

Maize Genome Sequencing Project: An NSF/DOE/USDA Joint Program

Program Solicitation

NSF 04-614



National Science Foundation
Directorate for Biological Sciences
Division of Biological Infrastructure



U.S. Dept. of Energy



U.S. Dept. of Agriculture

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

February 18, 2005

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Maize Genome Sequencing Project: An NSF/DOE/USDA Joint Program

Synopsis of Program:

Under the auspices of the National Plant Genome Initiative (NPGI), the National Science Foundation (NSF), the U.S. Department of Energy (DOE), and the U.S. Department of Agriculture (USDA) announce their intention to support large-scale sequencing of the maize genome. Previous funding has supported development of maize genome sequence resources, including physical and genetic maps, Expressed Sequence Tags (ESTs), sequences derived from gene-enriched genomic libraries, Bacterial Artificial Chromosome (BAC) sequences, and a community genome database. The objective of this program solicitation is to solicit proposals that build on these resources to develop a comprehensive sequence resource for the maize genome that will capture the majority of the sequence information in a timely and cost-effective manner.

Cognizant Program Officer(s):

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***Please note: All inquiries are to be directed to Dr. Jane Silverthorne.**

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

- 47.074 --- Biological Sciences

Eligibility Information

- **Organization Limit:**

Proposals are invited from U.S. academic institutions, U.S. non-profit research organizations, and consortia of U.S. organizations with appropriate research and educational facilities. A proposal from a multi-organizational consortium must be submitted by the lead U.S. organization as a single proposal. When a consortium submits a proposal, a single principal investigator must be designated as the project director and a single organization must accept overall management responsibility including the management of intellectual property that may result from the proposed research. Proposals may also be submitted by qualified Federal Agencies, however, these proposals would be eligible for funding only by USDA and DOE.

- **PI Eligibility Limit:** None Specified.
- **Limit on Number of Proposals:** None Specified.

Award Information

- **Anticipated Type of Award:** Other - Cooperative Agreement (NSF); Grant or Contract (DOE or USDA)
- **Estimated Number of Awards:** 2 - Approximately 2 new awards, pending availability of funds.
- **Anticipated Funding Amount:** \$30,000,000 It is anticipated that a total of \$30 million over 3 years will be made available, depending on the quality of proposals and availability of funds.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Full Proposal Preparation Instructions:** This solicitation contains information that deviates from the standard Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required.
- **Indirect Cost (F&A) Limitations:**

NSF - No Limit. Standard NSF policy regarding indirect cost rates should be applied to proposals submitted to this solicitation.

DOE and USDA - To accommodate differences in allowable indirect costs among participating agencies, proposers may be required at the time of award to submit a separate budget with indirect cost rates appropriate to DOE or USDA.

- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Full Proposal Deadline Date(s)** (due by 5 p.m. proposer's local time):
February 18, 2005

Proposal Review Information

- **Merit Review Criteria:** National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Standard NSF reporting requirements apply.

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I. INTRODUCTION

Under the auspices of the National Plant Genome Initiative (NPGI), NSF, DOE, and USDA announce their intention to support large-scale sequencing of the maize genome. This project represents one of the goals of the current 5-year plan for the NPGI (National Plant Genome Initiative 2005-2008: <http://www.ostp.gov/NSTC/html/npgi2003/index.htm>).

The NPGI was established in 1998 to support research on plant genomics and to accelerate the acquisition and utilization of new knowledge and innovative approaches to the analysis of fundamental biological processes in plants. The Initiative focuses on plants of economic importance and plant processes of potential economic value. For the last 6 years, the NSF, USDA, and DOE have supported and coordinated the development of maize genome resources through the NPGI. While sequencing of the maize genome has been a long-term goal from the beginning, its size and complexity have warranted a staged approach.

Like many of the cereals, maize has a large genome, the 10 chromosomes together comprising about 2.5 Gigabases (Gb) of DNA. The maize genome is therefore about the same size as the human genome and about 21 times larger than the Arabidopsis genome. The genome organization of maize is complex, with more than 88% of the DNA consisting of repetitive sequences, and about 12%, or about 300 Megabases (Mb), encoding genes. In addition, the maize genome is highly polymorphic and individual lines can be highly variable in sequence and gene content.

In July 2001, a community workshop was held in St. Louis, MO, to discuss sequencing the maize genome, and in particular, which maize genome should be sequenced, the technical approaches to, and possible outcomes of, such a project. A key recommendation of this workshop was that initial sequencing efforts focus on the inbred line B73, the source of DNA for the BAC libraries used to construct the physical map as well as many of the public ESTs. The public B73 line is a good representative of commercially important germplasm and focusing on a single DNA source was recognized as a way to avoid complications arising from sequence polymorphisms.

After the workshop, the first stage towards sequencing the maize genome was to develop a detailed picture of its landscape. While the size and complexity were well known, the precise organization of the sequence components within the genome was largely uncharacterized. As a result of coordinated research efforts, including physical mapping and sequencing of fractions of the genome enriched for genes, a picture has emerged of a maize genome that comprises islands of genes surrounded by a sea of repetitive sequence. A substantial amount of sequence information has been gathered as well as information about the genic and repeat sequence content. The second stage is to now use this information to develop a cost-effective strategy to sequence the maize genome and anchor the assembled sequence to the genome map.

II. PROGRAM DESCRIPTION

This Program Solicitation invites proposals to sequence the maize genome and to anchor the assembled sequence to the genome map. It is expected that proposals will build on the available maize genome resources and will provide a detailed justification for each of the key strategies proposed.

Maize Genome Resources Substantial investments have already been made by the various agencies participating in the NPGI to develop a maize genome map and sequence resources, as well as a community database. In keeping with the goals of the NPGI, all of these resources are freely available and in the public domain. A complete catalog of these resources with links to the primary data is available at the maize community genomics database MaizeGDB (<http://www.maizegdb.org>), along with maize workshop reports, and a primer on what is known about the structure of the maize

genome. MaizeGDB also contains information about where to obtain seed, DNA, and libraries for the standard B73 line. Publicly available genome resources for maize include:

- Genetic and physical maps
- BAC libraries
- BAC-end sequences
- BAC sequences
- EST sequences
- Methyl-filtered and High C₀t genome sequences enriched for genes
- Whole genome shotgun sequences

In March 2004, an industrial consortium announced the public availability of over 3 million EST and 30,000 full-length cDNA sequences from a number of maize inbred lines. More information about the sequences and terms of access can be found at <http://www.maizeseq.org>.

The DOE Joint Genome Institute recently announced the plan to generate and release to GenBank one million whole genome shotgun sequence reads from B73 maize. This valuable resource is being provided to facilitate rational development of maize genome sequencing and assembly strategies. All reads and trace files are anticipated to be deposited in GenBank by the end of October 2004.

Key components of the maize genome sequencing project

The Maize Genetics Executive Committee, an elected body representing the broader maize community, has polled its membership about what the maize genome sequence resource should contain, and developed a definition of the "gold standard" for the maize genome sequence resource (see: <http://www.maizegdb.org> for the full report). Proposals should address the key components listed below:

- The maize genome-sequencing project must provide the complete sequence and structures of all maize genes and their locations (in linear order) on both the genetic and physical maps of maize.
- The gene space of B73 maize (gene sequences and adjacent regulatory regions) should be of finished quality according to currently acceptable standards (as per Bermuda/Ft. Lauderdale agreements).
- If applicable, the sizes of gaps between the genes should be estimated and draft sequences of repetitive DNA between genes presented where possible.
- The sequence must be fully integrated with the genetic and physical maps.
- Annotation should include gene models, predicted exon/intron structure, incorporation of EST and full-length cDNA data, gene ontology, and relationship with homologs in other organisms, including but not limited to, the other sequenced plant genomes.
- Annotation should be coordinated with existing maize community and comparative databases with the eventual goal of generating complete curation of the genomic sequences to a standard set by established model organism databases.

Additional considerations

- International research collaborations are welcomed. When applicable, proposed research activities should be coordinated with similar efforts in other countries to maximize efficiency and avoid unnecessary duplication of effort. However, foreign participants should secure support for their component of the collaboration from their own national programs.
- Private industry has already made significant investments in plant genome research. Innovative collaborations with industry are encouraged when they advance the goals of this project. Funds awarded under this solicitation may not be used to support industrial collaborators and release of data and information must comply with the requirements set out in this solicitation. Requests for funding to pay for industrial fee-for-service sequencing are permitted. However, a draft of the sequencing contract must be provided with the proposal that includes specific information about what will be provided, and a timetable for sequence production.
- These projects offer an ideal opportunity to train young scientists at the interface of modern sequencing technologies and bioinformatics, and to promote increased participation by members of underrepresented groups. All proposals are expected to integrate research and education, taking advantage of opportunities unique to the project. Training

and outreach activities should be integrated into the research plan commensurate with the scale and scope of the project.

III. ELIGIBILITY INFORMATION

Proposals are invited from U.S. academic institutions, U.S. non-profit research organizations, and consortia of U.S. organizations with appropriate research and educational facilities. A proposal from a multi-organizational consortium must be submitted by the lead U.S. organization as a single proposal. When a consortium submits a proposal, a single principal investigator must be designated as the project director and a single organization must accept overall management responsibility including the management of intellectual property that may result from the proposed research. Proposals may also be submitted by qualified Federal Agencies, however, these proposals would be eligible for funding only by USDA and DOE.

PI Eligibility Limit: None Specified.

Limit on Number of Proposals: None Specified.

IV. AWARD INFORMATION

It is anticipated that at least 2 awards will be supported, but they will be linked to form a single "virtual" consortium. It is anticipated that a total of \$30 million over 3 years will be made available, depending on the quality of proposals and availability of funds. Funding recommendations are expected to be made by May 2005 with awards expected to start in August 2005. NSF awards will be made as cooperative agreements. DOE and USDA may provide their funds as grants or contracts.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Instructions:

Proposals submitted in response to this program announcement/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/cgi-bin/getpub?gpg>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

Potential proposers are strongly encouraged to carefully read the program solicitation prior to preparation of proposals and to contact a cognizant Program Director if there are any questions. Proposals that do not meet the guidelines may be returned without review.

Proposals must be submitted by FastLane (see "FastLane Requirements" section below) and must follow the guidelines described in the GPG. The following exceptions and additions apply to proposals submitted to this Solicitation:

Proposal Cover Sheet: In the NSF FastLane system, follow the instructions on proposal preparation. When completing the Cover Sheet, click on the GO button at "Program Announcement /Solicitation/ Program Description No." Highlight "Plant Genome Research Project" and click on the Select button. Your proposal will automatically be assigned to DBI--Plant Genome Research Project. 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 sheet. Additional Co-PIs and Senior Personnel should be included in the complete list

provided in the Project Summary.

BIO Proposal Classification Form (PCF): Complete the BIO PCF, available on the NSF FastLane system. The PCF is 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/Biolnstr.htm>.

Project Summary (maximum 1 page): The project summary should consist of **three separate parts** in the following order:

- (1) A list of senior personnel (PI, Co-PIs, key-collaborators) along with their home organizations.
- (2) A summary of the scientific objectives and approaches.
- (3) Expected broader impacts of the proposed research.

Both the scientific aspects and the anticipated broader impacts must be addressed or the proposal will be returned without review. Please read the Important Notice from the Director of NSF, which can be found at <http://www.nsf.gov/pubs/2002/iin127/imptnot.pdf>.

Project Description (maximum 20 pages) In addition to the standard description in the GPG, the guidelines below should be followed, noting that the page allowances listed are part of the overall 20-page maximum:

- **Progress report (3 pages):** Groups that have received prior funding to map or sequence the maize genome, or to develop maize informatics resources, should include the grant title and number, the funding agency, and a summary of exactly what has been released or developed (e.g. information about the status of a map, or bases sequenced and deposited in GenBank as finished sequence, the number of sequences which are in the process of being sequenced, sequence read lengths and quality scores).
- **Research plan:** Describe the goals of the project, scientific and technical approaches, including informatics and information management where appropriate, with expected outcomes. Descriptions must be sufficiently detailed to allow adequate review.
 - **DNA substrate and sequencing strategy:** Include the source of the DNA (genomic DNA, BAC clones), the method of library preparation, and any other pertinent information. Describe the overall strategy to be used and how this will deliver the key components of the “gold standard” genome.
 - **Sequence quality and quantity:** The discussion of sequence quality and quantity should contain the following elements:
 - The overall approaches to be used (for example, whole genome shotgun, fosmids, BACs, selected

genomic regions).

- The type(s) of sequence to be generated (Phase I, Phase II, or Phase III).
 - For shotgun projects, the number of attempted sequence reads to be performed and anticipated read lengths (in bases of phred20, or equivalent, quality).
 - The anticipated amount of shotgun sequence to be delivered including such metrics as the number of successful sequence reads, total phred20 bases, paired end rate, where applicable, and fold coverage as appropriate.
 - Timetable for and location(s) of sequence production.
 - Steps to be taken to evaluate sequence quality, and the quality metrics to be used.
 - If appropriate, plans for assembly, finishing, and annotation, including how the sequence will be assembled onto the genome map, and how gaps will be captured or closed.
- **Summary sequencing costs:** Provide the following information in tabular form for each type of sequence to be generated. Cost estimates should include direct costs for labor and materials:
 - Total number of attempted and successful sequencing reads budgeted
 - Anticipated sequence read length (in phred20 bases)
 - Anticipated paired end rate
 - Estimated cost of library preparation
 - Estimated cost per phred20 base
 - Estimated cost per finished base
 - **Plan to integrate research and education:** The proposal should include a thoughtful training/educational component that takes advantage of unique and specific opportunities the proposed project would provide. The following items must be included: (1) a well designed plan to increase participation of members of under-represented groups that is specific to the proposed project, (2) an education plan for project trainees, and (3) a description of how these plans are integrated with the proposed research plan. A clear and realistic discussion of how the plan will be implemented should be included in the proposal. Simply describing general policies and ongoing efforts at the investigators' organizations will not be sufficient.

References Cited (*no page limit*): Follow the GPG guidelines for all references cited. Indicate with an asterisk any cited publications that resulted from prior research funded by NSF for the PI, or Co-PI.

Biographical Sketches (*2 pages each*): Biographical sketches following the GPG guidelines must be listed for the PI, Co-PIs and each of the Senior Personnel listed on the Project Summary page.

Proposal Budget: Provide yearly budgets and a summary budget for the duration of the proposed project. When subawards are involved, yearly and summary budgets are required for each subaward. A Budget Justification (maximum 3 pages per budget and subaward budget) should be provided. A careful and realistic budget will add to the overall strength of a proposal. Funds for facility construction or renovation may not be requested. Funds to cover the cost of attendance of the PI and one co-PI (the informatics co-PI, where appropriate) at each year's annual awardee meeting in Arlington, VA should be requested.

Current and Pending Support: Current and Pending Support following the GPG guidelines must be listed for the PI, Co-PIs and each of the Senior Personnel listed on the Project Summary page.

Facilities, Equipment and Other Resources: Provide a description of available facilities and priorities for its use. For

projects requiring additional equipment, justify the need for these resources in the context of the work proposed.

Special Information and Supplementary Documentation: Include the following materials, clearly labeled (A-1, A-2, etc.), and submit them under the "Supplementary Documents" section of FastLane:

(A-1) Sharing of Results and Management of Intellectual Property (maximum 5 pages): Describe the management of intellectual property rights related to the proposed project, including plans for sharing data, information, and materials resulting from the award. This plan must be specific about the nature of the results to be shared, the timing and means of release, and any constraints on release. The proposed plan must take into consideration the following conditions where applicable:

- Sequences must be released to GenBank according to the currently accepted community standard (Bermuda and Ft. Lauderdale agreements), following the current guidelines for quality assessment (see <http://www.genome.gov/page.cfm?pageID=10506537>). For large-insert clone projects, it is expected that DNA sequence assemblies of 2kb or greater will be deposited in GenBank within 24 hours of generation. For whole genome shotgun projects, sequence traces are to be deposited to the NCBI Trace repository within one week of production, with whole genome assemblies deposited in GenBank as soon as possible after the assembled sequence has met the quality evaluation criteria stated in the Project Description. Deposited data should be available to all for use without restriction.
- If the proposed project produces additional resources (libraries, software, etc.), these should be made available as soon as their quality is checked to satisfy the specifications approved prior to funding. The timing of release should be stated clearly in the proposal. The resources produced must be available to all segments of the scientific community, including industry and the international community. A reasonable charge is permissible for distribution, but the fee structure must be outlined clearly in the proposal. If accessibility differs between industry and the academic community, the differences must be clearly spelled out. If a Material Transfer Agreement is required for release of project outcomes, the terms must be described in detail.
- When the project involves the use of proprietary data or materials from other sources, the data or materials resulting from research supported by this program must be readily available without any restrictions to the users (no reach-through rights). The terms of any usage agreements should be stated clearly in the proposal.
- Budgeting and planning for short-term and long-term distribution of the project outcomes must be described in the proposal. If a fee is to be charged for distribution of project outcomes, the details should be described clearly in the proposal.
- In case of a multi-organizational proposal, the lead organization is responsible for coordinating and managing the intellectual property resulting from this award. Organizations participating in multi-organizational projects should formulate a coherent plan for the project prior to submission of the proposal.
- Please note that key project personnel may be required, prior to an award decision, to submit copies of any intellectual property agreements or material transfer agreements they have signed, or are planning to sign, that would impact the unrestricted and timely distribution of the outcomes of the research funded through this program.

(A-2) Management Plan (maximum 5 pages): The management plan should include plans for internal means of communication, coordination of data and information management across the project, evaluation and assessment of progress, as well as allocation of funds and personnel.

- A statement should be provided agreeing to the formation of a "virtual" consortium with any other awardees should the proposal be recommended for funding.
- Each investigator's role should be described and a table summarizing the role of each investigator provided. The exact time commitment of each key project member should be indicated in the management plan, regardless of any request for his/her salary from NSF. A project timetable with yearly goals should be provided that includes benchmarks for the major anticipated outcomes and expected dates for their release.
- The relationship of the proposed activity to the other maize sequencing and bioinformatics projects, and how these activities will be coordinated, should be described.

(A-3) Sequencing Provider Profile (maximum 10 pages): Please provide the following information for all participating sequence providers:

- Total annual sequencing capacity.
- A list of ongoing projects with the capacity and time committed to each.
- The proportion of production sequencing dedicated to whole genome shotgun and BAC-based shotgun reads.
- The average length of production sequencing reads (in bases of phred20, or equivalent, quality) and the average usable read length.
- The amount of data deposited in a public database (bases deposited in a public nucleotide sequence database and reads deposited in a trace archive). All of this sequence must be available to reviewers.
- The center's total current monthly production capacity based on an average of the last six months of sequencing, including the number of attempted and successful reads, the number of base pairs per read of at least phred20 (or equivalent) quality, and the frequency of double ended reads, if appropriate.
- The internal metrics (e.g., reads per month, failed lanes, base pairs per lane) used to evaluate and manage progress.
- Sequence assembly experience at all scales (large-insert clones through whole genomes), including any draft genome assemblies deposited in public databases.
- Finishing process (if appropriate), from draft-level sequence or whole genome shotgun assemblies, including gap closing and building of contiguous finished sequence.
- The amount of finished genomic sequence in finished base pairs produced in the last 12 months and how much of this has been deposited in a public database. All of this sequence must be available to reviewers.
- Procedures used to check the quality of sequences and assemblies at each scale produced.

(A-4) Letters of collaboration: Letters from collaborators who are not requesting funds from the proposal must be attached, describing the nature of the collaboration and the source of their support. General letters of support are not allowed.

Color Images (if applicable): Be advised that NSF cannot accommodate the printing of color images as part of proposal submission through the FastLane system, and submitted proposals that require the use of color or of very high resolution photographic images will necessitate additional steps. Further instructions will be provided after the proposal has been received.

Any material not specifically requested or in excess of the page allowances will be discarded prior to review. It is the submitting organization's responsibility to ensure that the proposal is compliant with the guidelines. Non-compliant proposals may be returned without review.

Single Copy Documents:

Correspondence to the program not intended to be sent to reviewers such as the Conflict of Interest Document, a list of potential reviewers, or confidential materials, can be sent through the "Single Copy Document" section of FastLane. All other supplemental material intended for review should be uploaded into the "Supplementary Documents" section.

Conflict of Interest Document (no page limit): This document should be provided in **table or spreadsheet form only**, and should be sent as a single document through the Single Copy Document section of FastLane at the time of proposal submission. 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 (PI and Co-PIs) 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 or advisees, and (3) any other individuals or organizations 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.

Proposers are reminded to identify the program announcement/solicitation number (04-614) in the program announcement/

solicitation block on the proposal Cover Sheet. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

Cost Sharing:

Cost sharing is not required in proposals submitted under this Program Solicitation.

Indirect Cost (F&A) Limitations:

NSF - No Limit. Standard NSF policy regarding indirect cost rates should be applied to proposals submitted to this solicitation.

DOE and USDA - To accommodate differences in allowable indirect costs among participating agencies, proposers may be required at the time of award to submit a separate budget with indirect cost rates appropriate to DOE or USDA.

Other Budgetary Limitations:

See Section II (Additional considerations) and Section V.A. (Proposal Budget).

C. Due Dates

Proposals must be submitted by the following date(s):

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

February 18, 2005

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this announcement/solicitation through the FastLane system. Detailed instructions for proposal 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 announcement/solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this announcement/solicitation.

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. Proposers are no longer required to provide a paper copy of the signed Proposal Cover Sheet to NSF. Further instructions regarding this process are available on the FastLane Website at: <http://www.fastlane.nsf.gov>

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest, at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

The National Science Board approved revised criteria for evaluating proposals at its meeting on March 28, 1997 ([NSB 97-72](#)). All NSF proposals are evaluated through use of the two merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

On July 8, 2002, the NSF Director issued [Important Notice 127](#), Implementation of new Grant Proposal Guide Requirements Related to the Broader Impacts Criterion. This Important Notice reinforces the importance of addressing both criteria in the preparation and review of all proposals submitted to NSF. NSF continues to strengthen its internal processes to ensure that both of the merit review criteria are addressed when making funding decisions.

In an effort to increase compliance with these requirements, the January 2002 issuance of the GPG incorporated revised proposal preparation guidelines relating to the development of the Project Summary and Project Description. Chapter II of the GPG specifies that Principal Investigators (PIs) must address both merit review criteria in separate statements within the one-page Project Summary. This chapter also reiterates that broader impacts resulting from the proposed project must be addressed in the Project Description and described as an integral part of the narrative.

Effective October 1, 2002, NSF will return without review proposals that do not separately address both merit review criteria within the Project Summary. It is believed that these changes to NSF proposal preparation and processing guidelines will more clearly articulate the importance of broader impacts to NSF-funded projects.

The two National Science Board approved merit review criteria are listed below (see the [Grant Proposal Guide](#) Chapter III.A for further information). 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 he/she is qualified to make judgments.

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 and original 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?

NSF staff 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.

Additional Review Criteria:

The above standard NSF review criteria will be interpreted within the context of the program solicitation. In addition, reviewers will evaluate proposals on all the issues required to be addressed as described in the "Program Description" section and the "Proposal Preparation Instructions" of this Program Solicitation.

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Ad Hoc and/or panel review. The three participating Agencies will establish a single special emphasis panel to review proposals submitted to this solicitation. The Agencies may decide to conduct site visit reviews following the panel review.

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.

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 Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

The program officers from the participating agencies will formulate a consensus funding recommendation. Once a decision is made, each agency will determine the award instrument. NSF awards will be made as cooperative agreements. Awardees may need to submit a separate proposal to USDA or DOE depending on the award instrument selected by these agencies. Regardless of the mode of support by DOE and USDA, the awardees will be required to adhere to the terms and conditions of the NSF's cooperative agreement. Awards will be managed by a group of program officers representing NSF, DOE and USDA.

NSF is striving to be able to tell proposers whether their proposals have been declined or recommended for funding within six months. The time interval begins on the closing date of an announcement/solicitation, or the date of proposal receipt, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

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 Division 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.A. 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 (NSF-GC-1); * or Federal Demonstration Partnership (FDP) Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Website at <http://www.nsf.gov/cgi-bin/getpub?gpm>. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Website at <http://www.gpo.gov>.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the PI must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for the PI and all Co-PIs. 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. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, 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.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding this program should be made to:

- Jane Silverthorne, Program Director, Directorate for Biological Sciences, 690 N, telephone: (703) 292-8470, fax: (703) 292-9063, email: jsilvert@nsf.gov
- Ed Kaleikau, National Program Leader, Plant Genome Program, USDA/CSREES/Competitive Programs, telephone: (202) 401-1931, email: ekaleikau@csrees.usda.gov
- Kay Simmons, National Program Staff, USDA/ARS, telephone: (301) 504-5560, email: kws@ars.usda.gov

- Sharlene Weatherwax, Program Manager, DOE/Office of Basic Energy Sciences, telephone: (301) 903-6165, email: sharlene.weatherwax@science.doe.gov

***Please note: All inquiries are to be directed to Dr. Jane Silverthorne.**

For questions related to the use of FastLane, contact:

- Ms. Victoria J Bryan, Science Assistant, Plant Genome Research Program, telephone: (703) 292-8470, email: biofl@nsf.gov

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at <http://www.nsf.gov/cgi-bin/getpub?gp>. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF [E-Bulletin](#), which is updated daily on the NSF Website at <http://www.nsf.gov/home/ebulletin>, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's [Custom News Service](http://www.nsf.gov/home/cns/start.htm) (<http://www.nsf.gov/home/cns/start.htm>) to be notified of new funding opportunities that become available.

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The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF, although some programs may have special requirements that limit eligibility.

Facilitation Awards for Scientists and Engineers with Disabilities (FASSED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the GPG Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

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: pubs@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; 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 applicant 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 needing information as part of the review process or in order to coordinate programs; 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," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). 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 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 this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Division of Administrative Services, National Science Foundation, Arlington, VA 22230.

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