Navigating the NSF Funding Process

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Charles Cunningham
Program Director & CDF Cluster Leader
Division of Molecular and Cellular Biosciences
Directorate for Biological Sciences
National Science Foundation

Outline

- Overview of NSF
- Funding Opportunities
- NSF Merit Review Criteria and Process
- Tips: How to Write a Successful Proposal

NSF Versus NIH

Similarities

- Based on peer review
- Overlapping scientific interests
- Integration of separate organizational units (*Directorates versus Institutes*)

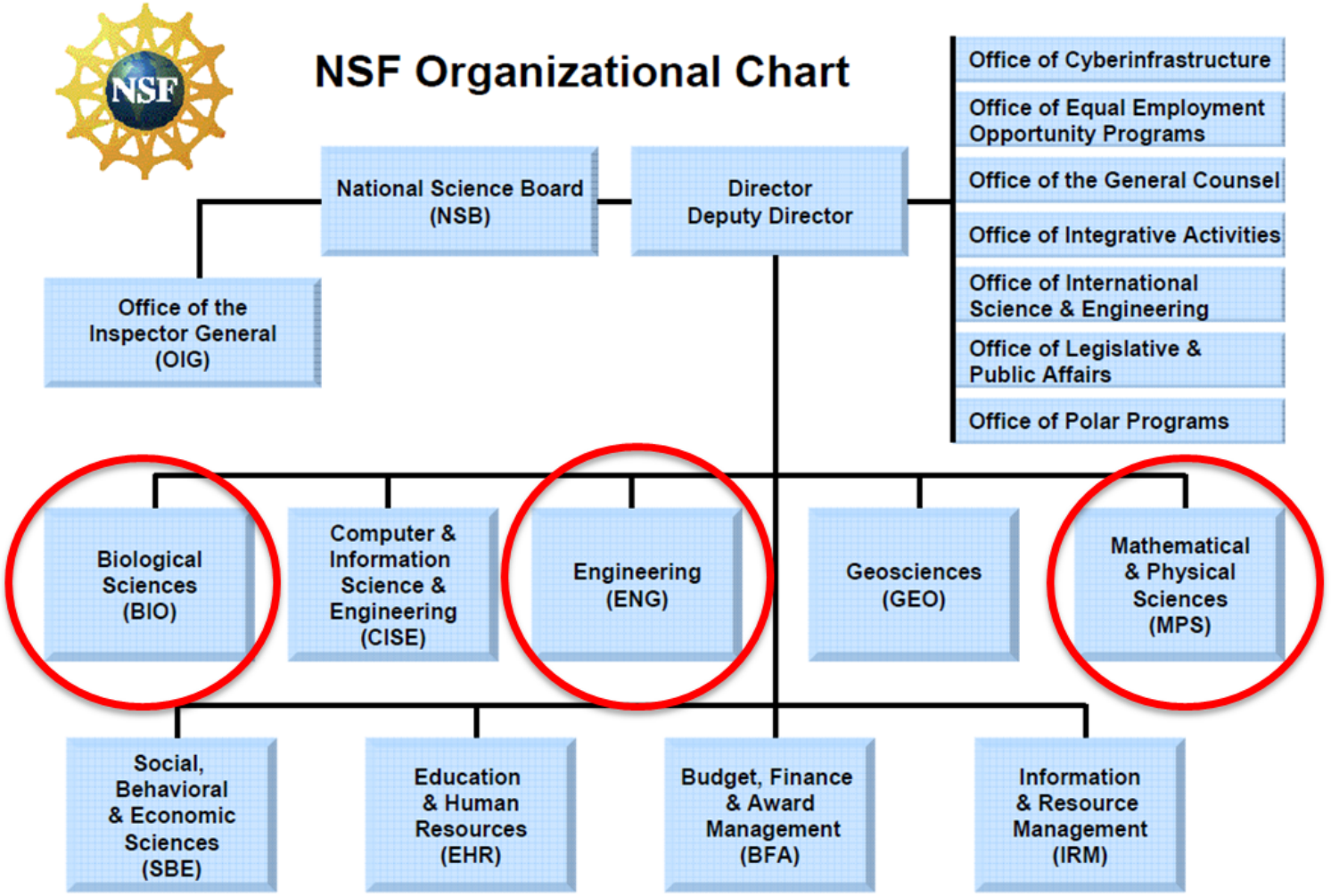
Differences

- Missions (*basic science vs. biomedicine*)
- Review criteria
- Details of review process
- Role of program directors and process of award recommendations
- Budgets (*NSF<NIH*) and award durations

NSF at a Glance

- Supports basic science, engineering and education
- Budget: ~$7.5 billion
- Makes 11,000 new awards from > 40,000 submissions with approximately 23% success rate
- Funds approximately 24% of federally funded research at colleges and universities
- Supports ~200,000 faculty, researchers, fellows, students at 1,922 colleges, universities and other institutions
- About half of program officers are “rotators”

Organizational Structure of NSF



Directorate for Biological Sciences Mission and Structure

- Mission: To enable discoveries for understanding life
- Four Divisions
  - Biological Infrastructure
  - Environmental Biology
  - Integrative Organismal Systems
  - Molecular and Cellular Biosciences

Biological Infrastructure (DBI)

Supports infrastructure for contemporary research in biology

- **Research Resources**
  - Biological Informatics
  - Biological Research Collections
  - Biological Field Stations (NEON!)
  - Instrument Development
- **Human Resources**
  - Research Experiences for Undergraduates
  - **Postdoctoral Research Fellowships (inc.Plant Genome Initiative)**
  - Research Coordination Networks

Environmental Biology (DEB)

Supports research on origins, functions, relationships, interactions, and evolutionary history of populations, species, communities, and ecosystems

- **Ecosystem Science**
- **Evolutionary Processes**
- **Population and Community Ecology**
- **Systematics and Biodiversity Science**

Integrative Organismal Systems (IOS)

Supports research aimed at understanding organisms as units of biological organization, with emphasis on systems-level approaches to the study of their development, function, behavior, and evolution

- **Behavioral Systems**
- **Developmental Systems**
- **Neural Systems**
- **Physiological and Structural Systems**
- **Plant Genome Research Program**

Molecular and Cellular Biosciences (MCB)

- Supports fundamental research and related activities designed to promote understanding of complex living systems at the molecular, subcellular, and cellular levels.
- MCB supports quantitative, predictive, and theory-driven research designed to decipher the molecular underpinnings of complex living systems.

MCB Cluster descriptions
Molecular Biophysics

- General principles of the relationship between structure, dynamics and function of biomolecules.
- Fundamental principles governing biomolecular interactions and mechanisms.

MCB Cluster descriptions
Systems and Synthetic Biology

- Systems level, theory driven analysis of regulatory, signaling and metabolic networks.
- Synthetic biology to address fundamental biological problems including the origin of life, minimal cell, emergent behavior in complex systems, robustness in design and organization.
- Tool development to facilitate systems and synthetic biology study.

MCB Cluster descriptions
Genetic mechanisms

- Gene expression, including epigenetics and RNA-mediated regulation.
- Chromosome dynamics, DNA replication, repair, recombination and and inheritance.
- Evolution of genes and genomes.

MCB Cluster descriptions
Cellular Dynamics and Function

- Predictive understanding of the behavior of living cells through integration of modeling and experimentation.
- Integrative cellular functions across broad spatiotemporal scales from single molecules to whole cells.
- Origin, evolution and function of cells, organelles and microcompartments.

Molecular and Cellular Biosciences (MCB)

- MCB supports quantitative, predictive, and theory-driven research designed to decipher the molecular underpinnings of complex living systems.
- MCB encourages proposals that address major biological questions using approaches at the intersections of biology with other disciplines
- "Research with disease-related goals, including work on the etiology, diagnosis or treatment of physical or mental disease, abnormality, or malfunction in human beings or animals, is normally NOT supported.

Related Chemistry Programs

- The Chemistry of Life Processes (CLP) Program supports investigations at the interface of Chemistry and Biology in which the primary knowledge contributions and innovations are in the chemistry aspects of the project; for example, in the study of molecular structure and reaction mechanisms of biologically important systems.

Related Physics Programs

- The Physics of Living Systems program (PoLS) supports synergy of theoretical and experimental research exploring fundamental physical processes utilized by living systems in dynamic and diverse environments. The focus of the research proposals should be on understanding basic physical principles that underlie biological function.

Funding Opportunities

- Regular Research Awards
- Research in Undergraduate Institutions (RUI) Awards
- Faculty Early Career Development (CAREER) Awards
- Grants for Rapid Response Research (RAPID) Awards
- Early-Concept Grants for Exploratory Research (EAGER) Awards
- Research Advanced by Interdiciplinary Science and Engineering (RAISE) Awards

Regular Research Proposals

- Quantitative, predictive, theory-driven
- Address questions relevant to any research area in the MCB Division (often at the interface)
- Encouraged to apply integrative approaches to address major biological questions (including theory, methods and technologies from physical sciences, mathematics, computational sciences, and engineering)
- Require substantial preliminary data
- Typical award duration: 3-4 years

Research in Undergraduate Institutions (RUI)

- Predominantly undergraduate institutions
- Research scope and expected progress smaller relative to research grants from larger institutions
- Significant preliminary data expected
- Typical award duration: 3 years

EArly-concept Grants for Exploratory Research (EAGER)

- High risk – High payoff
- Radically different approaches, applies new expertise or engages novel disciplinary perspectives
- Exploratory work in its early stages
- Untested, potentially transformative ideas
- $300,000 for 2 years

Rapid Response Research (RAPID)

- Projects with severe urgency with regard to availability of, or access to data, facilities or specialized equipment.
- Includes quick-response research on natural or anthropogenic disasters and similar unanticipated events.

Faculty Early Career Development Award (CAREER)

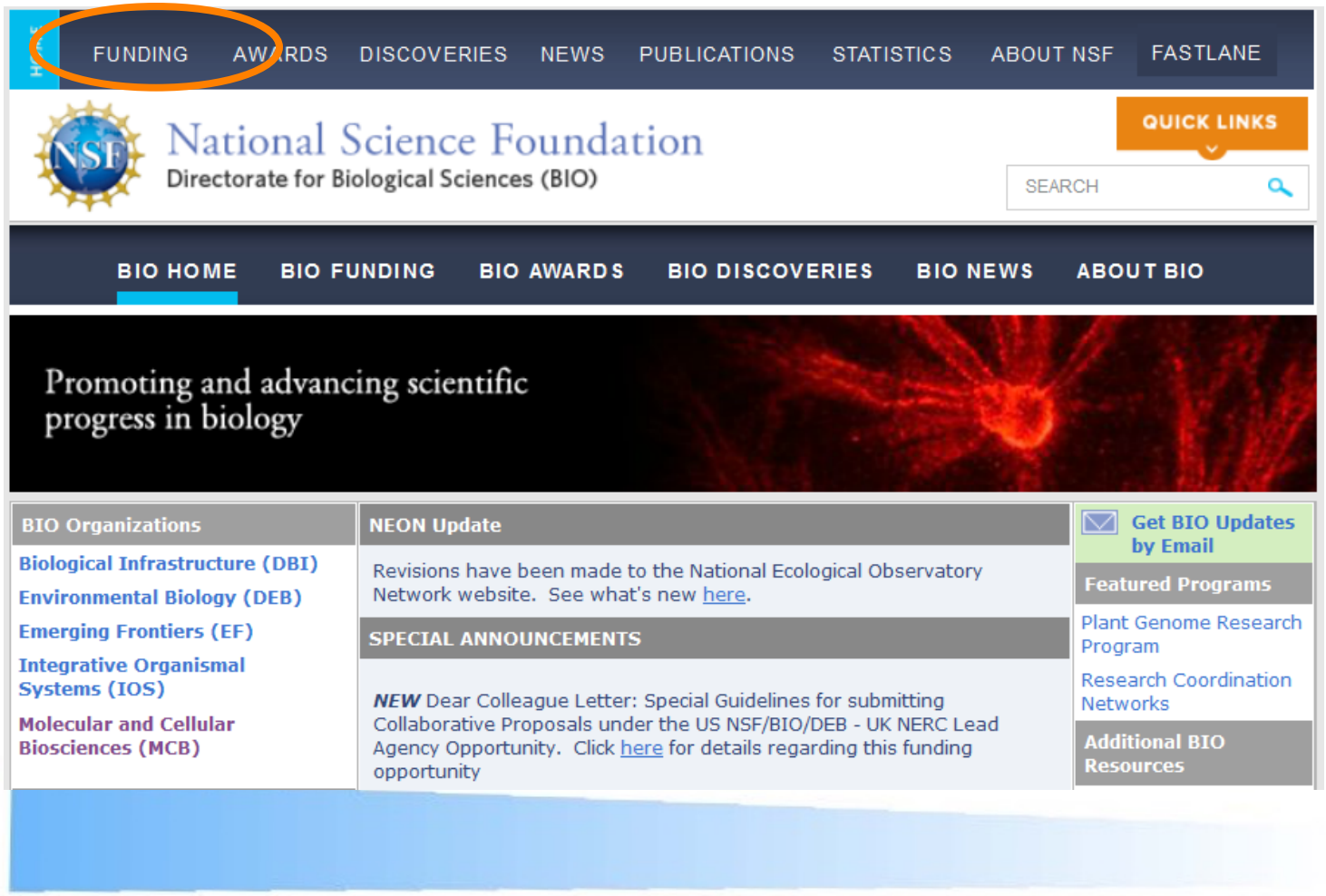
- Support non-tenured faculty members to become the next generation of academic leaders
- Emphasis on projects that effectively integrate research and education
- Require substantial preliminary data
- Typical award duration: 5 years with **minimum** funding of $100,000 per year

Research Advanced by Interdisciplinary Science and Engineering (RAISE)

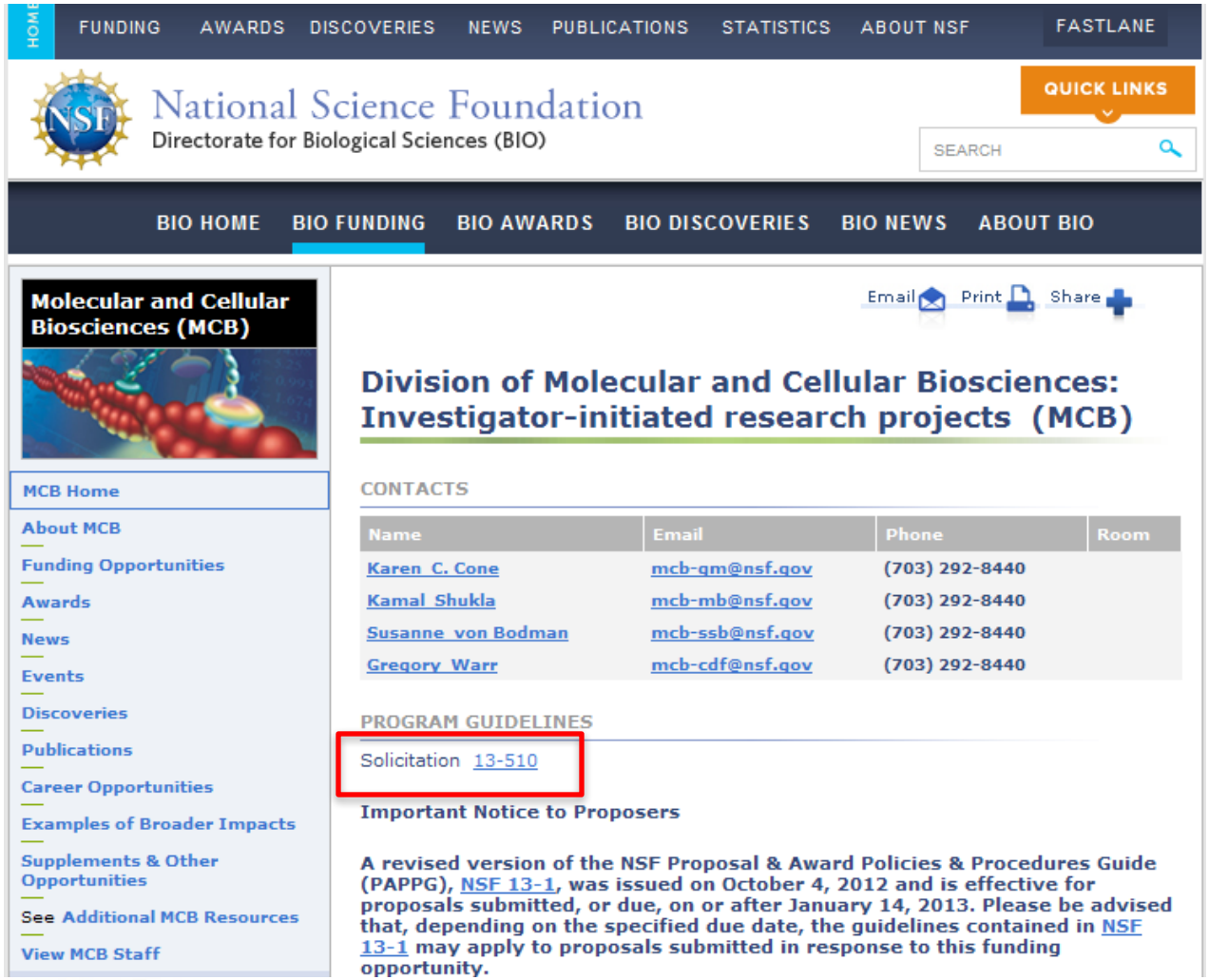
- Bold, High-risk, potentially transformative, interdisciplinary projects in all NSF-supported areas of science, engineering, and education
- Interdisciplinary projects that are not accommodated by traditional or co-review
- Typical award duration: maximum of 5 years and $1 million

Finding Funding Opportunities

- www.nsf.gov
- NSF Updates
- Award Search
- Division Websites



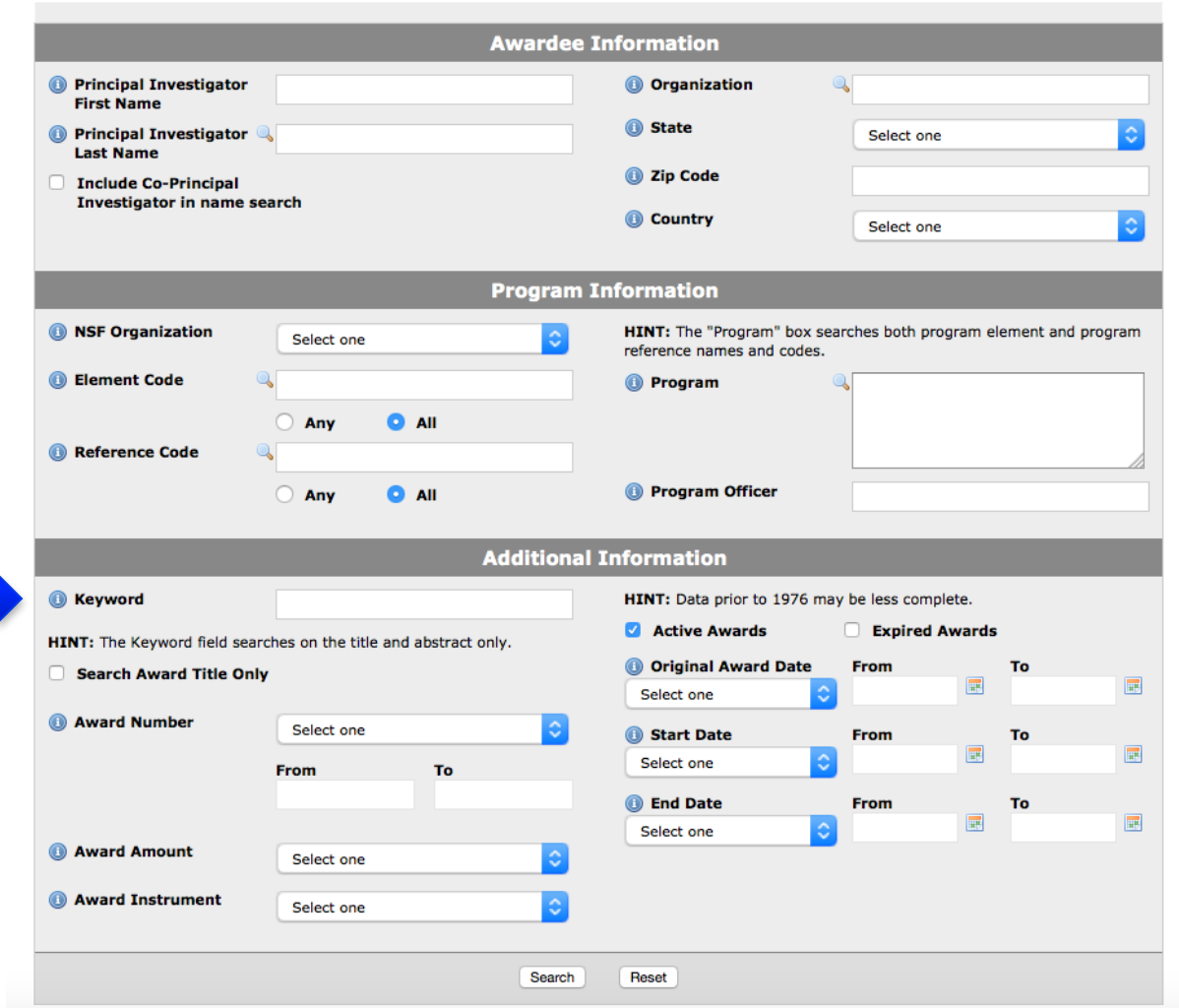
Solicitations



NSF Award Database

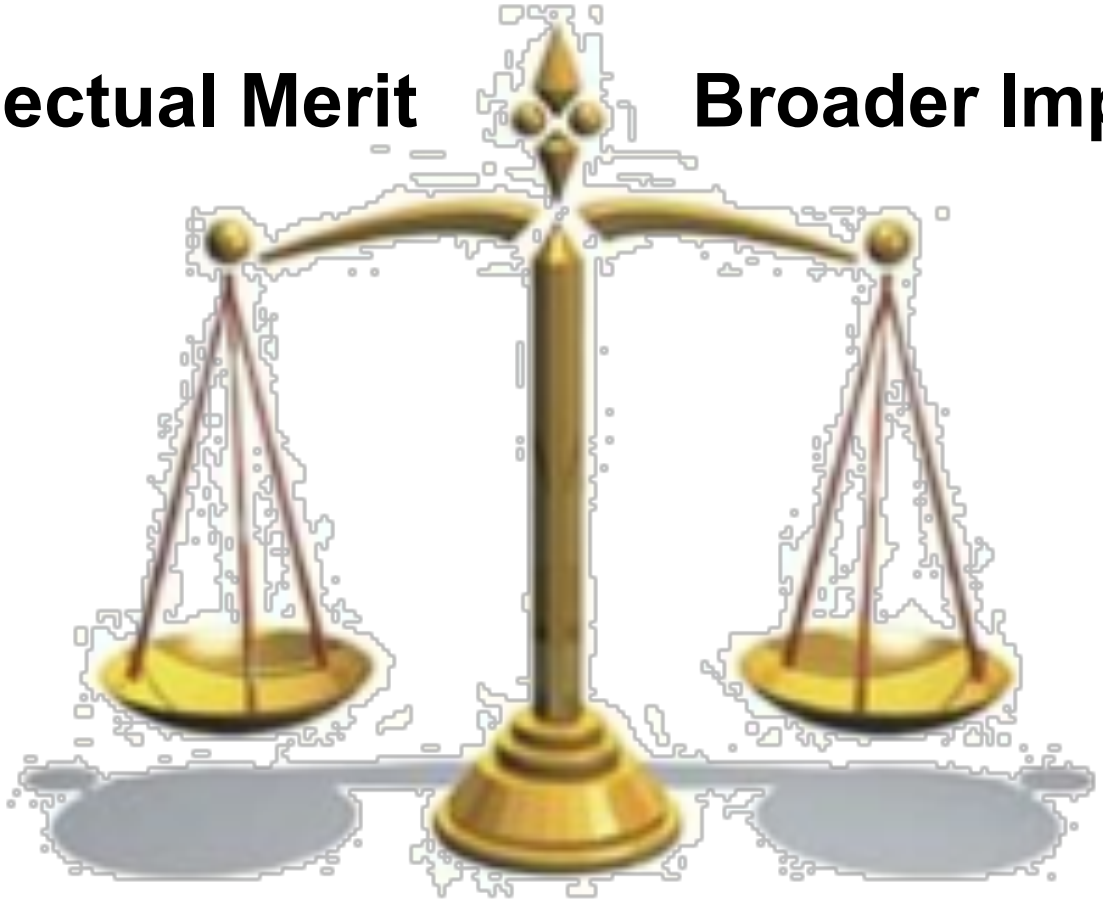
PI

Keyword



NSF Merit Review Criteria

Intellectual Merit **Broader Impacts**



NSF Merit Review Criteria

- **What is the intellectual merit and quality of the proposed activity?**
  - Creativity, originality, potentially transformative concepts
  - Potential to advance knowledge and understanding within and across fields
  - Conceptualization and organization
  - Qualifications of investigators
  - Access to resources

NSF Merit Review Criteria

- **What are the broader impacts of the proposed activity?**
  - Discovery while promoting teaching, training and learning
  - Participation of underrepresented groups
  - Enhancement of infrastructure for research and education
  - Broad dissemination
  - Benefits to society

Examples of Broader Impacts

- Training and mentoring students at all levels (HS to PD)
- Mentoring junior faculty
- Presenting seminars, organizing workshops & conferences
- Writing articles aimed at non-specialists; writing textbooks
- Broadening participation – supporting members of under-represented groups or minority-serving institutions, support interactions among research intensive, 4-year, and 2-year institutions
- Working with HS teachers and influencing curriculum development
- Outreach to K-12, general public
- **Not one size fits all – do something you like!**

The Review and Award Process

- Flexibility in peer-review – panels (in person and virtual) and ad hoc reviews
- Panel and reviewers give advice to the Programs
- Program Director makes recommendations
- Portfolio balance – areas of scientific priority, potential impact, risk/reward, beginning investigators, underrepresented groups, institutional, geographic and demographic balance.

Strategies for Writing a Successful Proposal

- Before you write
  - Identify the most appropriate funding opportunity and program
  - Discuss your idea with a program director
  - Review submission guidelines in the solicitation
  - Understand who will read your proposal
  - Identify your audience
- As you write
  - Cover all the bases in your proposal
    - Intellectual Merit and Broader Impacts
    - Data Management Plan
    - Postdoctoral Mentoring Plan
  - Get feedback and revise

Elements of an NSF Proposal

- Intellectual Merit
  - Innovative concept
  - Well-conceived research plan
- Broader Impacts
  - Plan for demonstrating societal benefit of the project with measurable outcomes
  - Plan for assessing success
- Data Management Plan
- Postdoctoral Mentoring Plan

Innovative Conceptual Framework

- Describe the “big picture”
- Link research goals to questions of fundamental or *broad significance*
- Describe how the results will make a *significant or creative* advance in an area of broad interest
- Get this all done in the first two pages

Hypotheses and Data

- State hypotheses, alternate hypothesis, and predictions
  - The hypotheses should be testable
  - The data should test hypotheses and predictions
  - The results should distinguish among competing hypotheses
- Include preliminary data
  - Convince reviewers that the work is important and feasible
  - Establish that a phenomenon or pattern exists and is worth pursuing
  - Demonstrate your competence to do the work

Broader Impacts Plans

- State your goals for your intended audience(s)
- Present reasonable plans
  - Activities
  - Assessment of success
- Do not simply state your past success
- Ask for money to do this, if you need it
- Do this in one or two pages

Reasons Proposals Fail to Get Funding

- Absence of innovative ideas or hypotheses
  - Will provide only an incremental advance
  - Not exciting or cutting edge
- Errors
  - Unclear or incomplete expression of aims
  - Faulty logic or experimental design
  - Less than rigorous presentation
- Unrealistic, sloppy, superficial or incomplete
- Resources and facilities not in place
  - PI qualifications/expertise not evident
  - Necessary collaborations not documented
- Uncertainty concerning future direction

Questions?