Opportunities in Biology at the National Science Foundation

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Today’s Topics

• Brief introduction to NSF
• Organization of the Directorate for Biological Science (BIO)
• Major funding programs in BIO
• New, little-known, and cross-directorate funding opportunities
• Thoughts on preparing proposals
• Questions
NSF

- Established as an independent agency under the Executive Branch (NSF Act of 1950)
- Supports basic science and education
- Budget: ~$7 billion
- Makes 11,000 new awards from > 40,000 submissions with approx 23% success rate
- Supports ~200,000 faculty, researchers, fellows, students
- About half of program officers are “rotators”
BIO’s mission

Enable discoveries for understanding life
BIO support for basic research

Federal Support for Basic Research in Non-Medical Biological Sciences at Academic Institutions

Federal Support for Basic Research in Environmental Biology at Academic Institutions

NSF 68%

Other federal spending 32%

NSF 63%

Other federal spending 37%
Environmental Biology (DEB)

- Fundamental research on the 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
- Starting with the January 2012 submission deadline
  - Require a pre-proposal submission in January followed by full proposal deadline in August.
Integrative Organismal Systems (IOS)

- Research aimed at understanding the living organism -- plant, animal, microbe -- as a unit of biological organization
  - Behavioral Systems
  - Developmental Systems
  - Neural Systems
  - Physiological and Structural Systems
  - Plant Genome Research Program

- Starting with the January 2012 submission deadline
  - Require a pre-proposal submission in January followed by full proposal deadline in August.
Molecular and Cellular Biosciences (MCB)

- Research aimed at understanding life processes at the molecular, subcellular and cellular levels
  - Biomolecular Dynamics, Structure and Function
  - Cellular Processes
  - Genetic Mechanisms
  - Networks and Regulation
Emerging Frontiers (EF)

- Multidisciplinary research and networking activities that arise from advances in disciplinary research
  - Advancing Digitization of Biodiversity Collections (ADBC)
  - Dimensions in Biodiversity FY12
  - MacroSystems Biology
  - Ocean Acidification
Biological Infrastructure (DBI)

Research Resources Cluster

- Advances in Biological Informatics (ABI)
- Collections in Support of Biological Research (CSBR)
- Improvements in Facilities, Communications, and Equipment at Biological Field Stations and Marine Labs (FSML)
- Instrument Development for Biological Research (IDBR)

Human Resources Cluster

- Postdoctoral Research Fellowships in Biology
- Research Experiences for Undergraduates (REU)
Advances in Biological Informatics

- Biology is an information science. Information is encoded, exchanged and interpreted at all scales from molecular to ecosystem.
- ABI funds research in methods and development of tools for capture, management, and analysis of digital biological information.
- Priority on projects responsive to well-defined biological research requirements as relevant to MCB, IOS, DEB and EF programs.
ABI Program Details

• Annual budget ca $26M
• Awards made in 2012 ranged from 300K to 1.5M, average ca 800K
• Award durations are 2-5 years, most 3+
• Three award types
  – Innovation – emphasis on novelty, potential impact, high risk
  – Development – requirements driven, well documented workplan, risk management, dissemination and sustainability
  – Sustaining - support ongoing operations and maintenance of existing cyberinfrastructure
Examples

• Innovation
  – PlantSimLab: simulation for plant biology

• Development
  – Galaxy-P: integrated access and analysis of MS data
  – Morphbank: morphology image data
Postdoctoral Research Fellowships in Biology (PRFB)

- Promotes independent research projects for recent doctoral degree recipients

- Four Areas:
  - Broadening Participation
  - Intersection of Biology and (Mathematical and Physical Sciences and Engineering)
  - Plant Genome
  - International collaboration not covered under the first three
Software Infrastructure for Sustained Innovations (SI²) - Mechanisms

- Create a software ecosystem that scales from individual or small groups of software innovators to large hubs of software excellence

**Scientific Software Elements (SSE):** 1–2 PIs
- $0.2 - 0.5M/yr, 3 years

**Scientific Software Integration (SSI):** Focused Groups
- ~$1M /yr, 3 - 5 years

**Scientific Software Innovation Institutes (S2I2):** Large Multidisciplinary Groups
- $6-8M /yr, 5 (+) years
  - Conceptualization Phase
BIGDATA
Things to watch for:

• Nitrogen: Improving on Nature
  – Solicitation: 12-579
  – Preliminary Proposals: Sept 7, 2012; Full Proposals: February 1, 2013

• Catalyzing New International Collaborations
  – Solicitation: NSF 12-573
  – Full proposals: Any time

• Advanced Digitization of Biological Collections (ADBC)
  – Solicitation: NSF 12-565
  – Full proposals: October 19, 2012

• MacroSystems Biology
  – Solicitation: NSF 12-532
  – Full proposals: April 1, 2013

• International Collaborations in Organismal Biology Between US and Israeli Investigators (ICOB)
  – Solicitation: NSF 12-577
  – Between IOS and BNF
Identifying Relevant NSF Programs: Web Search, Contact a Program Director

• Where is the “intellectual center of gravity” in my project?
  – Population, Community, Ecosystem Structure, Dynamics?
  – Structure and Function of Organisms?
  – Molecular and Cellular Structures and Processes?
  – Tool and algorithm creation and development?

• Examine the websites of the relevant division(s)
  – Try to identify several programmatic Clusters
  – Contact one of the listed Program Directors with questions about relevance of your project
Finding funding opportunities

www.nsf.gov

Where in NSF might my research be supported?
Division of Molecular and Cellular Biosciences: Investigator-initiated research projects (MCB)

Note updates

See the recently issued Dear Colleague letter (11-056) and Frequently Asked Questions document (11-055) for additional information.

CONTACTS

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<tr>
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Solicitation 11-545

Full Proposal Deadline Date: May 21, 2012

SYNOPSIS
Dear Colleague Letter: Cyberinfrastructure in Support of Biological Sciences

Directorate for Biological Sciences
Office of Cyberinfrastructure
Offices of the Assistant Directors

November 22, 2011

The relationship between transformative scientific discovery and technological advance is an iterative, symbiotic one. The Directorate for Biological Sciences and the Office of Cyberinfrastructure would like to call attention to a recent, cross-foundation solicitation that provides a unique opportunity for members of the biological (and collaborating) sciences to become engaged in advancing an innovative and sustainable cyberinfrastructure in support of biological sciences. The Software Infrastructure for Sustained Innovation (SI2) (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503489&org=NSF&sel_org=XCUT&from=fund) program takes a multi-dimensional approach to the development and provisioning of scientific software. The SI2 program has recently announced a competition that includes Conceptualization Awards, which are planning awards aimed at organizing an interdisciplinary community to examine and define their software requirements and challenges.

Numerous Dear Colleague Letters, research initiatives, and programs offered through the BIO Directorate, have drawn attention to significant areas of research where potential grand-challenge problems can be identified, including, but not limited to:

- environmental research at macro scales;
- predicting phenotypes from genotypes;
- characterizing and understanding dimensions of biodiversity on the planet;
- understanding complexity in biological systems; and
- research in science, engineering, and education for sustainability.
Where in NSF might my research be supported?
Request email updates
Types of proposals and submissions

• Solicited vs. unsolicited proposals
  – Solicitation is a document describing program
  – Unsolicited programs include “core programs,” such as those in DEB, IOS, and MCB clusters

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

• BIO uses Deadlines
  – Firm date for proposals
  – No deadlines for some proposals (small grants, workshops)
What has Changed?

• Starting with the January 2012 submission deadline
  – **All** proposals submitted to IOS and DEB
    1. Require a **pre-proposal** submission in January followed by **full proposal** deadline in August.
    2. Full proposals can be submitted **ONLY** if invited by the program based on review of a pre-proposal.

• MCB submission is every eight months.
Small grants: special circumstances

– RAPID (Grants for Rapid Response Res.)
  • 2-5 pp; 1 yr, up to $200K; internal review only
– EAGER (EArlly-concept Grants for Exploratory Res.)
  • 5-8 pp; up to 2 yr, $300K; internal review only
– CREATIV (Creative Research Awards for Transformative Interdisciplinary Ventures)
  • Support interdisciplinary research that would not fit under existing programs
  • Find two program managers in intellectually distinct divisions
  • 2-5 pp; up to 5 yr, $1M
Proposal preparation

- **Read the solicitation!**
  - Tells about *specific* proposal format, PI eligibility, budget limits, etc.

- **Read the GPG (Grant Proposal Guide)!**
  - Tells about *general* proposal format, review process, etc.
  - “Non-compliant” proposals are “RWR” (returned without review)
    - Up to 40% non-compliance in some programs

- Doubts? Confusion? Questions?
  - Contact the cognizant program officer
Proposal Review at NSF

- How will your proposal be evaluated?
- Who will evaluate it?
- What feedback will you receive?
NSF Merit Review Criteria

The National Science Board has established and approved two criteria for review:

- **Intellectual Merit**
- **Broader Impacts**

At NSF, these are considered equally important merit criteria.
**Intellectual Merit**

- Potential to advance knowledge and understanding within and across fields
- Creativity and originality
- Qualifications of investigators
- Conceptualization and organization
- Access to resources
- Transformative Research
Broader Impacts

- Advance discovery while promoting teaching, training, and learning
- Broaden the participation of under-represented groups
- Enhance infrastructure for research and education
- Make data or results readily available
- Provide potential benefits to society
- Present a convincing plan for the proposed activities
Two Kinds of Reviews

• *ad hoc* Reviews
  – Experts in the specific subject or methods
  – Evaluate both criteria
  – Text is more important than the score
  – Not comparative, as ad hoc reviewers evaluate only one or two proposals

• Panel Reviews
  – Not necessarily experts in the specific subject
  – Evaluate both criteria
  – Text is more important than score
  – Compare across all proposals in the panel
Panel Review Process

• Panelists selected for breadth and expertise
  – Take a broad comparative view of proposals
  – Have access to the expert ad hoc reviews
  – Recommend a panel rating that’s synthetic, not a simple averaging of reviewer scores
  – Rate highly those proposals that will move a field forward in significant ways (focus on link of the project to the big picture)

• Panel advice to the program is important, but NSF does not fund proposal based on rank order of panel rating
If You Are Declined

• You are in good company—highly competitive
• You will receive verbatim all reviews and the Panel Summary of the discussion of your proposal
• Not all reviews are equal in value
  – We do not average scores
  – Text is more important than ratings box checked
• After considering the reviews, contact a PD to get their take on the significant problems
• Remember that a resubmission may not be seen by identical reviewer set
• Do not be discouraged; be persistent!
Program Director Considerations in Recommending Funding

- Likely high impact
- PI career point (encouragement of beginning PIs)
- Place in Program’s scientific portfolio of awards
- Other grant support for the PI
- Impact on institution or state
- Special programmatic considerations (CAREER, RUI, RCN, LTREB, etc.)
- Diversity issues
- Educational impact
Participating in a Panel

• Contact your program director
• Offer to serve as an ad hoc reviewer and/or panelist
• E-mail your CV to your program director
• Include your contact information
• Indicate your areas of expertise
• Follow up with a phone call
• *Be persistent, but polite and pleasant*
Questions?
Award Search

Search Award For: bioinformatics
Restrict to Title Only: 

Program Information

Program:
Field of Application:

Hint: The text field below 'Search Award For' searches the title, abstract, and award number fields.

Hint: This "Program" box searches both program element and program reference names and codes. Program names are sometimes entered in abbreviated formats. For best results, please use the program look up function to select the program you are searching for. Free text searches can return incomplete results.

Active Awards Only:
Active and Expired Awards:
Expired Awards Only:
Historical Awards:

Search Reset
<table>
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<tr>
<th>Award Number</th>
<th>Title</th>
<th>NSF Organization</th>
<th>Program(s)</th>
<th>Start Date</th>
<th>Principal Investigator</th>
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<tr>
<td>1127112</td>
<td>IPGA: Gramene - Exploring Function through Comparative Genomics and Network Analysis</td>
<td>IOS</td>
<td>PLANT GENOME RESEARCH RESOURCE</td>
<td>06/01/2012</td>
<td>Ware, Doreen</td>
<td>NY</td>
<td>Cold Spring Harbor Laboratory</td>
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<td>1157688</td>
<td>Molecular Basis of Mediator Interactions With RNA polymerase II Transcription Machinery</td>
<td>MCB</td>
<td>Genetic Mechanisms</td>
<td>05/15/2012</td>
<td>Takegi, Yuichiro</td>
<td>IN</td>
<td>Indiana University</td>
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<td>1150867</td>
<td>CAREER: Plant-in-a-Chip System for Sensing and Modulating Root-Pathogen Interactions</td>
<td>CBET</td>
<td>BIOSENSING</td>
<td>05/15/2012</td>
<td>Pendey, Santosh</td>
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<td>1149144</td>
<td>CAREER: Dynamics and Diversity of Bona Morphogenetic Protein Signaling in Epithelial Cells</td>
<td>IOS</td>
<td>EVOLUTION OF DEVELOPMENT MECHANISM</td>
<td>05/15/2012</td>
<td>Yakoby, Nir</td>
<td>NJ</td>
<td>Rutgers University Camden</td>
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<td>1238801</td>
<td>Meeting: EU-US Training in Marine Bioinformatics, June 17-30, 2012, Bremen, Germany</td>
<td>IOS</td>
<td>ORGANISM-ENVIRONMENT INTERACTIONS</td>
<td>05/01/2012</td>
<td>Biddle, Jennifer</td>
<td>DE</td>
<td>University of Delaware</td>
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<td>1159098</td>
<td>Variation in Small RNA Pathways Across Maize Tissues and Inbreds</td>
<td>MCB</td>
<td>PLANT GENOME RESEARCH PROJECT, Genetic Mechanisms</td>
<td>05/01/2012</td>
<td>Timmermans, Maria</td>
<td>NY</td>
<td>Cold Spring Harbor Laboratory</td>
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<td>1216472</td>
<td>Support for the 2nd Penn State Bioinorganic Workshop</td>
<td>MCB</td>
<td>Biomolecular Dynamics, StrucFunc</td>
<td>05/01/2012</td>
<td>Krebs, Carsten</td>
<td>PA</td>
<td>Pennsylvania State University</td>
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<td>1162472</td>
<td>AF: Medium: Parallel Algorithms and Software for High-Throughput Sequence Assembly</td>
<td>CCF</td>
<td>SOFTWARE &amp; HARDWARE FOUNDATION, ALGORITHMIC FOUNDATIONS</td>
<td>05/01/2012</td>
<td>Aluru, Srinivas</td>
<td>IA</td>
<td>Iowa State University</td>
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<td>1156810</td>
<td>REU Site: Channeling Bio-Majors into Research Careers in Bio-Molecular Sciences and Informatics</td>
<td>DBI</td>
<td>REU EXPERT FOR UNDERGRAD SITES</td>
<td>05/01/2012</td>
<td>Colon-Berlinger, Migdalis</td>
<td>PR</td>
<td>University of Puerto Rico-Rio Piedras</td>
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<td>1148330</td>
<td>SIZ-II: Connecting Cyberinfrastructure with the Cooperative Computing Tools</td>
<td>OCI</td>
<td>Software Institutes</td>
<td>04/15/2012</td>
<td>Thein, Douglas</td>
<td>IN</td>
<td>University of Notre Dame</td>
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<td>1156643</td>
<td>REU Site: CSHL NSF-REU Bioinformatics and Computational Biology Summer Undergraduate Program</td>
<td>DBI</td>
<td>REU EXPERT FOR UNDERGRAD SITES</td>
<td>04/01/2012</td>
<td>Lippman, Zachary</td>
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• MCB submission is every eight months.
Open Wet Ware

- Drew Endy, MIT
- 1.6 M
- Virtual collaboration tools for bench biology
Recently added Intellectual Merit

Transformative research

– To what extent does the proposed activity suggest and explore creative original and potentially transformative concepts?

– Potential to revolutionize entire disciplines, create entirely new fields, or disrupt accepted theories or principles
Common mistakes

• IM and BI not clearly and explicitly addressed in project summary (label it to be sure!)
• Postdoc mentoring and/or data management plans not included
• Non-compliant biosketches (follow GPG carefully!)
• Support letters included when not explicitly requested
• Project description font, spacing, length non-compliant
• Use of et al. in references or biosketches
• Proposed project not responsive to solicitation
What makes a competitive proposal?

- A timely and compelling idea
- Sound justification for the work
- Simple hypothesis(es)
- Clear, succinct experimental design and realistic scope of work
- Preliminary data or record of publication
- Clear management plan
- Goals for future work
- Written clearly and proofread carefully
Other requirements

- Training in the **Responsible Conduct of Research** (RCR) is required for any new full proposal involving undergraduates, graduate students, or postdocs
  - Proposing institution must certify RCR training
  - Other certifications incl. IACUC/AWA & IRB
- **1-page postdoc mentoring plan** required (or proposal will be RWR)
- **2-page Data management plan** required
What are Broader Impacts?

- How well does the activity advance discovery and understanding while promoting teaching, training and learning?
- How well does the proposed activity broaden participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
- To what extent will it enhance 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 to society of the proposed activity?
Appendix:
Broadening participation and training programs
Faculty Early Career Development Program (CAREER)

- Supports teacher-scholars who will become the academic leaders of the 21st century
- Supports plans that effectively *integrate* research and education
- *Minimum* funding of $500,000/year for 5 years (in BIO)
- NSF 08-557; July deadline
Opportunities for graduate students

• Primarily through research assistantships on grants
• **Graduate Research Fellowship Program (GRFP)**
  – Administered through EHR/DGE, not BIO
  – Must be graduating senior or first-year grad student to apply
  – Student applies directly through special web-based system

• **Doctoral Dissertation Improvement Grant (DDIG)**
  – Now limited only to projects within the purview of DEB or Behavioral Systems Cluster of IOS
  – Student must have advanced to candidacy before submission deadline (certification required)
  – PI is dissertation advisor
Research Experiences for Undergraduates (REU)

- “Cross-cutting” program, managed and budgeted within NSF research units
- Program officer(s) for REU in each NSF research unit
- Sites program or supplements to existing projects
- Sites: NSF 09-598; 4th Wed in August
Undergraduate Research and Mentoring Program (URM)

• Goal: “increase the number and diversity of individuals pursuing graduate studies” in biology
  – Particular emphasis placed on broadening participation of members of groups historically underrepresented in science
• Up to $1M for up to 5 years
  – Provides stipend of approx. $15,000/yr/student
• NSF 10-531; 1st Tues. in March
• Presently 23 URM sites
Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM)

• Goals:
  • Enhance education and training at intersection of the biological and mathematical sciences
  • Better prepare biology or mathematics students to pursue graduate study and careers that integrate mathematical and biological sciences.
  • Jointly-conducted, long-term research experiences for interdisciplinary teams of at least two undergraduates from departments in the biological and mathematical sciences.
• EHR, BIO, MPS
• NSF 08-510; 2nd Thurs in February
EHR programs for undergraduate research

• NSF 05-585: Louis Stokes Alliances for Minority Participation (LSAMP)
• NSF 10-518: Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)
• NSF 09-509: Tribal Colleges and Universities Program (TCUP)
International opportunities

• OISE maintains only one major research program:
  – Partnerships in International Science and Education (PIRE)

• But supports many other activities:
  – NSF 04-036: Developing Global Scientists and Engineers (International Research Experiences for Students (IRES) and Dissertation Enhancement Awards (DDEP))
  – NSF 10-517: Pan American Science Institutes (PASI)
  – NSF 10-591: East Asia & Pacific Science Institute (EAPSI)
Morphbank

- Greg Riccardi, U. Florida
- 2.2 M
- Morphology image data
Galaxy and Galaxy-P

- Anton Nekrutenko, U. Penn
- 750K
- Integrated access and analysis of genome data resources

- Timothy Griffin, U. Minn.
- 1,300K
- Galaxy-P: integration of tools for mass spectrometry (MS) proteomics research using Galaxy
Graemlyn

- Serafim Batzoglou, Stanford
- 330K
- Prediction of protein interaction networks
Cross-directorate programs

- **BIGDATA**
  - CISE, OCI, BIO, GEO, MPS, and SBE
- **Water Sustainability and Climate (WSC)**
  - BIO, ENG, GEO, and SBE
- **Software Infrastructure for Sustained Innovation (SI2)**
  - OCI, BIO, CISE, ENG, GEO, OISE, MPS, SBE
NSF-wide programs

- Research Experiences for Undergraduates (REU)
- Faculty Early Career Development (CAREER)
- International Research Fellowship Program (IRFP)
- Major Research Instrumentation (MRI)
- ADVANCE: Increasing Participation and Advancement of Women in Academic Science and Engineering Careers
NSF: Inside the Capitol Beltway