Infrastructure Capacity for Biological Research (Capacity)

PROGRAM SOLICITATION
NSF 21-501

REPLACES DOCUMENT(S):
NSF 18-594

National Science Foundation

Directorate for Biological Sciences
Division of Biological Infrastructure

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

This solicitation has revised to incorporate revised descriptions of the programmatic areas that are eligible for support.

A description of how to report the public release of data from previously funded projects in the "Results from Prior NSF Support" section has been updated.

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:

Infrastructure Capacity for Biological Research (Capacity)

Synopsis of Program:

The Infrastructure Capacity for Biological Research (Capacity) Program supports the implementation of, scaling of, or major improvements to research tools, products, and services that advance contemporary biology in any research area supported by the Directorate for Biological Sciences at NSF. The Capacity Program focuses on building capacity in research infrastructure that is broadly applicable to a wide range of researchers in three programmatic areas: Cyberinfrastructure, Biological Collections, and Biological Field Stations and Marine Laboratories. This program will also accept proposals for planning activities or workshops to facilitate coordination that may be necessary in building capacity in infrastructure that meets the needs of a research community. Areas not included in this program are instrumentation (PIs should submit to the MRI program) and, projects that develop infrastructure for a specific research project, laboratory, or institution (PIs should submitted to the relevant BIO programs that would normally support that research). Projects are expected to produce quality products, result in important science outcomes that will be achieved by the users of the resource, be openly accessible to a broad scientific and education

community, and serve a community of researchers beyond a single research team.

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.

- Capacity Cyberinfrastructure, telephone: (703) 292-8470, email: DBICyberinfrastructure@nsf.gov
- Capacity Biological Collections, telephone: (703) 292-8470, email: DBIBioCollections@nsf.gov
- Capacity Biological Field Stations, telephone: (703) 292-8470, email: DBIBioFieldStations@nsf.gov

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

- 47.074 --- Biological Sciences

Award Information

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

Estimated Number of Awards: 50 to 75

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

Anticipated Funding Amount: $18,000,000 to $20,000,000

Approximately $18-20 million is expected to be available for new awards in FY 2021. The size and duration of any individual request should be justified by the amount and complexity of the work to be accomplished. As a rule, the larger the budget, the greater the expected impact on the biological research community.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
  - Full Proposals submitted via 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. Additional merit review criteria apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

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

Reporting Requirements:

Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

Transformative discoveries in the biological sciences are often catalyzed by the development and dissemination of new research tools and methods. For such advancements to take place, research infrastructure needs to be supported at all stages of its life-cycle that includes: **Innovation** (the design of novel or greatly-improved research infrastructure), **Capacity** (the scaling of or major improvements to infrastructure), and **Sustainability** (continued operation of existing infrastructure). The Division of Biological Infrastructure (DBI) supports this life-cycle of research resources in biology by having three different programs focused on each of these important stages of development of research infrastructure in resources and services. The goals of the **Capacity** program are aligned with the second stage in this cycle to advance contemporary biology in any research area supported by the Directorate for Biological Sciences at NSF.

DBI 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 design related research. Proposals to develop or provide infrastructure that is primarily to enable research in these excluded topics are not eligible for support under this solicitation and will be returned without review.

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

[2] https://www.nsf.gov/od/oia/activities/ceose/reportCEOSE_ReportToCongress_RP_FVmp_508.pdf

II. PROGRAM DESCRIPTION

The Infrastructure Capacity for Biology (Capacity) Program supports the scaling of or major improvements to research tools, products, and services that advance contemporary biology in any research area supported by the Directorate for Biological Sciences (BIO) at NSF. The Capacity Program focuses on building capacity in research infrastructure that is broadly applicable to a wide range of researchers in three programmatic areas: Cyberinfrastructure, Biological Collections, and Biological Field Stations and Marine Laboratories. This program will also accept proposals for planning activities or workshops to facilitate coordination that may be necessary in building capacity in infrastructure that meets the needs of a research community. Areas not included in this program are instrumentation (PIs should submit to the MRI program); and, projects that develop infrastructure for a specific research project, laboratory, or institution (PIs should submitted to the relevant BIO programs that would normally support that research). Projects are expected to produce quality products, result in important science outcomes that will be achieved by the users of the resource, be openly accessible to a broad scientific and education community, and have the potential to be used by a community of researchers beyond a single research team.

Budgets and award durations should accommodate the iterative process of bringing a proof-of-concept resource into a form that is sufficiently robust to become a broadly-adopted infrastructure resource. Proposals should be product-driven and typically will be assessed on their perceived contribution to a broad portfolio of national infrastructure capacity. PIs are encouraged to leverage NSF-supported scientific infrastructure, such as databases, data networks, computational resources, software, and centers. Proposals may include limited data collection, experimentation or other research activities as appropriate to design, evaluate, or calibrate the proposed infrastructure.

The three programmatic areas of the Capacity Program are described below. Please see links for further information in each area. PIs are encouraged to contact the program officers using the contact information above if they have questions about where to submit a proposal within this solicitation or if their proposed work cuts across one or more of these programmatic areas.

> ***Cyberinfrastructure Programmatic Area:*** *https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505538&org=DBI&from=home*
>
> The Cyberinfrastructure Programmatic Area supports the implementation of, scaling of, or major improvement to cyberinfrastructure for biology that advances or transforms contemporary biology and that is broadly applicable to a wide range of researchers.
>
> ***Biological Collections Programmatic Area:*** *https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505541*
>
> The Biological Collections Programmatic Area supports major improvements to or digitization of biological collections and collection-based information, enabling the advancement of biological understanding in important research areas, and increasing the broader applicability of collections.
>
> ***Biological Field Stations and Marine Laboratories Programmatic Area****: https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5449&org=DBI*
>
> The Biological Field Stations and Marine Laboratories Programmatic Area supports major improvements to biological field stations or laboratories in any terrestrial, marine, estuarine, or freshwater environment for research and education.

Planning proposals. Proposals for comprehensive planning to transform a resource (or a network of resources) in terms of its research and training mission. The effort should produce a strategic or other type of plan for advancing research (and education, if relevant) for at least a five-year time frame. Planning proposals may address, but are not limited to, research/training program development, infrastructure needs assessment, and research infrastructure coordination at regional (or broader) scales. Proposed activities will normally include meetings or travel for engaging research, educational (if relevant), or stakeholder communities. For planning activities to develop resources for biological research projects that may ultimately be more appropriate to other NSF programs, such as the Mid-scale Research Infrastructure program, please contact a Program Officer to determine whether such a project should be submitted as a planning proposal to this solicitation. Award of a planning grant does not imply an NSF commitment for support beyond the planning period.

Other proposal types

In addition to the regular research proposals sought under this solicitation, the programmatic areas 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.**

III. AWARD INFORMATION

Estimated program budget, number of awards and average award size and duration are subject to the availability of funds, the quality of submissions, and the anticipated benefits to biological research. Both standard and continuing grants will be awarded. Large and complex projects may be awarded as cooperative agreements. The specific award type will be determined on a proposal by proposal basis.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via 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.

The following information provides instructions that supplement the PAPPG and the NSF Grants.gov Application Guide.

Cover Page: The title should be descriptive of the project and avoid acronyms or proper names that merely identify, rather than describe the research project. Any relevant prefixes as per PAPPG or other solicitation (eg RUI, RCN) guidelines should be applied to the title.

Project Summary (1 page): Each Project Summary must include the following sections labelled as they are here:

Overview: **This section should begin with a comma-separated list of keywords as the first line.** It should then provide a brief overview of the proposed activities, planned deliverables, and the anticipated impacts on the research community.

Intellectual Merit: This section should include a brief description of the proposed activities and the anticipated impacts on basic biological research.

Broader Impacts: This section should include a brief description of the potential impacts beyond the targeted research community, including general science, educational, or public audiences.

Project Description (maximum length 15 pages):

Please include the following sections and topics within the Project Description text.

Overview (include sub-header).

The first paragraph of the project description should provide a concise, clear description of the proposed resource(s) that will be made available under this award. Describe, using a minimum of specialized language, what the resource will consist of, where it will fit within the broader context of existing infrastructure, what functionality it will offer to advance science, and what activities or acquisitions will be undertaken to implement or improve it.

Results from Prior NSF Support (include sub-header).

General guidance is provided in the NSF PAPPG, Chapter II.C.2.d(iii). Where appropriate, distinguish between the proposed resource and any existing infrastructure resulting from prior NSF support. When appropriate, this section must include evidence of deposition of samples, data and/or data products in recognized, accessible, community-accepted repositories by listing such repositories and, if practical, metadata. All publications, data, data products, programs and/or scripts that are specifically mentioned in the Results from Prior NSF Support section must be referenced in the References Cited section and must provide unique, resolvable and persistent identifiers (such as Digital Object Identifiers [DOIs]; Uniform Resource Locators (URLs), or similar).

The remaining sections, described below, may appear in any order in the project description. They need not be explicitly labeled except as noted, but the content of each should be appropriately addressed.

Rationale.

Explain how the infrastructure will uniquely address a general need in fundamental biological research; and, clearly define the research gaps that its development or improvement will address. Provide sufficient background information to describe the existing capacity and how the proposed work deviates from prior capacity or, if appropriate, from prior funded work. Proposals should identify the biological user community and explicitly describe how the project will advance the capabilities of that community. In the case of proposals that improve existing infrastructure, provide a description of its current capacity and document its prior use and impacts.

Design and implementation.

Provide a detailed description of the infrastructure for which funding is requested, its specific requirements, planned functionality, and relevant community standards, as appropriate, to explain what is to be implemented and what the necessary effort and potential risks will be. Describe the workplan for implementing the project, including, when appropriate, a graphical or tabular summary of the major deliverable components, a schedule and milestones for completion, the allocation of resources to tasks, and any associated risk and plans for mitigating them.

Project Management.

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

Broader Impacts (include sub-header).

General guidance is provided in the NSF PAPPG, Chapter II.C.2.d(i)). For all activities or outcomes described under broader impacts, demonstrate how they will benefit from proposed infrastructure.

Communication and Dissemination.

Describe how the products of this work will be accessible to its target audience and to the broader biological, interdisciplinary, and other audiences. Provide a clear statement of relevant intellectual property considerations and any constraints these may place on access to the proposed resource.

Outcomes Assessment.

Identify what metrics will be used to measure success toward the stated goals of the project (both for Intellectual Merit and Broader Impacts) and by what process the project will collect and evaluate them.

Sustainability.

Identify what will be the ongoing costs for continued availability of the resource beyond the term of NSF support and present a plan for how these are to be met. PIs are encouraged to consider alternative models for long-term sustainable financial support and leveraging use of resources provided through other funding sources within and beyond NSF.

Note: Inclusion of URLs linking to external resources for the purpose of providing additional description of the proposed project is not allowed and may result in return without review. Reviewers will be advised to review what is presented in the 15 pages and not to consider additional information provided on a web site. Additional guidance on page limitations and inclusion of uniform resource locators is provided in the NSF PAPPG, Chapters II.C.2.d(ii). URLs may appear in the reference cited section if what is being cited is an online resource.

Facilities, Equipment and Other Resources (Maximum length 2 pages)

The purpose of the facilities section is to document those existing resources, including space, computational equipment, or effort that will contribute to the project goals. Only those resources that will be used by the project should be listed with the understanding that listing them implies a commitment that they will be available. No dollar amounts may be referenced for any resource discussed in the Facilities section. If the budget requests funds for equipment, materials, or resources identified in the facilities section, the budget justification should clearly account for the duplication. The Division of Biological Infrastructure expects that institutions suitable for the development of advanced infrastructure will typically have adequate computing and equipment resources as well as appropriate support staff to facilitate the proposed research.

Special Information and Supplementary Documents

This section may contain ONLY the following types of documents.

Letters of Collaboration.

All Proposed activities must be documented in the Project Description. Statements from individuals providing assistance or collaboration to the project who are identified and whose role is discussed in the Project Description as must follow NSF PAPPG, Chapter II.C.2.d.iv. No other letters will be accepted. Inclusion of other letters will be cause for return without review.

Cost Basis.

Quotes, estimates or price lists that verify the basis for budget estimates for any capital equipment, contracted, or consultant services. These may include plans, drawings, or other graphical content provided with those estimates.

Authorities.

Memoranda of Understanding, Permits, Licenses, Agreements, or other documents as appropriate that demonstrate that the awardee institution has the appropriate authority to carry out proposed activities on property or resources owned by other organizations. For example, permits allowing a university to improve a facility on federally owned land.

Data Management Plan.

Proposals are expected to address, as part of the required Data Management Plan (DMP), the long-term availability of data, software or services generated as deliverables under this funding. This includes identification of which deliverables are appropriate for long-term preservation and the process the project will use in selecting them. It should specify any policies developed, or followed, by this project that cover the intellectual property rights, confidentiality, access conditions, or terms of use, for any research products that have been produced this project, or that may be deposited with, or accessed from, a resource developed under this project. The DMP should indicate how dissemination of digital products makes full use of independent, broadly recognized repositories, and is compliant with any relevant community standards. The DMP should explain how users of infrastructure supported under this program will be advised of their obligations to share data generated from its use in accordance with NSF policies and what the operators of this infrastructure will do to facilitate that goal. Further guidance for the Data Management Plan can be found on the BIO website at: https://www.nsf.gov/bio/biodmp.jsp.

Post Doctoral Mentoring Plan (If applicable). General guidance is provided in the NSF PAPPG, Chapter II.C.2.j

Single-Copy Documents

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

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Budget Preparation Instructions:

Budget Guidance: Budgets should be well justified according to the effort required to carry out the proposed work. Typical award budgets vary widely depending on the nature of the infrastructure, the resources and effort required to implement them, and the relative breadth of the biological science community likely to be impacted. Proposers are advised to pay close attention to the following guidelines:

- Proposals that are primarily for capital improvements, acquisition, and/or deployment of fully developed technology many not include compensation for permanent employees to carry out oversight, review, operation, or other administrative tasks that would be considered within their existing job description. Salary for in-house hiring for activities directly involved in the improvement like construction, design, commissioning, etc., that would otherwise be covered through external contracts would be allowable.
- For proposals requiring substantial PI and/or senior personnel effort to carry out the proposed aims and activities, proposers should carefully read the NSF PAPPG, Chapter II.C.2.g.i.a concerning Senior Project Personnel Salaries. An appointment in a “soft-money” position is NOT by itself sufficient justification for exceeding the 2 month limit.
- The budget justification should clearly identify how the NSF funds will be allocated to the major activities and deliverables identified in the above section. It must be clear how the effort requested for each individual is apportioned to the activities they will be doing.
- For major equipment or software purchases, a vendor, model, and price quote should be included or referenced with a catalog citation. Justification should explicitly address why the need cannot be met by existing facilities either at the institution or within national cyberinfrastructure or other instrumentation facilities supported by other NSF programs. Requests for equipment must account for administration and maintenance both during and beyond the tenure of the award. For equipment, the proposal should also explain how any usage time or storage space not consumed by the project would be made available to the broader scientific community at the campus, regional or even national scale.
- Travel requests must be justified in reference to specific activities described in the proposal’s scope of work. Foreign travel must identify the destination country or countries.
- Limited budgets for data acquisition through observation, experiment, or modeling activities will be considered only if a strong justification for why this is needed to inform or validate the proposed infrastructure work is provided.
- If there is an institutional policy setting direct cost fees for the use of computational facilities by sponsored projects, then funds for these fees should be included on line G4 Computer Services as per the NSF PAPPG, Chapter II.C.2.g.vi.d. Budgets must not include costs on other lines that are redundant

with the services provided by these fees.
- Budgets may not include costs for contingency.

C. Due Dates

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

  Proposals Accepted Anytime

D. 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.

Additional Solicitation Specific Review Criteria

Infrastructure supported by this program is expected to build capacity in research infrastructure that is broadly applicable. Projects are expected to produce quality products, result in important science outcomes that will be achieved by the users of the resource, and have the potential to be used by a community of researchers beyond a single research team. Reviewers will be instructed to consider the following additional criteria when evaluating proposals submitted to this program:

1. *Rationale*: How compelling is the case for the proposed resource to result in significant advances to biological research through its adoption and use? What is the quality of the needs assessment, including the size, diversity, and significance of the targeted user community as a scale far beyond that of the proposing institution?
2. *Design and implementation*: Do the workplan and proposed functional requirements provide a compelling case for success? Does the proposed infrastructure consider and comply with relevant community standards such as data formats, methodological practices, engineering standards, or green and sustainable practices?

3. *Project Management*: How clearly defined are the projects activities and how well is the team organized to complete them? How effective is the assessment plans for setting milestones, timelines, evaluation criteria, and change control on a local, regional, national, and/or global scale?
4. *Communication and dissemination*: How effective are the proposed plans for engaging with its target audience for disseminating its impacts to the broader research, education, and public communities? Is there engagement with the targeted user community through the entire development/implementation cycle?
5. *Outcomes Assessment*: How well has success been defined and how effective are the plans for assessing it?
6. *Sustainability*: How will the impacts of this resource be sustained and what would be needed to ensure that?

B. Review and Selection Process

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

Most proposals will be reviewed by a combination of adhoc and panel review. Proposals with large budgets (ca >$1M annually) will likely be subjected to either a site or reverse site visit.

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.

Special Award Conditions:

Large awards with complex workplans may be required to complete a Project Execution Plan (PEP) with additional details on scope of work, schedule, costs, engineering plans, and project management. In addition, these projects may be required to provide further documentation on cost estimates and engineering requirements. Where this is applicable, the program officer will notify the PI and provide the necessary templates and guidelines for creating the required documents. These documents must be completed prior to a final recommendation being made but are not required at time of initial proposal submission to the Capacity solicitation. If awarded, PIs will be expected to address progress on PEP task items in their annual reports.

National Environmental Policy Act. Projects involving renovation, construction, or major fixed equipment installation may require additional information to assess

compliance with any applicable laws such as the National Environmental Policy Act, National Historic Preservation Act, or Endangered Species Act. If review of this material indicates that the project execution is not adequately prepared or that the barriers to NEPA compliance are prohibitive, the program may elect to not proceed with an award. PIs are strongly encouraged to contact the program in advance if they are considering proposals that involve construction or any other activities that might impact the natural or cultural environment.

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.

PIs are required to list in their annual reports all unique, resolvable and persistent identifiers (such as Digital Object Identifiers [DOIs]; Uniform Resource Locators (URLs), or similar) for any products described in the report.

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:

- Capacity Cyberinfrastructure, telephone: (703) 292-8470, email: DBICyberinfrastructure@nsf.gov
- Capacity Biological Collections, telephone: (703) 292-8470, email: DBIBioCollections@nsf.gov
- Capacity Biological Field Stations, telephone: (703) 292-8470, email: DBIBioFieldStations@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.

Other Related Sources of Support

Major Research Instrumentation (MRI): MRI supports the acquisition and development of major research instruments in all areas of science. The Division of Biological Infrastructure participates in this program and considers proposals for instruments that enable BIO-supported research.

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

The Office of Advanced Cyberinfrastructure (OAC) of the Directorate for Computer and Information Science and Engineering offers funding opportunities in advanced computing infrastructure, long-term data preservation, data interoperability, software development, and other topics.

The **Chemical, Bioengineering, Environmental and Transport Systems (CBET)** division of the Directorate for Math and Physical Sciences supports innovative research and education in the fields of chemical engineering, biotechnology, bioengineering, and environmental engineering, and in areas that involve the transformation and/or transport of matter and energy by chemical, thermal, or mechanical means.

SBIR/STTR may provide support commercialization of outcomes of NSF funded projects.

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