

EXPLORATORY RESEARCH ON BIOSYSTEMS AT THE NANOSCALE

Program Solicitation

NSF 99-109

DIRECTORATE FOR ENGINEERING

DEADLINE DATE: AUGUST 16, 1999



NATIONAL SCIENCE FOUNDATION

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SUMMARY OF PROGRAM REQUIREMENTS

GENERAL INFORMATION

Program Title:

EXPLORATORY RESEARCH ON BIOSYSTEMS AT THE NANOSCALE

Synopsis of Program:

The Engineering Directorate of the National Science Foundation (NSF) announces an initiative seeking high risk/high return, exploratory research feasibility studies on biosystems at the nanoscale. These systems may be entirely biological in origin, composites of biological and non-biological materials, or mimetics of biological systems. These systems should possess unique and useful properties conferred on them by the nanoscale of operation. Researchers are encouraged to visit the Engineering Directorate web-site (www.eng.nsf.gov/programs/nsf99-109).

Program Point of Contact:

George B. Vermont, Program Director, Engineering, Bioengineering and Environmental Systems, Room 565 S, (703) 306-1318, gvermont@nsf.gov

Mihail C. Roco, Program Director, Engineering, Chemical and Transport Systems, Room 525 N, (703) 306-1371, mroco@nsf.gov

Rajinder Khosla, Program Director, Engineering, Electrical and Communication Systems, Room 675S, (703)-306-1339, rkhosla@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA):

- 47.041 --- Engineering

ELIGIBILITY INFORMATION

- **Organization Limit:** U.S. academic institutions
- **PI Eligibility Limit:** None.
- **Limitation on the Number of Proposals That May be Submitted by an Organization:** None

AWARD INFORMATION

- **Type of Award:** Standard Grant
- **Estimated Number of Awards Anticipated in FY 2000:** 20
- **Anticipated Funding Amount:** \$3M in FY 2000
- **Anticipated Award Date:** 12/1/99

PROPOSAL PREPARATION & SUBMISSION INSTRUCTIONS

◆ Proposal Preparation Instructions

- Letter of Intent requirements: **None**

- Preproposal requirements: **None**
- Proposal preparation instructions: **Standard NSF Grant Proposal Guide instructions (GPG), NSF 99-2**
- Supplemental proposal preparation instructions: **None**
- Deviations from standard (GPG) proposal preparation instructions: **None**

◆ **Budgetary Information**

- Cost sharing/matching requirements: **None**
- Indirect cost (F&A) limitations: **None**
- Other budgetary limitations:

Award amounts up to \$100,000 (\$200,000 for essential collaborations) for Phase I proposals submitted in response to this announcement

◆ **FastLane Requirements**

- FastLane proposal preparation requirements: **FastLane use required.**
- FastLane point of contact: **Marcia Rawlings, 703-306-1318, mrawlings@nsf.gov, Fast Lane User Support, 703-306-1142, <fastlane@nsf.gov>**

◆ **Deadline/Target Dates**

- Full Proposal Deadline **5:00 PM local time, August 16, 1999 (FastLane)**

PROPOSAL REVIEW INFORMATION

- ◆ Merit Review Criteria: **Standard National Science Board approved criteria**

AWARD ADMINISTRATION INFORMATION

- ◆ Grant Award Conditions: **GC-1 or FDP III**
- ◆ Special grant conditions anticipated: **None anticipated**
- ◆ Special reporting requirements anticipated: **None**

INTRODUCTION

Many biological molecules and biomimetic systems exist on the size scale of approximately 10^{-9} to 10^{-7} meters, which we refer to as nanoscale. These systems may possess unique properties or functionality because of the size of their individual particles, clusters, micelles, etc. Some of these unique attributes may be related to the ability of biomolecules and biomimetic systems to assume specific conformations, bond with specific congeners, or even to replicate themselves. These unique characteristics should be very valuable in solving problems in areas such as medical sensing, drug and gene delivery, tissue engineering, dispersions and coatings, and separations. Other areas include molecular computations, opto-electronic devices, molecular motors, etc. Proteins, nucleic acids, and lipids or their non-biological mimics are examples of materials that have been shown to possess these unique size-related properties. The Engineering Directorate of the National Science Foundation (NSF) announces an initiative seeking high risk/high return, exploratory research feasibility studies on biosystems at the nanoscale. These systems may be entirely biological in origin, composites of biological and non-biological materials, or mimetics of biological systems. These systems should possess unique and useful properties conferred on them by the nanoscale of operation. Researchers are encouraged to visit the Engineering Directorate web-site (www.eng.nsf.gov/programs/nsf99-109).

PROGRAM DESCRIPTION

The initial phase (Phase I) of this program will emphasize high risk/high return, exploratory feasibility studies of biomaterials at the nanoscale. We anticipate receiving 50-100 feasibility proposals and funding 20-30% of these, subject to quality considerations, at levels up to \$100,000 (\$200,000 for essential collaborations) and 2 years duration. Emphasis will be placed on novel phenomena and processes, new molecular architectures, molecular modeling and novel systems. Far reaching exploratory topics such as self-replication, adaptive behavior, self-repair, controlled disintegration, and self-learning, are encouraged. The criteria for accepting a proposal in response to this initiative are:

1. The system must be biologically based or biologically inspired. Composites of biological components with macromolecules, inorganic chemicals, etc., are acceptable.
2. The biosystem must exhibit novel properties and the properties must be directly related to the nanoscale of operation.
3. We seek novel ideas that are NOT already widely researched and published. These ideas may be supported by only limited preliminary data. The novelty can be in the structures, properties, phenomena and/or potential applications. New materials that perform similarly to others that have been evaluated in the past are not appropriate.
4. The proposals must contain a high level of engineering technology input.
5. A reasonable plan for the feasibility demonstration within the time and cost guidelines must be included.

The Announcement will focus on four areas of nanobiotechnology:

- Controlled design and synthesis of functional bio- or bioinspired nanosystems by self-organization of molecules or other patterning methods.
- Composites of biomaterials with inorganic or macromolecular systems that possess unusual and potentially valuable attributes due to their nanostructures, e.g., high tensile strength, ductility, abrasion resistance, durability, or biocompatibility.
- Controlled nanoparticle drug or gene delivery to specific body sites/organs due to their nanoscale size or

nanoscale recognition sites.

- Nanoscale biosensors for directly measuring cellular or human physiological processes in-vivo.

ELIGIBILITY

Proposals may be submitted by U.S. academic institutions in support of individual investigators or small groups. Synergistic collaboration among researchers and collaboration or partnerships with industry or government laboratories is encouraged when appropriate. Only one proposal may be submitted by a Principal Investigator and he/she may collaborate in one other proposal as a co-Investigator. Group and collaborative proposals involving more than one institution must be submitted as a single administrative package from one of the institutions involved. Due to the limited availability of funds, prospective applicants are strongly urged to contact [one of] the program officer[s] listed at the end of this document for guidance.

AWARD INFORMATION

We anticipate receiving 50-100 feasibility proposals and funding 20-30% of these, subject to quality considerations, at levels up to \$100,000 (\$200,000 for essential collaborations) and 2 years duration. Emphasis will be placed on novel phenomena and processes, new molecular architectures, molecular modeling and novel systems.

Successfully demonstrated feasibility (Phase I) studies will be eligible to compete for Phase II grants of \$500,000 - \$800,000 and three years duration beginning in fiscal year 2001. Details on this competition will appear in a subsequent program announcement.

PROPOSAL PREPARATION & SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions.

Proposals submitted in response to this program announcement should be prepared and submitted in accordance with the general guidelines contained in the *Grant Proposal Guide (GPG)*, NSF 99-2. The complete text of the GPG (including electronic forms) is available electronically on the NSF Web site at: <<http://www.nsf.gov/>>. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone 301.947.2722 or by e-mail from pubs@nsf.gov.

Proposers are reminded to identify the program announcement number (NSF 99-109) in the program announcement/solicitation block on the NSF Form 1207, "*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. Proposal Due Dates.

Electronic submission of proposals **MUST** be submitted by 5:00 PM, local time, August 16, 1999. Copies of the signed proposal cover sheet must be submitted in accordance with the instructions identified below.

Submission of Signed Cover Sheets. For proposals submitted electronically via FastLane, the signed proposal Cover Sheet (NSF Form 1207) should be forwarded to the following address and received by NSF by August 23, 1999:

National Science Foundation
DIS-FastLane Cover Sheet
4201 Wilson Blvd.
Arlington, VA 22230

A proposal may not be processed until the complete proposal (including signed Cover Sheet) has been received by NSF.

C. FastLane Requirements.

The NSF FastLane system is available for electronic preparation and submission of a proposal through the Web at the FastLane Web site at <<http://www.fastlane.nsf.gov/>>. The Sponsored Research Office (SRO or equivalent) must provide a FastLane Personal Identification Number (PIN) to each Principal Investigator (PI) to gain access to the FastLane "Proposal Preparation" application. PIs that have not submitted a proposal to NSF in the past must contact their SRO to be added to the NSF PI database. This should be done as soon as the decision to prepare a proposal is made.

In order to use NSF FastLane to prepare and submit a proposal, the following are required:

Browser (must support multiple buttons and file upload)

- Netscape 3.0 or greater
- Microsoft Internet Explorer 4.01 or greater

PDF Reader (needed to view/print forms)

- Adobe Reader 3.0 or greater

PDF Generator (needed to create project description)

- Adobe Acrobat 3.01 or greater
- Aladdin Ghostscript 5.10 or greater

A list of registered institutions and the FastLane registration form are located on the FastLane Web page.

PROPOSAL REVIEW INFORMATION

A. Merit Review Criteria.

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, adjacent disciplines to that principally addressed in the proposal, etc.

Proposals will be reviewed against the following general merit review criteria established by the National Science Board. Following each criterion are potential considerations that the reviewer may employ in the evaluation. These are suggestions and not all will apply to any given proposal. Each reviewer will be asked to address only those that are relevant to the proposal 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 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?

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 learner perspectives. PIs should address this issue in their proposal to provide reviewers with the information necessary to respond fully to both NSF merit review criteria. NSF staff will give it careful consideration in making funding decisions.

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 -- are 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. PIs should address this issue in their proposal to provide reviewers with the information necessary to respond fully to both NSF merit review criteria. NSF staff will give it careful consideration in making funding decisions.

B. Merit Review Process.

Most of the proposals submitted to NSF are reviewed by mail review, panel review, or some combination of mail and panel review. Proposals submitted in response to this announcement will be reviewed by panel review only.

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Reviewers will be asked to formulate a recommendation to either support or decline each proposal. A program officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation. In most cases, proposers will be contacted by the program officer after his or her recommendation to award or decline funding has been approved by his or her supervisor, the division director. This informal notification is not a guarantee of an eventual award. NSF will be able to tell applicants whether their proposals have been declined or recommended for funding within six months for 95 percent of proposals in this category. The time interval begins on the proposal deadline or target date or from the date of receipt, if deadlines or target dates are not used by the program. The interval ends when the division director accepts the program officer's recommendation.

In all cases, after final programmatic approval has been obtained, award recommendations are then 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 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 an 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 Officer does so at its own risk.

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 (DGA). 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.

B. Grant Award Conditions.

An NSF grant consists of: (1) the award letter, which includes any special provisions applicable to the grant 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 grant conditions, such as Grant General Conditions (NSF GC-1)* or Federal Demonstration Partnership Phase III (FDP) Terms and Conditions* and (5) any NSF brochure, program guide, announcement or other NSF issuance that may be incorporated by reference in the award letter. Electronic mail notification is the preferred way to transmit NSF grants 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 Web site at: <<http://www.nsf.gov/>>. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone 301.947.2722 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, (NSF 95-26) available electronically on the NSF Web site. The GPM also is available in paper copy by subscription from the Superintendent of Documents, Government Printing Office, Washington, DC 20402. The GPM may be ordered through the GPO Web site 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 expiration of a grant, the PI also is required to submit a final project report. Approximately 30 days before expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

NSF has implemented a new electronic project reporting system, available through FastLane, which 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. Reports will continue to be required annually and after the expiration of the grant, but PIs will not need to re-enter information previously provided, either with the proposal or in earlier updates using the electronic system.

Effective October 1, 1998, PIs are required to use the new reporting format for annual and final project reports. PIs are strongly encouraged to submit reports electronically via FastLane. For those PIs who cannot access FastLane, paper copies of the new report formats may be obtained from the NSF Clearinghouse as specified above. NSF expects to require electronic submission of all annual and final project reports via FastLane beginning in October, 1999.

D. New Awardee Information.

If the submitting organization has never received an NSF award, it is recommended that the organization's appropriate administrative officials become familiar with the policies and procedures in the *NSF Grant Policy Manual* which are applicable to most NSF awards. The "Prospective New Awardee Guide" (NSF 97-100) includes information on: Administration and Management Information; Accounting System Requirements and Auditing Information; and Payments to Organizations with Awards. This information will assist an organization in preparing documents that NSF requires to conduct administrative and financial reviews of an organization. The guide also serves as a means of highlighting the accountability requirements associated with Federal awards. This document is available electronically on NSF's Web site at: <<http://www.nsf.gov/cgi-bin/getpub?nsf97100>>.

CONTACTS FOR ADDITIONAL INFORMATION

General inquiries should be made to the Exploratory Research on Biosystems at the Nanoscale Program, Dr. George B. Vermont, Program Officer, Bioengineering and Environmental Systems Division, 703-306-1318, gvermont@nsf.gov, Dr. Mihail Roco, Program Officer, Chemical and Transport Systems Division, 703-306-1371, mroco@nsf.gov or Dr. Rajinder Khosla, Electrical and Communication Systems Division, 703-306-1339, rkhosla@nsf.gov. For questions related to use of FastLane, contact Mrs. Marcia Rawlings, 703-306-1318, mrawlings@nsf.gov.

OTHER PROGRAMS OF INTEREST

The NSF Guide to Programs is a compilation of funding opportunities for research and education in science, mathematics, and engineering. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter. Beginning in fiscal year 1999, the NSF Guide to Programs only will be available electronically, at <<http://www.nsf.gov/cgi-bin/getpub?gp>>. Many NSF programs offer announcements concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices listed in Appendix A of the GPG.

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, available electronically on the NSF Web site at: <<http://www.nsf.gov/home/ebulletin/>>. Subscribers can also sign up for NSF's Custom News Service to find out what funding opportunities are available.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Grantees 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 (unless otherwise specified in the eligibility requirements for a particular program).

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 program announcement or contact the program coordinator at (703) 306-1636.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation regarding NSF programs, employment, or general information. TDD may be accessed at (703) 306-0090 or through FIRS on 1-800-877-8339.

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 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.

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: Reports Clearance Officer; Information Dissemination Branch, DAS; National Science Foundation; Arlington, VA 22230.

YEAR 2000 REMINDER

In accordance with Important Notice No. 120 dated June 27, 1997, Subject: Year 2000 Computer Problem, NSF awardees are reminded of their responsibility to take appropriate actions to ensure that the NSF activity being supported is not adversely affected by the Year 2000 problem. Potentially affected items include: computer systems, databases, and equipment. The National Science Foundation should be notified if an awardee concludes that the Year 2000 will have a significant impact on its ability to carry out an NSF funded activity. Information concerning Year 2000 activities can be found on the NSF web site at <http://www.nsf.gov/oirm/y2k/start.htm>.

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