Division of Integrative Organismal Systems Core Programs

PROGRAM SOLICITATION
NSF 21-506

REPLACES DOCUMENT(S):
NSF 20-536

National Science Foundation

Directorate for Biological Sciences
Division of Integrative Organismal Systems

Full Proposal Deadline(s):

Proposals Accepted Anytime

IMPORTANT INFORMATION AND REVISION NOTES

IMPORTANT INFORMATION

Innovating and migrating proposal preparation and submission capabilities from FastLane to Research.gov is part of the ongoing NSF information technology modernization efforts, as described in Important Notice No. 147. In support of these efforts, the Directorate for Biological Sciences (BIO) is now requiring the use of Research.gov for the preparation and submission of proposals in response to its core programs that do not have deadline dates (see Dear Colleague Letter NSF 20-129). As such, full research proposals submitted in response to this program solicitation must be prepared and submitted via Research.gov. Proposals also may continue to be submitted via use of Grants.gov.

NSF is taking proactive steps to move the preparation and submission of all proposals from FastLane to Research.gov, however until capabilities are fully implemented, the other types of proposals outlined in Chapter II.E of the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), as well as accomplishment-based renewal proposals, must be prepared and submitted via FastLane or Grants.gov in accordance with the applicable guidance contained in the PAPPG or the *NSF Grants.gov Application Guide*.

REVISION NOTES

IOS continues to accept unlimited no deadline full proposal submission: **proposals may be submitted any day, any time** with no limit on the number of proposals that may be submitted by an individual investigator.

RoL Track: The Rules of Life (RoL) track is no longer a part of this solicitation. It is anticipated that a new funding opportunity supporting RoL research activities will be released. Sign up for NSF Updates to be notified when it is.

Program Name Change: The name of one of the programs in the Physiological and Structural Systems Cluster has changed. The former Symbiosis, Defense and Self-recognition program has been re-named *Symbiosis, Infection, and Immunity*.

NSF-BSF Submissions: This solicitation includes updated information about international collaborative research opportunities with the U.S.-Israel Binational Science Foundation as described in Dear Colleague Letter NSF 20-094.

Research Experiences for Undergraduates (REU), Research Experience for Teachers (RET), Research Assistantships for High School Students (RAHSS) or Research Opportunity Award (ROA) Activities: Requests for supplemental funding for expected REU, RET, RAHSS or ROA activities may be included in the proposal at submission. Post-award requests for supplemental funding are expected to reflect unanticipated opportunities that arise after an award is made.

Full research proposals submitted in response to this program solicitation can no longer be prepared and submitted via FastLane.

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:

Division of Integrative Organismal Systems Core Programs

Synopsis of Program:

The Division of Integrative Organismal Systems (IOS) Core Programs support research aimed at understanding why organisms are structured the way they are and function as they do. Proposals are welcomed in all of the core scientific program areas supported by the Division of Integrative Organismal Systems (IOS). Areas of inquiry include, but are not limited to, developmental biology and the evolution of developmental processes, nervous system development, structure, modification, function, and evolution; biomechanics and functional morphology, physiological processes, symbioses and microbial interactions, interactions of organisms with biotic and abiotic environments, plant and animal genomics, and animal behavior. Proposals should focus on organisms as a fundamental unit of biological organization. Principal Investigators are encouraged to apply systems approaches that will lead to conceptual and theoretical insights and predictions about emergent organismal properties.

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.

- Developmental Systems Program Directors, telephone: (703) 292-8417, email: IOSDSC@nsf.gov
- Behavioral Systems Program Directors, telephone: (703) 292-8423, email: IOSBSC@nsf.gov
- Physical & Structural Systems Program Directors, telephone: (703) 292-8413, email: IOSPSS@nsf.gov
- Plant Genome Research Program Directors, telephone: (703) 292-8420, email: dbipgr@nsf.gov
- Neural Systems Program Directors, telephone: (703) 292-8421, email: IOSNSC@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

Estimated Number of Awards: 250

Anticipated Funding Amount: $70,000,000

IOS estimates that approximately$70,000,000 will be available for new and continuing awards per fiscal year. Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

Eligibility Information

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

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 Research.gov: *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 apply.

Award Administration Information

Award Conditions:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

The Division of Integrative Organismal Systems (IOS) supports research aimed at improving our understanding of organisms as integrated units of biological organization. The division welcomes diverse approaches to research addressing organismal questions, and especially encourages integrative and interdisciplinary perspectives on complex problems in organismal biology.

The goal of the IOS Core Programs is to understand the forces behind form; to predict why organisms are structured the way they are and function as they do in a variety of developmental, social, physiological, and natural environmental contexts. Projects that innovatively apply approaches that combine experimentation, computation, and modeling, and which lead to new conceptual and theoretical insights and testable predictions about integrated organismal properties are encouraged. Research that integrates data across spatial/temporal/biological scales, leads to transformative methods, tools, and resources, and/or seeks breakthroughs in the understanding of complex traits and emergent properties of organisms (e.g. robustness, resilience) is also emphasized.

IOS recognizes that an understanding of organismal form and function has many potential applications to societal needs. Investigators are encouraged to

consider these applications as Broader Impacts of the proposed work (e.g., bio-based technologies, impacts on the bioeconomy including applications to the production of food, fibers, and fuels, applications addressing environmental issues, or applications to human health and welfare). However, research addressing the mechanisms of human disease or disease therapeutics is not supported by IOS, and such proposals will be returned without review.

All IOS programs also encourage proposals that leverage NSF-supported scientific infrastructure, including but not limited to cyberinfrastructure (e.g. Cyverse, Environmental Data Initiative), and infrastructure for monitoring the organism's natural environment (e.g. the National Ecological Observatory Network (NEON), National Ocean Observatories, Critical Zone Observatories).

IOS continues to support projects that provide unique educational and training opportunities for the next generation of researchers, scientific educators and scientifically literate citizens. To address the Broader Impacts review criterion, proposals can contain the development of innovative educational, broadening participation, and outreach activities or substantive participation in existing institutional infrastructure for education, training and outreach with additional budget requested to support those activities. Successful proposals often demonstrate close integration of the scientific and educational goals.

IOS is particularly interested in increasing the participation of underrepresented groups in biological research and education such as women, persons with disabilities, and underrepresented minorities[1] [2], and those from geographically underrepresented areas in science, technology, engineering, and mathematics (STEM). Proposals submitted to any program described in this solicitation are strongly encouraged to involve PIs, co-PIs, postdoctoral fellows, students, and other personnel who are members of these groups. Proposers are also strongly encouraged to consider involving veterans of the U.S. Armed Forces as part of NSF's broader effort to promote veteran involvement in STEM research and education.

Proposers should review the Introduction section of the PAPPG for a general description of research topics normally outside the scope of NSF funding such as disease, clinical, or drug related or other biomedically related research. Proposals to develop or provide infrastructure that is primarily to enable research in these excluded topics will not be eligible for support under this program and will be returned without review.

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[1] https://ncses.nsf.gov/pubs/nsf19304/digest/introduction

[2] https://www.nsf.gov/od/oia/activities/ceose/reports/CEOSE_ReportToCongress_RP_FVmp_508.pdf

II. PROGRAM DESCRIPTION

Proposals are welcomed in all of the core scientific program areas supported by the Division of Integrative Organismal Systems, including projects that cross traditional disciplinary boundaries. IOS is organized into five clusters, that contain the core scientific programs. Click on a cluster name to go to the cluster web page and learn more about each cluster and its programs.

Biological questions, rather than techniques or approaches, should guide program selection.

After reading the cluster and program descriptions, discuss any questions about the potential fit of a project to one of the clusters with the Program Director you believe is most closely associated with your field of interest. Please consult the IOS web page for information about specific Program Directors associated with each program. This interaction can be a critical aspect for ensuring that your proposal is assigned to the most appropriate program for review.

The clusters/programs in IOS which are participating in submissions to this solicitation are:

Behavioral Systems Cluster

The Behavioral Systems cluster contains the Animal Behavior Program.

Developmental Systems Cluster

Programs within the Developmental Systems Cluster are: the Plant, Fungal and Microbial Developmental Mechanisms Program, the Animal Developmental Mechanisms Program and the Evolution of Developmental Mechanisms Program.

Neural Systems Cluster

Programs within the Neural Systems Cluster are the Organization Program, the Activation Program and the Modulation Program.

Physiological and Structural Systems Cluster

Programs within the Physiological and Structural Systems Cluster are: the Symbiosis, Infection, and Immunity (SII) Program (formerly Symbiosis, Defense and Self-recognition), the Physiological Mechanisms and Biomechanics Program (PMB), the Integrative Ecological Physiology Program (IEP) and the NSF-NIFA Plant Biotic Interactions Program (PBI).

Important Note: PBI is jointly managed by the NSF and USDA-NIFA. Proposals intended for PBI should be submitted directly through its solicitation which can be found on the PBI web page along with the program description and contact information for its program directors.

The Plant Genome Research Program.

The Plant Genome Research Program (PGRP) supports genome-scale research and tool development to address challenging questions of biological, societal, and economic importance. Proposals intended for PGRP should be submitted directly through its solicitation which can be found on the PGRP program web page along with additional guidelines and current program contacts.

Note: you must select a program name on the Cover Sheet during submission.

C. Additional Information for Other Types of Proposals under this Solicitation

In addition to the regular research proposals sought under this solicitation, the programs support a variety of other Foundation-wide activities:

- Faculty Early Career Development Program (CAREER) proposals may be submitted to any of the clusters/programs described in this solicitation but must be submitted by the deadlines listed in the CAREER solicitation and follow the proposal preparation guidance in that solicitation.
- Research Coordination Networks (RCN), and Research at Undergraduate Institutions (RUI) proposals may be submitted at any time, to any of the clusters/programs described in this solicitation but must follow the proposal preparation guidance in those solicitations.
- This solicitation will accept Renewal and Accomplishment Based Renewal (ABR) Proposals. Information on eligibility, scope, and format for Renewal and ABR submissions can be found in the PAPPG. If you are considering an ABR submission you are strongly advised to contact a Program Officer prior to submission.
- Grants for Rapid Response Research (RAPID), Early-concept Grants for Exploratory Research (EAGER), Research Advanced by Interdisciplinary Science and Engineering (RAISE), Grant Opportunities for Academic Liaison with Industry (GOALI) and proposals for Travel or Conferences support, including workshops, can be submitted at any time to any of the clusters/programs described in this solicitation. These types of proposals should be submitted in accordance with the guidance in the PAPPG. Conference and Travel proposals should be submitted at least 6 months before the start date of the conference or workshop; you are strongly advised to contact a Program Officer prior to submission. **Note that before submitting RAPID, EAGER, or RAISE proposals you must receive approval from a Program Officer in the area of the proposal.**

U.S.-Israel Binational Science Foundation (BSF) Collaborative Proposals

Proposals for international research in accordance with the Dear Colleague Letter NSF 20-094 describing an international collaborative activity with the BSF will be accepted under this solicitation. Complete instructions for proposal submission can be found in the Dear Colleague Letter. Questions about this activity should be directed to NSF-IOS-BSF@nsf.gov.

International Activities

Investigators may include well justified international components in proposals submitted to any relevant NSF program or request supplemental funding for projects already supported by NSF. Additional information about opportunities for research involving international partners can be found in NSF's Office for International Science and Engineering (OISE).

D. Additional Funding Opportunities

Enabling Discovery Through GEnomic Tools (EDGE)

EDGE is designed to provide support for development and rapid dissemination of functional genomic tools, approaches, and associated infrastructure to enable direct tests of hypotheses about gene function in diverse non-model organisms for which such resources are presently unavailable. The EDGE program web page contains Program contacts, prior webinars, FAQ, submission deadlines and a link to the current EDGE solicitation.

Supplemental Funding Requests:

Mid-Career Investigator Supplements in Integrative Organismal Biology (MCI).

Instituted in 2013, Mid-Career Investigator Supplements provide support for mid-career researchers/scientists to acquire new skills in any additional area of organismal biology, or to add the use of new tools and/or novel technologies to answer organismal questions. MCI activities may be included in full proposals submitted to this solicitation. A "mid-career" investigator is defined here as any researcher who is post-tenure or its equivalent and not retired. Requests for MCI supplements may include support for research visits, for participation in training opportunities in other laboratories, and for the use of research facilities not available at the applicant's institution. Support can be requested for an investigator's own activities or to host an eligible mid-career investigator and can include a request for salary support during periods of training. Investigators interested in the MCI activity are strongly encouraged to contact a program director for further guidance prior to submission of a proposal containing these activities.

REU, RET, RAHSS and ROA.

The target date for most IOS programs for Research Experiences for Undergraduates (REU), Research Experiences for Teachers (RET), Research Assistantships for High School Students (RAHSS), and Research Opportunity Award (ROA) supplement requests is **March 1 annually** (or next business day if that is a weekend or holiday). Note: Supplemental funding is intended for unanticipated opportunities only and should be justified on this basis. *Requests for support of planned REU, RET, RAHSS, and ROA activities may be included in the full proposal budget at the time of submission*.

Career Life Balance Supplements.

The Division will continue to support Career Life Balance (CLB) supplements. NSF's Career-Life Balance (CLB) Initiative builds on family-friendly practices among individual NSF programs to expand them to activities NSF-wide. Funded Principal Investigators (PIs) are invited to submit supplemental funding requests to support additional personnel (e.g., research technicians or equivalent) to sustain research when the PI is on family leave. More information and FAQ can be found on the Career-Life Balance Initiative Web Page.

III. AWARD INFORMATION

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 250

Anticipated Funding Amount: $70,000,000

IOS estimates that approximately $70,000,000 will be available for new and continuing awards per fiscal year. Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

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 Research.gov or Grants.gov.

- Full Proposals submitted via Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and 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) 292-8134 or by e-mail from nsfpubs@nsf.gov. The Prepare New Proposal setup will prompt you for the program solicitation number.
- 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) 292-8134 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 Research.gov. 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.

Additional Proposal Preparation Instructions:

Preparation of proposals should follow the guidance in the PAPPG. Below we provide *additional* information and resources to aid preparation:

- **Collaborators & Other Affiliations (COA) Information.** Additional information and FAQs about using the COA template can be found on the Collaborators and Other Affiliations Information page. This information is used to manage the selection of reviewers.
- **Data Management Plan.** The PAPPG requires the inclusion of a Data Management Plan with all full proposal submissions. The Data Management Plan can be no longer than 2 pages and must be inclusive of the entire project. The Directorate for Biological Sciences provides additional context and guidance to PIs on the preparation of Data Management Plans. All projects must ensure that data and biological materials are collected, archived, digitized, and made available using methods that allow current and future investigators to address new questions as they arise. Funded projects **must** disseminate project data broadly, using widely accepted electronic data standards. Investigators are strongly encouraged to make use of appropriate community infrastructure for data management.
- **For planned REU, ROA, RET or RAHSS activities,** a **Supplementary Document** (limited to three pages as described in the REU solicitation) should be included that describes those activities. Funds for these proposed activities are included in the budget. Additional guidance for REU activities can be found in the REU solicitation and on the REU program page. Additional guidance for ROA, RET or RAHSS activities can be found in the Facilitating Research at Primarily Undergraduate Institutions: Research in Undergraduate Institutions (RUI) and Research Opportunity Awards (ROA) solicitation and the RAHSS DCL.

Proposal Checklist for Compliance:

- The proposal must be submitted to this solicitation or to the RUI/ROA solicitation, if eligible and providing required documentation. **Do not** submit the full proposal to the PAPPG.
- The proposal is compliant with the provisions of this solicitation and the PAPPG. Where the two differ, this solicitation takes precedence. Any section or document not mentioned here follows the PAPPG guidance.
- Cover Sheet- the title includes any necessary prefix(s) (e.g. "Collaborative Research:"; "NSF-BSF"). Appropriate boxes have been checked, and requisite information provided.
- REU, RET, ROA and RAHSS activities, if planned, are described in three pages maximum, uploaded into Supplementary Documents, and included in the budget request.

- Letters of Collaboration focus solely on affirming the collaboration, follow the format in the PAPPG and are loaded into Supplementary Documents. General letters of support are **not** allowed.
- It is highly recommended that a list of 6-12 suggested reviewers who are **not** listed on the Collaborators and Other Affiliations Information is submitted by the PI or Co-PI(s) be submitted as a Single Copy Document, including the individuals' names, institutions, and areas of expertise, email addresses, and URLs if available.
- Contact a Program Officer if you have questions about these or other Supplementary Documents that you plan to upload.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

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

  Proposals Accepted Anytime

There are no proposal deadlines or caps on submission.

D. Research.gov/Grants.gov Requirements

For Proposals Submitted Via Research.gov:

To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html. For Research.gov user support, call the Research.gov Help Desk at 1-800-673-6188 or e-mail rgov@nsf.gov. The Research.gov Help Desk answers general technical questions related to the use of the Research.gov 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: https://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 Research.gov may use Research.gov 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.

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) 292-8134 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.

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:

- Developmental Systems Program Directors, telephone: (703) 292-8417, email: IOSDSC@nsf.gov
- Behavioral Systems Program Directors, telephone: (703) 292-8423, email: IOSBSC@nsf.gov
- Physical & Structural Systems Program Directors, telephone: (703) 292-8413, email: IOSPSS@nsf.gov
- Plant Genome Research Program Directors, telephone: (703) 292-8420, email: dbipgr@nsf.gov
- Neural Systems Program Directors, telephone: (703) 292-8421, email: IOSNSC@nsf.gov

For questions related to the use of FastLane or Research.gov, contact:

- FastLane and Research.gov Help Desk: 1-800-673-6188
- FastLane Help Desk e-mail: fastlane@nsf.gov.
- Research.gov Help Desk e-mail: rgov@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 https://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** (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) 292-8134
- **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 System of Record Notices, NSF-50, "Principal Investigator/Proposal File and Associated Records," and NSF-51, "Reviewer/Proposal File and Associated Records." 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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Reports Clearance Officer
Office of the General Counsel
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