# NSF Grants Conference.

## Overview of Directorate for Mathematical and Physical Sciences

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Program Director - MPS
Division of Materials Research

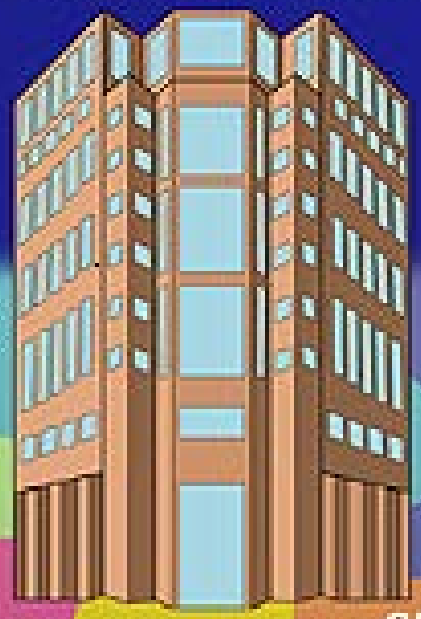
**March 19-20, 2012**

**Hosted by: Loyola University Chicago & Northwestern University Evanston, IL**

# NSF Grants Conference

# OneNSF

***catalyze*** human capital development



***improve*** organizational efficiency

***create*** networks and infrastructure for the nation

***spark*** greater innovation and opportunity for scientific discoveries

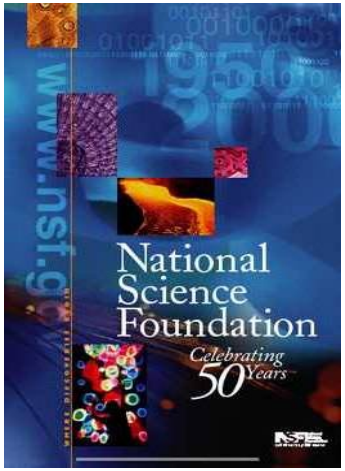
***address*** multidisciplinary challenges of national/global significance

***support*** fundamental research in all disciplines

# NSF Vision and Goals

- Vision
  - » Advancing discovery, innovation and education beyond the frontiers of current knowledge, and empowering future generations in science and engineering
- Goals
  - » Discovery
  - » Learning
  - » Research Infrastructure
  - » Stewardship

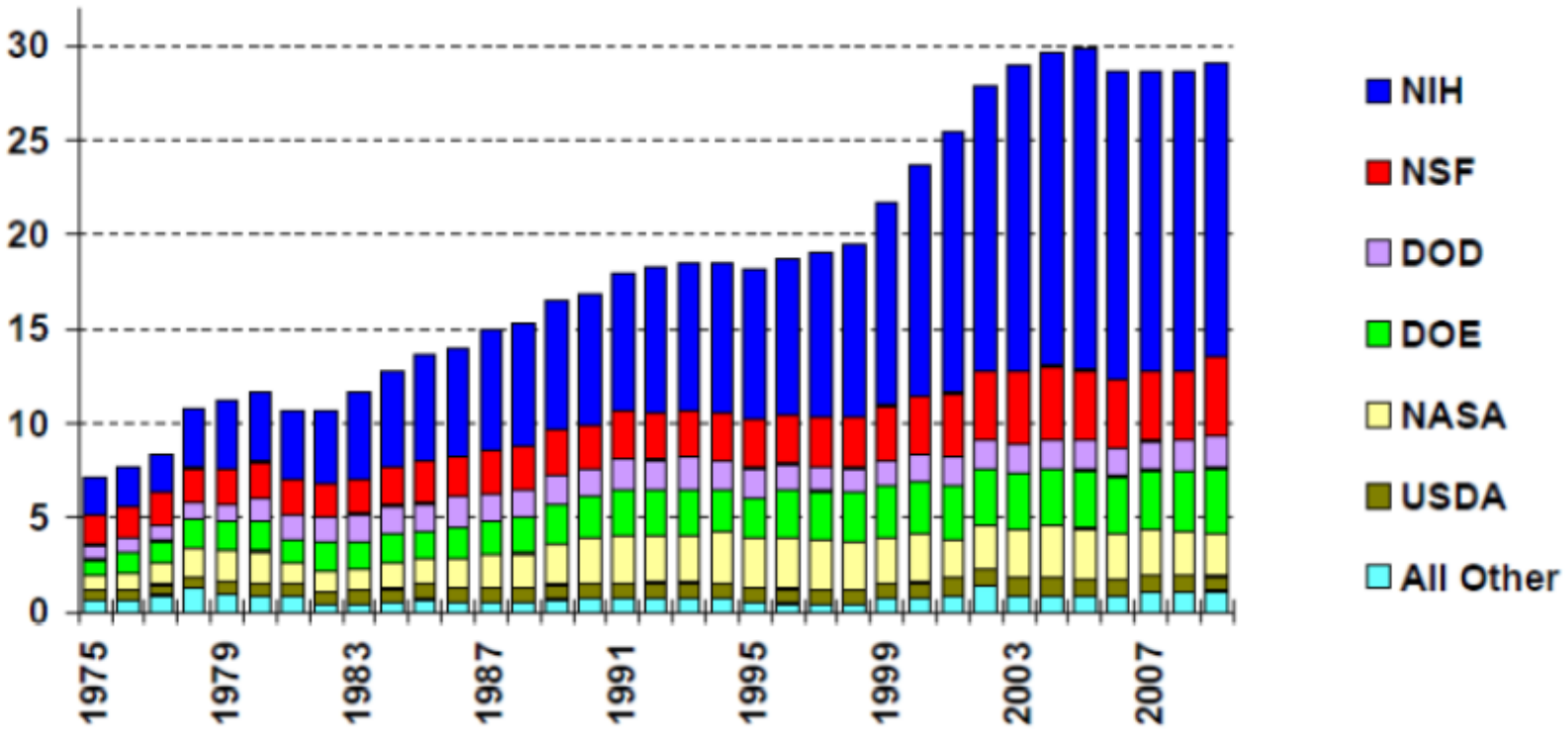
# NSF in a Nutshell




- Independent agency
- Support basic research and education
- Use grant mechanism in two forms:
  - » Unsolicited, curiosity driven (majority of $)
  - » Solicited, more focused
- Peer reviews: Intellectual Merit & Broader Impacts
- Support all fields of science/engineering
- Discipline-based structure
- Cross-disciplinary mechanisms
- Support large facilities

# Trends in Basic Research by Agency, FY 1975-2009 *

## in billions of constant FY 2008 dollars

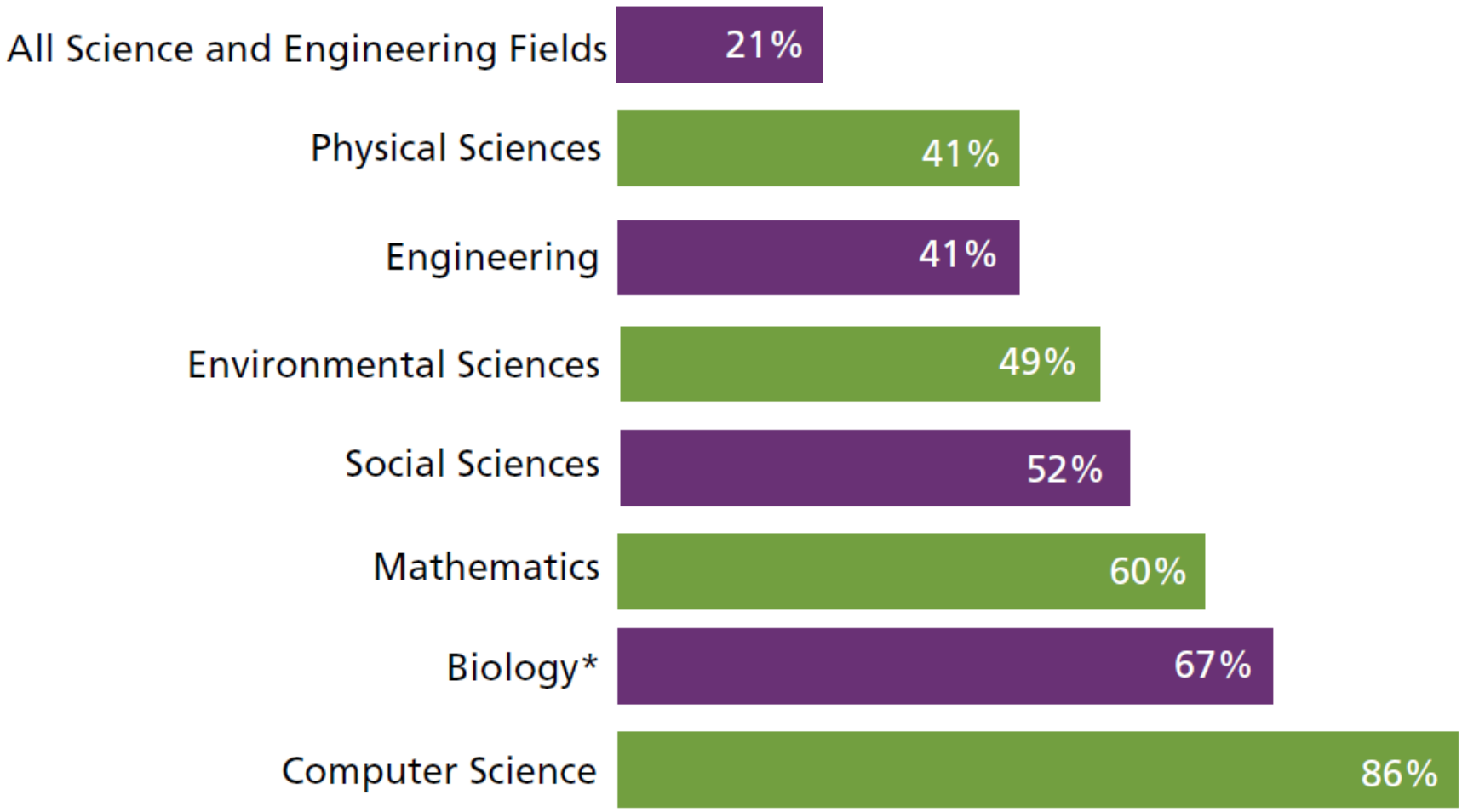



Source: AAAS analyses of R&D in *AAAS Reports VIII-XXXIII*. * FY 2009 figures are latest AAAS estimates of FY 2009 request.
Basic research only.
MARCH '08 REVISED © 2008 AAAS

AAAS

# NSF SUPPORT OF ACADEMIC BASIC RESEARCH

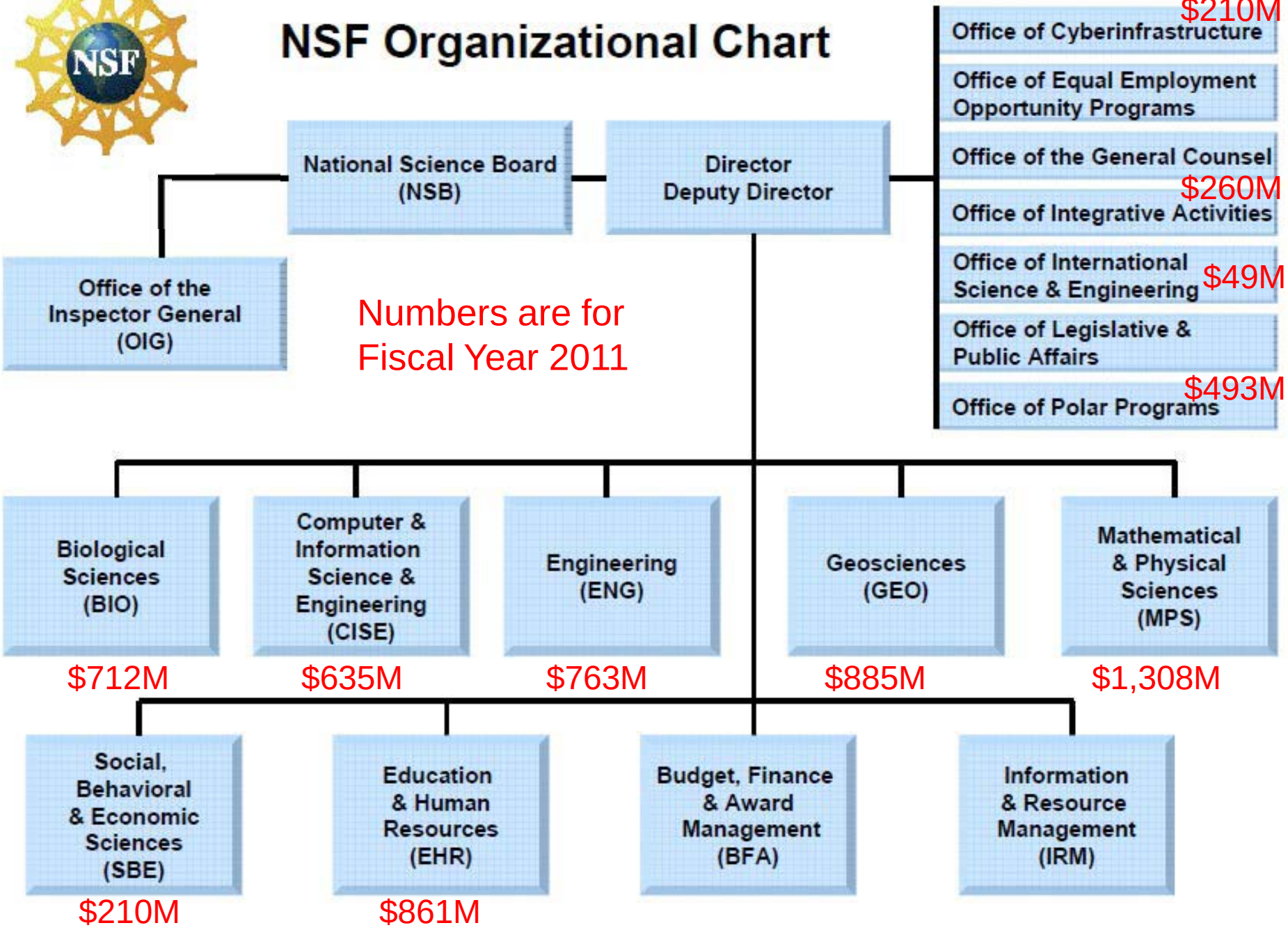
*(as a percentage of total federal support)*




*Excludes the National Institutes of Health.

*Source:* NSF Survey of Federal Funds for Research and Development.

# NSF Organizational Chart



# NSF-Wide Scientific Investments

Directorates

- Biological Sciences
- Computer & Information S&E
- Engineering
- Geosciences
- Math and Physical Sciences
- Social, Behavioral, & Econ Sci.
- Education & Human Resources
- OPP, OIA, OISE, OCI

Cyber-enabled Discovery & Innovation

Nano-scale Science & Engineering

Networking & Information Technology R&D

Science and Engineering Beyond Moore's Law

Broadening Participation

# NSF-Wide Programs

Directorates

- Biological Sciences
- Computer & Information S&E
- Engineering
- Geosciences
- Math and Physical Sciences
- Social, Behavioral, & Econ Sci.
- Education & Human Resources
- Office of Polar Programs
- Office of Integrative Activities

CAREER

ADVANCE

EPSCOR

IGERT

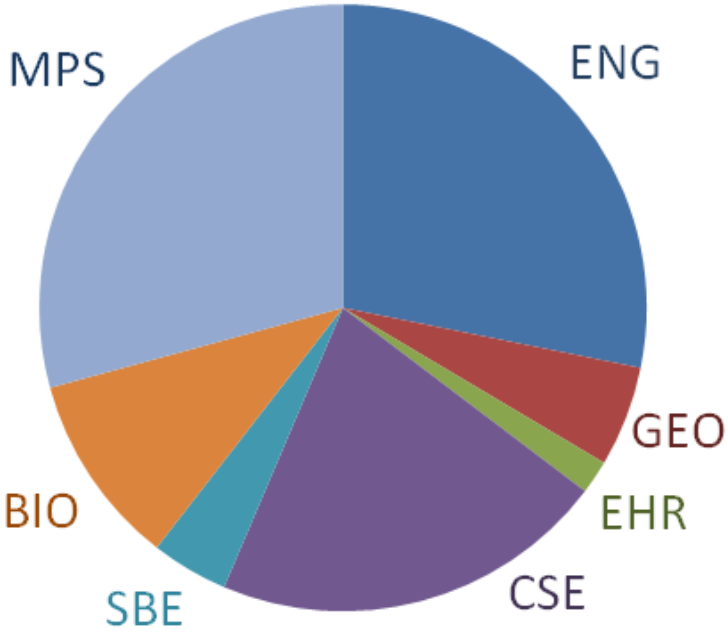
REU

RET

RUI, ROA

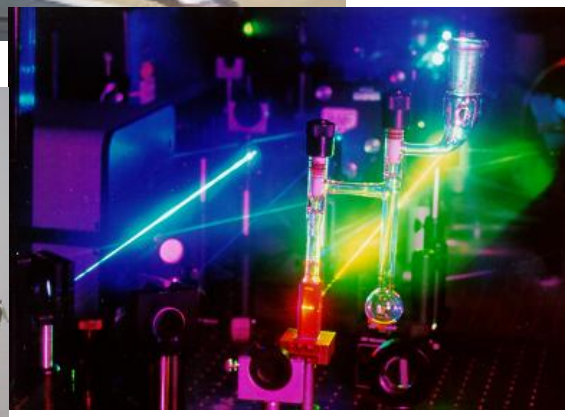
# CAREER Program

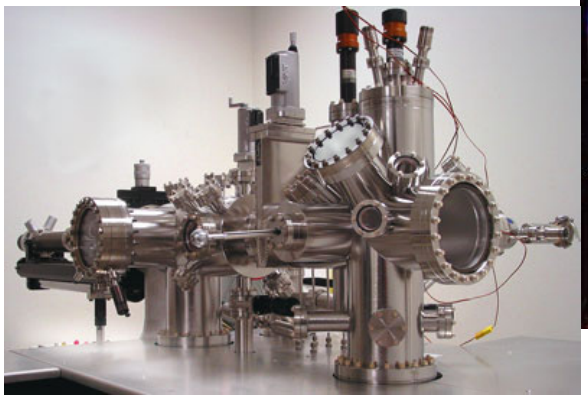
- NSF's most prestigious awards for junior faculty.
- Awardees are selected based on their plan of outstanding research, excellent education, and the integration of research and education within the context of the mission of their organizations, building a firm foundation for a lifetime of leadership.
- Increased participation of those traditionally under-represented in science and engineering is encouraged.



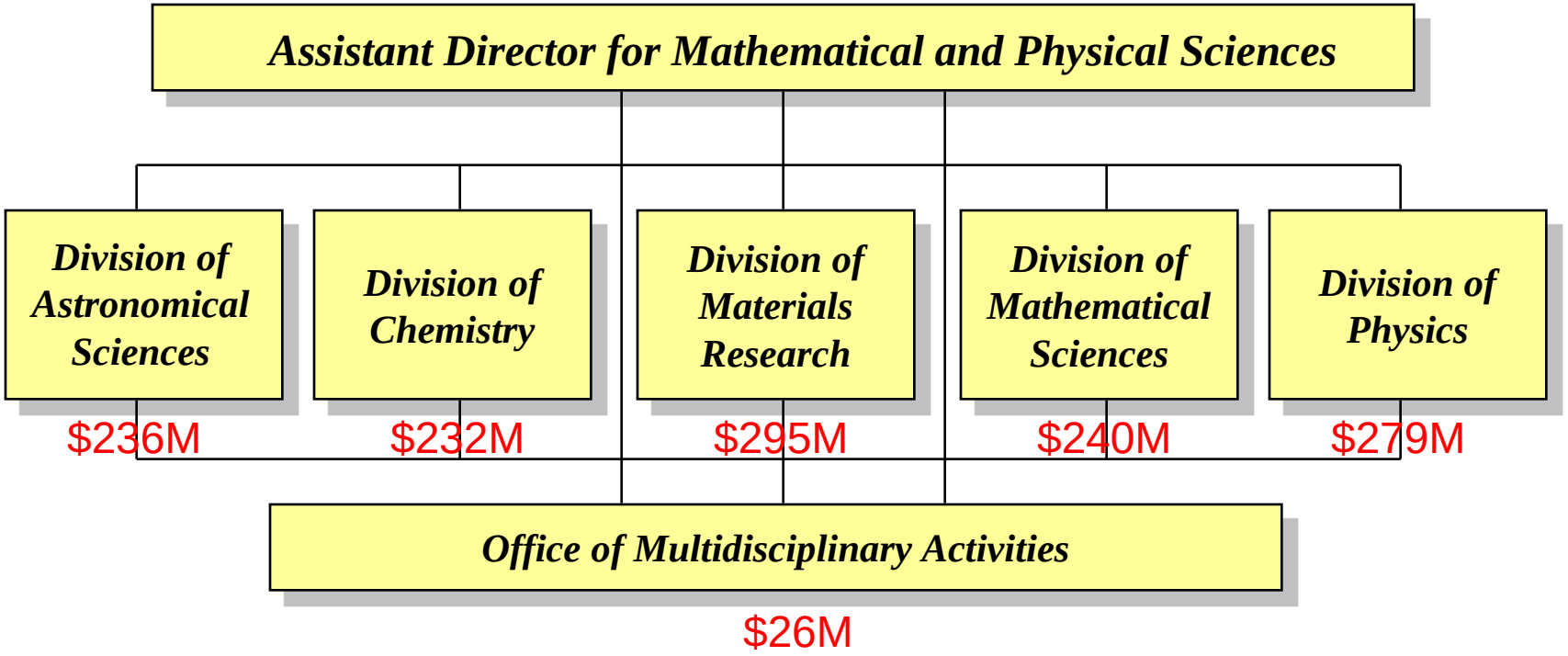
# Instrumentation

- Both acquisition and development
- Major Research Instrumentation (MRI)
- Divisional instrumentation programs
- Research grants





# Directorate for Mathematical and Physical Sciences (MPS)




Numbers are for Fiscal Year 2011
Total = $1308M.

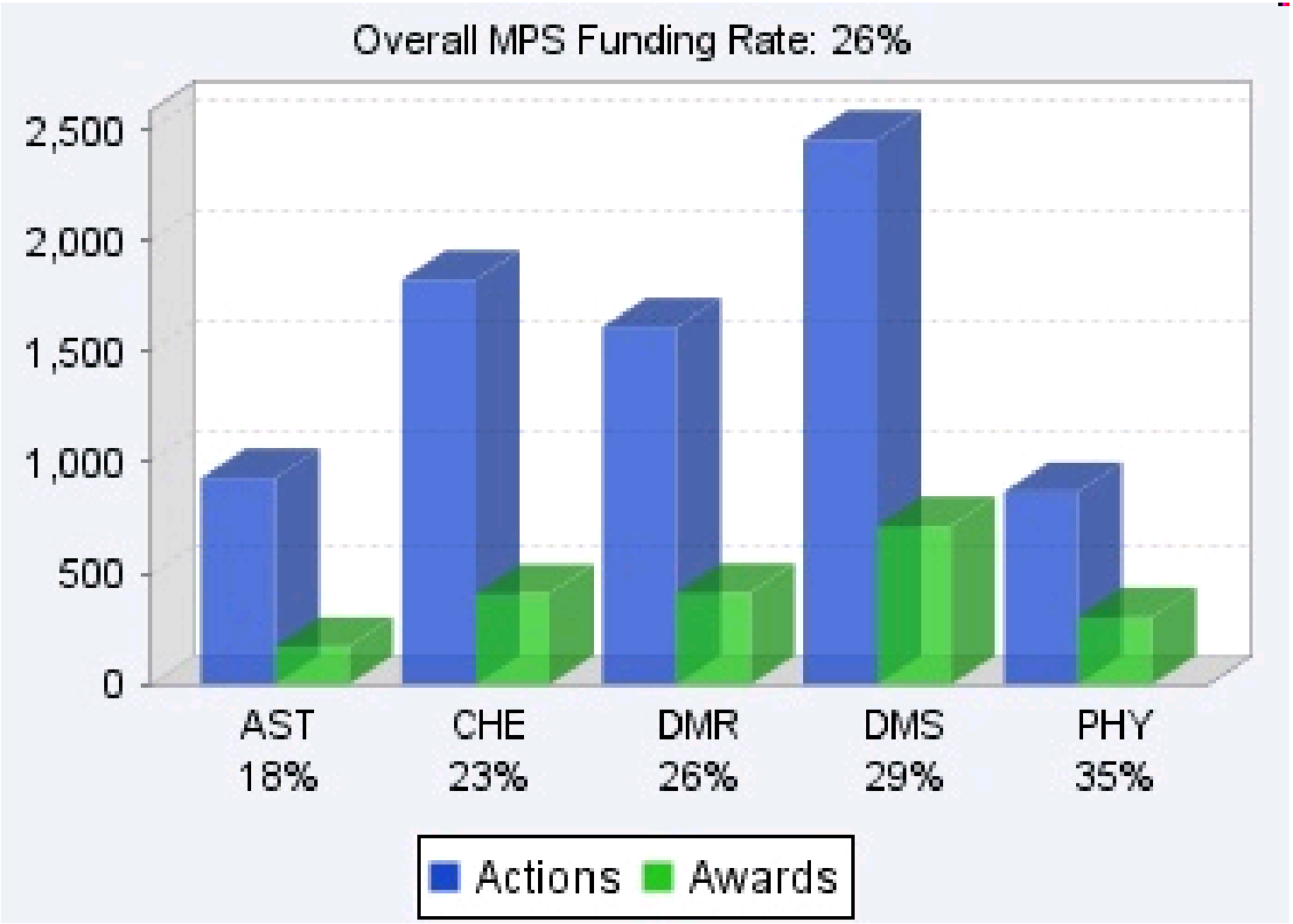
# Directorate for Mathematical and Physical Sciences

- To make discoveries about the Universe and the laws that govern it;
- To create new knowledge, materials, and instruments which promote progress across science and engineering;
- To prepare the next generation of scientists through research, and to share the excitement of exploring the unknown with the nation.

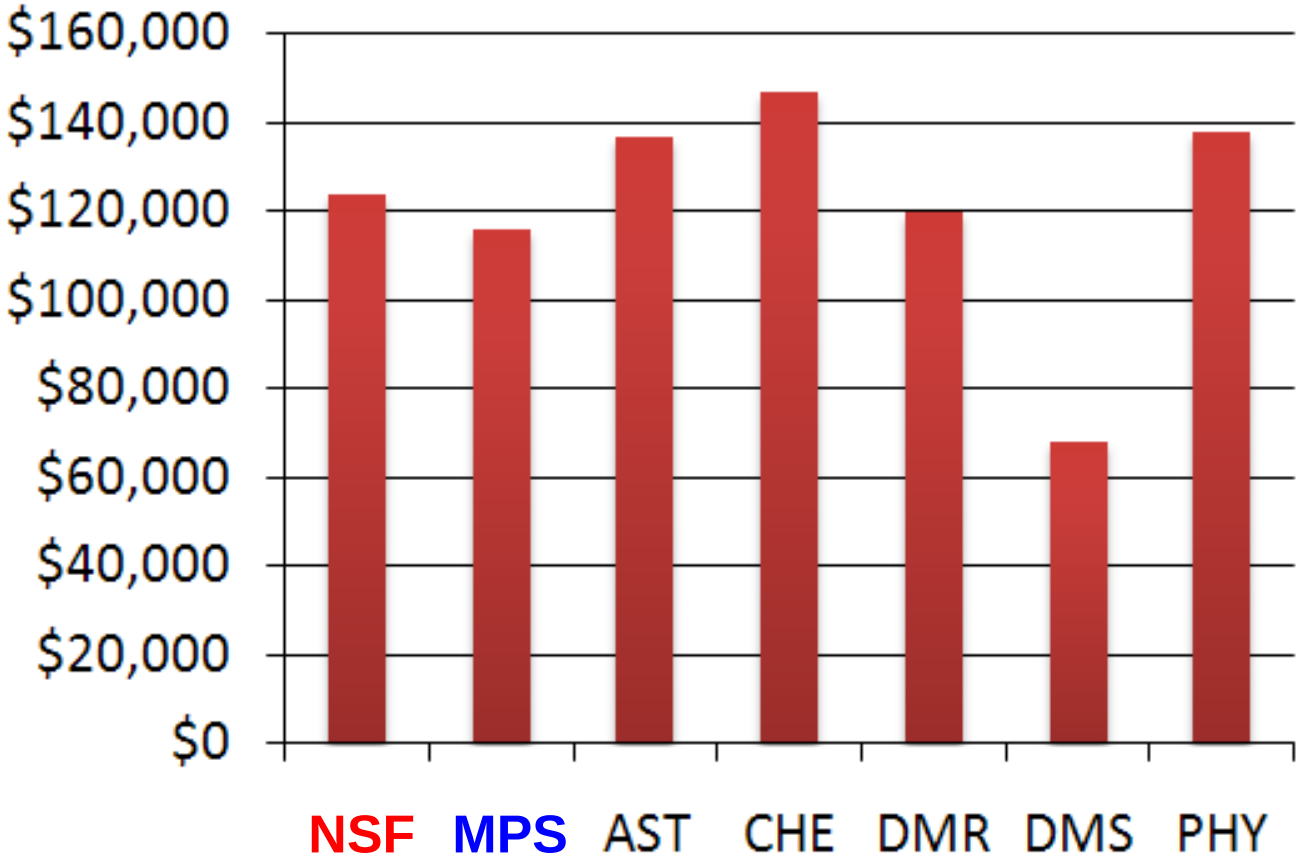
# Directorate for Mathematical and Physical Sciences

- Largest directorate
  - ~25% of R&RA, ~18% of proposals, FY11 request $1410m
- Nearly half of NSF's large facilities
- Responsible for the three "core" university disciplines - Physics, Chemistry, Mathematics – plus Astronomy and Materials Research
- Over 40% of university federal funding in the physical sciences
  - More than 80% in mathematics, and (was) growing
  - Federal steward for ground-based astronomy
- Science scope - extension on every scale
  - Femtoseconds and attoseconds to petaseconds and exaseconds
  - From the Planck size to the Cosmic size
  - From nanoKelvin to GigaKelvin
  - From fundamental research to marketable technologies
  - Every mental horizon from n-dimensions to infinity and beyond …

# Funding Rates (2010)

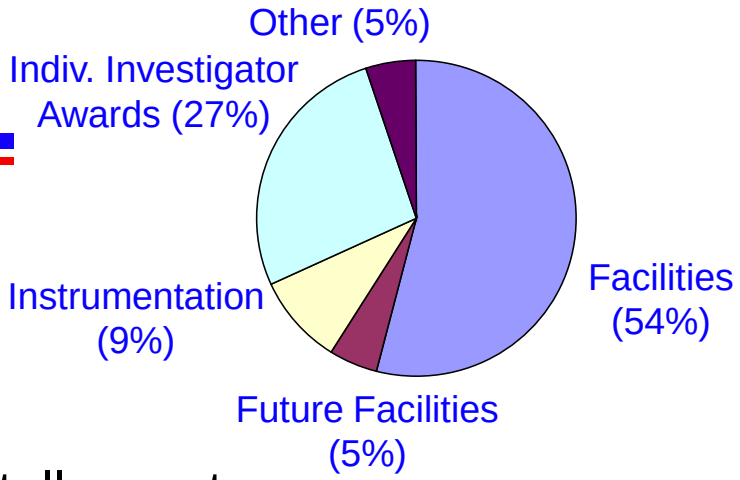


# Median Annualized Award Size (2010)




Mean Award Duration: About Three Years

# Astronomical Sciences (AST)




- From the Big Bang to DNA
  - » Origin and evolution of the Universe
  - » Origin and evolution of galaxies
  - » Origin and evolution of planetary and stellar systems
- National astronomy portfolio
  - » Three agencies – NSF, NASA, and DoE – and international partnerships
  - » Strong tradition of private funding
  - » NSF assigned federal stewardship of ground-based astronomy
  - » **Includes open-access facilities and mission-free unrestricted grants**

AST has a strong program in Education and Special Programs (including a major investment in post-docs)

# Chemistry (CHE)

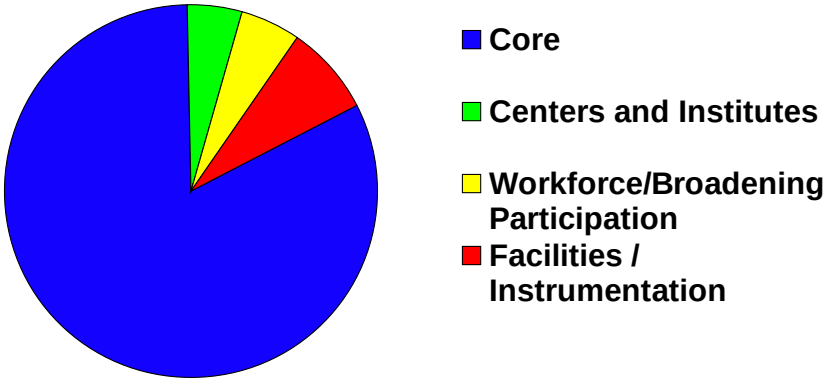
- Chemical Synthesis
- Chemical Structure, Dynamics, and Mechanisms
- Theory, Models, and Computational Methods
- Chemical Measurement and Imaging

**Integrative Chemistry Activities**

- Centers
- Education and Broadening Participation
- Facilities and Instrumentation

- Environmental Chemical Sciences
- Chemistry of Life Processes
- Chemical Catalysis
- Macromolecular, Supramolecular, and Nanochemistry

- Major CAREER and REU support
- Centers program growing
- Collaborations with NIH and DOE
- Critical areas of research for FY 2010: Energy, Element and Molecule Recycling, Designed Emergent Behavior, Imaging the Ultrasmall



# Materials Research (DMR)

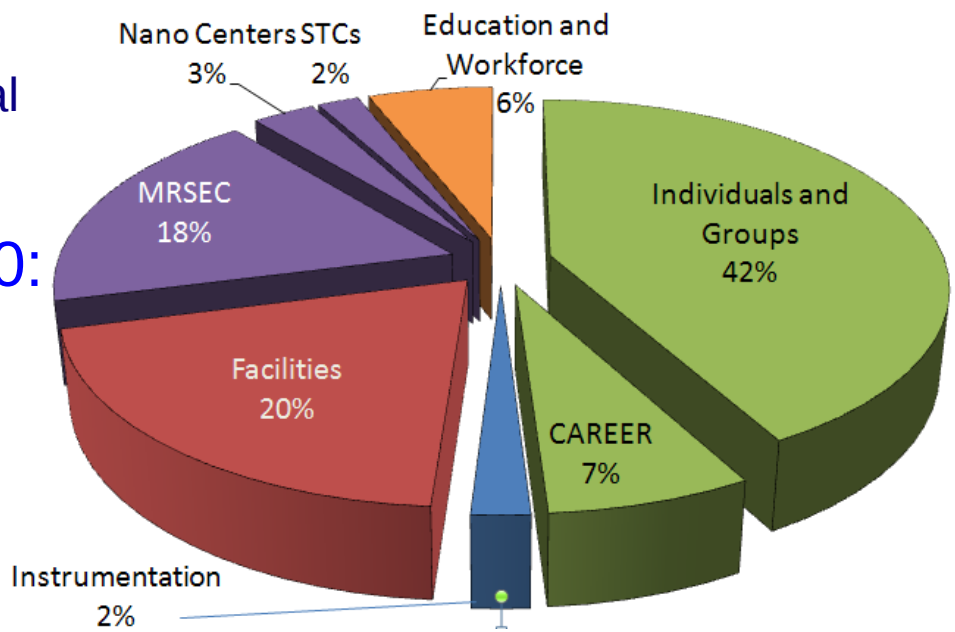
## DMR Programs:

- Ceramics, Electronic and Photonic Materials, Metals and Metallic Nanostructures
- Condensed Matter Physics, Condensed Matter and Materials Theory
- Biomaterials, Polymers, Solid-Sate and Materials Chemistry
- Materials Research Science and Engineering Centers
- National Facilities and Instrumentation
- Office of Special Programs (international collaboration; education)

DMR supports a wide breadth of science – fundamental research to the development of technological applications.

## Key Research Areas for FY 2010:

» Environmental, energy, and economic sustainability
» Matter by design
» The quantum realm
» Physical-chemical-biological interfaces



# Mathematical Sciences (DMS)

| Analysis | Algebra Num. Th. Combinat | Geometry Topology | Applied Math | Comp Math | Probabil. Statistics | Workforce | Institutes |
|---|---|---|---|---|---|---|---|

"Core business:" single investigator and group proposals through targeted solicitations

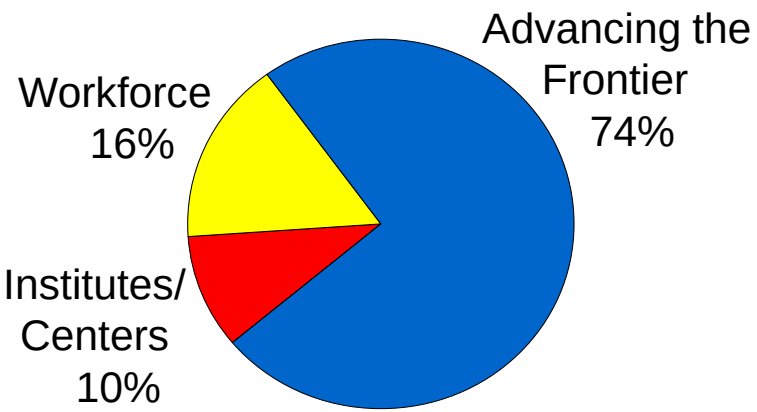
Covers the entire mathematical spectrum

Institutes: 5 NSF-initiated, support for 3 others

» Visitors to long term programs, workshops

Workforce: responding to a major challenge.

» EMSW21 training grants
» Postdoctoral fellowships
» Research for Undergraduates




In addition to the fundamental research in mathematical sciences, DMS plays an enabling role of all other sciences; DMS has been successful in partnering with other NSF Divisions and Directorates and with other government agencies.

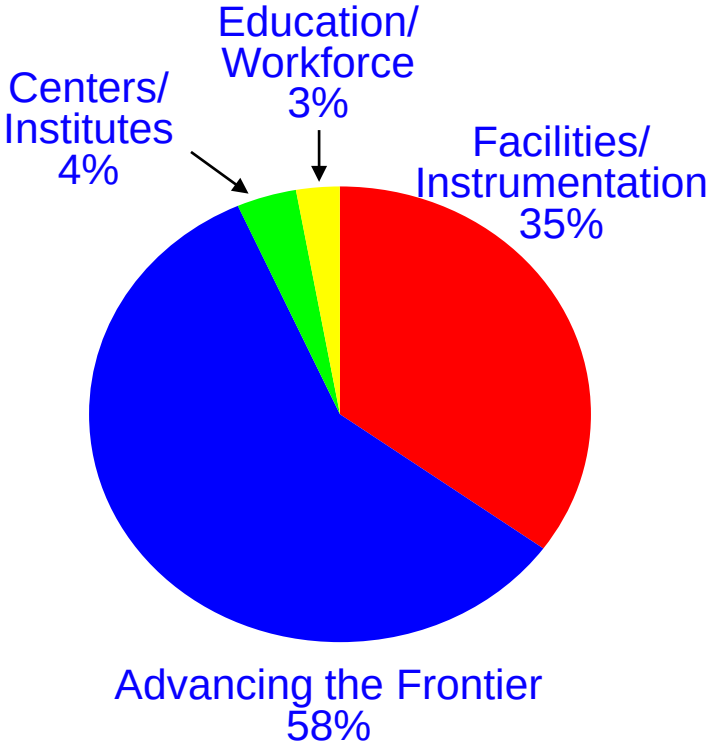
# Physics (PHY)

Facilities:

LHC, LIGO, IceCube, NSCL, …

Programs:

- Atomic, Molecular, Optical, and Plasma Physics
- Biological Physics
- Elementary Particle Physics
- Gravitational Physics
- Nuclear Physics
- Particle and Nuclear Astrophysics
- Physics at the Information Frontier
- Physics Frontiers Centers
- Theoretical Physics
- Education and Interdisciplinary Programs




PHY collaborates closely with DOE and international partners to support science at large facilities. NSF's physics portfolio is more diverse than physics portfolios at any other federal agency.

# Grant Proposal Guide, January 2011

Available Formats: HTML | PDF
Document Type: General Information
Document Number: gpg11001

Public Comment: Effective for proposals submitted on or after January 18, 2011. Please see the the FAQs associated with this guide.

Document History: Posted: October 1, 2010. Replaces: gpg101.

For more information about file formats used on the NSF site, please see the Plug-ins and Viewers page.



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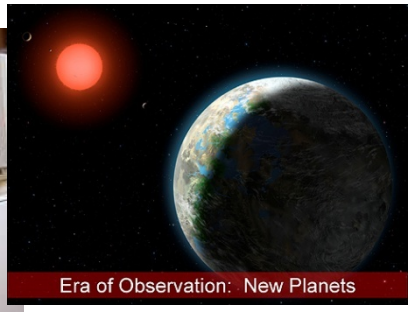
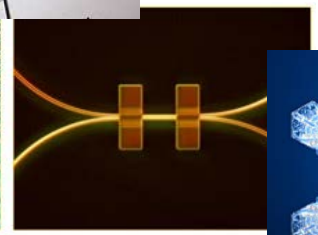
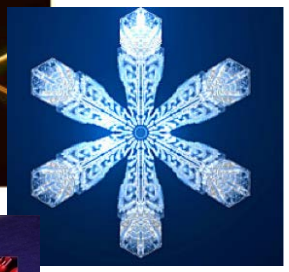
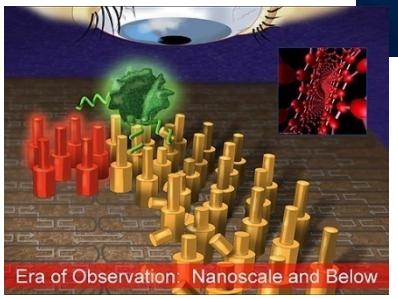
# Merit Review Criteria: Intellectual Merit

- 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?
- 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?









# Merit Review Criteria:
# Broader Impacts

- How well does the activity advance discovery and understanding while **promoting teaching, training, and learning**?
- How well does the proposed activity broaden the participation of **underrepresented groups**?
- To what extent will it enhance the **infrastructure** for research and education, such as facilities, instrumentation, networks, and partnerships?
- Will the **results be disseminated** broadly to enhance scientific and technological understanding?
- What may be the benefits of the proposed activity to **society**?

# What Makes a Strong Proposal?

- New and original ideas (what?)
- Sound, succinct, detailed focused plan (how?)
- Preliminary data and/or feasibility calculations
- Relevant experience (why me/us?)
- Clarity concerning future direction (so what?)
- Well-articulated broader impacts

# NSF Proposal Preparation

- Read the funding opportunity (program descriptions, solicitations) carefully, and ask an NSF Program Director for clarifications if needed
- Contact the Program Director(s) to discuss your project: email with 1-2 page description and questions, call, visit
- Be familiar with programs and funded projects
  - Guide to Program:
    http://www.nsf.gov/funding/browse_all_funding.jsp
  - Award information, including abstracts:
    http://www.nsf.gov/awardsearch
- Know the audience for your proposal's review - it is a competition!

# NSF Proposal Submission

- Know and follow the ***current*** Grant Proposal Guide (GPG) - it changes! (data management, postdoc mentoring, …)
- ***Explicitly*** address Intellectual Merit and Broader Impacts in both the Project Summary and Project Description
- Match and justify the budget to the scope of the proposed work - ask for what you need
- Submit proposals before the last day/hour
- Download your completed proposal back to you to check it's what you sent

# www.nsf.gov

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Special Notices
NSF is currently accepting nominations for the 2011 Alan T. Waterman Award (deadline: October 30, 2010)
NSB is currently accepting nominations for the 2011 Vannevar Bush Award and the 2011 NSB Public Service Award (Deadline: November 3, 2010)
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# Get Involved

- Proposals: Send your best ideas to NSF
- Reviewers and panelists: Create an informative web site and update it at least once a year
- Workshop participants and organizers
- Rotators

For information on a particular MPS division and program, go to the following web address and pick a Division:

**http://www.nsf.gov/home/mps**

**Contact NSF Program Directors for questions & suggestions**

# Some Useful Web Sites

- NSF: www.nsf.gov
- MPS: http://www.nsf.gov/home/mps
- Guide to Program: http://www.nsf.gov/funding/browse_all_funding.jsp
- Award information: http://www.nsf.gov/awardsearch
- FastLane: https://www.fastlane.nsf.gov
- Broader impacts: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf
- Data management plan: http://www.nsf.gov/bfa/dias/policy/dmp.jsp
- CAREER: http://www.nsf.gov/CAREER

# NSF Regional Grant Conference

## Thanks

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