  - conduct research in federal agencies/facilities
- **GROW (Graduate Research Opportunities Worldwide)**
  - conduct collaborative research with host researchers in partner countries

Graduate Research Internship Program

Fellows conduct mission-related, collaborative research projects at federal facilities and national laboratories.

Partner Agencies

Department of Homeland Security
Environmental Protection Agency
Federal Bureau of Investigation
National Oceanic and Atmospheric Administration
Office of Naval Research
Smithsonian Institution
U.S. Census Bureau
U.S. Geological Survey

Graduate Research Opportunities Worldwide

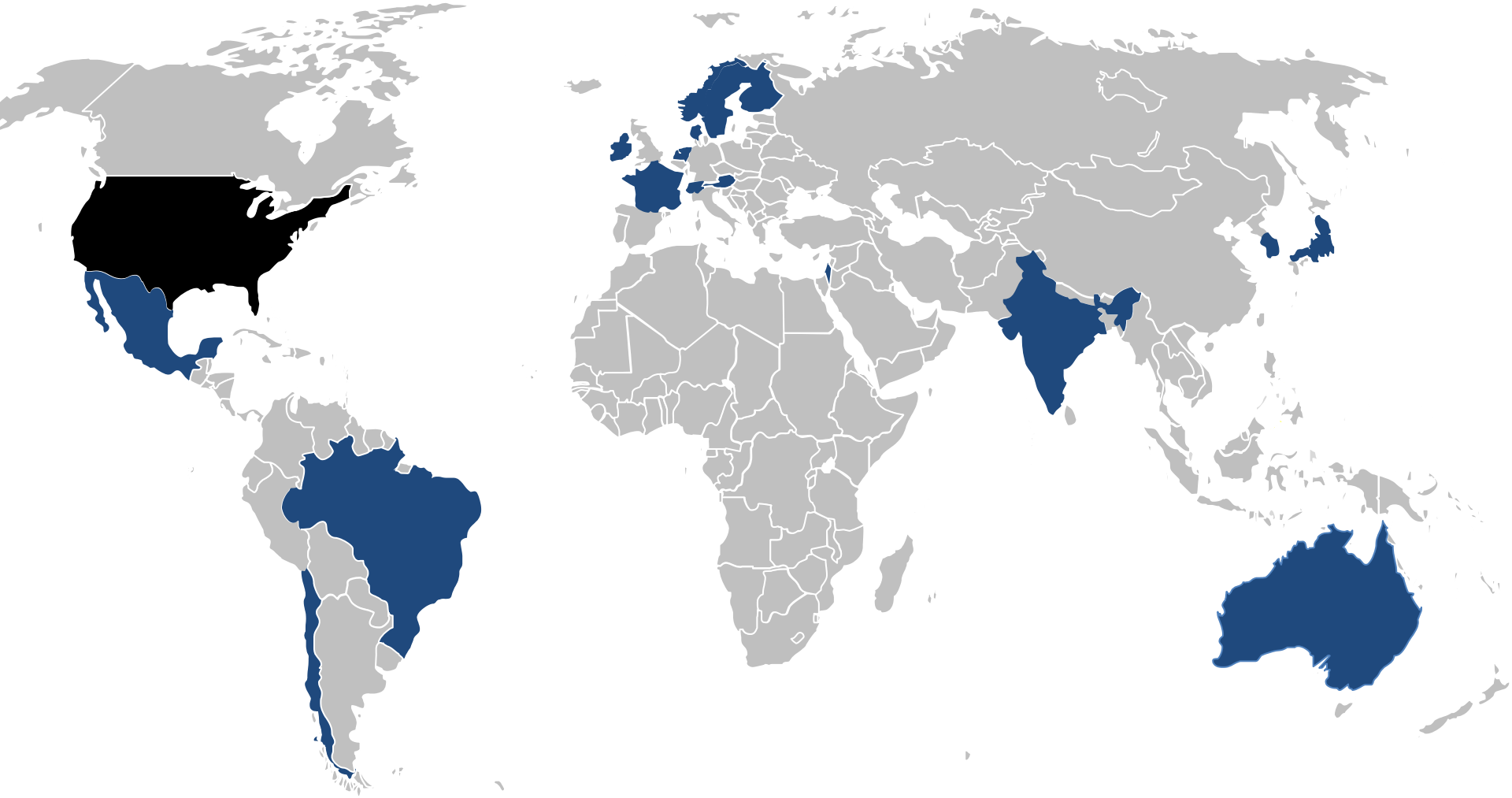
Fellows engage in **research collaborations** with investigators in partner countries through agreements between NSF and counterpart agencies.

Partner Countries

Australia	Finland	Japan	Norway
Austria	France	Korea	Singapore
Brazil	India	Mexico	Sweden
Chile	Ireland	Netherlands	Switzerland
Denmark			

NSF Graduate Research Opportunities Worldwide

Partners



What are the Benefits to Fellows?

- $5,000 Travel allowance
- Additional in-country support from partner agency

- $5,000 Research allowance
- Additional research support from partner agency

- Access to facilities, data, equipment, field sites
- New collaborations and expanded network
- Skill development and exposure to different cultures (both international and domestic)

Division of Graduate Education Portfolio

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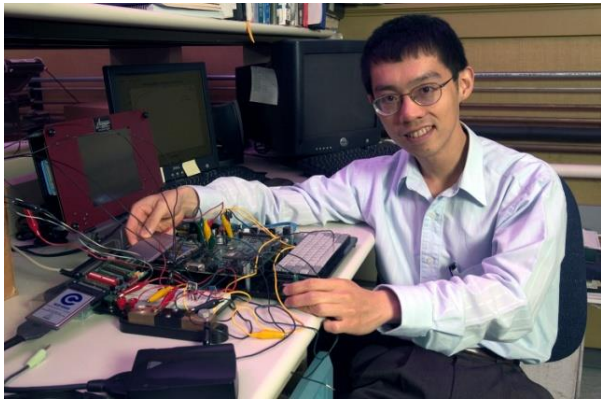


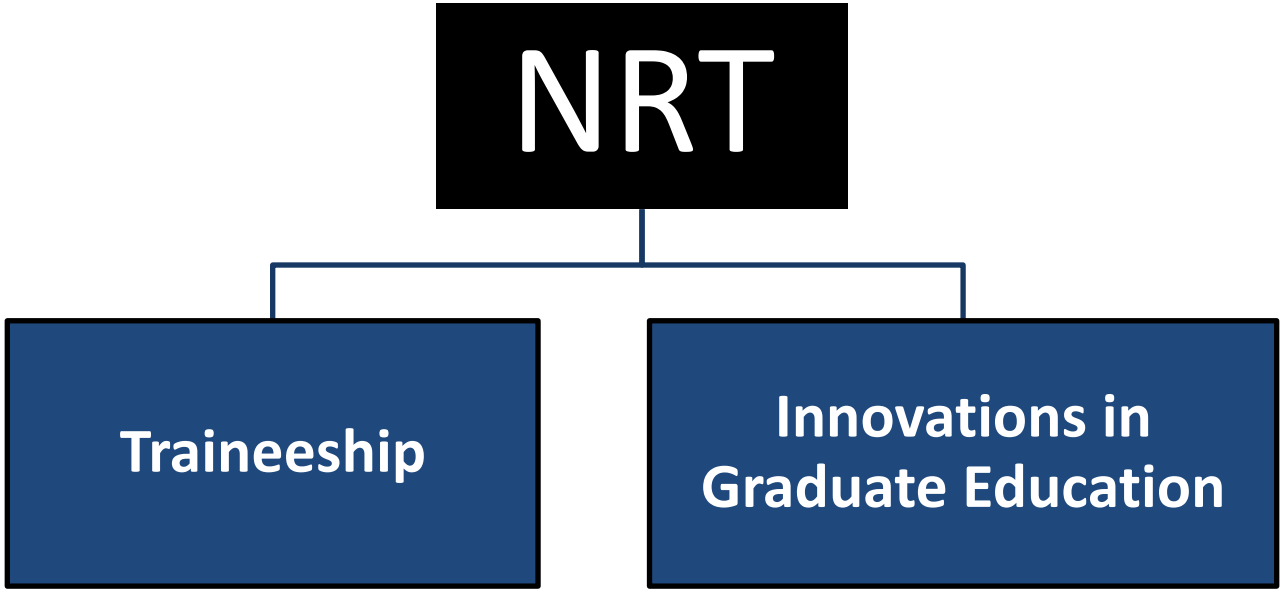
NSF Research Traineeship (NRT) Program

Research and Capacity Building & Student Support

- Launched in Spring 2014 as the successor to IGERT
- Encourages the development and implementation of **bold, new, and potentially transformative models** for STEM graduate education and training
- Seeks proposals that ensure that graduate students in research-based MS and PhD programs develop the skills, knowledge, and **competencies needed to pursue a range of STEM careers**

NSF Research Traineeship (NRT) Program

Research and Capacity Building & Student Support



2016 Deadlines

Letter of Intent: **December 09, 2015**

Full Proposal: **February 09, 2016**

2017 Deadlines

Letter of Intent: **December 09, 2016**

Full Proposal: **February 07, 2017**

How Do the Tracks Differ?

	Traineeship Track	IGE Track
Primary Aim	Comprehensive graduate student training	Pilot, test, and evaluate targeted new approaches, models and activities
Interdisciplinary	Yes	Not Required
Stipend & COE Support:	Yes	No
Duration/Amount	Up to 5 years; < $3 M	Up to 3 years, $300K-$500K
Limit per Organization	2	2
Eligible Organizations	US Institutions that award research-based master's and doctoral degrees	All organizations eligible to submit to the NSF

FY 2016 Traineeship Priority Areas

- **D**ata-**E**nabled **S**cience & **E**ngineering (**DESE**)
- **I**nnovations at the **N**exus of **F**ood, **E**nergy and **W**ater **S**ystems (**INFEWS**)
- **U**nderstanding **t**he **B**rain (**UtB**)
- Other Crosscutting, Interdisciplinary Themes

NRT Addresses Graduate Preparedness

- Develop innovative approaches to graduate education for MS and/or PhD students
- Expand/enhance professional development
- Encourage strategic collaborations with stakeholders (e.g., university-industry partnerships)
- Rely on existing evidence of effective practices in STEM education (evidence-based approaches)
- Generate new knowledge that promotes transformative improvements in graduate education

III. Your Input

What should NSF be thinking about as we improve our programs and develop new initiatives to support graduate education?