Developing a National Research Infrastructure for Neuroscience (NeuroNex)

PROGRAM SOLICITATION
NSF 16-569

National Science Foundation

Directorate for Biological Sciences
Division of Integrative Organismal Systems
Emerging Frontiers
Division of Biological Infrastructure

Directorate for Mathematical & Physical Sciences
Division of Physics
Division of Mathematical Sciences
Division of Materials Research
Division of Chemistry

Directorate for Social, Behavioral & Economic Sciences
Division of Behavioral and Cognitive Sciences

Directorate for Engineering
Division of Electrical, Communications and Cyber Systems

Letter of Intent Due Date(s) *(required)* (due by 5 p.m. submitter's local time):

September 02, 2016

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

October 21, 2016

IMPORTANT INFORMATION AND REVISION NOTES

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 16-1), which is effective for proposals submitted, or due, on or after January 25, 2016.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Next Generation Networks For Neuroscience (NeuroNex)

Synopsis of Program:

Understanding the brain is one of the grand scientific challenges at the intersection of experimental, theoretical, and computational investigation in the life, physical, behavioral, and cognitive sciences. Rapid proliferation of advanced measurement instrumentation and techniques has allowed researchers to study the brain and behavior at ever finer physical and temporal scales and in broader social and environmental contexts. At the same time, achieving a comprehensive, transformational understanding of the brain in action and in context will require an increased emphasis on systematic, interdisciplinary collaboration and team science, and the increased use of theoretical frameworks, including evolutionary ones, to explore questions that span organizational levels, scales of analysis, and a wider range of species optimal for experimental exploration of brain function. To catalyze such understanding, NSF announced its intention to support the development of innovative, accessible, and shared capabilities and resources towards the establishment of a coherent national infrastructure for neuroscience research, as described in the Dear Colleague Letter NSF 16-047.

The goal of this solicitation is to foster the development and dissemination of (1) innovative research resources, instrumentation, and neurotechnologies, and (2) theoretical frameworks for understanding brain function across organizational levels, scales of analysis, and/or a wider range of species, including humans. This interdisciplinary program is one element of NSF's broader effort directed at Understanding the Brain, a multi-year activity that includes NSF's participation in the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative (http://www.nsf.gov/brain/) and the phased approach to develop a national research infrastructure for neuroscience as outlined in the Dear Colleague Letter NSF16-047. NSF envisions a connected portfolio of transformative, integrative projects that create synergistic links across investigators and communities, yielding novel ways of tackling the challenges of understanding the brain in action and in context.

This program solicits proposals that will develop and disseminate innovative neurotechnologies and/or theoretical

frameworks that will transform our understanding of the linkages between neural activity and cognition and behavior across different systems, environments, and species, while also providing an avenue for widespread dissemination of these technologies and theoretical frameworks as well as broad training opportunities.

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.

- Edda Thiels, BIO/IOS, telephone: (703) 292-8167, email: ETHIELS@nsf.gov
- Sridhar Raghavachari, BIO/IOS, telephone: (703) 292-4845, email: sraghava@nsf.gov
- Reed S. Beaman, BIO/DBI, telephone: (703) 292-7163, email: rsbeaman@nsf.gov
- Krastan B. Blagoev, MPS/PHY, telephone: (703) 292-4666, email: kblagoev@nsf.gov
- Mary Ann Horn, MPS/DMS, telephone: (703) 292-4879, email: mhorn@nsf.gov
- Christopher Sanford, BIO/DBI, telephone: (703) 292-2209, email: csanford@nsf.gov
- Nandini Kannan, MPS/DMS, telephone: (703) 292-8104, email: nakannan@nsf.gov
- David A. Rockcliffe, MPS/CHE, telephone: (703) 292-7123, email: drockcli@nsf.gov
- Aleksandr L. Simonian, MPS/DMR, telephone: (703) 292-2191, email: asimonia@nsf.gov
- Mona Zaghloul,ENG/ECCS, telephone: (703) 292-8339, email: mzaghlou@nsf.gov
- Alumit Ishai, SBE/BCS, telephone: (703) 292-5145, email: aishai@nsf.gov

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

- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences
- 47.074 --- Biological Sciences
- 47.075 --- Social Behavioral and Economic Sciences

Award Information

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

Estimated Number of Awards: 10 to 15

Up to 15 awards.

Anticipated Funding Amount: $16,000,000 to $30,000,000

The typical award size is expected to range from $500K to $2M/year, depending on the project size and scope and the availability of funds. Awards are expected to be three to five years in duration.

Eligibility Information

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI: 1

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - 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: http://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

- **Letter of Intent Due Date(s)** ***(required)*** (due by 5 p.m. submitter's local time):

  September 02, 2016

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

  October 21, 2016

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:

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

Reporting Requirements:

Standard NSF reporting requirements apply.

TABLE OF CONTENTS

I. INTRODUCTION

Understanding the brain is one of the grand scientific challenges at the intersection of experimental, theoretical, and computational investigation in the life, physical, behavioral, and cognitive sciences. Rapid proliferation of advanced measurement instrumentation and techniques has allowed researchers to study the brain and behavior at ever finer physical and temporal scales and in broader social and environmental contexts. At the same time, achieving a comprehensive, transformational understanding of the brain in action and in context will require an increased emphasis on systematic, interdisciplinary collaboration and team science, and the increased use of theoretical and evolutionary frameworks to explore questions that span organizational levels, scales of analysis, and a wider range of species optimal for experimental exploration of brain function, including humans. To catalyze such understanding, NSF announced its intention to support the development of innovative, accessible, and shared capabilities and resources towards the establishment of a coherent national infrastructure for neuroscience research, as described in the Dear Colleague Letter NSF 16-047.

This specific activity, **NeuroNex**, calls for proposals addressing fundamental questions in neuroscience and cognitive science that by their nature require the convergence of multiple disciplines to answer. Through NeuroNex, NSF seeks to support groups of investigators with a wide variety of disciplinary backgrounds to work together at the *nexus* of their respective fields to accelerate our understanding of brain function across the phylogenetic spectrum.

This solicitation aims to support highly interdisciplinary teams of investigators for two types of activities: (1) neurotechnology hubs to develop, institutionalize, and disseminate the use of innovative brain technologies by investigators studying brain structure and function in diverse species, and/or (2) theory teams to foster theoretical approaches that have the potential to reveal the neural underpinnings of behavior and cognition across organizational levels, scales of analysis, and/or a range of species, including humans.

II. PROGRAM DESCRIPTION

The goal of this solicitation is to support the establishment of neuroscience research hubs and teams of theorists that will catalyze our integrative understanding of brain structure and function. NeuroNex will play a central role in coordinating team science driving the development, enhancement, and integration of theory, technologies, and resources that can be rapidly disseminated. Toward that end, NSF is requesting proposals from (1) teams of investigators to establish neurotechnology hubs to develop and disseminate innovative neurotechnologies, and (2) theory teams to advance theoretical approaches to neuroscience problems, exploring the relationship between neural activity and cognition and behavior in complex organisms and environments. Successful projects will bring together diverse groups of scientists to promote research and community engagement, leading to cutting-edge neuroscience while fostering a vibrant environment at all levels from students to senior investigators.

1. Neurotechnology Hubs:

As part of the BRAIN Initiative, NSF and other Federal agencies have invested in the development of technologies that have the potential to accelerate significantly exploration of the brain, its structure and its function. Proposals in response to this solicitation should leverage existing technology resources and investments where possible. Collectively, technology hubs will be expected to represent an “ecosystem” of methodologies, instrumentation, hardware, software, data resources, and expertise that will enable rapid dissemination and accessibility of neurotechnologies to the research community. To realize the full potential of innovative neurotechnologies, a successful hub must have a cogent plan for technology development, adaptation and refinement of these neurotechnologies for their deployment in diverse species and/or environments, and enabling disparate research communities through training, widespread dissemination, and resource-sharing.

Proposals must lay out the immediate or near-term need for the proposed neurotechnology and demonstrate scalability to serve a substantial and expandable number of users. The effort targeted by a Neurotechnology Hub award is up to a level roughly comparable to: summer support for two to four investigators with complementary expertise; two to four graduate students; two to four senior personnel (including post-doctoral researchers, software developers, and staff); and their collective research needs (e.g., materials, supplies, travel) for three to five years. The integrative contributions of a Neurotechnology Hub team should clearly be greater than the sum of the contributions of each individual member of the team.

Potential projects of interest could include, but are not limited to:

- Technologies for linking large-scale temporal activity maps of neural circuits to quantifiable behavioral paradigms,
- Novel instrumentation that improves current technologies to determine circuit connectivity and neural activity,
- Tools for identifying functional populations of neuronal and glial cells,
- Systems biology approaches to mark neural activity with fine temporal and spatial granularity for reconstruction, visualization and manipulation,
- Tools to provide high-speed generation of anatomical/functional brain maps across phylogeny,
- Tools to manipulate the activity of identified neural circuits during quantifiable behaviors,
- Tools for linking large-scale activity maps of neural circuitry to cognitive processes, and
- Technologies for understanding modulation in neural activity as a function of realistic, complex environments.

Proposals requesting primarily support for the development and maintenance of core facilities will be returned without review.

2. Theory Teams:

Understanding the relation between neural activity and behavioral outcomes requires an understanding of the algorithms and mechanisms that govern information processing within a circuit and between interacting circuits in the brain as a whole, with consideration of interrelationships among cognition, behavior, and social interactions, ideally in natural settings. Formal and normative theories, drawing on insights from a variety of disciplines, have the potential to elucidate how complex cognition and behavior relate to the activity of neural circuits at multiple scales. Such theoretical frameworks have the predictive power to inform the design and collection of data and form testable hypotheses. Statistical approaches based on such normative models can further be utilized to support or refute hypotheses from the formal analysis of data. However, the need for formal theories goes beyond current experimental imperatives. The goal of this track is to promote the development of sufficiently general theories that have the potential to enable ways of inferring neural, circuit and behavioral dynamics in a manner not currently imagined. NSF recognizes that such advances may require the collective endeavor of teams of researchers, working in concert with experimentalists. The advantages of pooled insights, complementary expertise, diverse points of view, and shared tasks make a successful research team more than the sum of its parts.

Theory Team awards will support groups of researchers who will advance theoretical approaches to neuroscience problems. Proposals must articulate how the team will advance theoretical (including evolutionary) frameworks in neuroscience, and enhance

integration of analyzed data across temporal, spatial, and/or biological scales of analysis. The effort targeted by a Theory Team award is up to a level roughly comparable to: summer support for two to four investigators with complementary expertise; two to four graduate students; four to six senior personnel (including post-doctoral researchers, software developers, and staff); and their collective research needs (e.g. materials, supplies, travel) for three years. The integrative contributions of a Theory Team should clearly be greater than the sum of the contributions of each individual member of the team.

Proposals must articulate how the team will advance theoretical (including evolutionary) frameworks in neuroscience, and enhance integration of analyzed data across temporal, spatial, behavioral, social and/or biological scales of analysis. Theory team proposals must identify, but not necessarily include, experimentalists who will work with theorists to test, validate, or model theories proposed.

Successful technology hub or theory team proposals must have a synergy or value-added rationale that justifies the team while advancing neuroscience beyond what is possible by single investigators through enabling team approaches to critical problems in neuroscience. Maximum flexibility in the design of hubs funded through this program is essential, so the specific organization of the hub is left to the creativity of the principal investigators. Proposals to the program will be judged by the two standard NSF criteria of intellectual merit and broader impact. In addition to these criteria, major deciding factors in determining whether the hub qualifies for funding are the scientific goals, synergy, and value added that justifies this relatively large-scale support (see Additional Solicitation Specific Review Criteria section)

III. AWARD INFORMATION

Approximately $16-30 million will be made available in FY 2017 to support an estimated 10 to 15 awards. Estimated program budget, number of awards, and average award size and duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI: 1

Additional Eligibility Info:

All proposals (Neurotechnology Hubs and Theory Teams) must include at least two investigators, in order to bring deep, complementary expertise to challenging interdisciplinary problems.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent *(required)*:

Potential proposers may not submit a proposal without first submitting a corresponding FastLane Letter of Intent (LOI), compliant with the instructions below, by the LOI deadline. Submission of multiple Letters of Intent by a Project PI is not allowed.

Submitting a LOI does not oblige potential proposers to submit a full proposal. For planned collaborative proposals, a single LOI should be submitted by the lead institution only. LOIs are not subject to merit review, but are used for internal planning purposes. Investigators should not expect to receive any feedback on their LOIs. There is no limit on the number of LOIs from any given institution.

Each letter of intent must include the following information:

1. In the Project PI and Senior Project Personnel sections, list the full names and institutional affiliations for all PIs, Co-PIs, and senior personnel on the project, including all collaborative proposals and subawardees. The point of contact for NSF inquiries must be the same as the project PI, with the project PI's e-mail address.
2. In the Participating Organizations section, list all of the institutions involved in the project.
3. In the “Synopsis” data field, provide a synopsis that describes the work in sufficient detail to permit an appropriate selection of potential reviewers. Be sure to specify whether a proposal for a technology hub, a theory team or combined technology/theory hub will be submitted. (limit: 2500 characters, including spaces)
4. What are the distinct areas of expertise, research approaches, or disciplines represented by the investigator team, and how is that evident (e.g., via training histories, departmental affiliations, publication or presentation venues)? (limit: 255 characters, including spaces)

Upon successful submission of the Letter of Intent by the Sponsored Projects Office, please save a PDF copy of the submitted LOI, for use in the Full Proposal submission.

Letter of Intent Preparation Instructions:

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- Submission by an Authorized Organizational Representative (AOR) is required when submitting Letters of Intent.
- A Minimum of 0 and Maximum of 4 Other Senior Project Personnel are allowed
- A Minimum of 0 and Maximum of 5 Other Participating Organizations are allowed
- Expertise, Research Approaches, or Disciplines is required when submitting Letters of Intent
- Submission of multiple Letters of Intent is not allowed

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

- 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 Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG 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 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: (http://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. Chapter II, Section D.5 of the Grant Proposal Guide provides additional information on collaborative proposals.

See Chapter II.C.2 of the GPG 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 GPG instructions.

Except as modified below, proposals should be prepared in accordance with the guidelines in the NSF Grant Proposal Guide or Grants.gov Application Guide.

All proposals submitted to this program solicitation must submit a **Coordination Plan**. Up to two additional pages are permitted in the **Project Description** for the **Coordination Plan**, for a maximum of 17 pages total. The **Coordination Plan** must include: 1) the specific roles of the collaborating PIs, Co-PIs, other Senior Personnel and paid consultants at all organizations involved; 2) how the project will be managed across institutions and disciplines; 3) identification of the specific coordination mechanisms that will enable cross-institution and/or cross-discipline scientific integration (e.g., workshops, graduate student exchange, project meetings at conferences, use of videoconferencing and other communication tools, software repositories, etc.), and 4) specific references to the budget line items that support these coordination mechanisms.

The **Budget** should include travel funds for the PIs to attend Awardee meetings with NeuroNex and other BRAIN Initiative awardees and NSF staff.

Supplementary Documents (see guidance in the NSF Grant Proposal Guide)

All proposals submitted to the National Science Foundation now require a **Data Management Plan** (**DMP**) submitted as a Supplementary Document (see NSF Grant Proposal Guide, Chapter II.C.2.j). The **DMP** (2 pages) should specifically address the following points in up to two pages:

- Description and significance of the data, software, code bases, stimuli, models, or other resources, including their quality, scientific importance, structure, format, and scale,

- Plan for resource preparation and deployment, including technical plans, metadata and documentation, and

- Relationship to similar data or other resources and relevant standards.

Further guidance for DMPs can be found on the BIO website: http://www.nsf.gov/bio/biodmp.jsp

Proposals requesting support for Post-doctoral researchers must include a **Postdoctoral Mentoring Plan** as Supplementary Documents (see NSF GPG Chapter II.C.2.j for guidance). See the NSF Grant Proposal Guide for additional supplementary documents that may be applicable to a particular proposal.

Additional Required Supplementary Documents

As stated in the Synopsis of this Program Solicitation, the goal of this solicitation is to foster the development and dissemination of innovative research resources, instrumentation, neurotechnologies, and theoretical and evolutionary frameworks for understanding brain function across organizational levels, scales of study, and a range of species. Therefore, all Neurotechnology Hub proposals must include a **Resource Sharing Plan** submitted as a Supplementary Document (2 pages) that addresses the following points:

- Anticipated range of uses of the proposed neurotechnologies and theories for research and education in neuroscience and other fields,

- Coordination with related available resources and infrastructure, and potential for integration with such resources,

- Strategy for disseminating the neurotechnology resource rapidly to users that are most likely to benefit from its development,
- Plans for outreach and community input, and
- Anticipated implementation timetable and strategy for evaluation and management over the course of the award period.

All Theory Team proposals must include a **Synergistic Activities Plan** (2 pages) submitted as a Supplementary Document that should address the following points:

- Proposed interactions and collaborations with other institutions and sectors, as appropriate,
- Plans for seminar series, colloquia, workshops, conferences, visitor programs, summer schools, and related activities, as appropriate,
- Plans for outreach and community input, and
- Anticipated implementation timetable and strategy for evaluation and management over the course of the award period.

Additional Required Documentation

A PDF copy of the corresponding **Letter of Intent** must be included as a **single-copy document**, not as a supplementary document.

Applicants must complete the Proposal Classification Form. The Proposal Classification Form is required for all submissions to BIO; FastLane will not allow processing of the proposal without it.

Proposals containing special information or supplementary documentation that has not been explicitly allowed in the GPG or this solicitation, such as article reprints or preprints, or appendices, will be returned without review.

Additional Related Funding Opportunities

Projects that would fit within the scope of existing programs should be submitted to those programs. For example, the Advances in Biological Informatics (ABI) (NSF 15-582) program supports innovation and development of cyberinfrastructure resources that are applicable to a broad range of biological research questions, including new tools that scale to complex biological data. Theoretical research on data structures and the design of easy-to-use interfaces and tools for data input, manipulation, analysis, and extraction, and the development of innovative knowledge bases are also supported by ABI.

The Division of Behavioral and Cognitive Sciences (BCS) in the Directorate for Social, Behavioral, and Economics Sciences supports research on the neural basis of human cognition, behavior, and development.

The Division of Advanced Cyberinfrastructure (ACI) in the Directorate for Computer and Information Science and Engineering, in conjunction with BIO and other Directorates, offers funding opportunities for development and deployment of shared cyberinfrastructure projects and resources at the institutional, regional and national scales, in advanced computing infrastructure, data and software infrastructure, workflow systems, and cyberinfrastructure areas.

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

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

- **Letter of Intent Due Date(s)** ***(required)*** (due by 5 p.m. submitter's local time):

  September 02, 2016

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

  October 21, 2016

D. FastLane / Grants.gov Requirements

For Proposals Submitted Via FastLane:

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

A comprehensive description of the Foundation's merit review process is available on the NSF website at: http://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 *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. 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. (GPG 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 GPG 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

In addition to the review criteria outlined above, it is suggested that reviewers focus on the following critical aspects of the proposed work:

- The research questions driving the proposed neurotechnology hub or theory team proposal,
- The potential catalytic impact and transformative nature of the novel neurotechnology and/or theoretical efforts being proposed,
- For Neurotechnology Hubs, the proposed plans for continued development of the transformative neurotechnologies,
- The potential extension of the proposed projects to other systems and/or species and its potential impact on associated research communities,
- An analysis of the risk and potential benefits of the proposed goals/aims,
- The quality of the integrative activity proposed in the Coordination Plan,
- The quality of the Data Sharing Plan (see http://www.nsf.gov/bio/pubs/BIODMP_Guidance.pdf for more details), and
- The quality and potential for broad impact of the proposed Resource Sharing Plan (for Neurotechnology Hub proposals) or the proposed Synergistic Activities Plan (for Theory Team proposals).

For those proposals involving multiple organizations, the quality of the Coordination Plan and likelihood of successful project coordination.

Proposals requesting primarily support for the development and maintenance of core facilities will be returned without review.

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 http://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 *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

Special Award Conditions:

Neurotechnology Hub awards will be cooperative agreements that will follow NSF requirements for reporting, and will report on research and integration activities. Additionally, all awardees will agree to attend an annual Awardees meeting composed of other BRAIN Initiative awardees and NSF staff. Awardees are expected to develop policies as appropriate to share resources and data and to accept and implement any other common guidelines and procedures approved at the meeting.

There may be additional reports for the data management practices to conform and integrate with future activities related to a phased approach for developing a national research infrastructure for neuroscience. Site visits may be conducted, and a comprehensive site visit will occur at the end of the second year of the Neurotechnology Hub awards.

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 *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

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:

- Edda Thiels, BIO/IOS, telephone: (703) 292-8167, email: ETHIELS@nsf.gov
- Sridhar Raghavachari, BIO/IOS, telephone: (703) 292-4845, email: sraghava@nsf.gov
- Reed S. Beaman, BIO/DBI, telephone: (703) 292-7163, email: rsbeaman@nsf.gov
- Krastan B. Blagoev, MPS/PHY, telephone: (703) 292-4666, email: kblagoev@nsf.gov
- Mary Ann Horn, MPS/DMS, telephone: (703) 292-4879, email: mhorn@nsf.gov
- Christopher Sanford, BIO/DBI, telephone: (703) 292-2209, email: csanford@nsf.gov
- Nandini Kannan, MPS/DMS, telephone: (703) 292-8104, email: nakannan@nsf.gov
- David A. Rockcliffe, MPS/CHE, telephone: (703) 292-7123, email: drockcli@nsf.gov
- Aleksandr L. Simonian, MPS/DMR, telephone: (703) 292-2191, email: asimonia@nsf.gov
- Mona Zaghloul, ENG/ECCS, telephone: (703) 292-8339, email: mzaghlou@nsf.gov
- Alumit Ishai, SBE/BCS, telephone: (703) 292-5145, email: aishai@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@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 http://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 provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 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 http://www.nsf.gov

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **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
Arlington, VA 22230