

**Program Announcement
To DOE National Laboratories
LAB 02-23**

***Terrestrial Carbon Sequestration
Using the Poplar***

The Office of Biological and Environmental Research (OBER) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announces interest in receiving proposals for the Terrestrial Carbon Sequestration Using the Poplar research program. Research is requested that could lead to strategies to improve the use of the poplar tree, genus *Populus*, for long-term sequestration of atmospheric carbon: (1) by leveraging the planned genomic sequencing of the poplar, and/or (2) through understanding of the microbial communities found in the poplar rhizosphere. Proposals are sought for research to develop the scientific understanding needed to develop and apply genomic methods to enhance carbon sequestration by poplar. Genomics, which is revolutionizing the biological and environmental sciences, uses the genetic information within a cell to understand phenotypic expression of an organism, such as *Populus*. The focus of genomics in this solicitation is on how gene functions of *Populus* affect and can be manipulated to affect the phenotypic expression of processes that control the fixation and sequestration of carbon in above- and below-ground biomass and the soil.

SUPPLEMENTARY INFORMATION: The Department of Energy Joint Genome Institute will be sequencing the nuclear, genomic DNA from a member of the *Populus* genus, *Populus balsamifera* ssp. *trichocarpa*, commonly known as black cottonwood. This *Populus* genome will be sequenced to a three-fold coverage in 2002, and increased to six-fold coverage in 2003. It will be the first woody plant species to be sequenced, and the draft sequence will be available immediately to the research community.

Poplar has many advantages both as a model organism and as a crop for carbon sequestration. Poplar is easily mutated, has facile transgenesis, and is easily cloned. The molecular physiology is well characterized. It has a relatively small, compact genome of approximately 550 Mbases. Much is known already about its genome, and genetic tools exist, such as genetic linkage maps, BAC (bacterial artificial chromosome) libraries, EST (expressed sequence tags) libraries, and QTL (quantitative trait locus) mapping of physiological traits. Research on trees has some advantages over non-woody plants for carbon sequestration due to the large fraction of total global terrestrial biomass in forests, rapid growth, high value products other than carbon sequestration that could help the economics of carbon sequestration, and widespread distribution.

Genomic studies of the poplar may result in improved breeding and options for cultivation that will enable significant quantities of carbon to be sequestered using poplar or other trees. This announcement solicits research that will build on the planned sequencing of the poplar to investigate ways in which carbon sequestration of the above-ground bole and branches of trees can be improved. In addition, a significant fraction of the carbon associated with a stand of trees is in the soil, rather than the above-ground biomass. Carbon sequestration in soils may be a

critical natural sink for anthropogenic carbon dioxide emitted to the atmosphere. Carbon sequestration in forest soils also has many potential ancillary benefits, such as improved fertility and water holding capacity of soil, thereby reducing both erosion and the need for fertilizers, and the possibility of soil carbon sequestration credits to save forests on lands that might otherwise be converted to other use.

The proposed research should be linked to possible options for purposeful enhancement of carbon sequestration. In below-ground sequestration, for example, carbon could be partitioned so that roots contain more biomass than usual. Recalcitrant forms of carbon, such as lignin, could be over-expressed in roots. The plant biochemistry could be manipulated so that secondary compounds of interest could be exuded from the roots into the soil with the intent of increasing carbon storage in the soils. These techniques would alter the natural flow of carbon fixed from the atmosphere by the tree so that more carbon would be added to the soil and/or the carbon would remain in the soil longer.

For the goal of carbon management using the above-ground biomass, the bole and branches could be manipulated to make them more conducive for use as an energy source, effectively slowing the increase in atmospheric carbon dioxide concentrations compared with the same energy production from fossil fuels. For proposed products that are not replacing fossil fuels, a justification needs to be made that significant additional carbon will be sequestered. The total life cycle global carbon sequestered should be at least on the order of 1 Gigatonne carbon per decade. These products need to have lifetimes of decades so that the carbon involved remains sequestered.

Researchers should describe a phased research program that takes advantage of the draft DNA sequence as it becomes available over the next two years. The proposed research could lead to the development of high throughput experimental and computational methods for understanding of the functional genomics and proteomics of the poplar, especially as related to carbon utilization. Research topics might include (but are not limited to): the identification of gene function(s), the ability to rapidly develop mutants and transform cells, high throughput assays for SNPs (Single Nucleotide Polymorphisms) that alter function(s), the development of systems for phenotyping important traits in mutants, and the understanding and control of metabolic and regulatory pathways.

Research is also being sought that investigates the microbial community in the poplar rhizosphere with the intent of understanding its role in the transfer of carbon from roots to the soil. Research topics might include: (but are not limited to): a characterization of the bacterial and fungal organisms that metabolize the products, for example, exudates and structural root components, from the roots to form compounds with a long (decades) turnover time. Research is preferred on organisms and pathways that serve to increase long-term carbon storage over organisms and pathways that would serve to decrease carbon storage. A link should be made to potential techniques that would lead to increased carbon storage in the poplar rhizosphere and surrounding soil, such as a manipulation of the soil chemical environment to promote certain microorganisms or particular metabolic pathways.

Researchers are encouraged, where appropriate, to include computational biology and informatics techniques in the research. Where practical, data should be made accessible, in machine-readable format, to other researchers. Researchers are strongly encouraged to include an informatics plan for managing the emerging data so that, to the extent practical, the data is compatible with other researchers and data sets.

DATES: Researchers are encouraged (but not required) to submit a brief preproposal for programmatic review. Early submission of preproposals is suggested to allow time for meaningful dialogue.

The deadline for receipt of formal proposals is 4:30 p.m., E.D.T., May 30, 2002, to be accepted for merit review and to permit timely consideration for award in Fiscal Year 2002 and early Fiscal Year 2003.

ADDRESSES: Preproposals, referencing Program Announcement LAB 02-23, should be sent E-mail to: john.houghton@science.doe.gov.

Formal proposals, referencing Program Announcement LAB 02-23, should be sent to: U.S. Department of Energy, Office of Science, Office of Biological and Environmental Research, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 02-23. This address must also be used when submitting proposals by U.S. Postal Service Express Mail or any other commercial overnight delivery service, or when hand-carried by the proposer.

FOR FURTHER INFORMATION CONTACT: Dr. John Houghton, Office of Biological and Environmental Research, Office of Science, U.S. Department of Energy, 19901 Germantown Road, Germantown, MD 20874-1290, telephone: (301) 903-8288, E-mail: john.houghton@science.doe.gov, fax: (301) 903-8519.

Program Funding

It is anticipated that up to \$1,500,000 will be available for multiple awards to be made in Fiscal Year 2002 and early Fiscal Year 2003, in the categories described above, contingent on the availability of appropriated funds. Proposals may request project support up to three years, with out-year support contingent on the availability of funds, progress of the research and programmatic needs. Annual budgets are expected to range from \$100,000 to \$400,000 total costs, unless there is prior approval from the Program Manager. DOE is under no obligation to pay for any costs associated with the preparation or submission of proposals if an award is not made.

Collaboration

Researchers are encouraged to consider proposing multidisciplinary, collaborative research projects. Researchers are encouraged to collaborate with researchers in other institutions, such as: universities, industry, non-profit organizations, federal laboratories and Federally Funded Research and Development Centers (FFRDCs), including the DOE National Laboratories, where appropriate, and to include cost sharing and/or consortia wherever feasible. Additional

information on collaboration is available in the Application Guide for the Office of Science Financial Assistance Program that is available via the World Wide Web at:

<http://www.science.doe.gov/production/grants/Colab.html>.

Preproposals

A brief preproposal is strongly encouraged (but not required) prior to submission of a full proposal. The preproposal should identify on the cover sheet the institution, Principal Investigator's name, address, telephone, fax and E-mail address, title of the project, and proposed collaborators. The preproposal should consist of a one to two page narrative describing the research project objectives and methods of accomplishment. These will be reviewed relative to the scope and research needs of the Terrestrial Carbon Sequestration Using the Poplar research program. Please note that notification of a successful preproposal is not an indication that an

The research project description must be 20 pages or less, exclusive of attachments and must contain an abstract or summary of the proposed research. All collaborators should be listed with the abstract or summary. On the cover face page provide the Principal Investigator's phone number, fax number, and E-mail address. Attachments include curriculum vitae, a listing of all current and pending federal support and letters of intent when collaborations are part of the proposed research. Curriculum vitae should be submitted in a form similar to that of the National Institutes of Health (NIH) or the National Science Foundation (NSF) (two to three pages), see for example: <http://www.nsf.gov/bfa/cpo/gpg/fkit.htm#forms-9>.

The instructions and format described below should be followed. Reference Program Announcement LAB 02-23 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 \$25,000 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.