COMPUTATIONAL BIOLOGY ACTIVITIES

Program Announcement

RESEARCH RESOURCES CLUSTER
DIVISION OF BIOLOGICAL INFRASTRUCTURE
DIRECTORATE FOR BIOLOGICAL SCIENCES

PROPOSAL DEADLINE: ***10 January***

NATIONAL SCIENCE FOUNDATION

COMPUTATIONAL BIOLOGY AT THE NATIONAL SCIENCE FOUNDATION

Computation in biological research has changed dramatically in the last decade. New observational and data collection techniques have expanded the capabilities of biological research and are changing the scale and complexity of biological questions which can be productively posed. Biological systems are complex and range from the molecular and cellular to the organismal and ecosystem. Understanding these complex systems and their interactions require the development of algorithms, heuristics, and software for the accumulation, manipulation, and especially modeling of biological data, and their incorporation into biological disciplinary research.

The Computational Biology Activity (CBA) was created to support studies developing or requiring computational techniques outside the normal scope of the various disciplinary programs of the NSF. For purposes of this announcement, computational biology is defined as the development and application of computational methods, including their theoretical, mathematical, and engineering bases, to biology. Computational biology is inherently interdisciplinary, and many important biological problems will require fundamental advances in computer science and mathematics. Moreover, the application of biological ideas and materials to problems from computer science and engineering is likely to yield significant biological insight.

The Computational Biology Activity supports the development and use of computational tools, algorithms, and related research that will enhance both the underlying biology and the associated computational infrastructure. Projects are expected to have a broad impact on biology. To meet these objectives, CBA will consider appropriate projects involving both single investigators and teams of researchers. Collaborations among biological, computational, mathematical, and other scientists as appropriate are encouraged. CBA supports formal and informal training of investigators at all levels to develop and use these techniques.

EXAMPLES OF SUPPORTED AREAS

The examples below are only illustrative and not intended to be comprehensive or to limit the scope of applications. Potential applicants are strongly encouraged to discuss their ideas with the Program Director prior to proposal submission (see the Inquiries section of this announcement).

Novel Algorithms, Heuristics, or Methods Addressing a Biological Problem. CBA supports the development of novel, computational, or mathematical approaches, and their incorporation into useful tools that will extend the application of computer science to biology, especially to biological areas and systems which are not well served at present. The scientific purpose of these approaches must be justified within the context of the research areas supported by the Directorate for Biological Sciences. Examples include computational, mathematical, or theoretical approaches to subjects such as: simulation of neuronal systems; construction or integration of phylogenies from different types of data; ecological dynamics; examination of the significance of cell migration and apoptosis in development; analysis of complex molecular networks; simulation of evolutionary mechanisms and their effects on populations; simulation of the effects of mutations; evaluation of experimental and simulated molecular structure and dynamics; theory of and generalizable tools for the design and optimization of large-scale or automated experiments; exploration of the dynamics of physiological processes and systems; computational tests of proposed ion channel mechanisms; and inventory and assessment of biological diversity.

Theoretical and Applied Algorithm Development. CBA supports the development and testing of new algorithms or heuristics that are expected to have a significant impact on future biological research. The scientific purpose and need for such algorithms within the research areas supported by the Directorate for Biological Sciences must be documented. Examples include pattern recognition techniques, particularly over non-string or heterogeneous data; multiple sequence and structure alignments; image reconstruction from microscopic, x-ray, or NMR data; techniques for aggregation and simplification in large-scale statistical models; numerical solution or simulation of large nonlinear systems; spatial statistical optimization; visualization of complex data; and new computational or engineering models based on biological phenomena, systems, or materials, and their theoretical foundations (for example, molecular computing and nanotechnology).

Implementation and Deployment of Essential Computational Infrastructure for Biology. CBA supports the development, testing, and implementation of software when this would provide important, state-of-the-art capabilities to the biological community. The scientific purpose and need for such software within the research areas supported by the Directorate of Biological Sciences must be documented. Examples include software for simulating ecological dynamics over spatial and temporal environmental parameters; toolkits to simulate the effects of genes and molecules implicated in pattern formation; improvement of data aspects of instrument operation, e.g., direct data capture and real-time analysis, both locally and over networks; the empirical analysis and simulation of biological networks; phylogenetic analysis of disparate types of data; and

quantitative image analysis. CBA also considers support of the maintenance, archiving, and upgrading of such software if community usage warrants and if user fees are inappropriate and other support unavailable.

Small Grants for Exploratory Research (SGER). CBA supports small exploratory projects which would have substantial scientific impact if successful, but for which feasibility, either of measuring the requisite biological data or of the fundamental basis of the computations, has not yet been demonstrated. These conditions are particularly likely to apply in the initial stages of interdisciplinary work, when definition of the biological and computational problems is preliminary and the utility of collaborations must be assessed. Proposals for such work may be submitted at any time during the year *after* discussion of the project with the Program Director. Further details on these awards may be found in the NSF Grant Proposal Guide (GPG) NSF 98-2.

EXCLUDED ACTIVITIES

The Biological Sciences Directorate of NSF normally does not support biomedical research with clinical or disease-related goals, including work on the etiology, diagnosis, epidemiology, or treatment of physical or mental disease, abnormality, or malfunction in human beings or animals. The study of animal models of such conditions or the development or testing of drugs or other procedures for the treatment of such conditions generally are not eligible for support. NSF also does not normally support technical assistance, pilot plant efforts, research requiring security classification, the development of products for commercial marketing (except through the SBIR mechanism), or market research for a particular product or invention.

PROPOSAL SUBMISSION

Proposals to CBA must be received at the National Science Foundation by January 10, except for SGER and conference proposals (see below). The Computational Biology Activity will accept proposals from individuals, institutions, and organizations who meet the general eligibility requirements outlined in the Grant Proposal Guide (which also contains detailed instructions on proposal format and submission). Both the Grant Proposal Guide (NSF 98-2) and the Proposal Forms Kit (NSF 98-3) contain the necessary forms. These guides can be accessed through the NSF Home Page (http://www.nsf.gov/). Submissions should adhere strictly to the format guidelines given in the Guide or they will be returned unreviewed. Although videotape, software, or other appendices can be valuable to a reviewer, *prior* permission to submit such material must be obtained from the CBA Program. Proposals submitted to this Activity should have on the cover page in the upper left hand corner "For Consideration by NSF Organization: Computational Biology Activity". Fifteen copies of the proposal should be sent to the address given in the Grant Proposal Guide:

ANNOUNCEMENT/SOLICITATION NO. _____
NATIONAL SCIENCE FOUNDATION PPU _____
NSF PROGRAM _____
4201 WILSON BLVD. ROOM P60
ARLINGTON, VA 22230

Normally it takes about six months from receipt to complete review of a proposal. However, a coordinated review between the Computational Biology Activity and other Programs in the Foundation could extend the time required for the review. In these instances, the Principal Investigator will be notified. SGER proposals may be received at any time after discussion with the Program Director. Conference proposals also may be submitted at any time, but, for effective planning should be submitted approximately one year before the date of the proposed conference.

ALLOWABLE COSTS, TYPES OF AWARDS, DURATION OF SUPPORT

Proposals submitted to the Computational Biology Activity may request funds for investigators, postdoctoral researchers, graduate and undergraduate students, programmers or other technical help, computers and related equipment, and other expenditures *(e.g.*, travel, materials and supplies) as appropriate to, and where justified, by the project. A broad range of award sizes is responsive to the diverse needs of the projects supported. In recent years, CBA has awarded or cofunded approximately thirty grants each year, with support averaging about $100,000 *per annum* including indirect costs, with an average duration of three years. Support under SGER awards is limited to a maximum of $100,000 (total costs) for one year and is not renewable. Support is also available in any of the areas supported by CBA for meetings of various types. Support for acquisition or development of computational hardware serving several investigators may be included in a proposal for co-review by CBA with Multi-User Biological Equipment or Instrument Development for Biological Research in the Division of Biological Infrastructure. As with other NSF-supported activities, awards in CBA are subject to the availability of funds.

REVIEW PROCESS AND PERSPECTIVE

Grants will be awarded on a competitive basis. Proposals fulfilling the criteria for consideration by CBA will typically be reviewed by both *ad hoc* reviewers in the biological sciences and other appropriate scientific areas and also by an interdisciplinary advisory panel of scientists. Since most CBA proposals are reviewed jointly with the appropriate disciplinary program(s), it is particularly important that proposals communicate effectively across disciplinary boundaries. Site visits will be made if deemed necessary. There is one CBA review cycle each year.

The merit review criteria used in the evaluation are described in the Grant Proposal Guide (GPG) NSF 98-2. Briefly, the two criteria are: (1) What is the intellectual merit and quality of the proposed activity? and (2) What are the broader impacts of the proposed activity? Additional information on the merit review criteria can be found on http://www.nsf.gov/cgi-bin/getpub?nsbmr975.

Reviewer perspectives depend somewhat on the type of application. For research proposals, reviewers typically comment, for example, on the novelty of the idea or approach, its technical soundness, the capability of the investigator, and projected mechanisms for distributing resulting software (an important aspect for software development proposals). For meeting proposals, on the other hand, considerations often include the significance of the topic, the likely impact on fostering research in computational biology, the scheduling of similar conferences, and the participation by individuals from various disciplines and underrepresented groups. Applicants contemplating meeting or workshop proposals are encouraged to consider how they can strengthen the quality and depth of intellectual exchange. Further details on conference and workshop proposals may be found in the Grant Proposal Guide (GPG).

AWARD ADMINISTRATION

Awards made as a result of this document are administered in accordance with the terms and conditions of NSF CG-1, "Grant General Conditions," FDP-III " Federal Demonstration Project General Terms and Conditions" depending on the grantee organization, or "Cooperative Agreement General Terms and Conditions." This information can be obtained from the NSF Online Document System (http://www.nsf.gov/). Copies of these documents are available at not cost from the NSF Clearinghouse, P. O. Box 218, Jessup, Maryland 20794-0218, phone (301) 947-2722, or via e-mail (pubs@nsf.gov/). More comprehensive information is contained in the NSF Grant Policy Manual (NSF 95-26), for sale through the Superintendent of Documents, Government Printing Office, Washington, DC 20402. The telephone number at GPO is (202) 783-3238 for subscription information.

Since the primary purpose of CBA is to enhance biological research and infrastructure through the development and use of computational tools, algorithms, and related research, grantees are expected to share these items and to reasonably facilitate their appropriate use by others less conversant with computational techniques. Software and data collections should be made available, on request or by placement in an appropriate public repository in both human and machine readable form and with adequate documentation. Use of the Internet and World-Wide Web as distribution and facilitation mechanisms is strongly encouraged, and reasonable costs for these activities will be supported. In some situations, in accordance with the policies of an investigator's institution, users charges or commercialization may make software more readily available or otherwise add significant value.

At the end of the award, all principal investigators are expected to electronically forward to the CBA Program Directors for public distribution a brief summary of the project's major results for an interdisciplinary, scientifically literate audience, in addition to the NSF required Final Project Report (see Grant Proposal Guide). Principal investigators and grantees are expected to share results of NSF-assisted research with the appropriate disciplinary communities. Significant findings should be promptly submitted for publication with authorship that reflects the contributions of those involved; such publications must acknowledge the NSF as a source of support for the work.

RELATIONSHIP OF COMPUTATIONAL BIOLOGY TO OTHER NSF PROGRAMS

The focus of the Computational Biology Activity is to augment, rather than replace the computational activities of existing disciplinary programs. Proposals that emphasize disciplinary research (i.e., activities currently supported by primarily disciplinary programs) should be submitted to those disciplinary programs. Most Computational Biology proposals are multidisciplinary or may have implications and application beyond a single discipline, so most are reviewed jointly with other appropriate programs. For example, projects involving optimization of searches in protein folding calculations may be co-reviewed with Biophysics and/or the Computational Mathematics Program; those with a significant database component, with the Biological Database Activity or the Database Program of the Division of Information, Robotics, and Intelligent Systems (Directorate for Computer Science and Engineering, CISE); those emphasizing neuroseiences, with the Computational Neuroscience Program; and those with a significant ecological focus, with the Ecology Program. If there are questions, please contact the relevant program(s), a list of which is included in the GPG Appendix A.

Research proposals submitted to the Biological Sciences Directorate that are duplicates of proposals submitted to other federal agencies will not be reviewed until the other agency takes action. Exceptions are made for proposals from beginning investigators, for conferences or workshops, and in cases where proposers and Federal program managers have previously agreed to joint review and possible joint funding. Beginning investigators are defined as individuals who have not been principal investigators on any Federally funded award except doctoral dissertation improvement grants, fellowships and research planning grants.

In no case should the same proposal be submitted concurrently to more than one program at the NSF. The responsibility for assignment of a proposal to a specific program for review lies with NSF staff.

INQUIRIES

Inquiries regarding the Computational Biology Activity should be directed to:

Computational Biology Activity
Division of Biological Infrastructure
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230
E-Mall: cba@nsf.gov
Tel: 703-306-1469
FAX: 703-306-0356

The National Science Foundation (NSF) provides awards for research in the sciences and engineering. The awardee is wholly responsible for the conduct of such research and preparation of the results for publication. The Foundation, therefore, does not assume responsibility for the research findings or their interpretations.

The Foundation welcomes proposals from all qualified scientists and engineers, and strongly encourages women, minorities, and persons with disabilities to compete fully in any of the research-related programs described here. In accordance with Federal statutes and regulations and NSF policies, no person on grounds of race, color, age, sex, national rigin, or disability shall be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving financial assistance from the National Science Foundation.

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 projects.

Privacy Act. The information requested on proposal forms is solicited under the authority of the National Science Foundation Act of 1950, as amended. It will be used in connection with the selection of qualified proposals and 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 application review process, award decisions, or the administration of awards; to government contractors, experts, volunteers, and researchers as necessary to complete assigned work; and to other government agencies in order to coordinate programs. See Systems of Records, NSF 50, "Principal Investigators/Proposal File and Associated Records", NSF 51, 60 Federal Register 4449 (January 23, 1995), "Reviewer/Proposal File and Associated Records", 59 Federal Register 8031 (February 17, 1994).

Public Burden. Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of your receiving an award. The 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 or any other aspect of this collection of information, including suggestions for reducing this burden, to Gail A. McHenry, Reports Clearance Officer, National Science Foundation, 4201 Wilson Boulevard, Suite 245, Arlington, VA 22230.

The National Science Foundation has TDD (Telephonic Device for the Deaf) capability, which enables individuals with hearing impairment to communicate with the Foundation about NSF programs, employment, or general information. To access NSF TDD, dial (703) 306-0090; for FIRS, 1-800-877-8339.

The program described in this announcement is in categories 47.074 (BIO), 47.070 (CISE), and 47.049 (MPS), of the Catalog of Federal Domestic Assistance.