Funding Potentially Transformative Research (PTR) at the National Science Foundation

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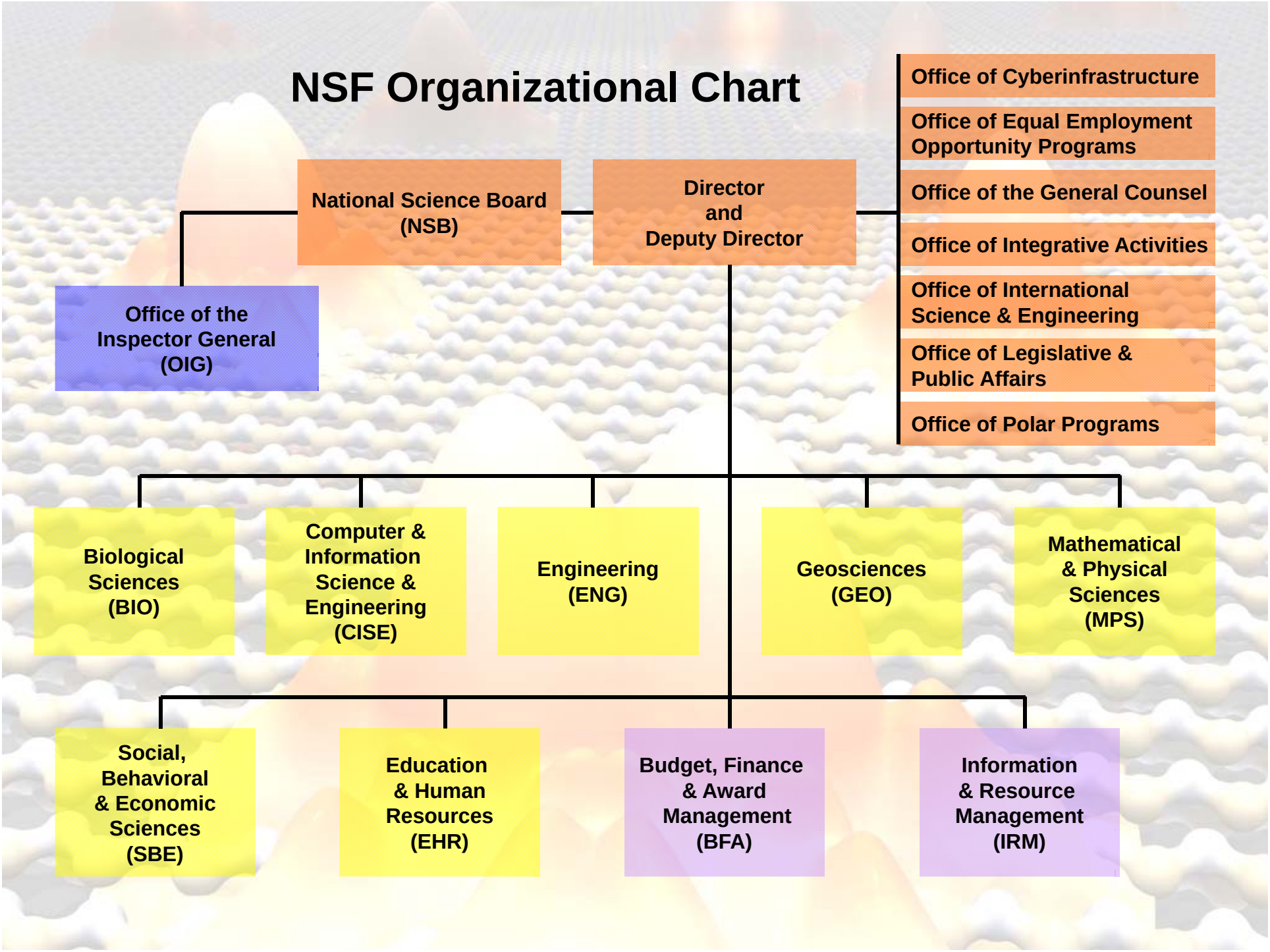
NSF Mission

- Advancing scientific discovery, innovation, and education beyond the frontiers of current knowledge, and empowering future generations in science and engineering
- Through competitive, merit-reviewed grants and cooperative agreements, primarily to universities

NSF Organizational Chart

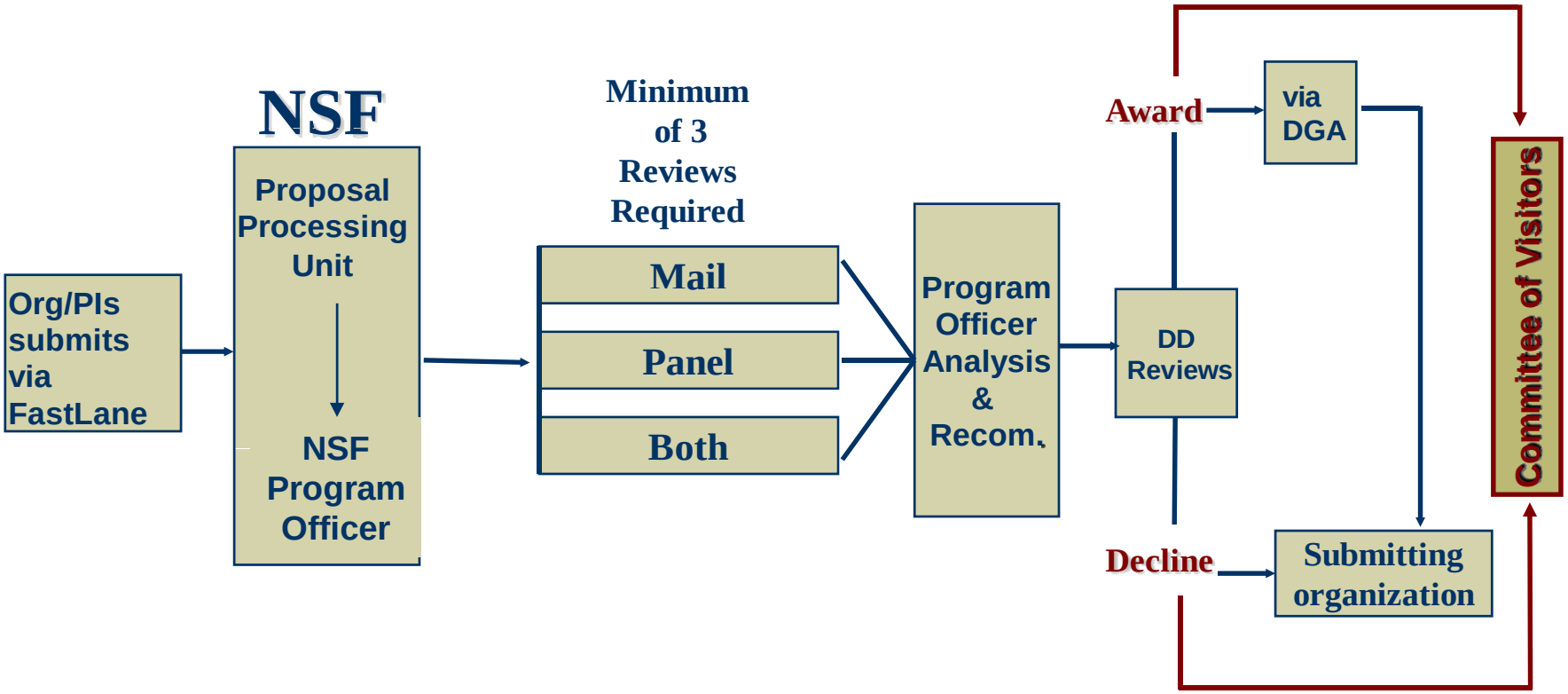


NSF PROPOSAL STATISTICS
(FY 2008)

$6.08 Billion

44,428	proposal actions
~248,000	reviews
~45,000	reviewers
11,149	awards

NSF Merit Review Process



NSF Merit Review Criteria

- What is the intellectual merit of the proposed activity?
- What are the broader impacts of the proposed activity?

Transformative Research Working Definition

- Transformative research involves ideas, discoveries, or tools that radically change our understanding of an important existing scientific or engineering concept or educational practice or leads to the creation of a new paradigm or field of science, engineering, or education. Such research challenges current understanding or provides pathways to new frontiers.

Transformative Research Working Definition (cont'd.)

- Transformative research results often do not fit within established models or theories and may initially be unexpected or difficult to interpret; their transformative nature and utility might not be recognized until years later.

Transformative Research Working Definition (cont'd.)

Characteristics of transformative research are that it:

- Challenges conventional wisdom,
- Leads to unexpected insights that enable new techniques or methodologies, and/or
- Redefines the boundaries of science, engineering, or education.

Examples of Transformative Research

- The continental drift model—at first controversial and then proved correct 50 years later based on new analytical methods and sampling of the ocean floor.
- The idea that polar ice sheets could serve as neutrino detectors, originally tested in Greenland.
- The discovery of the widespread exchange of genetic information in the environment, both among microbes and between microbes and higher organisms, which alters evolutionary changes such as in the development of disease resistance.
- The use of magnetic resonance imaging as a tool for monitoring brain function, which greatly expanded the limits of behavioral research.
- The careful refinement of distance measures in the Universe, intended to fine-tune cosmological parameters, which instead gave rise to radically new physics, and the concept of dark energy.

NSF Supports Potentially Transformative Research or PTR

Don’t know if research is truly transformational until years after initial support

NSF's Approach to Supporting PTR

- ***Learn*** **how to facilitate PTR**
- ***Lead*** **the community through opportunities for PTR proposal submissions**
- ***Infuse*** **support of Potentially Transformative Research (PTR) throughout NSF and all its programs**

Learn

National Science Board study (2007)

- Need a clear definition of transformative research.
- Substantial external perception that NSF does not support transformative research.
- Often does not fit within existing research or centers programs.
- Tends not fare well when a review system is dominated by experts highly invested in current paradigms or during times of limited budgets.
- Recommended the creation of a stand alone Transformative Research Initiative.

Learn

NSF work group on support of PTR (2008)

- NSF has a long history of supporting PTR through core programs and special solicitations
- Improvements can be made in training NSF Program Officers
- Improvements can be made in interactions with the scientific and engineering communities
- Need to provide tools and environment to enable Program Officers to support PTR

PI's and Reviewer's Views on PRT at NSF

Results of a 2007 Survey of NSF Proposers

- 56% believed to a great or moderate extent that NSF welcomes transformative research,
- 42% believed to a great or moderate extent that NSF tended to fund transformative research
- 45% would submit transformative proposals to NSF.

PI's and Reviewer's Views on PRT at NSF

65% believed they had submitted proposals to NSF for transformative research within a three year period. These data are in contrast to the finding that 61% of the respondents thought that less than 10% of the proposals they have reviewed over a three year period constituted transformative research.

Lead

- Notice sent to all NSF supported institutions expressing NSF's desire to support PTR (2007)
- Program Officer training associated with PTR established (2008)
- Outreach to science and engineering communities through "NSF Days," professional societies, and other university/college visits.

Infuse

- Core component of NSF's intellectual merit review criterion (2007)

  How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

Infuse

- **Panel/reviewer instructions**
  - Creativity/training on the part of Program Officers
- **Solicitations emphasizing PTR**
  - Cyber-enabled Discovery and Innovation
  - Science and Technology Centers
  - SOLAR
  - Many others
- **Offices in Research Directorates that facilitate the support of PTR**
  - MPS's Office of Multidisciplinary Activities
  - BIO's Emerging Frontiers Division
  - ENG's Office of Emerging Frontiers in Research and Innovation

Infuse

- In Fiscal Year 2010, NSF plans to have $92 million (~$2 million per division) to supplement or provide incentives to support additional PTR.

New Tool: EArly-concept Grants for Exploratory Research (EAGER)

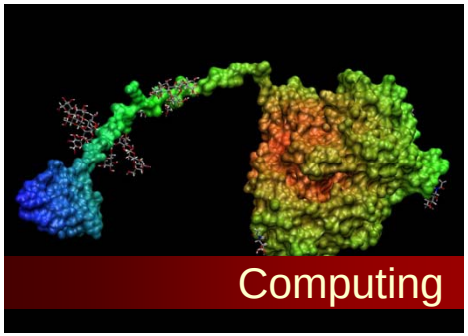
- Exploratory work in its *early stages* on untested, but potentially transformative, research ideas or approaches

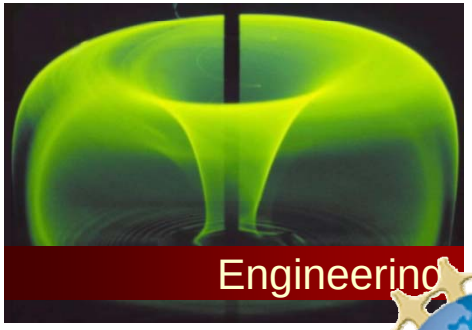
- Radically different approaches, new expertise, or novel disciplinary or interdisciplinary perspectives

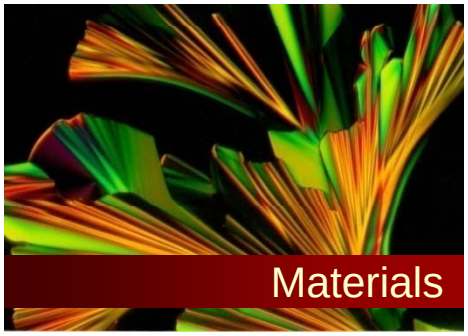
- Budget consistent with project scope and existing programmatic activities (up to $300K for 2 years)

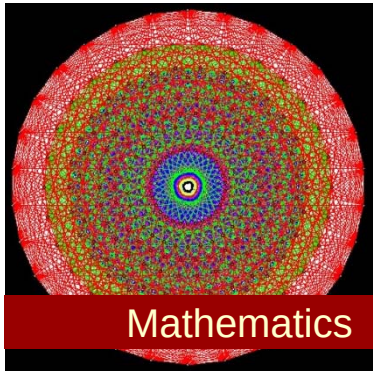
More EAGER

- Program Officer approval needed:
  - PI needs to convince appropriateness for
  - EAGER submission Vs “regular” NSF proposals
- Require internal review/with optional external input
- 5-8 page project description
- No cost extensions/supplements -- existing NSF policies



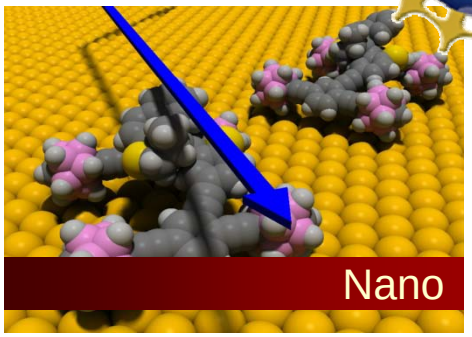


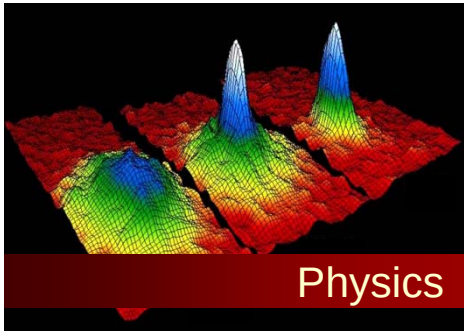




NSF

And so much more!





NSF Research Areas