Biology Integration Institutes (BII)

PROGRAM SOLICITATION
NSF 20-601

REPLACES DOCUMENT(S):
NSF 20-508

National Science Foundation

Directorate for Biological Sciences

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

January 27, 2021

IMPORTANT INFORMATION AND REVISION NOTES

The Design track has been eliminated. A Letter of Intent is no longer required. The deadline is now earlier.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 20-1), which is effective for proposals submitted, or due, on or after June 1, 2020.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Biology Integration Institutes (BII)

Synopsis of Program:

Biology has transformed science over the last century through discoveries that cross subdisciplines from the molecular to the organismal to the ecosystem level. While making great progress, biology has also slowly fragmented into subdisciplines, creating a dynamic tension between unifying principles and increasingly reductionist pursuits. The aim of this solicitation is to bring researchers together around the common goal of understanding how the processes that sustain life and enable biological innovation operate and interact within and across different scales of organization, from molecules to cells, tissues to organisms, species, ecosystems, biomes and the entire Earth. The Biology Integration Institutes (BII) program supports collaborative teams of researchers investigating questions that span multiple disciplines within and beyond biology.

Integration across biological disciplines is essential if we hope to understand the diverse and ever-increasing data streams of modern biology and tackle emergent questions about living organisms and the environment. Of equal importance is the need for groundbreaking and sustainable training programs that prepare the next generations of scientists to navigate the breadth of biological sciences, training in multiple disciplines without sacrificing depth of learning or innovation. In addition, the biology community must continue to develop practices and adopt strategies that leverage rapid advances in cyberinfrastructure and other technologies to bridge and integrate across subdisciplines and make resources accessible, re-usable, and adaptable for unanticipated purposes. In these ways, Biology Integration Institutes will focus on biological themes that enable the discoveries of life's innovations. The outcomes from biological integration will inspire new biotechnologies and applications to drive our bioeconomy and provide solutions to societal challenges. While this solicitation focuses on the integration of **biological** subdisciplines, any field beyond biology may be included as needed to address the overarching biological theme.

Cognizant Program Officer(s):

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

- Reed Beaman, Program Director, DBI, telephone: (703) 292-7163, email: rsbeaman@nsf.gov
- Stephen DiFazio, Program Director, MCB, telephone: (703) 292-4517, email: sdifazio@nsf.gov
- Wilson Francisco, Program Director, MCB, telephone: (703) 292-7856, email: wfrancis@nsf.gov
- Jodie M. Jawor, Program Director, IOS, telephone: (703) 292-7887, email: jjawor@nsf.gov
- Samuel M. Scheiner, Program Director, DEB, telephone: (703) 292-7175, email: sscheine@nsf.gov
- Anne W. Sylvester, Program Director, IOS, telephone: (703) 292-7168, email:ASYLVEST@nsf.gov

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

- 47.074 --- Biological Sciences

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 4 to 6

In FY 2021, depending on the quality of submissions and the availability of funds, approximately 4-6 awards will be made as Cooperative Agreements as an initial commitment of 5 years with the possibility of a 5-year continuation.

Proposals Involving Multiple Organizations. Of the two types of collaborative proposal formats described in the *Proposal & Award Policies & Procedures Guide* this solicitation allows only a single proposal submission with subawards administered by that lead organization (Chapter II.D.3.a). **In the case of proposals involving multiple organizations, a single organization must be identified as the lead, and a single proposal describing the entire project must be submitted by that organization.** Funds may be distributed among partner organizations via subawards from the lead organization. A budget on the standard NSF budget form should be submitted for each subawardee. The requirement for a single organization to submit the sole proposal for a project is designed to facilitate effective coordination among participating organizations and to avoid difficulties that ensue in funded projects when individuals change organizations and/or cease to fulfill project responsibilities.

Anticipated Funding Amount: $15,000,000 in FY 2021, pending the availability of funds.

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: 1

A person may be PI or co-PI on no more than **ONE** proposal.

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)** (due by 5 p.m. submitter's local time):

  January 27, 2021

Proposal Review Information Criteria

Merit Review Criteria:

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

Award Administration Information

Award Conditions:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

Biological research has achieved great depths of knowledge that fuel innovation over the last century. Despite this progress, biology has slowly fragmented into subdisciplines, creating a dynamic tension between unifying principles and increasingly reductionist pursuits. While interdisciplinary approaches to biology are not new, and have had notable successes, disciplines continue to evolve and emerge, forming new connections while at the same time reinforcing boundaries created by their language and culture differences.

Extraordinary advances in technology and analytical methods deliver ever larger quantities of high-resolution, multi-dimensional data that enable broader and deeper investigation of biological systems. The vast amount of new information, and the speed and regularity with which it arrives, creates the opportunity for finer levels of analysis and specialization. At the same time, this wealth of information opens up possibilities for cross-cutting discoveries from collaboration between scientists with diverse perspectives and training. A renewed emphasis on integration across biology will allow us to tackle formidable biological questions and extract comprehensive meaning from old and new data and will lead to the discovery of unifying biological principles.

Of equal importance, and perhaps an even greater challenge, is the need for effective and sustainable new training paradigms that are inclusive and prepare the next generations of scientists to navigate diverse fields in the biological sciences. Students and postdoctoral scholars need training to address barriers posed by language and cultural differences between fields and among people, to interpret a variety of data types with rigor, and to interrogate hypotheses that transcend narrow systems or sub-disciplines. The next generations of scholars and educators must reflect the diversity of peoples and cultures in the nation, and they will need working knowledge of not just experimental biology, but also theory, computation, and modeling, to name a few critical skills. At the same time, it is imperative that such integrative training does not upend in-depth disciplinary training. Most importantly, the success of the scientific enterprise depends on the

ability of future researchers to work in dynamic, diverse, and collaborative interdisciplinary teams.

II. PROGRAM DESCRIPTION

The NSF Directorate for Biological Sciences program for Biology Integration Institutes (BII) supports diverse and collaborative teams of researchers investigating questions that span multiple disciplines within and beyond biology. The goal is to stimulate creative integration of disparate fields using innovative experimental, theoretical, and modeling approaches to discover underlying principles operating across multiple levels of life, from molecules to cells, organisms, species, ecosystems, biomes and the entire Earth. Funding will be at a higher level and for a longer time frame than is typical for standard NSF awards. The Institutes must enable an environment conducive to integration of research, infrastructure, resources, and training, explore new modes of collaboration, and prepare the next generation of biological scientists to be leaders who pursue multidisciplinary research throughout their careers. These next generation leaders should be able to help transform the scientific enterprise to become fully inclusive. Institutes may be localized at one organization or may span multiple organizations; they may comprise a single group of collaborators or incorporate additional researchers as the project evolves. *While this solicitation focuses on the integration of **biological** subdisciplines, any field beyond biology may be included as needed to address the overarching biological theme.* NSF invites proposals with organizational structures that are best suited to tackle integrative biological questions. New models for team interaction may be needed for productive discipline-spanning research within each Institute. Therefore, while particular activities are not prescribed, proposers must demonstrate thoughtful attention to elements that will make the institutes function cohesively. For example, sustaining communication across disciplines over time requires creative community-building efforts and establishing "habitats" where language and cultural differences between disciplines and people can be addressed and harmonized. These new Institutes face additional challenges of logistics and project management, including: integration and interoperability of data, cyber, and other infrastructure among multiple disciplines, agreement on cross-organizational intellectual contribution and credit plans, development of co-mentorship and personnel exchange programs, and formalization of conflict resolution procedures. Solutions to these challenges will require thorough consideration and may necessitate innovative solutions tailored to the team and questions being addressed. In addition, it is expected that the institutes establish a climate of inclusion and equity through such practices as contemporary team science, open science, and other strategies that effectively include and engage scientists diverse in demography, disciplines, and geographies.

Each Institute must identify a **Research Theme**, centered around a compelling and broad biological question poised for breakthroughs by collaboration across biological subdisciplines. The Theme must be larger in scope than research projects typically submitted to core programs in the BIO Directorate. While it does not have to span all biological subdisciplines, it should span more than one subdiscipline and be compelling across the subdisciplines spanned.

To address such a broad question, the Research Theme of each Institute will likely encompass multiple research projects. The proposal must demonstrate how these projects, and associated community-building activities will integrate across different disciplines. Critically, it must show how the individual parts are necessary to answer the overarching question such that the whole is more than the sum of individual parts. The proposal must also describe how the educational components will enable researchers to work successfully across disciplines. Finally, the proposal must justify the involvement of each team member in addressing its goals.

Proposals must describe innovative approaches that tackle future challenges in how students learn, how diverse participation in biological research expands, and how biology moves forward. Team composition and budgets must be commensurate with the efforts proposed. The roles and interactions of each participant in both research and the training activities in the Institute must be clearly described. *The program expects to make awards covering a broad range of budget requests, commensurate with the scale and scope of each project.*

Proposers are highly encouraged to contact the Program Directors prior to submission with any questions about research ideas, budgets, and submissions.

To facilitate proposal planning, the following **Hallmarks of Successful Proposals** may be useful:

1. ***The proposed research plan must tackle critical, cross-cutting biological questions that are larger in scope than typical proposals to BIO Core Programs.***
2. ***The institute must have outcomes that are greater than the sum of its parts.*** Molecules, organisms and ecosystems are all greater than the sum of their parts. The study of biology should be the same, and to achieve this outcome, a successful Biology Integration Institute must show how its achievements, knowledge, and training outcomes will be greater than the efforts of each of the individual components.
3. ***The proposed research plan should include a range of objectives and research approaches that are clearly integrated under a coordinated vision.*** Proposals should include an explicit plan for integration, both among research projects and across disciplines, and articulate how the proposed research questions will lead to the integration of those research areas. Proposals in which specialized research groups pursue independent projects under the research theme are NOT encouraged.
4. ***Investigative teams should be optimally configured.*** A collaborative culture that values and benefits from shared research and multidisciplinary training is highly encouraged. Teams should be designed to achieve the goals of the proposed work, and budgets should be commensurate with the project goals. The role of each team member must be clearly described and justified. Team members may be from a single organization or multiple organizations. *It should be noted that while this solicitation focuses on the integration of **biological** disciplines, any field beyond biology may be included as needed to address the overarching biological theme.*
5. ***Investigative teams should be diverse.*** *Teams should include a diversity of types of participants, including individuals from a variety of career stages and members of underrepresented groups such as women, minorities, and those with disabilities. This diversity should extend to the team leadership.*
6. ***The management plan should promote the synthetic nature of the project.*** The proposed leadership and administrative structure must clearly enable integrative scientific activities and ensure cohesiveness of both research and education elements. The team should include strong project management expertise, including a time-phased milestone-driven management approach to monitor and assess the disciplinary integration occurring at the institute.
7. ***The proposal must include a robust, integrated education and training component.*** Research ideas and endeavors are rejuvenated by new participants. Training that enables individuals to overcome disciplinary barriers and succeed in cross-disciplinary research should be fully integrated into the project. A plan to evaluate training outcomes should be included.
8. ***The proposal should attempt to leverage prior NSF investments in biological research, training, and cyberinfrastructure resources, as appropriate.*** NSF has made significant investment in biological infrastructure, with intended applications spanning across scales and disciplines. It is expected that project teams will be knowledgeable about and leverage such resources relevant to their research.
9. ***Broadening participation must be inherent to the project as well as in the institute leadership.*** It is important to establish a climate of inclusion and equity to ensure access to research outcomes in ways that benefit the broader scientific community. Furthermore, team members should reach beyond their immediate network and incorporate diversity in both research and training. All projects must explain how project participation will be diversified and broadened as part of their Broader Impacts activities. As part of its commitment to broadening participation, NSF encourages proposals from a diverse range of proposers, including members of underrepresented groups such as women, minorities, and those with disabilities. Proposals from EPSCoR jurisdictions, Primarily Undergraduate Institutions, Historically Black Colleges and Universities, Hispanic Serving Institutions, Minority-

Serving Institutions, and Tribal Colleges and Universities are encouraged.

10. ***Outreach activities should include a clear assessment plan.*** Outreach activities that successfully penetrate societal communication barriers are encouraged. Efforts could include, for example, educating the general public about the research, developing citizen science activities, etc., as driven by the team's expertise and interests, and the needs of the community. Plans to assess the success of such efforts should be included.
11. ***Public access and timely release of project outputs should be clear and routine.*** Materials, data products, and other resources generated in the biological sciences are increasingly diverse and are being produced in massive quantities, often beyond the scope of description in published manuscripts. These include, for example, sequences of all types, biological materials, tools, images, software, publications, videos and other media, and teaching curricula. All of these products should be fully released within a reasonable time frame, consistent with community standards.
12. ***International collaborations, if included, must be fully justified.*** It is expected that any non-U.S. participants will secure support from their own national programs. However, international subawards may be included if the investigators bring unique research and training expertise and/or resources not available in the U.S. Information about international subawards is available in PAPPG Chapter I.E.6.

III. AWARD INFORMATION

Awards **MUST** be of five years duration and no more than $12,500,000 (i.e., an average of $2,500,000 per year). Each award will be made as a cooperative agreement to the lead organization, with an initial commitment for five years of support and a possibility of continuation for five additional years, subject to an evaluation of awardee performance, availability of funds, and review of an invited, renewal proposal.

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: 1

A person may be PI or co-PI on no more than **ONE** proposal.

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 FastLane or Grants.gov.

- 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) 292-8134 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) 292-8134 or by e-mail from nsfpubs@nsf.gov.

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.

Proposals Involving Multiple Organizations. Of the two types of collaborative proposal formats described in the Proposal & Award Policies & Procedures Guide this solicitation allows only a single proposal submission with subawards administered by that lead organization (Chapter II.D.3.a). **In the case of proposals involving multiple organizations, a single organization must be identified as the lead, and a single proposal describing the entire project must be submitted by that organization.** Funds may be distributed among partner organizations via subawards from the lead organization. A budget on the standard NSF budget form should be submitted for each subawardee. The requirement for a single organization to submit the sole proposal for a project is designed to facilitate effective coordination among participating organizations and to avoid difficulties that ensue in funded projects when individuals change organizations and/or cease to fulfill project responsibilities.

Title. The title of the proposal **must** begin with "**BII:".**

Results of Prior Support. This section is NOT required

Project Description. The Project Description consists of the following sections and is limited to **25 pages total**. These sections are in lieu of the usual Intellectual Merit and Broader Impacts sections.

Rationale, Justification and Integration of the Research Theme (Limit: 3 pages): Describe the overarching research theme of the Integration Institute that brings together different biological disciplines. Provide a clear rationale and description of the proposed Institute, including: 1) brief summaries of the goals and projects within the research theme; 2) an explanation of how the projects connect with each other to advance the research theme; and 3) a description of how the educational activities integrate with the research and advance the goal of cross-disciplinary training. Summarize specific efforts to promote diversity, outreach to the scientific community and general public, any collaborations with industry or other sectors, and outline the management plan. The summary should also clarify how the research activities (see below) are more than the sum of individual parts and what areas of biology will be more integrated by the institute activities.

List of Participants (Limit: 1 page): List the PI, any co-PIs and all senior personnel by full name. Note their organizational and departmental affiliation, and their research and educational activities related to the project. *Do **NOT** include additional descriptive information.*

Project Management (Limit: 3 pages): Describe the overall leadership structure of the Institute, and how the structure will facilitate integration of the research activities. Describe plans for administration of the Institute, including the functions of key personnel and the role of any advisory committee, executive committee, program committee, or their equivalent, with specific reference to how evidence from the science of team science discipline will be incorporated. Describe the procedures and criteria used to select, administer, and evaluate the activities of the Institute. Include plans for to develop team policies in an inclusive way for authorship expectations and decisions, data sharing and access, personnel expectations, resource reallocation, and contingencies to mitigate possible risks to the project. Identify the roles, contributions of, and benefits to any partners (for example, industry or foundation partners). Describe plans for administering the educational programs and outreach activities. Describe the overall leadership structure (e.g., distributed, collaborative, etc.) and opportunities for early-career leadership experience, as well as how it may evolve over the span of the project, and provide evidence for leadership mentoring, training, and succession.

Research Activities (Limit: 10 pages): The Institute may include multiple research activities under its overall research theme. Provide a concise description of the long-term goals and intellectual focus of each activity, and a clear explanation of how the activities integrate under the overall research theme of the Institute. Explain why the proposed Institute is the appropriate mechanism to advance the stated goals. Describe how the proposed projects will necessitate the integration of subfields of biology and detail where and how data and concepts from one project would be used to inform/assist/influence other projects. Describe the research activities in sufficient detail to enable assessment of scientific merit and significance. Describe the role and intellectual contribution of each senior participant in each activity. Briefly outline the resources needed to accomplish the stated goals. Identify the roles of any external partners or international collaborators in the project.

Research Resources (Limit: 2 pages): Describe any existing research infrastructure (e.g., cyberinfrastructure, data resources, biological materials and other research resources) that will be leveraged and are not a part of the Institute's own Facilities. Explain how those resources will be integrated with Institute capabilities and utilized in the research, education, or outreach activities. If the Institute will generate novel research resources as outcomes that are intended for use beyond the Institute, describe these deliverables and how they will be made accessible and disseminated to a broader community.

Education, Training, and Diversifying (Limit: 3 pages): Describe the proposed education and training activities of the Institute. Describe and rationalize the proposed training approaches (for example, mentoring structures, pedagogical activities, social organization), and identify the trainee population(s) that will be served and how the approaches will achieve success at diversifying the constitution of the team at all career levels, including trainees. This section must explain how the proposed activities will be well-integrated with the research plan, and how barriers to communication and information sharing between biological disciplines will be addressed. Discuss how trainees will be recruited, mentored, and retained, and describe any professional development activities. Explain how these efforts will increase participation of people from all demographics, thereby including those underrepresented in the scientific enterprise. This effort at broadening participation in science is a high-priority of the BIO Directorate and NSF. Identify the roles of any external partners or international collaborators in these activities. Proposals **must** describe the means of assessment of the effectiveness of these activities.

Outreach Activities (Limit: 2 pages): Describe plans for outreach to the broader scientific community and to the general public. Proposals **must** describe the means of assessment of the success of these activities.

Intellectual Contribution and Credit (Limit: 1 page): Provide a clear plan for the management of the rights of and credit to all project participants related to research products, including, but not restricted to: data, tools, methods, code, models, manuscript authorship, and other intellectual contributions. Describe how the Institute plans to share (within and outside the Institute) information, data, tools, and resources that result from the activities, regardless of the source of support and who has access to what. This section should complement, rather than overlap, the Data Management Plan and explain how the project participants will collaboratively ensure a fair and equitable assignment of credit to all project participants based on agreed-upon criteria of contribution. Because different subdisciplines and disciplines can have vastly different expectations related to credit, the proposers need to document how they will address these important policies, related to all project participants, especially early-career researchers.

Letters of Collaboration. The project description must fully detail any substantial collaborations and engagements (included or not included in the budget) with partner organizations. Letters of collaboration should be provided in the supplementary documents section of the proposal and **must** follow the format instructions specified in the NSF PAPPG.

Letters deviating from the guidance provided in the NSF PAPPG will not be accepted and may be grounds for returning the proposal without review.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

Proposals **must** include costs for representatives of the research team to travel to annual PI meetings that will be held in Alexandria, VA.

C. Due Dates

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

  January 27, 2021

D. FastLane/Research.gov/Grants.gov Requirements

For Proposals Submitted Via FastLane or Research.gov:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. 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 FastLane or Research.gov user support, call the FastLane and Research.gov Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov or rgov@nsf.gov. The FastLane and Research.gov Help Desk answers general technical questions related to the use of the FastLane and Research.gov systems. 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 FastLane or 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.

Additional Solicitation Specific Review Criteria

1. Does the plan merge ideas, approaches, and technologies from diverse fields of biology to stimulate and integrate discovery and innovation? Is the

proposed Institute as a whole more than the sum of its parts?
2. Is the integration and management plan well-reasoned, well-organized, optimally configured, and based on a sound rationale? Is the leadership structure laid out, are roles well-justified, and is the Institute likely to function effectively? Are risk management strategies (conflict resolution, resource reallocation, contingency planning) described and adequate? Are there milestones to monitor and ensure that the integration of distinct biological sub disciplines occur? Does the proposal incorporate a mechanism to assess success of both the science and the broader impacts?
3. Will the Institute leverage existing investments in biological infrastructure (software, data resources instrumentation, or other research resources) and will they be integrated effectively, if appropriate? If the Institute will generate biological infrastructure as outputs, how are these outputs made useful to other researchers and a broader community of other users, and are the methods of access or dissemination appropriate? Will access to project outputs be provided in a timely manner?
4. Is the training and education plan integrative and sufficient? Are the proposed activities well-grounded and likely to result in a next generation of researchers who are able to work fluently across biological subdisciplines? Does the proposal include sufficient resources and expertise to carry out the plans described? Is the plan to assess effectiveness of the educational activities sound?
5. How will the Institute diversify and broaden participation among team leadership, researchers, students, and trainees? How will the Institute work beyond its immediate network to increase its effectiveness?
6. Are the outreach activities compelling and directly integrated with the research activities? Is there a means for evaluating the Institute's outreach?
7. Does the plan for intellectual contribution and credit treat all team members in an equitable and fair way and does it help foster integration across subdisciplines?

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review, Internal NSF Review, Site Visit Review, or Reverse Site Review.

Proposals will be reviewed by a combination of Ad hoc and/or Panel Review and may also utilize site visits or reverse site visits.

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:

- Reed Beaman, Program Director, DBI, telephone: (703) 292-7163, email: rsbeaman@nsf.gov
- Stephen DiFazio, Program Director, MCB, telephone: (703) 292-4517, email: sdifazio@nsf.gov
- Wilson Francisco, Program Director, MCB, telephone: (703) 292-7856, email: wfrancis@nsf.gov
- Jodie M. Jawor, Program Director, IOS, telephone: (703) 292-7887, email: jjawor@nsf.gov
- Samuel M. Scheiner, Program Director, DEB, telephone: (703) 292-7175, email: sscheine@nsf.gov
- Anne W. Sylvester, Program Director, IOS, telephone: (703) 292-7168, email: ASYLVEST@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) 292-8569
- **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:

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

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