Division of Molecular and Cellular Biosciences: Investigator-initiated research projects (MCB)

PROGRAM SOLICITATION
NSF 13-510

REPLACES DOCUMENT(S):
NSF 11-545

National Science Foundation

Directorate for Biological Sciences
Division of Molecular and Cellular Biosciences

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

January 30, 2013

November 15, 2013

November 15, Annually Thereafter

All research proposals, including RUI and RCN proposals, will be accepted on or before these deadlines

IMPORTANT INFORMATION AND REVISION NOTES

Revision Summary

The Division has revised the solicitation to address some of the community input:

1. Division Description is modified to articulate its emphasis on interdisciplinary, quantitative, and predictive research and on development of resources and methods for such research.
2. Names of three clusters and descriptions of all clusters are revised to clarify the cluster scope for accepting proposals and their priorities for funding.
3. Beginning in November 2013, the Division will have one deadline per year for accepting proposals in response to this solicitation. All other Divisions that interact with MCB in core viewing proposals have a single deadline. In addition to this submission date, MCB will continue to accept research proposals through other mechanisms, such as CAREER proposals in July and EaGER proposals throughout the year.
4. The limit on the maximum number of proposals per investigator is removed to encourage submission of collaborative proposals at the interface between two or more disciplines. Researchers are strongly encouraged to submit only one proposal as the lead principal investigator, but can be a co-principal investigator on other proposals.

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:

Division of Molecular and Cellular Biosciences: Investigator-initiated research projects (MCB)

Synopsis of Program:

The Division of Molecular and Cellular Biosciences (MCB) supports quantitative, predictive, and theory-driven fundamental research and related activities designed to promote understanding of complex living systems at the molecular, subcellular, and cellular levels. MCB is soliciting proposals for hypothesis-driven and discovery research and related activities in four core clusters:

- Molecular Biophysics
- Cellular Dynamics and Function
- Genetic Mechanisms
- Systems and Synthetic Biology

MCB gives high priority to research projects that use theory, methods, and technologies from physical sciences, mathematics, computational sciences, and engineering to address major biological questions. Research supported by MCB uses a range of experimental approaches--including *in vivo*, *in vitro* and *in silico* strategies--and a broad spectrum of model and non-model organisms, especially microbes and plants. Typical research supported by MCB

integrates theory and experimentation. Projects that address the emerging areas of multi-scale integration, molecular and cellular evolution, quantitative prediction of phenome from genomic information, and development of methods and resources are particularly welcome. Highest funding priority is given to applications that have outstanding intellectual merit and strong broader impacts. Proposals that include research motivated by relevance to human health or address the molecular basis of human diseases and treatment are not appropriate for the Division and will be returned without review.

Cognizant Program Officer(s):

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

- Wilson Francisco, telephone: (703) 292-8440, email: mcb-mb@nsf.gov
- Engin Serpersu, telephone: (703) 292-8440, email: mcb-mb@nsf.gov
- Arcady Mushegian, telephone: (703) 292-8440, email: mcb-gm@nsf.gov
- Gregory Warr, Cellular Dynamics and Function, telephone: (703) 292-8440, email: mcb-cdf@nsf.gov

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

- 47.074 --- Biological Sciences

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 125

Anticipated Funding Amount: $85,000,000 Pending availability of funds, approximately $85M will be committed for the total budget of all new awards in each cycle.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

None. However MCB discourages submission of two or more proposals with the same researcher serving as the lead Principal Investigator. Proposals that are a duplicate of, or substantially similar to, a proposal already under consideration by NSF from the same submitter are subject to return without review. This also applies to previously declined proposals that have not been substantially revised.

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, 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

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

  January 30, 2013

  November 15, 2013

  November 15, Annually Thereafter

  All research proposals, including RUI and RCN proposals, will be accepted on or before these deadlines

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria apply.

Award Administration Information

Award Conditions:

Standard NSF award conditions apply.

Reporting Requirements:

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

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I. INTRODUCTION

The Division of Molecular and Cellular Biosciences (MCB) supports quantitative, predictive, and theory-driven fundamental research and related activities designed to decipher molecular underpinnings of complex living systems. MCB encourages proposals that address major biological questions using research at the intersections of biology with other disciplines, such as physics, chemistry, mathematics, computer sciences, and engineering.

MCB encourages research utilizing model systems that are appropriate to the questions being addressed. If the proposed research

is relevant to a bio-based economy and biological industries, researchers are strongly encouraged to highlight the relevance of their research to bio-inspired solutions to clean energy, biomaterials, industry, and environmental change. However, **research motivated by relevance to human health and disease is not supported by MCB**. Proposals that include reference to the etiology, diagnosis or treatment of human disease, or that are relevant to or motivated by the medical importance of the research topic will be returned without review.

The following cross-cutting areas of research will be given high priority for funding in all clusters in MCB.

- **Integrating Across Scales.** Integrating knowledge from single molecules to molecular machines and from networks to cellular and organismal complexity
- **Transformative Methods and Resources.** Developing technologies for molecular and cellular biology research, including biophysical and computational methods for broad application and genetic resources for model systems
- **Molecular and Cellular Evolution.** Discovering mechanisms and theoretical underpinnings of evolutionary changes in molecules, genomes, and cells
- **Synthesizing Life-like Systems.** Using synthetic molecular parts and processes to understand the transition from simple to complex and to build novel living systems
- **Genomes to Phenomes.** Integrating theoretical, computational and high-throughput experimental approaches aimed at understanding and predicting how the genome (and epigenome) gives rise to the phenotype

MCB continues to support projects that provide unique educational and training opportunities for the next generation of researchers, scientific educators, and scientifically literate citizens. Proposals can contain development of innovative educational, broadening participation, and outreach activities, or participation in the existing institutional infrastructure for education, training and outreach. Successful proposals often demonstrate close integration between scientific and educational aims. MCB gives high priority to innovative projects to broaden participation of underrepresented individuals and institutions in research in molecular biosciences.

II. PROGRAM DESCRIPTION

This solicitation invites research proposals for the following clusters in MCB:

Cellular Dynamics and Function
The cluster seeks theory-driven predictive investigations of diverse cellular and subcellular systems. Research projects are encouraged that use multidisciplinary physical, chemical, mathematical and computational approaches to provide novel techniques and integrative insight into fundamental cellular functions. Emphasis will be placed on innovative projects in plants, microbes and nontraditional model species. Research leading to clearly defined measurement standards throughout cell science is expected.

The cluster encourages proposals in the following areas:

- Predictive understanding of the behavior of living cells through integration of modeling and experimentation
- Integrative cellular function across broad spatiotemporal scales, from single molecules to whole cells
- Origin, evolution and function of cells, organelles and microcompartments

Genetic Mechanisms
The cluster supports inventive studies seeking to address the fundamental questions of how genes work, how genes are maintained and inherited, and how genes and genomes change. Theoretical and experimental research is welcome that integrates structural, biochemical, genetic, and "omic" (genome, transcriptome, interactome, phenome, etc.) data to understand the mechanistic relationship of genotype to molecular phenotype. Of particular interest are research projects aimed at discovering integrated mechanisms coordinating processes that have traditionally been studied as discrete steps in gene expression, for example, chromatin modification, replication, transcription, RNA splicing/processing/degradation, and translation. When driven by compelling questions, development and use of innovative *in vivo* and *in vitro* approaches, as well as research at the interfaces of genetics and other disciplines, are encouraged.

Funding priority is given to proposals that promise high-impact contributions and significant advances in the following areas:

- Gene expression, including epigenetics and RNA-mediated regulation
- Chromosome dynamics, DNA replication, repair, recombination and inheritance
- Evolution of genes and genomes

Molecular Biophysics
The cluster supports fundamental biophysical and biochemical research projects that address the relationships among structure, function and dynamics in studies of individual biomolecules and their interactions. Research projects are encouraged that are designed to discover and define the general principles of macromolecular function, with the intent of understanding existing function and predicting and designing new functions, as well as projects that will develop cutting edge technology in the context of biological questions relevant to the cluster. Technologies should incorporate integrated approaches including theory, computation and experimental methods, such as spectroscopy, diffraction and single molecule methods. The cluster also encourages multidisciplinary research at the interface of biology with physical sciences, computer sciences and engineering. Funding priority is given to proposals that address fundamental gaps in our understanding of the roles of dynamics in biological function and that propose imaginative experiments that promise innovative breakthroughs.

The cluster encourages proposals such as the following areas of research:

- General principles of the relationship between structure, dynamics and function of biomolecules
- Fundamental principles governing biomolecular interactions and mechanisms.

Systems and Synthetic Biology
The cluster supports creative proposals that will generate a comprehensive understanding of emergent properties of biological systems through the development of an integrated theoretical framework that is guided by mathematical and physical principles and facilitated through the use of novel tools in systems and synthetic biology. The cluster funds proposals focused on regulatory and metabolic network dynamics, structure and function that govern the behavior of microbial communities, plant systems, and other model organisms. In addition, the cluster supports synthetic biology research with a focus on fundamental design principles of biological systems and questions related to the origin of life.

The proposals in the areas listed below are particularly encouraged.

- Systems-level, theory-driven analysis of regulatory, signaling and metabolic networks
- Synthetic biology to address fundamental biological questions including the origin of life, minimal cell, emergent behavior in complex systems, robustness in design and organization
- Tool development to facilitate systems and synthetic biology studies

Other Funding Opportunities in the Division

In addition to the regular research proposals sought under this solicitation, the Division supports a variety of other Foundation-wide and Directorate-wide activities:

- Faculty Early Career Development Program (CAREER) proposals should be submitted by the deadlines listed in the CAREER solicitation.
- Research Coordination Networks (RCN), and Research at Undergraduate Institutions (RUI) proposals should be submitted by the deadlines in this solicitation.
- Grants for Rapid Response Research (RAPID), for Early-concept Grants for Exploratory Research (EAGER), and for limited support of special meetings and workshops can be submitted at any time. Conference proposals should be submitted in accordance with the Grant Proposal Guide at least 6 months before the start date of the conference. See Grant Proposal Guide for information about these types of proposals. **Before submitting EAGER, RAPID, and conference proposals, please contact a program director in the area of the proposal.**
- Proposals for Creative Research Awards for Transformative Interdisciplinary Ventures (CREATIV, http://www.nsf.gov/pubs/2012/nsf12011/nsf12011.jsp; http://www.nsf.gov/pubs/2012/nsf12012/nsf12012.jsp) and for Science Across Virtual Institutes (SAVI; http://www.nsf.gov/pubs/2011/nsf11087/nsf11087.jsp; http://www.nsf.gov/pubs/2011/nsf11090/nsf11090.jsp) can be submitted at any time. **Before submitting CREATIV or SAVI proposals, please contact a program director in the area of the proposal.**

III. AWARD INFORMATION

Pending availability of funds, approximately $85M will be committed for the total budget of all new awards in each cycle. Requested budget and duration should be in proportion to the proposed scope of the project. The Division funds research projects of varying durations (typically 3 to 5 years) and size.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

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

None. However MCB discourages submission of two or more proposals with the same researcher serving as the lead Principal Investigator. Proposals that are a duplicate of, or substantially similar to, a proposal already under consideration by NSF from the same submitter are subject to return without review. This also applies to previously declined proposals that have not been substantially revised.

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 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.

Use the instructions in the Grant Proposal Guide for formatting proposals, however, this solicitation has a few additional instructions, as follows:

Proposal Cover Sheet: Fastlane Users: When completing the Cover Sheet, click on the GO button at "Program Announcement/Solicitation/ Program Description No." Select this solicitation. The cluster closest to the area of research should be selected as the NSF Unit of Consideration. Grants.gov Users: The program solicitation number will be pre-populated by Grants.gov on the NSF Grant Application Cover Page. Grants.gov users should refer to Section VI.1.2. of the NSF Grants.gov Application Guide for specific instructions on how to designate the NSF Unit of Consideration.

Be sure to complete the remainder of the cover sheet information. Please note that a maximum of 4 Co-PIs can be listed on the cover page. Additional Co-PIs and other Senior Personnel should be included in the complete list provided in the Project Summary. Duplicate proposals that are pending at other federal agencies can only be submitted if all PIs and coPIs are beginning investigators.

BIO Proposal Classification Form (PCF)*:* Complete the BIO PCF, an on-line coding system that allows the Principal Investigator to characterize his/her project when submitting proposals to the Directorate for Biological Sciences. Once a PI begins preparation of his/her proposal in the NSF FastLane system, selects any program within the Directorate for Biological Sciences as the first or only organizational unit to review the proposal, and saves the cover sheet, the PCF will be generated and available through the Form Preparation screen. Additional information about the BIO PCF is available in FastLane at http://www.fastlane.nsf.gov/a1/BioInstr.htm. Grants.gov Users: Refer to Section VI.5. of the NSF Grants.gov Application Guide for specific instructions on how to submit the BIO Proposal Classification Form.

Project Summary (maximum 1 page): Each proposal must contain a summary of the proposed project not more than one page in length. The Project Summary should be written in the third person, informative to other persons working in the same or related fields, and, insofar as possible, understandable to a scientifically or technically literate lay reader. It should not be an abstract of the proposal. The project summary should consist of three parts pasted in separate text boxes provided for the project summary.

(1) Overview

a. Project title
b. A list of senior personnel (PI, Co-PIs, key-collaborators) along with their home institutions
c. The overview includes a description of the activity that would result if the proposal were funded and a statement of objectives and methods to be employed.

(2) Intellectual Merit:

The statement on intellectual merit should describe the potential of the proposed activity to advance knowledge

(3) Broader impacts:

a. The statement on broader impacts should describe the potential of the proposed activity to benefit society and contribute to the achievement of specific, desired societal outcomes.
b. Keywords: 5-10 keywords or phrases should be included. You can use keywords from the program descriptions that are appropriate for the proposed research. The keywords will be used at various steps in the review process, such as assignment of proposals to appropriate panels in the Division and assignment of appropriate reviewers/panelists to the proposals.

Proposals that do not contain the Project Summary, including an overview and separate statements on intellectual merit and broader impacts will not be accepted by FastLane or will be returned without review. Additional instructions for preparation of the Project Summary are available in FastLane.

Project Description (maximum 15 pages): If results from prior NSF support are included in the project description, the PIs must include the accomplishments from the educational, outreach, and training impacts of the project in addition to the scientific outcomes. The PIs are encouraged to provide information about training of personnel in the previous project along with their current position and institution. The publications resulting from previous support can be listed in references cited and referred in the results from prior support.

References Cited: This section can include publications resulting from prior research funded by NSF (marked*). All authors and titles must be listed.

Proposal Budget: The Division reviews and funds proposals with a wide range of budgets and duration. Provide a summary budget and a yearly budget for the duration of the proposed project. A careful and realistic budget that is consistent with the proposed activities will add to the overall strength of a proposal. If a PI anticipates requesting REU support, the budget should include the funds for undergraduate research internships as the participant support costs.

Special Information and Supplementary Documentation:

Include the following materials in addition to the Project Description. These materials should be labeled clearly and included in the **Supplementary Documents** section of FastLane or Grants.gov. Provide only the allowable and applicable items as noted in the GPG or NSF Grants.gov Application Guide and this section. Include the materials in the proposal by transferring them as .PDF files through the "Supplementary Docs" module of FastLane or Grants.gov.

A1. Data Management Plan: It should contain the following.

- Measurement standards for the relevant experimental systems and data that are accepted community-wide
- Public availability of the data in an interoperable format that enables wide-scale data sharing and facilitates secondary use of the data.

A2. Postdoctoral Researcher Mentoring Plan (if the proposal requests funding to support postdoctoral researchers)

A3. Letters of Collaboration, if applicable: Multiple letters may be submitted, however each letter of collaboration must not exceed one page. If a proposal contains a letter that is more than one page, the proposal will be returned without review. Please note that the letters of collaboration must be limited to the nature of collaboration and commitments by the collaborator. If a proposal contains a letter of recommendation or a letter that includes results, it will be returned without review.

A4. RUI Impact statement, if applicable

No other supplementary documents will be allowed.

Single Copy Documents:

Conflict of Interest Document- A single integrated document (in table or spreadsheet form only) should be uploaded into the **Single Copy Documents (not Supplementary Documents)** section of FastLane at the time of proposal submission. (If submitting via Grants.gov, complete the information and attach as a PDF file in Field 5, Additional Single Copy Documents, on the NSF Grant Application Cover Page.)

Hard copies or e-mail copies will not be accepted. The document should consist of a list in the form of a single alphabetized table, with the full names (Last name, first name, middle initial) of all people having a conflict of interest with any senior personnel and any named personnel member whose salary is requested in the project budget. Conflicts to be identified are (1) Ph.D. thesis advisors or advisees, (2) collaborators or co-authors for the past 48 months, including postdoctoral advisors and advisees and (3) any other individuals or institutions with which the investigator has financial ties (please specify type). Members of current Advisory Committees who receive reimbursement for travel or honoraria should be included in this last category.

Other single copy documents- In addition to the Conflict of Interest Document, other correspondence to the program not intended to be sent to reviewers such as a list of potential reviewers can be uploaded as Single Copy Documents. Submission of a Single Copy Document will allow these documents to be reviewed by the NSF officials only, and they will remain confidential.

A proposal preparation checklist can be found in Grant Proposal Guide (http://www.nsf.gov/pubs/policydocs/pappguide/nsf13001/gpg_2.jsp#IIex1) and should be used to ensure that the proposal is compliant with the formatting guidelines in addition to the information provided in this solicitation.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

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

  January 30, 2013

  November 15, 2013

  November 15, Annually Thereafter

  All research proposals, including RUI and RCN proposals, will be accepted on or before these deadlines

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.

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.

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.

When submitting an annual or final report, the PIs are required to include the following information.

- Information about the project participants. It is essential that the PI reports names, roles on the project and current position (if the person has left the institution) of each person involved in the project. This includes information about the postdoctoral fellows, graduate students, undergraduate students, teachers, faculty from undergraduate institutions, and other personnel that were supported by the original grant or by a supplement to the grant. This information should be uploaded as a table.
- List of all publications must be reported through the Project Report System and not uploaded as a separate file.
- Broader impacts of the project, including educational and outreach activities must be included.

A project report will be returned to the PI if it does not contain information about human resources supported and their tracking or about the educational and outreach activity if included in the original grant or in a supplemental funding request.

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:

- Wilson Francisco, telephone: (703) 292-8440, email: mcb-mb@nsf.gov
- Engin Serpersu, telephone: (703) 292-8440, email: mcb-mb@nsf.gov
- Arcady Mushegian, telephone: (703) 292-8440, email: mcb-gm@nsf.gov
- Gregory Warr, Cellular Dynamics and Function, telephone: (703) 292-8440, email: mcb-cdf@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:

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Reports Clearance Officer
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