Advances in Biological Informatics (ABI)

PROGRAM SOLICITATION
NSF 15-582

REPLACES DOCUMENT(S):
NSF 12-567

National Science Foundation

Directorate for Biological Sciences
Division of Biological Infrastructure

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

September 22, 2015

September 09, 2016

Second Friday in September, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

1. Move deadline to mid-September
2. Update Program Description to be consistent with NSF organizational changes
3. Update Proposal preparation instructions
    1. add clarity and additional guidance to budget instructions
    2. inclusion of prior institutional and stakeholder support to sustaining project descriptions
4. Update Review criteria
    1. add reverse site visit and internal NSF review
    2. add Detailed Review Methods Description
    3. clarify review criteria for the three proposal tracks
5. Added Additional Award Conditions
    1. Project Execution Plan may be required for Development projects.

Important Information

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 16-1), which is effective for proposals submitted, or due, on or after January 25, 2016.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Advances in Biological Informatics (ABI)

Synopsis of Program:

The Advances in Biological Informatics (ABI) program seeks to encourage new approaches to the analysis and dissemination of biological knowledge for the benefit of both the scientific community and the broader public. The ABI program is especially interested in the development of informatics tools and resources that have the potential to advance- or transform- research in biology supported by the Directorate for Biological Sciences at the National Science Foundation. The ABI program accepts three major types of proposals: Innovation awards that seek to pioneer new approaches to the application of informatics to biological problems, Development awards that seek to provide robust cyberinfrastructure that will enable transformative biological research, and Sustaining awards that seek to support ongoing operations and maintenance of existing cyberinfrastructure that is critical for continued advancement of priority biological research.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Reed S. Beaman, telephone: (703) 292-7163, email: rsbeaman@nsf.gov
- Peter H. McCartney, telephone: (703) 292-8470, email: dbiabi@nsf.gov
- Jennifer Weller, telephone: 703-292-7121, email: JWELLER@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.074 --- Biological Sciences

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant or Cooperative Agreement

Estimated Number of Awards: 20 to 30

Actual number of awards may vary depending on the proportion of Innovation, Development, and Sustaining awards, which in turn may vary according to overall portfolio balance and individual proposal merits.

Anticipated Funding Amount: $12,000,000 to $15,000,000

Approximately $12-15 million is available for new awards depending on prior commitments and availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI:

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- **Cost Sharing Requirements:**

  Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

  Not Applicable

- **Other Budgetary Limitations:**

  Not Applicable

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

  September 22, 2015

  September 09, 2016

  Second Friday in September, Annually Thereafter

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

Biological processes at all scales from molecules to ecosystems are mediated through the encoding, exchange, and interpretation of information. Advances in the biological sciences are enabled by our capacity to recognize, manage, represent, and analyze the structure in biological data through the use of modern digital media and computational tools. Developing an integrated understanding of cell function, regulatory systems, or ecological responses to environmental change are just a few examples of biological research areas that involve large amounts of data generated through observation, experiment, and modeling.

The Directorate for Biological Sciences (BIO), through the Division of Biological Infrastructure (DBI), supports the design, development, implementation, and use of information resources and tools for which a need has been identified by the biology community. All fields of science supported by BIO are eligible for support under the ABI program. The ABI program seeks to encourage new approaches to the deployment of biological knowledge that renders the data and information therein of greater value to the scientific community. The ABI program is especially interested in proposals that offer potentially transformative outcomes through the development of informatics tools and resources that (1) offer novel and significant advances in the use of biological data and/or (2) will enable and stimulate advances through their impact on a significant segment of the biological research community supported by the NSF BIO Directorate.

The submission of duplicate or substantially similar proposals concurrently for review by more than one program without prior NSF approval may result in the return of such proposals without review. Research proposals to BIO cannot be duplicates of proposals to any other Federal agency for simultaneous consideration. The only exceptions to this rule applicable to the ABI program are proposals from PIs who are beginning investigators (individuals who have not been a principal investigator (PI) or co-principal investigator (co-PI) on a federally funded award with the exception of doctoral dissertation, postdoctoral fellowship or research planning grants). For proposers who qualify under this exception, the box for "Beginning Investigator" must be checked on the proposal Cover Sheet.

As per the *NSF Grant Proposal Guide* (GPG), Chapter 1.B, NSF does not normally support technical assistance, pilot plant efforts, research requiring security classification, the development of products for commercial marketing, or market

research for a particular project or invention. 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.

II. PROGRAM DESCRIPTION

Scope of the ABI Program

The Advances in Biological Informatics program seeks to support research that enables investigators to make use of biological data and information for the discovery of new knowledge and the advancement of the field of biology. Examples include new tools that scale well to complex biological data; theoretical research on data structures; design of easy-to-use interfaces and tools for data input, manipulation, analysis and extraction; and planning and prototype development of new types of biological data- or knowledge-bases. Proposals supported by ABI must lead to the solution of significant problems in biology. Multidisciplinary research is encouraged.

The ABI program encourages innovation, development, or sustained availability in areas that may include (but are not limited to):

- New data types, algorithms, and methods for recognizing and understanding complexity and connectivity in biological systems across multiple scales of organization from molecules to ecosystems
- Algorithms, software or ontologies related to the retrieval, integration, and use of heterogeneous biological information, for example, data-mining, search, portals, semantic integration or visualization
- Tools that facilitate biological research workflows, analytic pathways, or integration between the field and the laboratory, or between observation, experiments and models
- Software and methods for making use of new technologies for the acquisition, communication or visualization of biological data
- New methods and tools for the construction, operation, and utilization of biological databases, including research into database architectures and infrastructures, data standards designed to be extendable to different biological domains, and data structures for new types of biological information
- Informatics tools and approaches that bridge interdisciplinary differences in concepts and data between biology and other sciences

Types of Awards

The provision of cyberinfrastructure for scientific research often follows a trajectory from exploratory research on new methods and approaches; through development of robust, production quality databases and software tools; to the long term maintenance and operation of those resources. Complexity, effort required, and merit criteria can vary through this continuum, so the ABI program has defined three types of awards in order to appropriately align funding levels and review criteria.

Innovation awards. These awards are distinguished by a high degree of novelty and potential impact. The scope of the proposal should be focused on one discrete, or several very tightly coupled, problem(s) in biological informatics. Outcomes will typically be publication of new methodologies, proof of concept, or production of a prototype for further development. Innovation awards enable a team to solve challenging, high risk problems with relatively shorter timelines and less complex management plans. Innovation proposals focus on research into new methods and are assessed on their individual merits and their potential to advance bioinformatics approaches.

Development awards. These awards involve the development of a finished product that will have demonstrable impact in advancing biological research. Development awards convey their likelihood of success through greater attention to user engagement, design quality, engineering practices, management plan, and dissemination. Budgets and award durations should accommodate the iterative process of bringing a proof of concept into a robust, broadly-adopted cyberinfrastructure. Development proposals are more outcome-driven than Innovation awards and are typically assessed on their perceived contribution to a broad portfolio of cyberinfrastructure resources. Synergies with, and leveraging of, other existing and ongoing resources are taken into consideration.

Sustaining awards. These awards provide limited support for the cost of ongoing operations and maintenance of existing cyberinfrastructure that is critical for the continued advance of priority biological research. Requests for Sustaining awards may not include funds for research or development leading to new capabilities or features, but must be limited to activities and materials essential for maintaining the current level of functionality. Budgets must describe only those expenses to be covered with the NSF funds and may not reference expenses covered by other sources of funding. The merit of Sustaining awards will be assessed by the science impacts of the proposed resource to date and by the justification for projected impacts during the award period.

Other Program Considerations

The ABI program encourages proposals that conduct collaborative and planning activities such as conferences, network retreats, exchange visits, and the development of virtual organization frameworks. Those activities that promote interaction between the computational sciences and biology communities, as well as innovative networking strategies that foster research collaborations or enable new research directions, are especially encouraged. ABI does not provide support for, or travel to, recurring conferences, but may consider proposals to support student participation in specific training activities or networking opportunities which will broaden participation and human resource development in priority research areas. Activities that foster participation of colleagues at small institutions, minority-serving institutions, community colleges, and secondary school teachers are also recommended. Investigators are expected to incorporate undergraduate training into their research and make provisions in their budget accordingly. Supplements for Research Experience for Undergraduates (REU) will be considered only for unanticipated opportunities for broadening participation.

The ABI program will place a higher priority on proposals to create computational/informatics tools and database architectures that are applicable to a broad range of biological research questions. Proposals to develop tools or databases that are limited to a specific research project, laboratory, or institution should be submitted to the relevant BIO programs that would normally support that research.

Other Related Sources of Support

Biological informatics activities that address a specific biological research question or involve the generation or curation of data for use with existing computational methods or data resources may find support from those programs within the BIO Directorate that fund that particular area of biological research.

The Information and Intelligent Systems Division (IIS) of the Directorate for Computer and Information Science and Engineering (CISE) supports computer science research on integration of information and informatics applications in all sciences, including biology.

The Division of Advanced Cyberinfrastructure (ACI) of the Directorate for Computer and Information Science and Engineering, in conjunction with BIO and other Directorates, offers funding opportunities closely related to ABI including advanced computing infrastructure, long-term data preservation, data interoperability, software development, and other topics.

Finally, prospective PIs are encouraged to regularly review recent Dear Colleague Letters, Cross-cutting program announcements, and other communications that may identify potential funding opportunities for informatics-related projects or insights into initiatives that have relevance to informatics research.

III. AWARD INFORMATION

Estimated Number of Awards: 20 to 30. Actual number of awards may vary depending on the ratio of Innovation, Development and Sustaining awards, which in turn may vary according to over all portfolio balance and individual proposal merits.

Anticipated Funding Amount: Approximately $12-15 million is available for new awards depending on prior commitments.

Estimated program budget, number of awards and average award size and duration are subject to the availability of funds, the quality of submissions, and the anticipated benefits to biology. Both standard and continuing grants will be awarded. Large and complex projects maybe awarded as cooperative agreements. The specific grant type will be determined on a proposal by proposal basis. Earliest start dates for awards will be approximately six months after the proposal submission deadline.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI:

There are no restrictions or limits.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the

Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.5 of the Grant Proposal Guide provides additional information on collaborative proposals.

See Chapter II.C.2 of the GPG for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the GPG instructions.

The following information provides instructions that supplement the GPG or NSF Grants.gov Application Guide.

Cover sheet: The project title should be prefixed with "ABI Innovation:", "ABI Development:", or "ABI Sustaining:" according to which track of the program the proposal is targeted. If the proposal is part of a collaborative submission, then the prefix "Collaborative Research:" should be applied first. The title should be descriptive of the project and avoid acronyms or proper names that merely identify, rather than describe, the research subject.

Project Description (maximum length 15 pages): Proposals should address the project goals, the anticipated product(s) of the work, and implications for biological informatics with specific reference to the anticipated impact on the community served by the proposed developments.

Proposals should identify the biological user community and provide evidence of the need for the proposed work. Proposals should also explicitly state how the proposed work will advance the capabilities of the biology research community.

Proposals should discuss plans for making the products of research (e.g., publications, standards, software, and databases) available to the biological sciences research community.

Proposals should include a management plan that identifies the personnel responsible for all major tasks with time schedules for all members of the team for the duration of the project; annual milestones for judging productivity and progress; means of communication and data management within the project team; training and outreach activities, including field, laboratory, and museum experiences for trainees, leadership development for key team members, and integration of new team members; and plans for coordination with other projects.

Please note that per guidance in the GPG, the Project Description must contain, as a separate section within the narrative, a section labeled "Broader Impacts of the Proposed Work". This section should provide a discussion of the broader impacts of the proposed activities. You can decide where to include this section within the Project Description.

Note: Inclusion of a web site to provide additional description of the proposed project is not allowed. Reviewers will be advised to review what is presented in the 15 pages and not to consider additional information provided on a web site.

In addition to these general guidelines, proposals for the different award types should address the following specific guidelines:

Innovation Awards

Provide a thorough examination of the relevant literature and existing solutions such that a proper assessment of the novelty and potential contribution of the proposed innovation can be made. The proposal should clearly demonstrate how the proposed research will, if successful, have impacts on biological research that transcend the capabilities offered by existing solutions.

Provide a clear description of the methods and procedures to be applied in the proposed research; discussion of the expected results; and a justification for the choices that were made in formulating the proposed workplan.

Discuss any relevant preliminary results or data to support the methods; data or benchmarks that will be used to validate the results; or prototypes upon which the proposed research is based.

Development Awards

Present a conceptual design that specifies software architectures, data schemas, protocols, or metadata standards, as appropriate to explain what is to be developed and what the necessary effort and potential risks will be. Existing community driven standards should be utilized where they exist. To improve broader impact, preference will be given to proposals that provide community access to source software, data and methods.

Provide a workplan that includes a graphical or tabular summary of the major deliverable components, a schedule and milestones for completion, the allocation of resources to tasks, and the roles and responsibilities of project staff.

Provide a plan for user engagement that identifies how users will contribute to the design of the product and what their role in its evaluation will be. Preference will be given to proposals that seek to ensure usability, for example through a user-centered iterative design process.

Include a dissemination plan that identifies the products, and the timing and means of release. Describe how tools and resources that may have broad applicability will be made accessible and usable by the broader community of biologists and by those in other disciplines. Provide a clear statement of relevant intellectual property considerations and any constraints these may place on access to the proposed resource.

Present a sustainability plan for ensuring, beyond the term of NSF support for this project under the planned award. Alternative models for long-term sustainable financial support of important community information resources should also be addressed. These plans may include the use of resources provided through NSF cyberinfrastructure initiatives as well as other resources that provide opportunities for economies of scale. Programs such as SBIR, GOALI, or I-Corps should be considered where appropriate.

Sustaining Awards

Provide summary information on the user community, its usage statistics, demographics, disciplinary breadth, etc., in narrative, tabular, and/or graphical form. Expected expansion or growth of this user community should be demonstrated.

Identify, with appropriate citations, the impacts on science resulting from the use of the infrastructure to be supported under this proposal. The justification for projecting the estimated impact for the proposed period of support should be made clear.

Document mechanisms for interacting with the user community, including advisory boards, feedback mechanisms, support services,

outreach and training, etc.

Present an operations plan that identifies the services and products that are to be maintained; how the requested funds will be allocated to those activities; and a timetable accounting for expenditure and productivity milestones for the duration of the request.

Document the history of prior support for the resource from the institution, non-NSF funding sources, and/or cost-recovery in the form of contributed effort, facilities and equipment provided, and/or service fees collected.

Limit budget requests to ONLY expenses attributed to the ongoing costs of operation and/or maintenance of a resource at its present level of capacity and functionality. **Requests for improvements, enhancements, or refactoring should be submitted separately as a Development grant**.

Budget: Budgets should be well justified according to the effort required to carry out the proposed work. There are no specific guidelines for budget amounts beyond the information provided above regarding funds available for, and the anticipated number of, new awards. Proposers are advised to pay close attention to the following guidelines:

- The budget justification should clearly identify how the NSF funds will be allocated to the major activities and deliverables identified in the above section. It must be clear how the effort requested for each individual is apportioned to the activities they will be doing.
- Proposers should carefully read the NSF Grant Proposal Guide section II.C.2.g.i.a concerning Senior Project Personnel Salaries. Soft-money positions alone are NOT sufficient justification for exceeding the 2 month limit. The justification must clearly indicate why the requested time is needed and why the institution does not provide adequate time for that individual's participation in sponsored research activities.
- For major equipment or software purchases, a vendor, model, and price quote should be included or referenced with a URL or catalog citation. Justification should explicitly address why the need cannot be met by existing facilities either at the institution or within national cyberinfrastructure supported by other NSF programs. Requests for major computing infrastructure must account for administration and maintenance both during, and beyond, the tenure of the award. The proposal should also explain how any cycles or storage space not consumed by the project would be made available to the broader scientific community at the campus, regional or even national scale
- Travel requests must be justified to specific research, collaboration, or dissemination activities described in the proposal. Foreign travel must identify the destination country or countries.
- Limited budgets for data acquisition through observation, experiment, or modeling activities will be considered only if a strong justification for why this is needed to enable the proposed informatics work is provided.
- If there is an institutional policy setting direct cost fees for the use of computational facilities by sponsored projects, then funds for these fees should be included on line G4 Computer Services as per the NSF Grant Proposal Guide section II.C.2.g.vi.d.
- Note that resources or effort that will be contributed from non-NSF sources will be regarded as an important indicator of commitment to the resource by the institution and the stakeholder community. This is especially important with Sustaining or very large Development requests. However, such contributions must ONLY be described in narrative form (non-fiscal terms) in the Facilities, Equipment and Other Resources section of the proposal and may NOT be discussed in the budget justification.

Facilities, Equipment and Other Resources (maximum length 2 pages): The ABI program expects that institutions suitable for informatics research and development will typically have adequate compute resources and support staff to facilitate the proposed research. The purpose of the facilities section is to document those existing resources, including space, computational equipment, or effort that will contribute to the project goals. No dollar amounts may be referenced for any resource discussed in the Facilities section. If the budget requests computational equipment or materials listed in the facilities section, the budget justification should clearly account for the duplication.

Special Information and Supplementary Documentation:

Letters of collaboration: Projects requiring contributed effort or resources by an individual or organization not directly supported under this proposal should submit a signed letter of collaboration using the template below:

To: NSF ABI Program

By signing below I acknowledge that I am listed as a collaborator on this ABI proposal, entitled "_____ *proposal title*_____," with _____*PI name*_____ as the Principal Investigator. I am aware of, and agree to undertake, activities attributed to me in the proposal, and/or to provide or make available any resources so committed therein.

Signed: _____ Print Name:_____

Date: _____ Institution:_____

The Project Description should document the nature and need for the collaboration. Each statement must be signed by the designated collaborator. Requests to collaborators for these statements should be made by the PI well in advance of the proposal submission deadline, since they must be included at the time of the proposal submission. Letters deviating from this template in any way are **not accepted** and may be grounds for returning the proposal without review.

Single Copy Documents: A conflict of interest document - Prepare a list, in the form of a single alphabetized table, consisting of the full name (last, first, MI) of all people having a conflict of interest with any senior personnel and others whose biographical sketches are included in the proposal. Conflicts to be identified are (1) Ph.D. thesis advisors or advisees, (2) collaborators or co-authors for the past 48 months including postdoctoral mentors and mentees, and (3) any other individuals or institutions with which the senior personnel has financial ties.

In addition to the conflict of interest document, other correspondence to the program that are not intended to be sent to reviewers such as a list of potential reviewers should be provided through the Single Copy Document section of FastLane.

Data Management Plan: Proposals to ABI are expected to address, as part of the required Data Management Plan: the long-term availability of data, software or services generated as deliverables under this funding; the process the project will use in selecting which deliverables are appropriate for long-term preservation; and any policies developed, or followed, by this project that cover the intellectual property rights, confidentiality, access conditions, or terms of use, for any information resource that is deposited with, or accessed from, a data repository or software resource developed under this project.

Proposal Classification Form: Applicants must complete the Proposal Classification Form. The Proposal Classification Form is required for all submissions to BIO; FastLane will not allow processing of the proposal without it.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

  September 22, 2015

  September 09, 2016

  Second Friday in September, Annually Thereafter

D. FastLane / Grants.gov Requirements

For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www.grants.gov/web/grants/applicants.html. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in the GPG as Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: http://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by

investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (GPG Chapter II.C.2.d.i. contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including GPG Chapter II.C.2.d.i., prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
    a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
    b. Benefit society or advance desired societal outcomes (Broader Impacts)?
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 organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

Program-specific review criteria:

Innovation projects. Successful proposals in this category are expected to be responsive to well-defined biological needs, demonstrate novel contributions to biological informatics, offer potential impact to biological research supported in the BIO directorate, and draw upon advanced mathematical and computational methods. Reviewers will be instructed that risk is acceptable in the anticipation of potentially transformative outcomes.

Development projects. Successful proposals in this category are expected to be requirements-driven, have clear and detailed workplans, demonstrate potential for success and reasonable control over risks, and have well-defined plans for usability, dissemination, evaluation and sustainability. Reviewers will be instructed to consider the feasibility of the workplan, alignment with important biological research, engagement with users, and overall impact of the proposed work to biology.

Sustainability projects. Successful proposals in this category will demonstrate the current and potential impact of the resource on biological research, identify a user community and an effective model for serving them, and have a credible business model for management and fiscal sustainability. Reviewers will be instructed to assess the degree to which the resource is critical to a significant segment of the biological community such that the advancement of science would be demonstrably impeded by its absence.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by

Ad hoc Review and/or Panel Review, Internal NSF Review, Site Visit Review, or Reverse Site Review.

ABI proposals vary widely in scale and complexity. Proposals submitted under the Innovation and Development tracks will be reviewed in panels with the optional use of ad-hoc reviews for additional input. Very large development projects may be subjected to a reverse site visit. Sustaining proposals will be reviewed with a combination of ad-hoc reviews and internal NSF review by program officers whose programs support research in the targeted community.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/award_conditions.jsp?

org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

Special Award Conditions:

Project Execution Plan. Development awards may be required to complete a Project Execution Plan (PEP) with additional details on scope of work, schedule, costs, and project management. In addition, these projects may be required to provide further documentation on cost estimates. Where this is applicable, the program officer will notify the PI and provide the necessary templates and guidelines for creating the required documents. These documents must be completed prior to a final recommendation being made. If awarded, PIs will be expected to address progress on PEP task items in their annual reports.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Reed S. Beaman, telephone: (703) 292-7163, email: rsbeaman@nsf.gov
- Peter H. McCartney, telephone: (703) 292-8470, email: dbiabi@nsf.gov
- Jennifer Weller, telephone: 703-292-7121, email: JWELLER@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at http://www.grants.gov.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at http://www.nsf.gov

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center)**:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

  Send an e-mail to: nsfpubs@nsf.gov

  or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

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