Infrastructure Innovation for Biological Research (IIBR)

PROGRAM SOLICITATION
NSF 18-595

National Science Foundation

Directorate for Biological Sciences
Division of Biological Infrastructure

Full Proposal Deadline(s):

Proposals Accepted Anytime

IMPORTANT INFORMATION AND REVISION NOTES

There will be **no limits** on the number of proposals an investigator can submit as PI or co-PI.

Any proposal submitted in response to this solicitation should be submitted in accordance with the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG).

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Infrastructure Innovation for Biological Research (IIBR)

Synopsis of Program:

The Infrastructure Innovation for Biological Research (IIBR) solicitation supports new and innovative research in biological informatics, instrumentation and associated methods, as well as multidisciplinary approaches to these broad themes that address needs in basic biological research. These awards support pioneering approaches that develop de novo infrastructure, significantly redesign existing infrastructure, or apply existing infrastructure in novel ways. Activities must demonstrate the potential to advance or transform research in biology as supported by the Directorate for Biological Sciences at the National Science Foundation (https://nsf.gov/bio).

The "Rules of Life" is one of the NSF's ten big ideas for future investment. Understanding these basic "Rules" and how they operate across scales of time, space, and complexity to determine how genes function and interact with the environment will enable us to predict the phenotype, structure, function, and behavior of organisms. Providing scientists with the instrumentation and resources necessary to make these discoveries requires investments in new instrumentation capabilities and extending access to existing instrumentation and experimental facilities.

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.

- Robert Fleischmann, telephone: (703) 292-7191, email: rfleisch@nsf.gov

- Steve Ellis, telephone: (703) 292-7876, email: stellis@nsf.gov

- Jennifer W. 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 40

Actual number of awards may vary depending on the split of funds across the different programs, which in turn may vary according to submission distribution, individual proposal merits, and budget amounts, and availability of funds.

Anticipated Funding Amount: $10,000,000

Approximately $10 Million is expected to be available for new awards in FY19. The size and duration of any individual request (generally $300,000 - $800,000 for a period of 3 years) should be justified by the amount and complexity of the work to be accomplished. As a rule, the larger the budget, the greater the expected impact on the biological research community.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.

- 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* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
    - 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: https://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):**

Proposals Accepted Anytime

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 determined through the encoding, exchange, and interpretation of information. Advances in the biological sciences are enabled by our capacity to acquire, manage, analyze, and represent biological information through the use of modern computational tools and instrumentation. Developing an integrated understanding of cell function, regulatory systems, evolutionary processes, or ecological responses to environmental change are just a few examples of biological research areas that involve the acquisition, observation, experimentation, and modeling of large amounts of data.

The Infrastructure Innovation for Biological Research (IIBR) program encourages new approaches to the acquisition and use of biological data to provide greater value to the scientific community. The IIBR program is especially interested in proposals that offer innovative and potentially transformative advances in the acquisition and use of biological data through the development of 1) informatics methods and resources for organizing, analyzing, and displaying complex data sets, 2) novel instrumentation and associated methods for collection of new data, and 3) multidisciplinary approaches to innovative infrastructure solutions in data acquisition, management, or analysis. It is expected that awards made in the IIBR program will stimulate advances that impact a significant segment of the biological research community supported by the NSF Directorate for Biological Sciences (BIO). All fields of

science supported by BIO are eligible for support under the IIBR program.

Proposers should review the *NSF Proposal & Award Policies & Procedures Guide (PAPPG)* **Introduction A** for a general description of research topics normally outside the scope of NSF funding such as disease, clinical, or drug design related research. Proposals to develop or provide infrastructure that is primarily to enable research in these excluded topics are not eligible for support under this solicitation and will be returned without review.

II. PROGRAM DESCRIPTION

The IIBR program seeks to support research in biological informatics and innovative instrumentation that enables investigators to acquire and make use of biological data and information to generate knowledge and advance the field of biology. Thematic areas include: (1) new informatics tools that scale for complex biological data, theoretical research on data structures and modeling approaches, planning and prototype development of new types of biological data- or knowledge-bases; (2) new or significantly improved instrumentation and associated methods that enable the collection of new data types or significantly enhances methods of current data collection; and (3) multidisciplinary approaches that leverage advances in informatics and instrument innovation. Proposals supported by IIBR are expected to contribute to solving significant problems in biology of interest to the NSF Biological Sciences Directorate. The innovative nature of the proposed work must be emphasized, and proposals with high-risk/high reward potential are welcomed.

The program will accept proposals focused on the following themes:

Innovation in Biological Informatics: The provision of biological informatics for scientific research often follows a trajectory from exploratory research on new informatics methods and approaches; through development of robust, production quality databases and software tools; to the long term maintenance and operation of those resources. The IIBR program supports the first of these stages through innovation awards that 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. Areas of interest include (but are not limited to):

- Algorithms, software or ontologies aimed at integration, retrieval and mining heterogeneous data sets
- Methods and tools for designing and implementing biological databases, including new architectures and infrastructures, new data types, standards and structures
- Tools that create scientific workflows, for any stage from data collection to modeling
- Tools that facilitate data acquisition, sharing and visualization
- Algorithms and methods for analyzing biocomplexity, in spatial or temporal dimensions
- Informatics tools that bridge conceptual differences that inhibit information sharing between biology and other sciences.

Innovation in Instrumentation: Advances in the biological sciences are increasingly dependent upon new or innovative instrumentation and coupled methods for the collection of new data and data types. For such approaches to come to fruition, the identification of a clearly defined research gap that the new instrument will address, innovative design, execution of the development plan, testing of a prototype, and dissemination and feedback from the broader user community are required. The Innovation in Instrumentation theme does not support the development of laboratory methodologies, unless the methodologies are tightly coupled to instrument innovation and validation. The IIBR program supports the innovative stages of new or novel instrumentation and coupled methods that provide new research capabilities or significantly improves upon current technologies, such as, but not limited to:

- New and innovative approach not currently available,
- Accuracy of measurement,
- Resolution of data points,
- Throughput and speed of data capture,
- Development of methodologies coupled to the use or validation of the instrument,
- Breadth of application,
- Reduction in cost of construction or operation, or
- Ease of use.

Multidisciplinary Innovation: Proposals accepted to the IIBR program need not be limited solely to instrumentation or biological informatics as separate themes. The program encourages multidisciplinary proposals that draw upon expertise across these two areas of interest. Such proposals would result in an innovation with the potential to significantly advance the research supported by the Directorate for Biological Sciences (BIO).

Rules of Life (RoL) track: The Rules of Life track seeks to support integrative research and training that aims to identify the underlying general principles that operate across hierarchical levels of living systems, from molecules to organisms to ecosystems, and that explain emergent properties, e.g., robustness, adaptability. Discovery of fundamental principles through integrative research and enabling infrastructure will advance understanding and further predictive capability of how key properties of living systems emerge from the interaction of genomes, phenotypes, and environment. Research activities under Rules of Life should lead to new understanding of how higher-order structures and functions result from the interactions of heterogeneous biological components, as shaped by genomic, developmental, environmental or evolutionary processes.

Proposals submitted to the Rules of Life (RoL) track must integrate research activities across multiple levels of biological organization, and thereby span funding programs beyond a single division in the BIO. It is expected that RoL proposals will bring together diverse teams of scientists to create novel framings and solutions for conceptual problems in biology.

To be responsive to the RoL track proposed activities must:

- Engage or enable innovative approaches to fundamental questions in biology;
- Promise results or approaches that are generalizable beyond particular study systems;

- Seek to discover, enable and/or test foundational principles (rules, theory) that explain or predict the emergence of complex phenomena in biology; and
- Apply integrative approaches that span levels of biological organization beyond the funding programs within a single BIO division.

Additional priorities for Rules of Life proposals include projects that:

- Emphasize scaling and feedback mechanisms across hierarchical levels of biological organization;
- Use or develop novel approaches or tools to fill significant gaps in understanding structure and function of biological systems;
- Leverage existing infrastructure, data products, and other resources to increase the efficiency and effectiveness of research and training activities;
- Effectively integrate research and cross-disciplinary training throughout the duration of the project; and
- Build research capacity among traditionally underrepresented groups.

The Rules of Life track is common to each of the core research program solicitations in the Divisions of Biological Infrastructure, Environmental Biology, Integrative Organismal Systems, and Molecular and Cellular Biosciences. Proposals submitted to this track will be evaluated by co-review or joint review across two or more of these BIO divisions. Proposals should be submitted to a program in one of these divisions, and also must identify one or more programs in other BIO Divisions for co-review. Proposal titles should start with the designation "RoL:".

Award Profile:

Innovation proposals focus on core research into new or improved instrumentation and biological informatics methods, either separately or as multidisciplinary problems, and are assessed on their individual merits and their potential to advance novel data acquisition and analysis approaches to biological problems. Innovation awards enable a team to solve challenging, high risk problems with relatively short timelines and less complex management plans.

Priority is placed on ideas with a high degree of novelty and with the potential to transform research infrastructure. Typically these proposals come from smaller teams focused on one or two discrete, tightly-coupled problems. The duration is expected to be 2-3 years. Budget size is not explicitly limited, but awards are expected to be relatively lean and result in functioning designs and approaches, prototypes and pilot studies. Outcomes will typically be disseminated by publication of new methodologies, proof of concept examples, or availability of a prototype.

Special proposal types

Workshops. IIBR will consider workshop proposals as described in the "Conference" section of the NSF PAPPG, Part I II.E.7. Priority is given to meetings that have clearly defined goals that address compelling and broadly recognized common challenges in research infrastructure innovation, show a results-driven plan for meeting those challenges, and are broadly inclusive in their participation. IIBR does not typically provide support for, or travel to, recurring conferences, but recognizes that co-location of workshops with such events may promote broader engagement, student participation, and expanded networking opportunities.

RAPID/EAGER. IIBR will consider RAPID and EAGER proposals as described in the NSF PAPPG, Part I II.E.1&2.

Grant Opportunities for Academic Liaison with Industry (GOALI). IIBR accepts GOALI proposals as described in the PAPPG Part I II.E.4.

Research Coordination Networks (RCN). IIBR accepts proposals that follow the guidelines of the RCN solicitation (https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=11691&org=BIO&from=home) and benefit the goals of the program(s) to which it is directed. PIs are encouraged to contact program officers prior to submission.

Research Experience for Undergraduates/Research Experience for Teachers/Research Opportunity Awards (REU/RET/ROA). IIBR will consider supplemental funding for these activates as per DBI policy (https://www.nsf.gov/bio/dbi/suppopp.jsp).

Related programs. There are a number of related or complimentary programs in BIO and across the NSF described at the end of this solicitation. PIs are encouraged to consider whether these may be a more appropriate target before submitting to IIBR.

III. AWARD INFORMATION

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 may be awarded as cooperative agreements. The specific grant type will be determined on a proposal by proposal basis.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a

campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.

- 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 Proposal & Award Policies & Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG 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: (https://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. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.C.2 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 PAPPG instructions.

A. **Cover Page**:

The proposal title should be prefixed with "**IIBR Informatics**:", "**IIBR Instrumentation**:", or "**IIBR Multidisciplinary**:" according to which theme of the program the proposal is targeting. Proposals submitted to the *Rules of Life* track should begin with "**IIBR RoL:**" followed by the substantive title. The title should be descriptive of the project and avoid acronyms or proper names that merely identify, rather than describe the research project.

B. **Project Summary**:

The project summary consists of three sections: Overview, Intellectual Merit, and Broader Impacts.

1. **Overview**: The Overview should begin with a list of up to 5 keywords. The keywords should be in a comma separated list on a separate line that starts with: "**IIBR Keywords**:" and ends with a period. Keyword lists should be limited to 100 characters, including spaces and commas. In addition, this section should provide a brief overview of the proposal including the identified need in the research community for the proposed innovation including the objectives and methods to be employed.

For the *Rules of Life* track, the overview section of the Project Summary must specify the secondary relevant

BIO division(s) and program(s).

2. **Intellectual Merit**: This section should include a brief description of the proposed innovation, the nature of the improvement, and the potential of the proposed activity to advance knowledge.
3. **Broader Impacts**: This section should include a brief description of the potential impact of the innovation on the research community, education and outreach plans, and the potential of the proposed activity to benefit society and contribute to the achievement of specific desired societal outcomes.

C. **Project Description (maximum length 15 pages)**:

1. **Intellectual Merit**: Proposals should address the implications for innovation in infrastructure for basic biological research as supported by the Directorate for Biological Sciences, the project goals, and the anticipated product(s). Specific attention should be paid to the anticipated impact on the community served by the proposed innovations. Plans should be provided for assessing the outcomes of the project on student participation as well as assessing the outcomes of the innovations on the research community.

In addition to these general guidelines, IIBR proposals must contain the following specific sections labeled as shown:

   a. **Project Relevance to Advancing Basic Biological Research**: This section of the project description should address the biological user community impacted by the proposed effort and provide evidence of the need for the proposed innovation as compared to existing capabilities. Proposals should also explicitly state how the proposed work will advance the capabilities of the biological research community as it specifically relates to the research as supported by the divisions within the NSF Directorate for Biological Sciences Directorate.

   b. **Development Plan**: This section should describe the planned activities, including the design of the proposed innovation, performance metrics, the biological research motivations for performance criteria, and how the design plan derives from these motivations. This section should also include a discussion of the expected results, a risk assessment with alternative approaches should the proposed favored approach fail. The development plan should contain sufficient detail to allow assessment of the feasibility of the innovation and the potential success of the project. Included in this section should be details of a timeline for assessing development objectives.

   c. (**Management Plan**: This section should present a task analysis description that justifies the requested personnel funding over the duration of the proposed project. Included in this section should be details on project management including specific plans for making the products of research (e.g., publications, standards, design drawings, instrument prototypes, software, databases, and collections) locatable and available to the biological sciences research community. Plans for how these products of research will be communicated to the community should also be provided.

2. **Broader Impacts**: The Project Description must contain, as its own distinct element within the narrative, a section labeled "Broader Impacts". General guidance is provided in the NSF PAPPG, Chapter II.C.2.d(i). Broader impacts should include a description of how the innovation will advance scientific outcomes in the focus area or related disciplines. Research in new innovative approaches provides an ideal opportunity for student training across multiple disciplines. The IIBR program expects that all projects will include provisions for the training or education of undergraduate, graduate, and or postdoctoral students. Activities which increase participation of colleagues at smaller institutions, minority-serving institutions, community colleges, and K-12 students and teachers are also encouraged. Education and outreach activities must be integrated with the research focus. It is expected that detailed quantitative assessment plans will be included to measure the effect of all broader impact activities, with metrics defined for success or failure, and reporting mechanisms for these outcomes.

3. **Results of Prior Research**: The Project Description must contain, as its own distinct element within the narrative, a section labeled "Results of Prior Research". General guidance is provided in the NSF PAPPG, Chapter II.C.2.d(iii). Where appropriate, distinguish between the proposed resource and any existing infrastructure resulting from prior NSF support.

   Note: Inclusion of urls linking to external resources for the purpose of providing additional description of the proposed project is not allowed, but citations are permitted. Reviewers will be advised to review what is presented in the 15 pages and not to consider additional information provided on a web site. Additional guidance on page limitations and inclusion of uniform resource locators is provided in the NSF PAPPG, Chapters II.C.2.d(ii) and II.C.2.f(c).

D. **Budget**: There are no specific limits on the amount of funds that may be requested, but award sizes are generally $300,000 - $800,000. Requested funds and support duration should be commensurate with the proposed activities.

E. **Facilities, Equipment and Other Resources (Maximum length 2 pages):** 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. List only those resources that will be used by the project and understand that listing them implies a commitment that they will be available. No dollar amounts may be referenced for any resource discussed in the Facilities section. If the budget requests funds for equipment, materials, or resources identified in the facilities section, the budget justification should clearly account for the duplication. The Division of Biological Infrastructure expects that institutions suitable for the development of advanced infrastructure will typically have adequate computing and equipment resources as well as appropriate support staff to facilitate the proposed research.

F. **Special Information and Supplementary Documents:**

Letters of Collaboration - All proposed activities must be documented in the Project Description. Statements from individuals whose role is discussed in the Project Description as providing assistance or collaboration to the project must follow the NSF PAPPG, Chapter II.C.2.d.iv.

No other letters will be accepted. Inclusion of other letters will be cause for return without review.

Data Management Plan - Proposals to IIBR 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. Further guidance for the Data Management Plan can be found on the BIO website at: https://www.nsf.gov/bio/biodmp.jsp.

G. **Single-Copy Documents:**

Collaborators and Other Affiliations – Documentation of Collaborators and Other Affiliations Information must be separately provided for each individual identified as senior project personnel as specified in the NSF PAPPG, Chapter II.C.1.e.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

Budget Guidance: Budgets must be well justified according to the effort required to carry out the proposed work. Typical award budgets vary widely depending on the nature of the innovation and the resources and effort required to implement them. Proposers are advised to pay close attention to the following guidelines:

- For proposals requiring substantial PI and/or senior personnel effort to carry out the proposed aims and activities, proposers should carefully read the NSF PAPPG section II.C.2.g.i.a concerning Senior Project Personnel Salaries.
- The budget justification should clearly identify how the NSF funds will be allocated to the major activities and deliverables identified in the project description. It must be clear how the effort requested for each individual is apportioned to the activities they will be doing.
- For major equipment or software purchases, a vendor, model, and price quote should be included or referenced with a URL or catalog citation.
- Travel requests must be justified in reference to specific activities described in the proposal's scope of work. Foreign travel must identify the destination country or countries.
- 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 PAPPG section II.C.2.g.vi.d. Budgets must not include costs on other lines that are redundant with the services provided by these fees.
- Budgets may not include costs for contingency.

C. Due Dates

- **Full Proposal Deadline(s)**:

    Proposals Accepted Anytime

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 PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: https://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 *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. 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. (PAPPG 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 PAPPG 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

Successful proposals are expected to identify the biological user community that will be impacted by the innovative worked described in the proposal.   Proposals should relate the innovation to the needs of that community in the context of basic research supported by the Directorate for Biological Sciences at NSF. Reviewers will be instructed that risk is acceptable in the anticipation of potentially transformative outcomes. Proposals must explicitly define how research products will be shared, including the location for accessing code and data sets along with any expected restrictions, associated licenses and fees. Specifically, reviewers will be asked to address the following review considerations:

1. The need of the specific community of NSF BIO funded research that will benefit from this work, how that community was identified, and the evidence for both of these factors;
2. A clear demonstration of how this research represents an advance over currently available resources; and
3. The quality of the management plan for the project, providing clear milestones for assessing progress, problems, adjustments, and outcomes.

For proposals submitted to the **Rules of Life** track the following additional review criteria will apply:

Rules of Life track proposals will be evaluated with respect to their potential to discover, enable and/or test foundational principles that explain or predict the emergence of complex phenomena in biology.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

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 https://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 *Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Special Award Conditions:

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

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 Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

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:

- Robert Fleischmann, telephone: (703) 292-7191, email: rfleisch@nsf.gov

- Steve Ellis, telephone: (703) 292-7876, email: stellis@nsf.gov

- Jennifer W. 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 (FASED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 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 https://www.nsf.gov

- **Location:**   2415 Eisenhower Avenue, Alexandria, VA 22314

- **For General Information**   (703) 292-5111
  (NSF Information Center)**:**

- **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:

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel
National Science Foundation
Alexandria, VA 22314

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