Division of Molecular and Cellular Biosciences Core Programs (MCB)

PROGRAM SOLICITATION
NSF 23-548

REPLACES DOCUMENT(S):
NSF 21-509

National Science Foundation
Directorate for Biological Sciences
Division of Molecular and Cellular Biosciences

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

Proposals Accepted Anytime

IMPORTANT INFORMATION AND REVISION NOTES

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

The Division has revised the solicitation to update priority areas for funding.

Other changes include:

An Integrative Research in Biology (IntBIO) Track has been added. Proposers should note that proposals to the IntBIO Track require additional information that reviewers will be asked to evaluate. These are described in the program description and in the additional solicitation-specific review criteria.

Updated information is provided in the proposal preparation instructions for requesting support for Research Assistantships for High School Students (RAHSS), Research Experiences for Undergraduates (REU), Research Experiences for Postbaccalaureates (REPS), Non-Academic Research Internships for Graduate Students (INTERN), Research Experiences for Teachers (RET), and Research Opportunity Awards (ROA). Requests for supplemental funding for activities anticipated at the time of submission should be included in the proposal. Post-award requests for supplemental funding are expected to reflect unanticipated opportunities that arise after an award is made.

Safe and Inclusive Working Environments: The Directorate for Biological Sciences requires that proposers who include off-campus or off-site research as part of their project submit, as supplementary documentation, a Plan for Safe and Inclusive Working Environments. **Proposals submitted after April 18, 2023** that involve off-campus or off-site research, defined as data/information/samples collected off-campus or off-site, must include a Safe and Inclusive Work Environments Plan. For this solicitation, this document replaces the required plan associated with the certification in Chapter II.E.9 of the Proposal and Award Policies and Procedures Guide (PAPPG, NSF 23-1). Instructions for inclusion of the Plan for Safe and Inclusive Working Environments can be found in the additional proposal preparation instructions in this solicitation.

Additional proposal preparation instructions are included for proposers who include specimen collection in their projects.

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

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Division of Molecular and Cellular Biosciences Core Programs (MCB)

Synopsis of Program:

MCB supports research that promises to uncover the fundamental properties of living systems across atomic, molecular,

subcellular, and cellular scales. The program gives high priority to projects that advance mechanistic understanding of the structure, function, and evolution of molecular, subcellular, and cellular systems, especially research that aims at quantitative and predictive knowledge of complex behavior and emergent properties. MCB encourages research exploring new concepts in molecular and cellular biology, while incorporating insights and approaches from other scientific disciplines, such as chemistry, computer science, engineering, mathematics, and physics, to illuminate principles that govern life at the molecular and cellular level. MCB also encourages research that exploits experimental and theoretical approaches and utilizes a diverse spectrum of model and non-model animals, plants, and microbes across the tree of life. Proposals that pursue potentially transformative ideas are welcome, even if these entail higher risk.

This solicitation calls for proposals in research areas supported by the four MCB core clusters, including: (i) structure, dynamics, and function of biomolecules and supramolecular assemblies, especially under physiological conditions (Molecular Biophysics); (ii) organization, processing, expression, regulation, and evolution of genetic and epigenetic information (Genetic Mechanisms); (iii) cellular structure, properties, and function across broad spatiotemporal scales (Cellular Dynamics and Function); and (iv) systems and/or synthetic biology to study complex interactions through modeling or manipulation or design of living systems at the molecular-to-cellular scale (Systems and Synthetic Biology). All MCB clusters prioritize projects that integrate across scales, investigate molecular and cellular evolution, synergize experimental research with computational or mathematical modeling, and/or develop innovative, broadly applicable methods and technologies. Projects that bridge the intellectual edges between MCB clusters are welcome. Projects that integrate molecular and cellular biosciences with other subdisciplines of biology are also welcome through the new Integrative Research in Biology (IntBIO) track.

MCB strives to achieve key goals laid out in the NSF Strategic Plan. Among these goals are: (i) to empower Science Technology, Engineering, and Mathematics (STEM) talent to fully participate in science and engineering; (ii) to enable creation of new knowledge by advancing the frontiers of research and enhancing research capability; and (iii) to benefit society through translation of knowledge into solutions. In line with these goals, MCB seeks to increase the diversity of individuals and institutions in the molecular and cellular biosciences community we support. Hence, to be competitive, proposers must be intentional regarding broadening participation in their projects through efforts to promote diversity, equity, and inclusion of individuals traditionally underrepresented in STEM and of types of institutions, such as Minority-serving Institutions (MSIs), Primarily Undergraduate Institutions (PUIs), two-year colleges, institutions in jurisdictions associated with the Established Program to Stimulate Competitive Research (EPSCoR), as well as major research institutions.

Also aligned with the NSF Strategic Plan, MCB encourages basic research ideas that are inspired by curiosity and/or by their potential use for societal benefit, especially pertaining to pressing challenges such as, but not limited to climate change, clean energy, feeding the world sustainably, or health. With regard to health-related challenges, it should be noted that research using biomedical model systems to address questions of basic scientific interest is permissible. However, in accordance with the PAPPG, **MCB does not normally support** biological research on **mechanisms of disease in humans**, including on the etiology, diagnosis, or treatment of disease or disorder. Similarly, MCB does not normally support biological research to develop animal models of such conditions or testing of procedures for their treatment. Proposals motivated by such disease-related goals will be returned without review.

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.

- Manju M. Hingorani, telephone: (703) 292-7323, email: mcb-gm@nsf.gov
- Loretta Jackson-Hayes, telephone: (703) 292-4286, email: mcb-cdf@nsf.gov
- Jaroslaw Majewski, telephone: (703) 292-7278, email: mcb-mb@nsf.gov
- Anthony G. Garza, telephone: (703) 292-8440, email: mcb-ssb@nsf.gov

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

- 47.074 --- Biological Sciences

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 120

Anticipated Funding Amount: $100,000,000

$100M will be committed for the total budget of all new awards in each fiscal year.

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

  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:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

The Division of Molecular and Cellular Biosciences (MCB) prioritizes research that yields mechanistic insights into fundamental and emergent properties of living systems and leads to quantitative and predictive understanding of how life works at the molecular and cellular scale. MCB encourages projects that combine experimental, computational, and theoretical approaches in inventive ways to solve new or long-standing biological questions. MCB also encourages interdisciplinary research that draws on knowledge from and interfaces with other biological subdisciplines or other disciplines such as chemistry, computer science, mathematics, physics, and engineering. Proposals that pursue potentially transformative ideas are welcome, even if these entail higher risk.

Together, the core programs (clusters) in MCB support a wide range of research areas pertaining to the structure, function, and evolution of molecular, subcellular, and cellular systems. Each cluster has a distinct thematic focus, but all of them place a high priority on projects that:

- **Integrate across scales:** Connecting knowledge across spatiotemporal scales involving single molecules, macromolecular assemblies, molecular networks, and cellular processes for an integrative understanding of the molecular and cellular basis of life.
- **Investigate molecular and cellular evolution:** Discovering mechanisms, theoretical underpinnings, and consequences of evolutionary changes in molecules, genomes, and cells of all types, including bacteria, archaea, and eukaryotes, and their phages/viruses.
- **Synergize experimental research with computational or mathematical modeling:** Combining experiments and modeling for a predictive, systems-level understanding of the workings of molecular, subcellular, and/or cellular assemblies.
- **Develop innovative methods and technologies:** Creating innovative tools that are motivated by compelling biological questions at molecular and cellular scales and that have the potential for opening new avenues of inquiry.

MCB recognizes that fundamental knowledge of the molecular and cellular principles and processes of life has many potential applications to societal needs. Investigators are encouraged to consider how their basic research might relate to use-inspired goals and outcomes with broad impacts in areas such as advanced biotechnology and the bioeconomy, life on a warming planet, or emerging infectious diseases, among others. Use of convergence research approaches for addressing pressing societal concerns is welcome.

II. PROGRAM DESCRIPTION

MCB is organized into four broad scientific areas represented by core programs (clusters) that welcome proposals in the following topic areas: (i) structure, dynamics, and function of biomolecules and supramolecular assemblies, especially under physiological conditions (Molecular Biophysics); (ii) organization, processing, expression, regulation, and evolution of genetic and epigenetic information (Genetic Mechanisms); (iii) cellular structure, properties, and function across broad spatiotemporal scales (Cellular Dynamics and Function); and (iv) systems and/or synthetic biology to study complex interactions through modeling or manipulation or design of living systems at the molecular-to-cellular scale (Systems and Synthetic Biology).

Links to the websites of each cluster (listed alphabetically below) provide information on the current interests and funding priorities of each cluster, as well as contact information for associated Program Directors. Prospective PIs are *strongly encouraged* to consult with a Program Director most closely related to their research area for help with any questions, for example, about the potential fit of a project to a cluster.

Cellular Dynamics and Function (CDF)

Genetic Mechanisms (GM)

Molecular Biophysics (MB)

Systems and Synthetic Biology (SSB)

MCB welcomes projects that bridge the intellectual edges of more than one cluster within the division. Also, MCB seeks to foster cross-disciplinary research with the other BIO divisions—Integrative Organismal Systems, Environmental Biology, and Biological Infrastructure—and with programs in other directorates, such as in the Division of Chemical, Bioengineering, Environmental, and Transport Systems in the Directorate for Engineering and the Chemistry of Life Processes, Mathematical Biology, and Physics of Living Systems programs in the Directorate for Mathematical and Physical Sciences, among others. PIs are encouraged to explore all relevant areas within NSF and to contact the appropriate Program Directors with any questions.

NSF and MCB are committed to the inclusion of all people and institutions in the research enterprise because all are vital to the nation's health, security, and global leadership in STEM. The nation's changing demographics make this commitment all the more timely. Therefore, to be competitive, proposers must be intentional regarding broadening participation in their projects through efforts to promote diversity, equity, and inclusion of individuals and institutions traditionally underrepresented in STEM. NSF is interested in ensuring the inclusion of individuals from diverse social categories and/or identities including but not limited to: race, ethnicity, gender, sexual orientation, socio-economic status, disability status, veteran status, or geography—recognizing that underrepresentation can vary by career stage and discipline and that there are additional considerations of intersectionality. Proposers submitted to this solicitation *are strongly encouraged* to involve PIs, co-PIs, postdoctoral fellows, students, and other personnel who are members of these groups. MCB also recognizes that STEM research and education occurs at a wide range of institutions, including Minority-Serving Institutions (MSIs), Primarily Undergraduate Institutions (PUIs), and two-year colleges, as well as major research institutions. NSF welcomes single-institution and multi-institutional collaborative proposals from all types of institutions and encourages authentic and substantive collaborations and partnerships across diverse geographies and types of institutions. Proposals from EPSCoR jurisdictions are especially encouraged.

Integrative Research in Biology (IntBIO) Track

The IntBIO Track invites submission of collaborative proposals to tackle bold questions in biology that require an integrated approach to make substantive progress in advancing fundamental knowledge. Integrative biological research spans subdisciplines and incorporates cutting-edge methods, tools, and concepts from each to produce groundbreaking biological discovery that is synergistic, such that the sum is greater than the parts. The research should produce a novel, holistic understanding of how biological systems function and interact across different scales of organization, e.g., from molecules to cells, tissues to organisms, species to ecosystems and the entire Earth. Where appropriate, projects should apply experimental strategies, modeling, integrative analysis, advanced computation, or other research approaches to stimulate new discovery and general theory in biology.

Proposals submitted to the IntBIO Track must span two or more subdisciplinary boundaries in biology. Projects suitable for review in a single existing BIO program should be submitted to that program and not to the IntBIO track. Proposers are *strongly encouraged* to contact a MCB Program Director prior to submission to obtain advice on suitability of the project idea for the IntBIO Track.

To be responsive to the IntBIO track, proposals must:

- Articulate a fundamental overarching biological question or technical challenge that is addressed either through a bold, integrative hypothesis- or question-driven research, and that aims to produce outcomes that are synergistic with various biological subdisciplines and have potential to reveal new principles underlying function or interaction of biological systems.
- Include a graphical illustration that effectively conveys how integration will be accomplished through interconnection among subdisciplines, elements, or systems and how integrated strategies will lead to a synergistic outcome.
- Have an optimally configured collaborative investigative team that includes two or more investigators with diverse perspectives and

expertise. The role of each team member must be clearly described and justified. Team members may be from a single organization or multiple organizations.
- Describe a training and education plan, as part of broader impacts, that is inclusive and involves training in integrative approaches to biological research.

The IntBIO Track is common to each of the core research program solicitations in the Divisions of Environmental Biology, Integrative Organismal Systems, and Molecular and Cellular Biosciences. Proposals should be submitted to a program in one of these divisions. Proposal titles should start with the designation "**IntBIO:**"

Other Opportunities for Funding in MCB

International Collaborative Proposals. MCB continuously considers how best to expand knowledge and enable investigators to leverage expertise and investments globally to push the frontiers of molecular and cellular biosciences. As such, MCB engages in several international agreements to provide funding for collaborative international projects. Core programs will accept proposals for international collaborative research via any one of several country-specific agreements that allow for a single review process between NSF and the relevant international partner. These opportunities are announced through Dear Colleague Letters.

Transitions to Excellence in Molecular and Cellular Biosciences Research (Transitions; NSF 21-508). This program supports mid-career or later-stage researchers (Associate or Full Professor, or equivalent) to pursue new and potentially transformative avenues of inquiry through a transition in their current research program. The Transitions program offers investigators support for sabbaticals or other forms of professional development during the first year and for developing the new research direction(s) in their own laboratory during two additional years.

Foundation- and Directorate-Wide Activities

In addition to the regular research proposals sought under this solicitation, the clusters/programs support a variety of other Foundation-wide and Directorate-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.
- Mid-Career Advancement program (MCA) proposals may be submitted to any of the clusters/programs described in this solicitation but must be submitted by the submission window for the MCA program. This is another opportunity available to mid-career researchers to advance their career trajectory.
- 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), Planning proposals, 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/Workshop/Travel proposals should be submitted at least 6 months before the start date of the conference or workshop in accordance with guidance in the PAPPG and on in the Additional Resources section of the MCB website; you are strongly advised to contact a Program Officer prior to submission. **Note that for RAPID, EAGER, RAISE, or Planning proposals, a concept outline must be submitted prior to submission of a full proposal with approval from an MCB Program Director from the cluster covering the research area of the proposal.**

III. AWARD INFORMATION

Pending availability of funds, approximately $100M will be committed for the total budget of all new awards in each cycle. Requested budget and duration should be in proportion to the proposed scope of the project. The Division funds research projects of varying durations (typically 3 to 5 years) and size.

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.

Additional Eligibility Info:

Proposals that are a duplicate of, or substantially similar to, a proposal already under consideration **by NSF** from the same submitter are subject to return without review. This also applies to previously declined proposals that have not been substantially revised.

Duplicate and Overlapping Proposals to Other Federal Agencies:

Only beginning PIs may submit duplicate and overlapping proposals under consideration **by another federal agency**. If a PI who is not a beginning investigator submits a substantially overlapping proposal to other federal agencies at the time of submission to MCB, or at any time during the review of the proposal by the Division, MCB will return the proposal without review or withdraw it from funding consideration. Beginning investigators are defined in the PAPPG as "...individuals who have not been a PI or co-PI on a Federally funded award with the exception of doctoral dissertation, postdoctoral fellowship or research planning grants."

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.E.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.D.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.

Results from Prior NSF Support: Results from prior NSF support must be reported for each PI or co-PI identified on the proposal who has received any NSF funding with an end date in the past five years, regardless of whether or not the support was directly related to this proposal. The format for results of prior support should follow instructions in the PAPPG.

For proposals submitted to the IntBIO Track: The title of the proposal should contain the designator, "IntBIO:", followed by the substantive title. The Project Description should contain the graphical illustration, information about the collaborative team, and (as a part of the Broader Impacts section) the description of the training and education plan.

For proposals requesting support for education or broadening participation activities: Information on eligible activities, such as RAHSS, REU, REPS, INTERN, RET, or ROA, can be found in the Additional Resources section of the MCB website. If such activities are anticipated, then requests should be included in full proposals at the time of submission, with details provided as Supplementary Documents (no more than 3 pages total, for RAHSS, REU, REPS, INTERN, or RET) or, for ROA, following instructions in the Facilitating Research in Primarily Undergraduate Institutions solicitation. Typical total budgets are:

- RAHSS - $6,000 per student;
- REU - $7,000 - $9,000 per student;
- INTERN - maximum $55,000 per student per 6-month period;
- RET - usually less than $15,000 per teacher; and
- ROA - usually less than $15,000 per faculty member.

It is recommended PIs budget $650 per week over 12 months, plus fringe benefits and travel per student for REPS activities.

Post-award requests for supplemental funding are expected to reflect unanticipated opportunities that arise after an award is made.

Safe and Inclusive Work Environments Plan: All proposals submitted to this solicitation that include research that will be conducted off-campus or off-site must submit a plan for safe and inclusive working environments as a supplemental document that will be considered under the broader impacts review criterion. This supplemental document is in lieu of the required plan associated with the certification called for in Chapter II.E.9 of the PAPPG, NSF 23-1). More information regarding review of the plan is provided under Solicitation Specific Review Criteria.

It is NSF policy to foster safe and harassment-free environments wherever science is conducted. Work conducted off-campus or off-site should be an enriching experience for everyone and help draw researchers to biological sciences research. By requiring advanced planning and attention to maintaining an inclusive environment, NSF is working to ensure that off-campus or off-site research is safe and inclusive for all participants.

Off-campus or off-site research is defined as data/information/samples being collected off-campus or off-site, such as fieldwork and research activities on vessels and aircraft. The plan must be no longer than two pages.

The plan for safe and inclusive working environments must include:

- a brief description of the field setting and unique challenges for the team;
- the steps the proposing organization will take to nurture an inclusive off-campus or off-site working environment, including processes to establish shared team definitions of roles, responsibilities, and culture, e.g., codes of conduct, trainings, mentor/mentee mechanisms and field support that might include regular check-ins, and/or developmental events;
- communication processes within the off-site team and to the organization(s) that minimize singular points within the communication pathway (e.g., there should not be a single person overseeing access to a single satellite phone); and
- the organizational mechanisms that will be used for reporting, responding to, and resolving issues of harassment if they arise.

For proposals that include specimen collection: If collecting or generating specimens (e.g., organisms, parts of organisms, fossils including trace fossils, microbial isolates, etc.) is proposed, the **Data Management Pla**n must include a description of how the specimens and associated data will be accessioned into and maintained in an established biological collection.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

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

  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 Research.gov 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 *Leading the World in Discovery and Innovation, STEM Talent Development and the Delivery of Benefits from Research - NSF Strategic Plan for Fiscal Years (FY) 2022 - 2026*. 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.D.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.D.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 other underrepresented groups 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

For IntBIO Track proposals, reviewers will be asked to evaluate the extent to which:

- The proposal describes a fundamental overarching question or significant technical challenge that is addressed through bold, integrative, hypothesis- or question-driven research and that aims to produce outcomes that are synergistic and have potential to reveal new principles underlying function or interaction of biological systems.
- The graphical illustration effectively conveys how integration will be accomplished through interconnection among subdisciplines, elements, or systems and how integrated strategies will lead to a synergistic outcome.
- The proposal provides a clear description of the investigative team and evidence that they are well-positioned to achieve the goals of the proposed work.
- The proposal describes an inclusive training and education plan, as part of broader impacts, that is likely to produce a new generation of diverse scientists who are trained in integrative approaches to biological research.

Reviewers will be instructed to evaluate the **Plan for Safe and Inclusive Work Environments** within the Broader Impacts review criterion, specifically:

- Is there a compelling plan (including the procedures, trainings, and communication processes) to establish, nurture, and maintain inclusive off-campus or off-site working environment(s)?
- Does the proposed plan identify and adequately address the unique challenges for the team and the specific off-campus or off-site setting(s)?
- Are the organizational mechanisms to be used for reporting, responding to, and resolving issues of harassment, should they occur, clearly outlined?

B. Review and Selection Process

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

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

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

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements or the Division of Acquisition and Cooperative Support 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 an NSF Grants and Agreements Officer. 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.

Administrative and National Policy Requirements

Build America, Buy America

As expressed in Executive Order 14005, Ensuring the Future is Made in All of America by All of America's Workers (86 FR 7475), it is the policy of the executive branch to use terms and conditions of Federal financial assistance awards to maximize, consistent with law, the use of goods, products, and materials produced in, and services offered in, the United States.

Consistent with the requirements of the Build America, Buy America Act (Pub. L. 117-58, Division G, Title IX, Subtitle A, November 15, 2021), no funding made available through this funding opportunity may be obligated for an award unless all iron, steel, manufactured products, and construction materials used in the project are produced in the United States. For additional information, visit NSF's Build America, Buy America webpage.

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:

- Manju M. Hingorani, telephone: (703) 292-7323, email: mcb-gm@nsf.gov
- Loretta Jackson-Hayes, telephone: (703) 292-4286, email: mcb-cdf@nsf.gov

- Jaroslaw Majewski, telephone: (703) 292-7278, email: mcb-mb@nsf.gov
- Anthony G. Garza, telephone: (703) 292-8440, email: mcb-ssb@nsf.gov

For questions related to the use of NSF systems contact:

- NSF Help Desk: 1-800-673-6188
- 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.F.7 for instructions regarding preparation of these types of proposals.

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

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

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

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

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information** (NSF Information Center)**:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090

- **To Order Publications or Forms:**

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

  or telephone: (703) 292-8134

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

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

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

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

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