

Quantitative Systems Biotechnology (QSB)

FY 2004

Program Solicitation

NSF 04-516

Replaces Document 03-517



National Science Foundation

Directorate for Biological Sciences

Directorate for Computer and Information Science and Engineering

Directorate for Engineering

Directorate for Mathematical and Physical Sciences

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

February 17, 2004

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Quantitative Systems Biotechnology (QSB)

FY 2004

Synopsis of Program:

As a result of recent advances in genomic and biochemical analysis, informatics, mathematics, and the engineering disciplines, it is now possible to approach an understanding of the integrated processes which translate the information contained in the genome into functioning biological entities. Systems engineering approaches will be essential for characterizing the emergence of biological phenotypes from underlying hierarchies of interactions and environmental influences. Understanding the quantitative systems behavior of cellular systems is important in its own right as well as providing a conceptual basis for biotechnological process development.

This Quantitative Systems Biotechnology solicitation seeks innovative high-risk/high-return proposals, which combine in-depth analysis of large-scale cellular biological systems, or their representations, with creative software tools for the development of computer models as well as complementary quantitative experimental approaches. Multidisciplinary proposals are encouraged.

Cognizant Program Officer(s):

- Frederick G. Heineken, Acting Division Director, **Solicitation Coordinator**, Directorate for Engineering, Division of Bioengineering & Environmental Systems, 565 S, telephone: (703) 292-7944, fax: (703) 292-9098, email:

- Cecilia A. McIntosh, Program Director, Directorate for Biological Sciences, Division of Molecular & Cellular Biosciences, 655 S, telephone: (703) 292-8441, fax: (703) 292-9061, email: cmcintos@nsf.gov
- Mitra Basu, Program Director, Directorate for Computer & Information Science & Engineering, Division of Computing and Communication Foundations, 1160 N, telephone: (703) 292-8910, fax: (703) 292-9059, email: mbasu@nsf.gov
- James Lee, Program Director, Directorate for Engineering, Division of Bioengineering & Environmental Systems, 565 S, telephone: (703) 292-7945, fax: (703) 292-9098, email: jlee@nsf.gov
- Maria Burka, Program Director, Directorate for Engineering, Division of Chemical & Transport Systems, 525 N, telephone: (703) 292-7030, fax: (703) 292-9054, email: mburka@nsf.gov
- Suvrajeet Sen, Program Director, Directorate for Engineering, Division of Design, Manufacture, & Industrial Innovation, 550 S, telephone: (703) 292-7081, fax: (703) 292-9056, email: ssen@nsf.gov
- Paul J. Werbos, Program Director, Directorate for Engineering, Division of Electrical & Communications Systems, 675 S, telephone: (703) 292-8339, fax: (703) 292-9147, email: pwerbos@nsf.gov
- Tapan K. Mukherjee, Program Director, Directorate for Engineering, Division of Engineering Education & Centers, 585 N, telephone: (703) 292-8381, fax: (703) 292-9051, email: tmukherj@nsf.gov
- Ken P. Chong, Program Director, Directorate for Engineering, Division of Civil & Mechanical Systems, 545 S, telephone: (703) 292-8360, fax: (703) 292-9053, email: kchong@nsf.gov
- Michael H. Steuerwalt, Program Director, Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4860, fax: (703) 292-9032, email: msteuerw@nsf.gov
- Glenn H. Larsen, Program Clearance Officer, Directorate for Engineering, 505 N, telephone: (703) 292-4607, fax: (703) 292-9013, email: glarsen@nsf.gov

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

- 47.074 --- Biological Sciences
- 47.070 --- Computer and Information Science and Engineering
- 47.041 --- Engineering
- 47.049 --- Mathematical and Physical Sciences

Eligibility Information

- **Organization Limit:** Only U.S. academic and non-profit research institutions with science and/or engineering research and education programs are invited to submit proposals.
- **PI Eligibility Limit:** None Specified.
- **Limit on Number of Proposals:** None Specified.

Award Information

- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 10
- **Anticipated Funding Amount:** \$4,000,000 in FY 2004 pending availability of funds and quality of proposals. Award amounts are limited to a maximum of \$500,000 for up to three years.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Full Proposal Preparation Instructions:** Standard GPG Guidelines apply.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required.
- **Indirect Cost (F&A) Limitations:** None
- **Other Budgetary Limitations:** Not Applicable.

C. Due Dates

- **Full Proposal Deadline Date(s)** (due by 5 p.m. proposer's local time):
February 17, 2004

Proposal Review Information

- **Merit Review Criteria:** National Science Board approved criteria apply.

Award Administration Information

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

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I. **INTRODUCTION**

Impressive gains in genome sequencing technology and the growing number of completely or nearly sequenced naturally occurring or engineered genomes have generated substantial data. The heightened availability of this genome-level data provides new opportunities for systems-based analyses and modeling of cellular systems and biotechnological processes. At the same time, advances in high performance computing, massive data storage, and new computational paradigms provide opportunities to approach this challenge quantitatively and computationally. In addressing the relationship between genotype and phenotype, and to accelerate progress towards realizing associated biotechnological opportunities, this program supports high risk/high return research devoted to developing, adapting, and exploiting systems analysis frameworks and data acquisition systems that hold promise for more efficiently relating genome- and environment-level data to a manifested phenotype.

The phenotype results from the interactions among numerous gene products and environmental factors, and so is best understood from a systems viewpoint. The construction and testing of quantitative frameworks, in turn, will be enabled by the collaborative input of bioengineers, complex systems analysts, biologists, and workers from other fields to contend creatively with the hierarchical and nonlinear nature of cellular systems, while maintaining a focus on directing the research results towards developing and improving cell-based, biotechnological processes. These frameworks may involve the use of different system analysis tools (discrete math, differential equations, complex systems simulation) and model-database integration architectures. Moreover, the engineering design and performance space for quantitative investigation may extend far beyond the examples and circumstances provided by nature and, consequently, may involve unusual analysis frameworks and phenotype drivers.

Highly defined biological systems will be required for developing such quantitative frameworks. At this juncture, unicellular or engineered unicellular organisms are perhaps the most desirable subjects for developing quantitative frameworks, as more rapid progress is possible when substantial genomic data are combined with the ability to more completely define phenotype as well as identify environmental conditions under which proliferation and gene expression occur.

Opportunities and needs also exist regarding data acquisition systems (e.g. arrays, two-dimensional gels). It would be beneficial, for example, to move beyond the output of data in ratio form so that the information can be more immediately used for model building or testing. New approaches that yield information that can, for example, link gene array, proteomic, and metabolic data sets in the context of understanding metabolic and signal transduction pathways are also important research objectives.

Additional information on QSB is available at the following web site, which reports on a QSB Workshop held at the National Science Foundation (NSF) on September 13-14, 2000:

<http://www.wtec.org/qsb/>

Three grant competitions for QSB have already been held ([NSF 01-37](#), [NSF 02-026](#), and [NSF 03-517](#)). The first competition resulted in 11 Awards (5 exploratory and 6 standard Awards) with a total funding level of \$3.1M, the second competition resulted in 7 Awards (2 exploratory and 5 standard Awards) with a total funding of \$2.5M, and the third competition resulted in 10 Awards (1 exploratory and 9 standard Awards) with a total funding of \$4.2 M.

II. PROGRAM DESCRIPTION

OVERALL GOALS & SCOPE

The ultimate goals of the QSB initiative are to:

- Predict cellular physiological function across a range of conditions and cell types and thus enable engineering of bioprocess behavior from knowledge about genomes.
- Gain a more comprehensive interpretation of genomic data.
- Unify and advance the understanding of the design principles of biological systems and options for genomic and metabolic systems.
- Develop software modules to perform computer simulation of cellular processes.

These goals must be approached using non-reductionist modeling approaches and improved data acquisition and integration methods.

In a typical case, it is likely that work supported by this initiative will use as components a set of known gene products, or sequences, whether coding or non-coding, a set of regulators, and/or a number of metabolites and pathways, and connect them in a fashion that would elucidate aspects of their integrated function, coordination, regulation, and role in phenotype determination. The detailed analysis of molecular mechanisms (e.g. ligand binding, protein-protein interactions, and molecular recognition) falls within the scope of QSB if the task is imbedded in an integrated assessment that shows promise for enhancing understanding at the intact system level.

There is no doubt that the identification and characterization of individual genomic or metabolic components is of extreme importance. However, the scope of QSB emphasizes the quantitative interactions between such components and the consequent phenotype. Thus, research focused on molecular component characterization falls outside the scope of QSB. The scope of the QSB initiative also does not embrace a focus on sequencing, genomic data acquisition, or statistical mining. Proposals may include such methodologies only in conjunction with other substantive system modeling tasks. Proposals on new screening strategies and assay technologies are encouraged if they demonstrate novelty and also explicitly address how quantitative modeling efforts will be enabled and pursued.

TOPICAL COMPONENTS

A responsive proposal should describe an overarching issue and present a solution path involving system analysis and/or experimentation. Some of the general topics of interest include:

- Mechanism-based, quantitative frameworks (*in silico* biotechnology) for assessing phenotypes based on genomic information and environmental factors.
- Improved experimental screening methods or assays to provide a basis for building and testing quantitative frameworks.
- Software tools to create computer models of cellular processes to allow investigators to explore research issues that

are not currently amenable to direct experimentation.

- Development and analysis of mathematical and statistical models of cellular processes to allow investigators to explore research issues that are not currently amenable to direct experimentation.

As described above, analysis and experimentation should be viewed as linked even if a proposed project emphasizes modeling versus experimentation. The following questions provide examples of some issues of interest. The examples are not meant to be inclusive; other integrative questions and the technological implications of the answers also merit investigation.

- What are the design principles or motifs that govern gene and/or metabolic regulation that can ultimately form the basis for bioprocess analysis and design?
- Is it possible to establish a catalog of regulatory "units" or "modules" that can be assembled for the prediction and understanding of larger regulatory circuits?
- How is system performance versus robustness/adaptability managed and traded off, and does this limit ultimate bioprocess efficiency?
- Concerning bioprocess control and repeatability, how do properties emerge as a result of initial values, genomic repertoire, and nonlinear interactions among system components, and what is the role of degeneracy?

Other Considerations

Quantitative Frameworks: Modeling work can be anticipatory or hypothesis-driven in that one need not delay the development of models until all necessary data are acquired. The fusion of different computational tools is highly encouraged as a means of addressing physicochemical and informational hierarchies, molecular biology, and other salient system features. Such frameworks may combine differential equations, discrete mathematics, and other system analysis tools. Other formalism issues such as revisiting how models connect with data bases to enable the prediction of emergent, branching, and other properties are of interest.

All models should be appropriately tested with respect to robustness and sensitivities to changes in parameters. The models should produce testable results and also guide the development of new experiments. It is desirable that the proposed program include model testing and validation in collaboration with bench scientists.

Screening & Data Acquisition Systems: Methods and strategies offering increased reliability, reproducibility, and resolution for gene expression and protein profiling are required. Such data must have the attribute of being more directly useable for quantitative model development and/or testing. In particular, moving beyond ratio analysis is needed where, for example, the information provided is in the form of molecules per cell, concentration, etc. This may involve inventing new methods or improving the output from existing methods. Apart from screening systems, new biomolecular screening strategies also need to be developed that allow for the link between gene expression (e.g. gene chip) and proteomic data to be more firmly established. Examples include new assay strategies for ascertaining metabolite profiles and second messenger levels.

Subject Systems: Unicellular or engineered unicellular organisms are viewed as the most desirable research subjects for progress to be made in the near term while also providing a platform for investigating other biological systems. The genome of the organism (or strain) need not be totally sequenced if the project entails using that organism for proving the concept behind a new screening or assay approach. However, the data-acquisition advances must have high potential for being applicable to organisms with completed genome sequences. Additionally, researchers must be cognizant of potential limitations when focusing on an organism to insure that valid conclusions are drawn and the results are not overly extrapolated. Biological modularity and common design-property relationships may exist, yet there may also be interesting variations when an organism's natural environmental niche versus a synthetic bioprocess (or laboratory) environment is considered. Therefore, some careful advance thinking and interpretative flexibility are desirable attributes of research programs, especially when delineating design rules and general patterns that comprise the goals.

III. ELIGIBILITY INFORMATION

Only U.S. academic and non-profit research institutions with science and/or engineering research and education programs are invited to submit proposals.

IV. AWARD INFORMATION

Funding of up to \$4M in FY2004 will be provided by participating NSF Programs. Estimated program budget, number of awards, and average award size are subject to the availability of funds and the quality of proposals received. Award amounts are limited to a maximum of \$500,000 for up to three years, subject to the availability of funds and the quality of proposals received.

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.

Proposers are reminded to identify the program announcement/solicitation number (04-516) in the program announcement/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.

B. Budgetary Information

Cost Sharing:

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

Indirect Cost (F&A) Limitations:

None

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 17, 2004

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: <http://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.

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 Review followed by 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.

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 date of receipt. 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:

- Frederick G. Heineken, Acting Division Director, **Solicitation Coordinator**, Directorate for Engineering, Division of Bioengineering & Environmental Systems, 565 S, telephone: (703) 292-7944, fax: (703) 292-9098, email: fheineke@nsf.gov
- Cecilia A. McIntosh, Program Director, Directorate for Biological Sciences, Division of Molecular & Cellular Biosciences, 655 S, telephone: (703) 292-8441, fax: (703) 292-9061, email: cmcintos@nsf.gov
- Mitra Basu, Program Director, Directorate for Computer & Information Science & Engineering, Division of Computing and Communication Foundations, 1160 N, telephone: (703) 292-8910, fax: (703) 292-9059, email: mbasu@nsf.gov
- James Lee, Program Director, Directorate for Engineering, Division of Bioengineering & Environmental Systems, 565 S, telephone: (703) 292-7945, fax: (703) 292-9098, email: jlee@nsf.gov
- Maria Burka, Program Director, Directorate for Engineering, Division of Chemical & Transport Systems, 525 N, telephone: (703) 292-7030, fax: (703) 292-9054, email: mburka@nsf.gov
- Suvrajeet Sen, Program Director, Directorate for Engineering, Division of Design, Manufacture, & Industrial Innovation, 550 S, telephone: (703) 292-7081, fax: (703) 292-9056, email: ssen@nsf.gov
- Paul J. Werbos, Program Director, Directorate for Engineering, Division of Electrical & Communications Systems, 675 S, telephone: (703) 292-8339, fax: (703) 292-9147, email: pwerbos@nsf.gov
- Tapan K. Mukherjee, Program Director, Directorate for Engineering, Division of Engineering Education & Centers, 585 N, telephone: (703) 292-8381, fax: (703) 292-9051, email: tmukherj@nsf.gov
- Ken P. Chong, Program Director, Directorate for Engineering, Division of Civil & Mechanical Systems, 545 S, telephone: (703) 292-8360, fax: (703) 292-9053, email: kchong@nsf.gov
- Michael H. Steuerwalt, Program Director, Directorate for Mathematical & Physical Sciences, Division of Mathematical Sciences, 1025 N, telephone: (703) 292-4860, fax: (703) 292-9032, email: msteuerw@nsf.gov
- Glenn H. Larsen, Program Clearance Officer, Directorate for Engineering, 505 N, telephone: (703) 292-4607, fax: (703) 292-9013, email: glarsen@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, Hours: Mon. - Fri. 8 AM to 8 PM ET, telephone: 800-673-6188, email: fastmail@nsf.gov
- Marcia Rawlings, Directorate for Engineering, Division of Bioengineering & Environmental Systems, 565 S, telephone: (703) 292-7956, fax: (703) 292-9098, email: mrawling@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>) to be notified of new funding opportunities that become available.

ABOUT THE NATIONAL SCIENCE FOUNDATION

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 (FASED) 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 or (800) 281-8749
- **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.

OMB control number: 3145-0058.

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