

Opportunities for Promoting Understanding through Synthesis (OPUS)

PROGRAM SOLICITATION NSF 19-584

REPLACES DOCUMENT(S):
NSF 18-582



National Science Foundation
Directorate for Biological Sciences
Division of Environmental Biology

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

August 28, 2019

August 03, 2020

First Monday in August, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

Updates include detail on what should be included in OPUS: Mid-Career Synthesis, Section 2 (Candidate's Proposed Mentored Research and Training Plan) and additional information regarding the COA spreadsheet and suggested reviewers.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) ([NSF 19-1](#)), which is effective for proposals submitted, or due, on or after February 25, 2019.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Opportunities for Promoting Understanding through Synthesis (OPUS)

Synopsis of Program:

Synopsis of Program:

The OPUS program seeks to provide opportunities for mid- to later-career investigators to develop new understanding of science in the fields supported by the Division of Environmental Biology (DEB) through two tracks of synthesis activities.

OPUS: Mid-Career Synthesis. This track aims to provide a mid-career researcher, defined as a candidate at the associate professor rank (or equivalent), with new capabilities to enhance their productivity, improve their retention as a scientist, and ensure a diverse scientific workforce that remains engaged in active research (including more women and minorities at high academic ranks). This track provides an opportunity for the mid-career scientist to enable a new synthesis of their ongoing research. Synthesis is achieved by developing new research capabilities through collaboration with a mentor to enable new understanding of the research system and questions of interest.

OPUS: Core Research Synthesis. This track provides an opportunity for an individual or a group of investigators to revisit and synthesize a significant body of their prior research in a way that will enable new understanding of their research system and questions of interest. This track would also be appropriate early enough in a career to produce unique, integrated insight useful both to the scientific community and to the development of the investigator's future career.

All four clusters within the Division of Environmental Biology (Ecosystem Science, Evolutionary Processes, Population and Community Ecology, and Systematics and Biodiversity Science) encourage the submission of these proposals enabling researchers to expand understanding and develop new insights in their research.

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.

- George W. Gilchrist, telephone: (703) 292-7138, email: ggilchri@nsf.gov
- Leslie J. Rissler, telephone: (703) 292-4628, email: lrissler@nsf.gov
- Kathryn Cottingham, telephone: (703) 292-2994, email: kcotting@nsf.gov

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

- 47.074 --- Biological Sciences

Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 8 to 15

Annually. Anticipated award size is \$175,000-\$350,000.

Anticipated Funding Amount: \$1,000,000 to \$3,000,000 per year, depending upon the availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

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

Who May Serve as PI:

OPUS: Mid-Career Synthesis (OPUS: MCS): PIs must be at the Associate Professor rank (or equivalent; see Additional Eligibility Information).

OPUS: Core Research Synthesis (OPUS: CRS): There are no restrictions on who can be a PI. In cases where multiple scientists have worked collaboratively, an OPUS award will provide support for collaboration on a synthesis.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
 - Full Proposals submitted via FastLane: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
 - Full Proposals submitted via 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:**

Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

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

August 28, 2019

August 03, 2020

First Monday in August, Annually Thereafter

Proposal Review Information Criteria

Merit Review Criteria:

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

Award Administration Information

Award Conditions:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

All four clusters within the Division of Environmental Biology (Population and Community Ecology, Ecosystem Science, Evolutionary Processes, and Systematics and Biodiversity Science) encourage the submission of OPUS proposals enabling researchers to expand understanding and develop new insights

in their research programs. The subject matter of the proposed activities must be appropriate to the program descriptions of one or more of the four clusters within the Division of Environmental Biology.

II. PROGRAM DESCRIPTION

Synthesis is an essential component of scientific inquiry, and it takes time to successfully accomplish. An academic career often does not provide the uninterrupted stretches of time necessary for acquiring and building new skills to enhance one's research program, or for reflecting on and synthesizing one's research. Many mid-career scientists understand that acquiring and synthesizing new skills or conceptual areas into their research program could enhance their scientific productivity and the quality of their research, including that of all mentored personnel (e.g., undergraduates, graduate students, postdocs, and colleagues). Likewise, scientists who have enjoyed a long career may accumulate a significant body of work that would benefit from synthesis and an inclusive reconsideration of their research program as a whole. Without such syntheses, the full importance of disaggregated products is often lost, which denies current and future students, as well as young investigators, the added value of the synthetic work. To encourage synthetic studies, the Ecosystem Science, Evolutionary Processes, Population and Community Ecology, and Systematics and Biodiversity Science Clusters in the Division of Environmental Biology have established OPUS (Opportunities for Promoting Understanding through Synthesis). OPUS now provides two tracks that support researchers interested in deepening the understanding of their research system and questions of interest.

OPUS: Mid-Career Synthesis (OPUS: MCS). This track provides an opportunity for a mid-career researcher, defined as a candidate at the associate professor rank (or equivalent), to develop new research capabilities through collaboration with a mentor, typically from an institution other than their home institution. That collaboration should facilitate a new understanding of the research system and questions of interest. The funding will enable the PI to learn new skills through a mentored partnership and to synthesize the new approaches with their existing empirical or conceptual system. Projects that envision new insights on existing problems or identify new but related problems previously inaccessible without new methodology are encouraged. The proposal should include a timeline for the career enhancement activities and associated products that will result from the collaborative work. The OPUS: MCS program seeks to provide mid-career scientists an opportunity to enhance their productivity and improve their retention as scientists, ensuring a diverse scientific workforce that remains engaged in active research (including more women and minorities at high academic ranks).

OPUS: Core Research Synthesis (OPUS: CRS). This track provides an opportunity for an experienced investigator or a group of investigators to revisit and synthesize a significant body of their prior research in a way that will enable new understanding of their research system and questions of interest. This award targets investigators who have, over time, produced important papers from a series of related research projects, but have not yet integrated that series in a single synthesis. In some areas, multiple investigators may have collaborated throughout the history of a series of research projects. In these cases, support would enable two or more scientists to work collaboratively on a synthesis. Proposals requesting support mainly for the production of new data or synthesizing other investigators' research are not appropriate. OPUS: CRS projects generally result in one or more products reflecting the synthetic activities. Products have been diverse, including papers, monographs, software, websites, books, films, and artistic interpretations.

We expect OPUS awards to generate novel understanding or syntheses that will produce new, emergent insights that are more than the sum of their individual parts. Individuals contemplating submission of an OPUS proposal are encouraged to look at the [abstracts of previously funded research](#) to see what kinds of synthetic products have been supported.

III. AWARD INFORMATION

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 8 to 15 annually. Anticipated award size is \$175,000-\$350,000.

Anticipated Funding Amount: \$1,000,000 to \$3,000,000 per year.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

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:

OPUS: Mid-Career Synthesis (OPUS: MCS): PIs must be at the Associate Professor rank (or equivalent; see Additional Eligibility Information).

OPUS: Core Research Synthesis (OPUS: CRS): There are no restrictions on who can be a PI. In cases where multiple scientists have

worked collaboratively, an OPUS award will provide support for collaboration on a synthesis.

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:

Additional Eligibility Info for the OPUS: MCS:

OPUS: MCS Mentor(s): Before submission of the proposal, the candidate must identify a well-qualified mentor who will have a) extensive expertise and a solid track-record in the research area of interest to the candidate and b) an interest in the career development of the candidate and in the supervision of the candidate's research enhancement activities. Mentors must hold a faculty appointment or equivalent but can be at any academic rank. In some cases, a second mentor may be appropriate. Each mentor must demonstrate their commitment by providing a Letter of Collaboration (see details below under "Additional Supplementary Documentation"). **Each mentor should be included in the proposal as Other Senior Personnel** and must submit a biographical sketch and a completed COA template, and be entered on the Personnel List Spreadsheet (see details below). Partnerships between the candidate and mentor(s) that are mutually beneficial and complementary in terms of both research and career advancement are particularly encouraged.

OPUS: MCS Tenure-Track Equivalency: For a position to be considered a tenure-track-equivalent position, it must meet all of the following requirements: 1) the employing department or organization does not offer tenure-track positions to any new hires; 2) the employee is engaged in research in an area of science supported by DEB; 3) the employee has a continuing appointment that is expected to last the two years of a Mid-Career Synthesis grant; and 4) the proposed project relates to the employee's career goals and job responsibilities as well as to the goals of the department or organization.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via FastLane, Research.gov, or Grants.gov.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full Proposals submitted via 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) 292-7827 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) 292-7827 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.C.2 for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the PAPPG instructions.

The following instructions deviate from or supplement the guidance in the PAPPG and NSF Grants.gov Application Guide:

OPUS: Mid-Career Synthesis (OPUS: MCS)

1. The **Title** of an OPUS: Mid-Career Synthesis proposal must begin with "OPUS: MCS", followed by the substantive title.
2. The **Project Description** of an OPUS: MCS proposal is limited to **ten** pages.
3. The **Project Description** must include the following four sections:

- o **Section 1. Candidate's Past Research:** All OPUS: Mid-Career Synthesis proposals must describe the past (and current) research efforts and accomplishments of the candidate to NSF-DEB science. In this section, the candidate should include a list of no more than 6 publications. Each should be followed by a brief explanation of its importance, the PI's role in the research, and funding source. This discussion should be incorporated into the section on Results of Prior NSF Support. It is not necessary to list the full citation of these articles in the Project Description; full citations of the articles discussed should be listed as a separate group in the References Cited section (see below).
 - o **Section 2. Candidate's Proposed Mentored Research and Training Plan:** All OPUS: Mid-Career Synthesis proposals must clearly justify the request for funding through this special program. The number of years at the Associate (or equivalent) rank, and evidence of exceptional service, teaching, or other activities that have decreased research productivity or competitiveness for extramural funding should be described. All proposals must also describe the scientific research and training enhancement experiences that will occur under the mentor's guidance. Details must be included on why expertise in new methods and/or new fields and the choice of sponsoring mentor(s) (and sponsoring laboratory and institution) would enhance the candidate's scholarship. The proposal should explain how mentoring will create "added value" for the candidate's research program, beyond that which could occur through a typical collaboration. It is expected that the candidate will devote some time at the mentor's institution for the career enhancement experience. Only in exceptional situations, which should be justified, should the mentor(s) be located at the same institution as that of the candidate. The candidate and mentor(s) should be engaged in a research project that addresses a fundamental question in DEB-related science. This section should also include a timeline for career enhancement activities and associated products.
 - o **Section 3: Candidate's Long-Term Career Plans:** This forward-looking section should describe how the proposed work builds upon past (and current) research and scientific accomplishments of the candidate to enable a productive long-term scientific career extending well beyond the award period.
 - o **Section 4: Broader Impacts:** Broader Impacts must be described in a separate section, following guidance in the PAPPG.
4. The **References Cited** section must include references to the articles discussed in Item 3, Section 1 above, grouped separately under a heading labeled "Past Research".
5. **Biographical Sketches:** The Principal Investigator and each mentor/sponsoring scientist must submit a biographical sketch. The biographical sketches should be prepared following the instructions in the PAPPG.
6. **Additional Supplementary Documentation Required for Mid-Career Synthesis Proposals:**

Scan the signed original(s) of the following document(s) and upload the scanned document as a PDF file into the Supplementary Documents section of the proposal. Do not send paper copies to NSF. All documents must be submitted with the proposal in FastLane or Grants.gov by the deadline. Requests for letters should be made by the PI well in advance of the proposal submission deadline because they must be included at the time of submission.

- a. **Letter of Collaboration by Mentor(s):** A letter documenting an intent to collaborate is required from the Mentor/Sponsoring Scientist. Any proposal submitted without this letter(s) will be returned without review. If there is more than one mentor, each person should include a letter. Mentors must hold a faculty appointment or equivalent, but can be at any academic rank. Each Letter of Collaboration should confirm that the candidate has discussed in detail the plans in the Mid-Career Synthesis proposal. The letter must be on letterhead, signed, and no more than 2 pages in length. The content should include:
 - A brief description of the research projects in the host research group(s);
 - A description of how the research and training plan for the applicant would fit into and complement ongoing research of the mentor(s);
 - A description of the role the mentor will play in the proposed research training and mentorship plans, including any training courses, laboratory training components, etc.; and
 - An acknowledgement that the mentor and PI have discussed and agree on the plans as written in the Mid-Career Synthesis proposal.
- b. **Departmental Letter:** To demonstrate the department's support of the Mid-Career Synthesis PI, the proposal must include one letter from the candidate's department head (or equivalent organizational official) demonstrating commitment to the candidate's research career enhancement. Any proposal that does not include a Departmental Letter will be returned without review. The Departmental Letter should be no more than 2 pages in length, on letterhead, and signed. The letter will be included as part of the consideration of the overall merits of the proposal and must include:
 - A discussion of the past successes of the candidate in terms of scholarship, teaching, and mentorship of students, faculty, etc.;
 - A description of how the duties of the candidate (research, service, and training) will be balanced during the award duration, especially since awards will require the candidate to spend some time at the mentor's institution for the career enhancement experience; and
 - An assessment of the potential contribution of the proposed activity to the candidate's advancement of their academic and research program.

7. Single Copy Documents

- o **Collaborators & Other Affiliations (COA) Information.** As detailed in the PAPPG (II.C.1.e), information regarding collaborators and other affiliations must be provided for each individual who has a biographical sketch in this proposal. If you have correctly added biographical sketches for all persons, there should be a separate space within Single Copy Documents to upload each individual's file. The COA information must be provided through use of the [COA template](#).
 - o **Suggested Reviewers.** PIs are encouraged to provide a list of suggested reviewers, including the individuals' names, institutions, and areas of expertise, email addresses, and URLs if available. Please ensure no one on this list has a conflict with the proposal.
8. **Personnel List Spreadsheet:** The spreadsheet template can be found at <https://www.nsf.gov/bio/deb/debpersonnellist.xlsx>. Please read the instructions carefully. Using the template, compile an Excel file that provides information for all persons identified in the proposal as: "PI or co-PI" (i.e., those listed on the cover page); "Other Senior Personnel/Subawardee"; or "Other Personnel" (including the mentor/sponsoring scientist) who have a biosketch included in the proposal. Only one spreadsheet should be submitted per project. All participants in a multi-institutional collaborative proposal should be included on the lead proposal's Personnel List Spreadsheet. The file **must include the FastLane proposal ID assigned after submission of your proposal (i.e., not the Temporary ID # or Grants.gov ID #)**. Once completed, the file should be submitted by email to debtemplate@nsf.gov **within one business day** of proposal submission.

OPUS: Core Research Synthesis (OPUS: CRS)

1. The **Title** of an OPUS: Core Research Synthesis proposal must begin with "OPUS: CRS", followed by the substantive title.
2. The **Project Description** of an OPUS: CRS proposal is limited to **ten** pages.
3. The **Project Description** must include:
 - o **Section 1: Candidate's Past Research:** This section should provide evidence of a series of related research projects that have resulted in

merit-reviewed articles ("Core Articles") and represents a significant body of work, but that have not been integrated within a single synthetic product. This discussion should be incorporated into the section on Results of Prior NSF Support. It is not necessary to list references to these articles in the Project Description; full citations of the articles discussed should be listed as a separate group in the References Cited section (see below).

- o **Section 2: Candidate's Proposed Research Synthesis Plan:** This section should present a compelling argument for the synthesis of the PI's research presented in the Core Articles. This plan should outline a process by which results and insights from accomplished work will be integrated into a new synthesis. Particular emphasis should be placed on the "added value" that this body of research will take on as a result of this synthesis. A specific plan for management of time should be included. The generation of new experimental data or the synthesis of other investigators' research is not appropriate for OPUS: CRS support.
 - o **Section 3: Broader Impacts and OPUS Products:** The project description should outline plans for a well-defined, widely accessible and disseminated product (or products) useful to current and future students and colleagues. This product should serve to provide added value to the existing body of Core Articles cited in the proposal. Additional plans for educational mentoring and outreach, the generation of infrastructure, and other appropriate broader impacts should be included here.
4. The **References Cited** must include references to the articles discussed in item 3, Section 1 above, grouped separately under a heading labeled "Core Articles".
 5. **Single Copy Documents**
 - o **Collaborators & Other Affiliations (COA) Information.** As detailed in the PAPPG (II.C.1.e), information regarding collaborators and other affiliations must be provided for each individual who has a biographical sketch in this proposal. If you have correctly added biographical sketches for all persons, there should be a separate space within Single Copy Documents to upload each individual's file. The COA information must be provided through use of the [COA template](#).
 - o **Suggested Reviewers.** PIs are encouraged to provide a list of suggested reviewers, including the individuals' names, institutions, and areas of expertise, email addresses, and URLs if available. Please ensure no one on this list has a conflict with the proposal.
 6. **Personnel List Spreadsheet:** The spreadsheet template can be found at <https://www.nsf.gov/bio/deb/debpersonnellist.xlsx>. Please read the instructions carefully. Using the template, compile an Excel file that provides information for all persons identified in the proposal as: "PI or co-PI" (i.e., those listed on the cover page); "Other Senior Personnel/Subawardee"; or "Other Personnel" who have a biosketch included in the proposal. Only one spreadsheet should be submitted per project. All participants in a multi-institutional collaborative proposal should be included on the lead proposal's Personnel List Spreadsheet. The file **must include the FastLane proposal ID assigned after submission of your proposal (i.e., not the Temporary ID # or Grants.gov ID #)**. Once completed, the file should be submitted by email to debtemplate@nsf.gov **within one business day** of proposal submission.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

Requests may be for up to two years. Direct costs are limited to:

1. Up to a total of 6.5 months salary plus fringe benefits for the PI may be requested. (NOTE: This is **not** a yearly amount; that is, a total of 6.5 months salary plus fringe benefits may be requested for a period spanning up to two years.) In cases where multiple investigators are involved, the total allowance of 6.5 months salary of the highest paid PI or co-PI may be distributed among investigators.
2. **For OPUS: MCS**, up to \$100,000 for direct costs other than PI salary plus fringe benefits.

For OPUS: CRS, up to \$25,000 for direct costs other than PI salary plus fringe benefits.

3. In lieu of PI salary or in cases where investigators do not need a full 6.5 months of salary to carry out the synthesis activities, the equivalent amount of money may be requested to support students, technicians or others who can directly support the PI's synthesis activities. In such cases, funds for PI salary and technical or other support may be flexibly allocated but may not exceed the total of 1) and 2) above. Discussion of such plans with a program director prior to proposal submission is highly recommended.
4. PIs who have substantial ongoing support from any source should contact a program director prior to submission of an OPUS proposal.

C. Due Dates

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

August 28, 2019

August 03, 2020

First Monday in August, Annually Thereafter

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

For Proposals Submitted Via FastLane or Research.gov:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: <https://www.fastlane.nsf.gov/a1/newstan.htm>.

To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html.

For FastLane or Research.gov user support, call the FastLane and Research.gov Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov or rgov@nsf.gov. The FastLane and Research.gov Help Desk answers general technical questions related to the use of the FastLane and

Research.gov systems. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: <https://www.grants.gov/web/grants/applicants.html>. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via FastLane or Research.gov may use Research.gov to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: https://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.C.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.C.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
 - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
 - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

Reviewers will be instructed to evaluate OPUS proposals using the following additional criteria:

1. Potential of the proposed activity to generate new understanding or a new research agenda as a result of synthetic analyses.
2. For both OPUS: MCS and OPUS: CRS proposals, student training, outreach, and other activities may be included as broader impacts but must involve aspects of the proposed synthesis activities. Broader impacts for OPUS: CRS proposals may differ somewhat from those of standard research proposals. A successful OPUS: CRS project may itself constitute a major broader impact if it generates new understanding or new research directions in a particular field.

B. Review and Selection Process

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

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

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

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

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:

- George W. Gilchrist, telephone: (703) 292-7138, email: ggilchri@nsf.gov
- Leslie J. Rissler, telephone: (703) 292-4628, email: lrissler@nsf.gov
- Kathryn Cottingham, telephone: (703) 292-2994, email: kcotting@nsf.gov

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

- FastLane and Research.gov Help Desk: 1-800-673-6188
FastLane Help Desk e-mail: fastlane@nsf.gov.

Research.gov Help Desk e-mail: rgov@nsf.gov

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF [Grants Conferences](#). Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on [NSF's website](#).

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at <https://www.grants.gov>.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) 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) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, [NSF-50](#), "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and [NSF-51](#), "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

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

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

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