Funding Opportunities in the Biological Sciences (BIO) Directorate at the National Science Foundation

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Outline for Today’s Talk

• Overview of the National Science Foundation and the Biological Sciences Directorate
  - Mission and organization
  - Scientific priorities and programs
• Getting funded at NSF
  - Funding cycle and review criteria
  - Types of grants
  - Opportunities
• Take home message
  - Talk to a program director!!!
National Science Foundation

- Supports **basic** research and education via grants
- Annual budget ~$ 8 billion
  - >50,000 proposals
  - ~12,000 new awards per year
  - ~350,000 scientists, educators and students
- Discipline-based structure
- Cross-disciplinary programs
Directorate for Biological Sciences (BIO)

“To enable discoveries for understanding life, advance the frontiers of biological knowledge, increase our understanding of complex systems, and provide a theoretical basis for original research in many other scientific disciplines.”

Supporting basic research to understand life across scales
What about medical research?

...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. Animal models of such conditions or the development or testing of drugs or other procedures for their treatment also are not eligible for support.

However, research in bioengineering, with diagnosis- or treatment-related goals, that applies engineering principles to problems in biology and medicine while advancing engineering knowledge is eligible for support. Bioengineering research to aid persons with disabilities also is eligible.

Proposal & Award Policies & Preparation Guide
http://www.nsf.gov/pubs/policydocs/pappg19_1/index.jsp#A
Biological Infrastructure (DBI)

Supports infrastructure for contemporary research in biology

• Research Resources
  – Infrastructure Innovation
    o Biological informatics
    o Instrument Development
  – Infrastructure Capacity
    o Collections
    o Cyberinfrastructure
    o Improvements to Field Stations & Marine Laboratories
    o Instrument Capacity
  – Advances in Digitization of Biological Collections

https://www.nsf.gov/funding/programs.jsp?org=DBI
Biological Infrastructure (DBI)

Supports infrastructure for contemporary research in biology

• Human Resources
  - Research Experiences for Undergraduates
  - Postdoctoral Research Fellowships
  - Research Coordination Networks for Undergraduate Biology Education

• Centers
  - NEON: National Ecological Observatory Network
  - CyVerse: Cyberinfrastructure for the Life Sciences
  - Synthesis Centers
  - Science and Technology Centers

https://www.nsf.gov/funding/programs.jsp?org=DBI
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

https://www.nsf.gov/funding/programs.jsp?org=DEB
Integrative Organismal Systems (IOS)

Supports research to understand organisms as integrated 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

https://www.nsf.gov/funding/programs.jsp?org=IOS
Molecular and Cellular Biosciences (MCB)

Supports quantitative, predictive and theory-driven research to understand complex living systems at the molecular, subcellular, and cellular levels

- Molecular Biophysics
- Cellular Dynamics and Function
- Genetic Mechanisms
- Systems and Synthetic Biology

https://www.nsf.gov/funding/programs.jsp?org=MCB
Biological Research Across Scales

Life innovates, biology integrates

Molecular & Cellular Biosciences (MCB)
Integrative Organismal Systems (IOS)
Environmental Biology (DEB)
Biological Infrastructure (DBI)
BIO Priorities: FY 2020

- Fundamental research
- Advancing convergence opportunities
- Continental scale ecosystem science
- Workforce development
NSF’s Ten Big Ideas

Understanding the Rules of Life (URoL): One of NSF’s Ten Big Ideas

Harnessing the Data Revolution

Convergent Research

# Rules of Life: Interdisciplinary Projects

<table>
<thead>
<tr>
<th>RoL</th>
<th>URoL</th>
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<tbody>
<tr>
<td>Rules of Life (across BIO)</td>
<td>Understanding Rules of Life</td>
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<tr>
<td>A track for submissions to the BIO directorate</td>
<td>One of NSF’s Ten Big Ideas</td>
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<td>Crosses BIO divisions</td>
<td>Crosses NSF directorates</td>
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<td>Projects integrate approaches across biological scales</td>
<td>Projects integrate approaches from more than one discipline</td>
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<tr>
<td>Topics up to you</td>
<td>Solicitations on specific topics</td>
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<tr>
<td>No deadlines</td>
<td>Deadlines apply</td>
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Rules of Life Research Examples

Minimal Rules

RAISE: Principles of Modular Organization in Resource-Limited Biological Circuits

Interaction Rules

EAGER: Determining the Interplay of Long- and Short-Range Interactions in Emergent Biological Collective Behavior

Scale Invariant Rules

RAISE: Design principles of evolved transportation networks in leaf veins
Funding Opportunities for Biological Research Outside the BIO Directorate

- Biological Sciences
- Engineering
- Mathematical & Physical Sciences
- Computer & Information Science & Engineering
- Geosciences
- Integrative Activities
- Education & Human Resources
- Social, Behavioral & Economic Sciences
- International Science and Engineering
- Biological Oceanography
- Physics of Living Systems
- Polar Programs (Arctic and Antarctic)
- Advanced Biomanufacturing of Therapeutic Cells
- Biological Anthropology
- Chemistry of Life Processes
- Environmental Engineering and Sustainability Cluster
Where to Find Program Information

NSF website: www.nsf.gov
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Getting Funded

• Identify possible programs that fit with your research

• **Discuss your idea with a program director!!!**

• Understand the review process and the merit review criteria
  • *Intellectual Merit*
  • *Broader Impacts*

• Review and adhere to submission guidelines in the solicitation and the Proposal & Award Policies & Procedures Guide
The Proposal Cycle

From the PI’s Perspective

The IDEA

Talk to a Program Director

Preliminary Results

Talk to a Program Director

Proposal Preparation and Submission

Merit Review
- Intellectual Merit
- Broader Impacts

A Decline

An AWARD!
INTELLECTUAL MERIT and BROADER IMPACTS

1. What is the potential for the proposed activity to:
   a) **INTELLECTUAL MERIT**: advance knowledge and understanding within its own field or across different fields; and
   b) **BROADER IMPACTS**: benefit society or advance desired societal outcomes?

2. To what extent do the proposed activities suggest and **explore creative, original, or potentially transformative concepts**?

3. Is the plan for carrying out the proposed activities **well-reasoned, well organized, and based on a sound rationale**? Does the plan incorporate a mechanism to **assess success**?

4. How well **qualified** is the individual, team, or institution to conduct the proposed activities?

5. Are there **adequate resources** available to the PI (either at the home institution or through collaborations) to carry out the proposed activities?
My Advice to PIs for Writing an Excellent Proposal

• Identify your audience
• Frame a big picture
• Identify significant needs, gaps, and hypotheses
• Describe the plan to address the needs, gaps, and hypotheses
• Emphasize creative or innovative aspects
• Provide proof-of-concept
• Describe the expected outcomes, metrics, and evaluation
• Relate the outcomes to what you set out to do
Questions I Hear from PIs About Broader Impacts

• What’s the formula?
• Pick two from a smorgasbord?
• How much time should I devote?
• Can I use existing programs at my institution?
• How do I pay for this?
• What if my institution won’t support this concept?
• How do I assess broader impacts?
Advice

• It’s not a formula
  – Do something that interests you, has measurable outcomes, and matches the time you are willing to devote
  – Go above and beyond what you are already paid to do

• Ask for money if you need it

• Use existing infrastructure, as appropriate
  – But...Give, as well as take
  – Realize that institutions certify to support your efforts

• Ask for help with assessment

• Consult broaderimpacts.net
Types of proposals and submissions

• Solicited vs. unsolicited proposals
  – Solicitation describes a specific funding program
  – Some programs do not have specific solicitations; submissions are submitted in response to the general NSF Proposal & Award Policies & Procedures Guide (PAPPG)

• Dear Colleague Letters (DCLs)
  – Usually announce a new funding opportunity or program emphasis

• Deadlines vs. Target Dates
  – Firm vs. flexible
  – No deadlines for some programs and some proposal types (small grants, workshops, supplements)
Most BIO Programs: No Deadlines

• Proposals may be submitted at any time to Core programs in MCB, IOS, DEB and DBI

• Two tracks
  – Core Program Track for proposals relevant to individual division’s priorities
  – Rules of Life Track for proposals that integrate across scales in biological sciences for projects that would not normally fit in one BIO division

• No limits on number of proposals per researcher
Timing Your No-Deadline Submission
Faculty Early Career Development Award (CAREER)

- For untenured, tenure-track faculty
- For development of activities that can effectively integrate research and education at your institution
- Five-year awards, ≥ $100,000 per year
- Deadlines in July
More Funding Opportunities

• **RAPID**
  - Grants for Rapid Response Research
  - Maximum $200,000, 1 year

• **EAGER**
  - EArly-concept Grants for Exploratory Research
  - High-risk, potentially transformative research
  - Maximum $300,000, 2 years

• **Supplement**
  - For those with NSF awards, provides funds for unanticipated opportunities
  - Within scope of the original award
  - Support for students, teachers, minority participation, research
  - Usual amount <20% of the original award total

• **Contact your program director to discuss your ideas**
Postdoctoral Research Fellowships in Biology

• Eligibility
  – U.S. citizen or permanent resident
  – You must not have served in postdoctoral capacity for more than 12 months prior to the application deadline

• Current areas
  – Broadening Participation of Groups Under-represented in Biology
  – Research Using Biological Collections
  – National Plant Genome Initiative (NPGI) Postdoctoral Research Fellowships

• Support for 2-3 years: $54,000 plus $15,000 allowance, annually

• Deadlines: Usually in November
Graduate Research Fellowships Program

• Eligibility
  – U.S. citizen or permanent resident
  – Planning to attend graduate school in an NSF-supported field of study in Fall of the following year, or have not completed more than 12 months of a graduate program

• Support provided for 3 years: $34,000 plus $12,000 cost of education allowance

• Deadlines usually in October
Where We Have Been

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NSF Needs You!

- Program Officers
- Division Directors
- Ad hoc Reviewers
- Advisory Panelists