Assembling, Visualizing, and Analyzing the Tree of Life (AVAToL)
An Ideas Lab activity to stimulate transformative approaches to building, visualizing, and analyzing an interactive tree of life

PROGRAM SOLICITATION
NSF 11-534

National Science Foundation

Directorate for Biological Sciences
   Division of Environmental Biology
   Division of Biological Infrastructure
   Emerging Frontiers

Preliminary Proposal Due Date(s) *(required)* (due by 5 p.m. proposer's local time):

   May 10, 2011

      Required for participation in the Ideas Lab, to be held August 22-26, 2011. Selected participants will be notified by June 22, 2011.

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

   November 04, 2011

      Deadline for submission of Invited Proposals. Only invited submissions will be considered for funding.

IMPORTANT INFORMATION AND REVISION NOTES

A revised version of the NSF Proposal & Award Policies & Procedures Guide (PAPPG), NSF 11-1, was issued on October 1, 2010 and is effective for proposals submitted, or due, on or after January 18, 2011. Please be advised that the guidelines contained in NSF 11-1 apply to proposals submitted in response to this funding opportunity. Proposers who opt to submit prior to January 18, 2011, must also follow the guidelines contained in NSF 11-1.

Cost Sharing: The PAPPG has been revised to implement the National Science Board's recommendations regarding cost sharing. Inclusion of voluntary committed cost sharing is prohibited. In order to assess the scope of the project, all organizational resources necessary for the project must be described in the Facilities, Equipment and Other Resources section of the proposal. The description should be narrative in nature and must not include any quantifiable financial information. Mandatory cost sharing will only be required when explicitly authorized by the NSF Director. See the PAPP Guide Part I: Grant Proposal Guide (GPG) Chapter II.C.2.g (xi) for further information about the implementation of these recommendations.

Data Management Plan: The PAPPG contains a clarification of NSF's long-standing data policy. All proposals must describe plans for data management and sharing of the products of research, or assert the absence of the need for such plans. FastLane will not permit submission of a proposal that is missing a Data Management Plan. The Data Management Plan will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate. Links to data management requirements and plans relevant to specific Directorates, Offices, Divisions, Programs, or other NSF units are available on the NSF website at: http://www.nsf.gov/bfa/dias/policy/dmp.jsp. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

Postdoctoral Researcher Mentoring Plan: As a reminder, each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. Please be advised that if required, FastLane will not permit submission of a proposal that is missing a Postdoctoral Researcher Mentoring Plan. See Chapter II.C.2.j of the GPG for further information about the implementation of this requirement.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

   Assembling, Visualizing, and Analyzing the Tree of Life (AVAToL)
   An Ideas Lab activity to stimulate transformative approaches to building, visualizing, and analyzing an interactive tree of life

Synopsis of Program:

   In the 150 years since Darwin's recognition that all living organisms are related by descent with modification, we

have made enormous progress in elucidating phylogenetic relationships within major branches of the tree of life. In the last decade, DNA sequences and other data have provided compelling confirmation of many previously inferred relationships, provided evidence of unexpected relationships, and accelerated the discovery of new clades. The NSF **A**ssembling the **T**ree **o**f **L**ife or AToL program has further enabled clarification of relationships within major groups of organisms. At this point, compelling needs are to achieve integration and synthesis of these separate phylogenies into a cohesive tree across all of life and to develop new tools for visualizing, querying, and further analyzing the tree of life. This is a daunting challenge requiring enormous conceptual advances, potential use of new kinds of data and characters, massive data collection, and the development of powerful analytical and visualization techniques.

The **A**ssembling, **V**isualizing and **A**nalyzing the **T**ree **o**f **L**ife (AVAToL) activity supports novel and transformative approaches to the development of an integrated and robust tree of life, as well as visualization and analysis on a dynamic tree of life. This will take place through the Ideas Lab project development and review process. The goal of this activity is to identify opportunities for investment to significantly advance the state-of-the-art in tree construction, visualization, and analysis across the tree of life. Participants selected through an open application process will engage in an intensive five-day residential workshop to generate project ideas through an innovative, real-time review process. New multidisciplinary teams will form during this workshop to engage in creative problem solving directed at outstanding problems concerning the tree of life. Multidisciplinary integrative approaches calling for communication and interaction among diverse scientists are key to the success of the approach. For example, in addition to those working in systematics and phylogenetics, AVAToL might benefit from mathematicians and computer scientists to contribute algorithms and models, bioinformaticians or genomicists to contribute data pipelines and novel molecular characters, or statisticians and artists with an interest in novel methods of visualization and interactive use of the tree of life. Therefore, members of the systematics research community, bioinformaticians, genomicists, morphologists, paleontologists, computer scientists, statisticians, mathematicians, educators involved in training the next generation of researchers, and representatives of any other disciplines that might contribute important ideas are all strongly encouraged to apply.

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.

- Timothy Collins, telephone: (703) 292-4763, email: BIO-AVAToL@nsf.gov

- Maureen Kearney, telephone: (703) 292-7187, email: BIO-AVAToL@nsf.gov

- Vicki J. Martin, telephone: (703) 292-7361, email: BIO-AVAToL@nsf.gov

- Anne M. Maglia, telephone: (703) 292-8470, email: BIO-AVAToL@nsf.gov

- Sarah Mathews, telephone: (703) 292-4415, email: BIO-AVAToL@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: 2 to 6 To be made in FY2012, pending availability of funds and the type, scale, and variety of project ideas developed at the Ideas Lab.

Anticipated Funding Amount: $12,000,000 Pending availability of funds in FY2012.

Eligibility Information

Organization Limit:

None Specified

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI: 1

The limit on number of proposals per PI applies to the preliminary proposal stage only. Each potential participant for the Ideas Lab must submit a separate preliminary proposal (1 preliminary proposal per person). No Co-PIs are permitted.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable

- **Preliminary Proposals:** Submission of Preliminary Proposals is required. Please see the full text of this solicitation for further information.

- **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

- **Preliminary Proposal Due Date(s)** *(required)* (due by 5 p.m. proposer's local time):

  May 10, 2011

    Required for participation in the Ideas Lab, to be held August 22-26, 2011. Selected participants will be notified by June 22, 2011.

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

  November 04, 2011

    Deadline for submission of Invited Proposals. Only invited submissions will be considered for funding.

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria apply.

Award Administration Information

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

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

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I. INTRODUCTION

In the 150 years since Darwin's recognition that all living organisms are related by descent with modification, we have made enormous progress in elucidating major branches of the tree of life. The NSF **A**ssembling the **T**ree **o**f **L**ife, or AToL program has made important contributions to the elucidation of relationships within major groups of organisms. At this point, a compelling need is to achieve integration and synthesis of these separate phylogenies into a cohesive tree across all of life. Key remaining questions include:

1. How can we best integrate the major branches of the tree of life into a single, continually updatable tree? This would involve both retrospective integration of completed projects, as well as providing the phylogenetic infrastructure, backbone, and standards for enabling connectivity of future studies within major unresolved branches of the tree of life. The result will be a dynamic, continually updated tree of life for all major lineages of organisms.
2. How should the prokaryotic portions of the Tree of Life be included? Some argue that, despite horizontal gene transfer in these organisms, there is a strong hierarchical signal that can be captured to infer relationships. If so, how should we proceed? If, on the other hand, the prokaryotic part of life is better described as an anastomosing network, how can we discover and visualize this network and integrate it with the eukaryotic tree of life?
3. How can we best develop software and tools for visualizing and manipulating very large trees; mapping traits; inferring processes such as selection; identifying well-supported vs. poorly supported regions on these massive trees; and facilitating use of the tree as a research and educational tool?
4. What are the best approaches to fill the major gaps in our current knowledge with the integration of diverse data types derived from previous AToLs and other relevant projects?
5. What is the best way to database and present these large sets of trees? Can we develop a system that dynamically updates the tree of life in real time for research, education and outreach? How can we best present the results of our studies to the scientific community and the public so that the "Tree of Life" is accessible, useful, and comprehensible to anyone?

These are important challenges requiring conceptual advances, novel approaches, new kinds of data, data collection, and analysis of massive and diverse data sets. In addition, the tools for analyzing and visualizing phylogenetic trees on this scale, both for scientific studies and for public presentation, have not been adequately developed.

The declining cost and exponentially growing rate of DNA sequence collection, including whole genome sequencing, as well as the growth and development of cyberinfrastructure, have now made this goal achievable. Predictive, robust, phylogenetic trees have proven useful across all of biology in identifying experimental systems for biological research, tracking the origin and spread of emerging diseases and their vectors, bioprospecting for pharmaceutical and agrochemical products, preserving germplasm, targeting biological control of invasive species, and evaluating risk factors for species conservation and ecosystem restoration. At the same time, progress in many disciplines from genomics to evolution and development will be facilitated by the availability of a robust phylogenetic framework across all of life to guide research. In addition, an integrated tree will provide a powerful evolutionary organizing principle for science, a natural information storage and retrieval system, and teaching tool for the classroom and the public.

The final realization of a tree of life, with all of the potential uses noted above, will require a multidisciplinary team of investigators. For example, in addition to those working in systematics and phylogenetics, AVAToL might benefit from mathematicians and computer scientists to contribute algorithms and models, bioinformaticians or genomicists to contribute data pipelines and novel molecular characters, or statisticians and artists with an interest in novel methods of visualization. Therefore, members of the systematics research community, bioinformaticians, genomicists, morphologists, paleontologists, computer scientists, statisticians, mathematicians, educators involved in training the next generation of researchers, and representatives of any other disciplines which might contribute important ideas are all strongly encouraged to apply.

II. PROGRAM DESCRIPTION

The goal of this activity is to identify opportunities for investment to significantly advance the state-of-the-art in tree construction, visualization and analysis across the tree of life. Despite significant progress in clarifying relationships within major branches of the tree of life, a robustly supported tree across all of life remains elusive. In addition, tools for visualization and analysis at this scale are not well developed. The goal of the Ideas Lab is to identify and explore the major barriers to progress on these problems, and to develop novel, transformative approaches to breaking these barriers. These approaches may be risky, with a significant possibility of failure, but with the potential to rapidly advance the field.

The Ideas Lab

The NSF Ideas Lab process entails participation in an intensive five-day residential workshop, the development of multidisciplinary collaborative proposals through a real-time and iterative review process, and the subsequent submission of full, invited proposals. The Ideas Lab process was modeled on the "IDEAs Factory" program developed by the Engineering and Physical Sciences Research Council (EPSRC) of the United Kingdom. The concept of the IDEAs Factory program is to organize intensive interactive multidisciplinary workshops ("Sandpits") involving 20-30 participants, with the aim of developing new and bold approaches to address grand challenge questions for topics that could benefit from a new dimension in thinking. The participants are assisted by a team of professional facilitators, and by a team of scientists with relevant expertise. These scientific experts, known as mentors, are not eligible for funds from the Ideas Lab, and therefore act as impartial referees of the process. The aim of this NSF Ideas Lab is to stimulate the development of research projects related to the tree of life and to fund new interdisciplinary collaborations among US scientists to foster major advances in current research practices. Anyone eligible to apply for funding from the NSF is eligible to apply to participate in the Ideas Lab.

In brief, interested PIs should respond to this solicitation by submitting preliminary proposals to apply for participation in the Ideas Lab activity, scheduled from August 22nd to August 26th, 2011. Each potential participant must submit a preliminary proposal (1 preliminary proposal per person); *no Co-PIs are permitted on the preliminary proposals*. Participants will be selected on the basis of the interests, expertise, and other characteristics described in their submitted preliminary proposals. Participants should be willing to engage in frank disclosure and assessment of ideas in a collegial and professional fashion. NSF program staff will assemble a team of mentors and provocateurs, selected for their relevant expertise, as well as professional facilitators to aid the workshop participants in the discussion of workshop topics and development of project ideas.

Submission of the preliminary proposal will be considered an indication of availability to attend and participate through the full course of the five-day residential workshop. The location of the Ideas Lab had not been finalized at the time of publication; information on the site, travel information, and other logistics will be provided to all selected participants. Travel and subsistence costs to attend the workshop will be reimbursed.

Participants in the Ideas Lab will frame a series of challenges in the development of a robust tree of life as well as visualization of, and analysis on, the tree of life. Specific challenges, as noted above, include synthesis across the tree of life (including integration of prior studies and developing standards for future studies), the problem of prokaryotic relationships, tools for visualization and analysis on a large tree or sets of trees, a system for dynamically updating an evolving tree of life, and the best approaches for making the tree accessible for educational purposes. In addition, participants are encouraged to frame novel challenges related to the tree of life. Mentors and participants will then engage in a real-time review process of constructive feedback to develop and refine promising ideas to address these challenges or novel challenges emerging from the Ideas Lab. Iterative project development activities will be used to select and advance the most meritorious, transformative, and innovative project ideas. It is expected that these activities and ideas will explore linkages with, and exploit leveraging from, other NSF activities such as the AToL program, the iPlant Collaborative Web Portal, and the Advances in Biological Informatics. Participants will be encouraged to develop a plan for a Research Coordination Network linking research programs developed as part of the AVAToL Ideas Lab to each other and to other NSF activities.

The recommendations provided by the mentor panel are advisory to the NSF. Within seven to fourteen days following the workshop, NSF will determine which participant teams will be invited to submit full proposals. The final funding decision(s) will occur after the full proposals have been received and reviewed. Additional guidance on the proposal content will be provided to workshop participants. Only invited full proposals will be considered for funding.

III. AWARD INFORMATION

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

IV. ELIGIBILITY INFORMATION

Organization Limit:

> None Specified

PI Limit:

> None Specified

Limit on Number of Proposals per Organization:

> None Specified

Limit on Number of Proposals per PI: 1

> The limit on number of proposals per PI applies to the preliminary proposal stage only. Each potential participant for the Ideas Lab must submit a separate preliminary proposal (1 preliminary proposal per person). No Co-PIs are permitted.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Preliminary Proposals *(required):* Preliminary proposals are required and must be submitted via the NSF FastLane system, even if full proposals will be submitted via Grants.gov.

The Project Description section of the preliminary proposal is limited to two pages. Figures may be included in the Project Description, but must fit within the 2-page limit. Each potential participant must submit a separate preliminary proposal (1 preliminary proposal per person). **No Co-PIs are permitted**. Standard NSF formatting guidelines will apply (see the NSF Grant Proposal Guide for guidance). The Project Description must conform to the following guidelines:

1. Page one:

- Provide a brief summary of your professional background (no more than one-half page).
- What expertise do you bring that is relevant to assembling, visualizing, or carrying out analyses on the tree of life (no more than one-half page).
- In fifty words or less, describe a major phylogenetic challenge or a breakthrough needed to advance the field.

2. Page two: Please spend some time considering your answers to the following questions. Your responses (no more than 100 words each) should demonstrate that you have suitable skills and aptitude to participate in the Ideas Lab event (unrelated to your

research track record).

- What is your personal experience with working in teams?
- How would you describe your ability to explain your research to non-experts?
- The Ideas Lab environment is especially suited to individuals who are willing to step outside their particular area of interest or expertise, who are positively driven, who enjoy creative activity, who can think innovatively and who can settle in easily in the company of strangers. Please describe an experience you have had in a comparable environment.
- What would you personally and professionally gain from participating in this Ideas Lab event?

Applicants must include a Biographical Sketch and a Current and Pending Support document (prepared in accordance with standard NSF formatting guidelines). All other elements of a full proposal are waived (Project Summary, References Cited, Budget, Budget justification, Facilities, Equipment and Other Resources). No appendices or supplementary documents may be submitted. ***Submission of the preliminary proposal will be considered an indication of availability to attend and participate through the full course of the five-day residential Ideas Lab workshop***. Selected participants will be notified, and logistics arranged for travel to, and participation in, the Ideas Lab. Following the conclusion of the Ideas Lab, NSF program staff will invite the submission of full proposals related to one or more of the ideas developed during the Ideas Lab.

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.4 of the Grant Proposal Guide provides additional information on collaborative proposals.

Information on the format and required elements of the full proposal will be provided to participants at the Ideas Lab. Only invited full proposals will be considered for funding. The budget for full proposals should include funds for attendance at a PIs meeting that will be held during the second year of the project.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited.

C. Due Dates

- **Preliminary Proposal Due Date(s)** *(required)* (due by 5 p.m. proposer's local time):

    May 10, 2011

    Required for participation in the Ideas Lab, to be held August 22-26, 2011. Selected participants will be notified by June 22, 2011.

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

    November 04, 2011

    Deadline for submission of Invited Proposals. Only invited submissions will be considered for funding.

D. FastLane/Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

    Detailed technical instructions regarding the technical aspects of preparation and submission via FastLane are 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.

    Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within

five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: https://www.fastlane.nsf.gov/fastlane.jsp.

- **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://www07.grants.gov/applicants/app_help_reso.jsp. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding 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.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program where they will be reviewed if they meet NSF proposal preparation requirements. 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 who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the 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.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf.

Mentoring activities provided to postdoctoral researchers supported on the project, as described in a one-page supplementary document, will be evaluated under the Broader Impacts criterion.

NSF staff also will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- 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.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by the Ideas Lab Review Procedures.

The "Ideas Lab" is a funding mechanism designed to support the development and implementation of creative and innovative project ideas that have the potential to transform research paradigms and/or solve intractable problems. These project ideas typically will be high-risk/high-impact, as they represent new and unproven ideas, approaches and/or technologies. This mechanism was developed collaboratively within NSF, modeled on the "sandpit" workshops that are a key component of the United Kingdom Research Council's "IDEAs Factory" program.

The implementation of the Ideas Lab mechanism is a four-stage process: the first stage is the selection of a panel of mentors; the second stage is the selection of participants; the third stage is the development and selection of project ideas; and the fourth stage is the review of and recommendation process for the invited full proposals.

Stage 1: **Selection of Mentor Panel**

Three to five appropriate and qualified persons external to NSF will be selected to serve on a panel of mentors. These individuals will be subject matter experts for the specific topic of the Ideas Lab. The role of Ideas Lab mentors is to: provide advice on the selection of participants; attend the Ideas Lab and provide an assessment of the project ideas developed there; and provide a review of the full proposals submitted after the Ideas Lab is over. These individuals are barred from receiving any research funding through the particular Ideas Lab in which they are involved.

Stage 2: **Selection of Participants**

Prospective participants apply via the submission of a two-page preliminary proposal in FastLane. Selection of participants will start via a panel review, the panel to be composed of the mentors that will attend the Ideas Lab as external reviewers. In addition, the applications of potential participants will be reviewed by an organizational psychologist, to provide advice on assembling a productive and creative mix of individuals. The NSF will make final selection decisions regarding participation in the Ideas Lab. Applicants will be notified electronically of the invite/do not invite decision, and will receive the panel summary. No individual reviews will be provided.

Stage 3: **Ideas Lab**

During the Ideas Lab participants will form groups and develop new ideas for projects, with ongoing anonymous real-time peer review from both participants and mentors. This review process is iterative, providing constructive feedback throughout the Ideas Lab and the development of project ideas. In addition a team of facilitators will help to guide the creative process, and ensure that the workshop progresses in a productive manner. At the end of the Ideas Lab, the mentor panel will provide a consensus report summarizing their evaluation of each project idea. The recommendations of the panel at the end of the Ideas Lab are advisory to the NSF. Within seven to fourteen days following the Ideas Lab, the NSF will determine which project ideas are meritorious and should be invited as full proposals.

Stage 4: **Review and recommendation of full proposals**

Invited full proposals (which are prepared in accordance with standard GPG formatting guidelines) should be submitted via FastLane or Grants.gov within two months by the deadline date. These proposals will be reviewed by the Ideas Lab mentor panel, with final funding recommendations by the NSF based on both intellectual merit and broader impacts.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. 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 is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, 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.

In all cases, 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 and 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.

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 letter, 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 letter; (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 letter. 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: NSF award requirements include required attendance at a PIs meeting that will be held during the second year of the project (full proposal budgets should include funds for attendance at this meeting).

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 at least 90 days before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after 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 that PI. 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 FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational), publications, and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report 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.

For collaborative projects, the annual and final reports by the lead Principal Investigator should summarize progress and integrate results for the entire collaborative.

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:

- Timothy Collins, telephone: (703) 292-4763, email: BIO-AVAToL@nsf.gov

- Maureen Kearney, telephone: (703) 292-7187, email: BIO-AVAToL@nsf.gov

- Vicki J. Martin, telephone: (703) 292-7361, email: BIO-AVAToL@nsf.gov

- Anne M. Maglia, telephone: (703) 292-8470, email: BIO-AVAToL@nsf.gov

- Sarah Mathews, telephone: (703) 292-4415, email: BIO-AVAToL@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, National Science Foundation Update is a free e-mail subscription service 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 Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the NSF web site.

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

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NSF receives approximately 40,000 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 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.

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

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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**   (703) 292-5111
  (NSF Information Center)**:**

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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
Division of Administrative Services
National Science Foundation
Arlington, VA 22230

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