

Program Announcement To DOE National Laboratories
LAB 00-04
Biotechnological Investigations - Ocean Margins Program
(BI-OMP)

The Office of Biological and Environmental Research (OBER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving research proposals involving the use of molecular biological and biogeochemical techniques to understand the linkages between carbon and nitrogen cycles (primary production and microbial processes) in ocean margins. This information is critical to understanding carbon fixation and sequestration in ocean margin ecosystems and global biogeochemical cycles. Proposals must involve mutually collaborative partnerships between institutions with a strong tradition of research in marine sciences and those institutions with developing research capabilities in marine science. Partnerships are particularly encouraged with institutions that traditionally have served groups under represented in the sciences. The goals of such collaborative research projects are to enhance the research capabilities of both institutions, to promote significant interactions between institutions, to foster long-term collaboration among investigators, and to advance understanding at the molecular and biogeochemical level of the linkages between nitrogen cycling and carbon fixation and sequestration in coastal oceans.

The primary research goal of the Biotechnological Investigations - Ocean Margins Program is to establish a more thorough understanding of the molecular to global scale links and feedback mechanisms between solar irradiance, marine microbial activity, primary productivity, carbon and nitrogen cycles and remotely-sensed ocean color data. Specifically, DOE seeks proposals to:

- I. Apply new and innovative techniques in marine molecular biology and marine biotechnology to assess fixation of carbon dioxide from the atmosphere, determine the mechanisms and processes that control the dynamics of nitrogen fixation or denitrification in coastal waters and sediments, define the coupling and/or decoupling of carbon and nitrogen cycles in coastal environments, and determine the linkages between the function and structure of microbial communities mediating carbon and nitrogen cycling in coastal environments, and
- II. Examine the environmental factors (including nutrient availability, temperature, irradiance, and biopolymer lability) that affect the linkages between primary productivity, the utilization of particulate and dissolved organic matter (POM and DOM) by bacterial populations, and nitrogen cycling in coastal areas.

This information is crucial to understanding the responses of marine biological systems to changes in atmospheric radiative budgets and global biogeochemical cycles.

Program Relationships

The Biotechnological Investigations - Ocean Margins Program is expected to build on past research results and accomplishments within the Ocean Margins Program (OMP) component of the Biological and Environmental Research (BER) program. The main objective of OMP was determining whether primary productivity on continental shelves is quantitatively significant in removing carbon dioxide (CO₂) from the atmosphere. Other objectives of the OMP were: 1) Quantifying the ecological and biogeochemical processes that affect the cycling, flux, and storage of carbon and other biogenic elements at the land/ocean interface; and 2) Defining ocean margin sources and sinks in global biogeochemical cycles.

Under the first phase of BI-OMP, molecular biological techniques were developed, adapted, and applied to determine how biological processes are regulated and controlled by genetic limitations and environmental variables. Research emphasis was placed on molecular regulation of photosynthetic carbon reduction by phytoplankton; molecular diagnostic markers of bacterial growth, production, and nutrient limitations to growth, and; molecular techniques for elucidating metabolic pathways.

Research in Biotechnological Investigations - Oceans Margins Program will complement ongoing OBER efforts in the area of ocean carbon sequestration. The Carbon Management Science Program is funding a DOE Center for Ocean Carbon Sequestration Research jointly lead by the Lawrence Berkeley National Laboratory and Lawrence Livermore National Laboratory. The Center is performing research necessary to evaluate the feasibility, effectiveness and environmental acceptability of sequestration of carbon in the ocean, either through direct injection of carbon dioxide to ocean depths or by fertilization of the ocean with limiting nutrients such as iron. The Carbon Management Science Program also is supporting the sequencing of microorganisms involved in ocean carbon cycling including *Prochlorococcus marinus*.

Biotechnological Investigations - Ocean Margins Program (BI-OMP)

BI-OMP is an outgrowth of the Ocean Margins Program (OMP). It places an increased emphasis on the application of modern molecular tools to marine microbes and their role in carbon and nitrogen cycling, and processes affecting global change. Photosynthetic rates in the ocean, and sequestration of atmospheric CO₂ by marine primary production greatly depend on the availability of fixed inorganic nitrogen. Three major external sources of fixed inorganic nitrogen are cultural eutrophication of the coastal zone; atmospheric deposition of anthropogenic and naturally produced oxides of nitrogen; and nitrogen fixation from the atmosphere by microorganisms.

Research in Temperate and High Latitude coastal areas indicates that the availability and cycling of nitrogen is likely to be the major control on primary productivity and carbon cycling in these areas. Moreover, it appears that denitrification (the reduction of fixed nitrogen to N₂) overwhelms nitrogen fixation by cyanobacteria in Northern Latitude waters and sediments. In these areas, there does not appear to be paucity of iron (Fe) to limit nitrogen fixation, but nitrogenase activity may be inhibited by the elevated concentrations of ammonia (NH₃) that occur in Arctic waters following phytoplankton blooms. Since little is known about the rates of nitrogen fixation, primary productivity, and bacterial respiration in cold water areas, this announcement calls for proposals to help understand the molecular to global scale links and

feedback mechanisms between solar irradiance, marine microbiology, coastal nitrogen and carbon cycles, primary productivity, and remotely-sensed ocean color data in the low-temperature waters, such as those off Alaska and the Pacific Northwest.

Although it is anticipated that most of the research performed will be laboratory-based, if field studies are necessary, they should be conducted in the coastal waters, including those off the North Slope of Alaska and Pacific Northwest; or, in the estuarine and shelf waters of the Mississippi River and Gulf of Mexico; Savannah River and South Atlantic Bight; or Chesapeake Bay and Mid-Atlantic Bight. Proposals that are solely concerned with the taxonomic characterization or distributions of bacteria, or the identification of new biochemicals or enzymes from marine organisms, are excluded from consideration within this announcement.

Application of Molecular Tools to Microbes Mediating Carbon and Nitrogen Cycling

This announcement encourages proposals that use molecular approaches to study marine microbial processes, in particular, carbon and nitrogen cycling. Insights can be gained from application of biotechnological tools to carbon sequestration and storage, nitrogen fixation and denitrification. Knowledge of the genes responsible for these processes, and most importantly, the expression of these genes in marine environments is needed. The mechanisms by which environmental factors regulate gene expression in ocean margin environments will help us to understand the natural controls on these processes.

The advent of modern molecular biology has provided powerful tools for examining genes and gene expression. Molecular methods are now being applied to research problems in marine biology, including the enzymes involved in carbon fixation (e.g., ribulose biphosphate carboxylase), nitrogen fixation (e.g., nitrogenase) and denitrification (e.g., nitrate reductase). Examples of enabling biotechnologies include in situ polymerase chain reaction (PCR) to amplify specific catabolic genes within bacterial cells, and fluorescent in situ hybridization (FISH) to elucidate genotypes in microbial communities. A fundamental knowledge of molecular regulatory mechanisms of photosynthesis and nitrogen cycling in the oceans is needed.

Environmental Factors That Affect Linkages Between Carbon and Nitrogen Cycling

Environmental factors such as nutrient availability, temperature, irradiance, and biopolymer lability affect the coupling and decoupling of primary production, bacterial respiration, POM and DOM formation, and nitrogen metabolism in coastal areas. The impact of individual environmental factors and synergistic effects of multiple environmental factors, on these processes is poorly understood. This announcement encourages proposals that address the environmental controls on carbon and nitrogen cycles, and their coupling and decoupling. An understanding of these linkages is critical to monitoring and predicting potential changes due to physical, chemical or biological factors, and may ultimately contribute to the development of algorithms for use in interpreting remotely sensed ocean color data.

Collaborative Partnerships

Research proposals shall include a mutually collaborative partnership between institutions that have a strong tradition of research in the marine sciences and those institutions with developing research capabilities in marine science. Participation of institutions with a high proportion of groups that are under represented in the sciences are particularly encouraged. Examples of collaborative activities include co-investigator status, periodic exchanges of researcher-in-residence between institutions, and joint supervision of research students. It is critical that both institutions have key roles in the collaboration. One institution should serve as the primary with a subcontract to the collaborative institution. The proposals should:

- Clearly state the nature of the collaborative research agreement between the institutions;
- Define respective research roles and responsibilities of scientists at each institution;
- Describe how the partnership between the institutions will be effected (e.g., team meetings, shared students, etc.); and
- Provide separate institutional budgets.

In addition, the proposals will need to show how their proposed collaborative research addresses the goals stated in this announcement and convey a commitment to developing research partnerships between respective institutions. Additional information on collaboration is available in the Application Guide for the Office of Science Financial Assistance Program that is available via the Internet at <http://www.sc.doe.gov/production/grants/Colab.html>.

DATES: To permit timely consideration for awards in Fiscal Year 2000 and early Fiscal Year 2001, formal proposals submitted in response to this announcement must be received by 4:30 p.m., E.S.T., February 10, 2000.

ADDRESSES: Formal proposals referencing Program Announcement LAB00-04 should be forwarded to: U.S. Department of Energy, Office of Science, Environmental Sciences Division, SC-74, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB00-04. This address also must be used when submitting proposals by U.S. Postal Service Express Mail or any commercial mail delivery service, or when hand-carried by the proposer.

FOR FURTHER INFORMATION CONTACT: Dr. Anna Palmisano, Environmental Sciences Division, SC-74, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, telephone: (301) 903-9963, e-mail: anna.palmisano@science.doe.gov, fax: (301) 903-8519.

Program Funding

It is anticipated that a total of up to \$1.5 million will be available for multiple awards in FY 2000 and FY 2001, contingent upon availability of appropriated funds. Proposals may request project support up to three years, with out-year support contingent on availability of funds, progress of the research and programmatic needs. Annual budgets are expected to range from approximately \$50,000 to \$500,000, depending on the number of partnerships involved and the nature of the research proposed. Proposals should include detailed budgets for each year of support requested.

Any recipient of an award from SC performing research involving recombinant DNA molecules and/or organisms and viruses containing recombinant DNA molecules shall comply with NIH "Guidelines for Research Involving Recombinant DNA Molecules," which is available via the world wide web at: <http://www.niehs.nih.gov/odhsb/biosafe/nih/rdna-apr98.pdf>, (59 FR 34496, July 5, 1994,) or such later revision of those guidelines as may be published in the Federal Register.

The instructions and format described below should be followed. Reference Program Announcement LAB00-04 on all submissions and inquiries about this program.

**OFFICE OF SCIENCE
GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS
TO BE SUBMITTED BY NATIONAL LABORATORIES**

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this program announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

1. Evaluation Criteria

Proposals will be subjected to formal merit review (peer review) and will be evaluated against the following criteria which are listed in descending order of importance:

Scientific and/or technical merit of the project

Appropriateness of the proposed method or approach

Competency of the personnel and adequacy of the proposed resources

Reasonableness and appropriateness of the proposed budget

The evaluation will include program policy factors such as the relevance of the proposed research to the terms of the announcement, the uniqueness of the proposer's capabilities, and demonstrated usefulness of the research for proposals in other DOE Program Offices as evidenced by a history of programmatic support directly related to the proposed work.

2. Summary of Proposal Contents

Field Work Proposal (FWP) Format (Reference DOE Order 5700.7C) (DOE ONLY)
Proposal Cover Page
Table of Contents
Abstract
Narrative

Literature Cited
Budget and Budget Explanation
Other support of investigators
Biographical Sketches
Description of facilities and resources
Appendix

2.1 Number of Copies to Submit

An original and seven copies of the formal proposal/FWP must be submitted.

3. Detailed Contents of the Proposal

Proposals must be readily legible, when photocopied, and must conform to the following three requirements: the height of the letters must be no smaller than 10 point with at least 2 points of spacing between lines (leading); the type density must average no more than 17 characters per inch; the margins must be at least one-half inch on all sides. Figures, charts, tables, figure legends, etc., may include type smaller than these requirements so long as they are still fully legible.

3.1 Field Work Proposal Format (Reference DOE Order 5700.7C) (DOE ONLY)

The Field Work Proposal (FWP) is to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Additional information is also requested to allow for scientific/technical merit review.

Laboratories may submit proposals directly to the SC Program office listed above. A copy should also be provided to the appropriate DOE operations office.

3.2 Proposal Cover Page

The following proposal cover page information may be placed on plain paper. No form is required.

Title of proposed project
SC Program announcement title
Name of laboratory
Name of principal investigator (PI)
Position title of PI
Mailing address of PI
Telephone of PI
Fax number of PI
Electronic mail address of PI
Name of official signing for laboratory*
Title of official
Fax number of official

Telephone of official

Electronic mail address of official

Requested funding for each year; total request

Use of human subjects in proposed project:

If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal should human subjects be involved.

Use of vertebrate animals in proposed project:

If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.

Signature of PI, date of signature

Signature of official, date of signature*

*The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

3.3 Table of Contents

Provide the initial page number for each of the sections of the proposal. Number pages consecutively at the bottom of each page throughout the proposal. Start each major section at the top of a new page. Do not use unnumbered pages and do not use suffices, such as 5a, 5b.

3.4 Abstract

Provide an abstract of no more than 250 words. Give the broad, long-term objectives and what the specific research proposed is intended to accomplish. State the hypotheses to be tested. Indicate how the proposed research addresses the SC scientific/technical area specifically described in this announcement.

3.5 Narrative

The narrative comprises the research plan for the project and is limited to 25 pages. It should contain the following subsections:

Background and Significance: Briefly sketch the background leading to the present proposal, critically evaluate existing knowledge, and specifically identify the gaps which the project is intended to fill. State concisely the importance of the research described in the proposal. Explain the relevance of the project to the research needs identified by the Office of Science. Include references to relevant published literature, both to work of the investigators and to work done by other researchers.

Preliminary Studies: Use this section to provide an account of any preliminary studies that may be pertinent to the proposal. Include any other information that will help to establish the

experience and competence of the investigators to pursue the proposed project. References to appropriate publications and manuscripts submitted or accepted for publication may be included.

Research Design and Methods: Describe the research design and the procedures to be used to accomplish the specific aims of the project. Describe new techniques and methodologies and explain the advantages over existing techniques and methodologies. As part of this section, provide a tentative sequence or timetable for the project.

Subcontract or Consortium Arrangements: If any portion of the project described under "Research Design and Methods" is to be done in collaboration with another institution, provide information on the institution and why it is to do the specific component of the project. Further information on any such arrangements is to be given in the sections "Budget and Budget Explanation", "Biographical Sketches", and "Description of Facilities and Resources".

3.6 Literature Cited

List all references cited in the narrative. Limit citations to current literature relevant to the proposed research. Information about each reference should be sufficient for it to be located by a reviewer of the proposal.

3.7 Budget and Budget Explanation

A detailed budget is required for the entire project period, which normally will be three years, and for each fiscal year. It is preferred that DOE's budget page, Form 4620.1 be used for providing budget information*. Modifications of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide a detailed justification of the need for each item of permanent equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget are given in section 4 of this guide.

* Form 4620.1 is available at web site: <http://www.sc.doe.gov/production/grants/forms.html>

3.8 Other Support of Investigators

Other support is defined as all financial resources, whether Federal, non-Federal, commercial or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort devoted to the project.

3.9 Biographical Sketches

This information is required for senior personnel at the laboratory submitting the proposal and at all subcontracting institutions. The biographical sketch is limited to a maximum of two pages for each investigator.

3.10 Description of Facilities and Resources

Describe briefly the facilities to be used for the conduct of the proposed research. Indicate the performance sites and describe pertinent capabilities, including support facilities (such as machine shops) that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution, if any.

3.11 Appendix

Include collated sets of all appendix materials with each copy of the proposal. Do not use the appendix to circumvent the page limitations of the proposal. Information should be included that may not be easily accessible to a reviewer.

Reviewers are not required to consider information in the Appendix, only that in the body of the proposal. Reviewers may not have time to read extensive appendix materials with the same care as they will read the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts (accepted for publication), abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

4. Detailed Instructions for the Budget

(DOE Form 4620.1 "Budget Page" may be used)

4.1 Salaries and Wages

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Proposers should list the number of postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

4.2 Equipment

DOE defines equipment as "an item of tangible personal property that has a useful life of more than two years and an acquisition cost of \$5000 or more." Special purpose equipment means equipment which is used only for research, scientific or other technical activities. Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

4.3 Domestic Travel

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

4.4 Foreign Travel

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

4.5 Other Direct Costs

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

a. Materials and Supplies

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

b. Publication Costs/Page Charges

The budget may request funds for the costs of preparing and publishing the results of research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

c. Consultant Services

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate and number of

days expected service. Consultant's travel costs should be listed separately under travel in the budget.

d. Computer Services

The cost of computer services, including computer-based retrieval of scientific and technical information, may be requested. A justification based on the established computer service rates should be included.

e. Subcontracts

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item.

4.6 Indirect Costs

Explain the basis for each overhead and indirect cost. Include the current rates.