

**Office of Science
Notice 02-23**

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

Department of Energy

Office of Science Financial Assistance Program Notice 02-23; Terrestrial Carbon Sequestration Using the Poplar

AGENCY: U.S. Department of Energy

ACTION: Notice inviting grant applications.

SUMMARY: 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 applications 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. Applications 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.

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

The deadline for receipt of formal applications 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: Preapplications, referencing Program Notice 02-23, should be sent E-mail to: john.houghton@science.doe.gov.

Formal applications, referencing Program Notice 02-23, should be sent to: U.S. Department of Energy, Office of Science, Grants and Contracts Division, SC-64, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Notice 02-23. This address must also be used

when submitting applications by U.S. Postal Service Express Mail or any other commercial overnight delivery service, or when hand-carried by the applicant.

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. The full text of Program Notice 02-23 is available via the World Wide Web using the following web site address: <http://www.science.doe.gov/production/grants/grants.html>.

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 notice 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.

Applicants 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.

Applicants 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. Applicants 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.

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. Applications 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.

Collaboration

Applicants are encouraged to consider proposing multidisciplinary, collaborative research projects. Applicants 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>.

Preapplications

A brief preapplication is strongly encouraged (but not required) prior to submission of a full application. The preapplication 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 preapplication 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 preapplication is not an indication that an award will be made in response to the formal application.

Merit Review

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following evaluation criteria listed in descending order of importance as codified at 10 CFR 605.10(d):

1. Scientific and/or Technical Merit of the Project,
2. Appropriateness of the Proposed Method or Approach,
3. Competency of Applicant's Personnel and Adequacy of Proposed Resources,
4. 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 and the agency's programmatic needs. Note, external peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Non-federal reviewers may be used, and submission of an application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

Information about the development and submission of applications, eligibility, limitations, evaluation, selection process, and other policies and procedures may be found in 10 CFR Part 605, and in the Application Guide for the Office of Science Financial Assistance Program. Electronic access to the Guide and required forms is made available via the World Wide Web at:

<http://www.science.doe.gov/production/grants/grants.html>. DOE is under no obligation to pay for any costs associated with the preparation or submission of applications if an award is not made.

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 grant face page, form DOE F 4650.2, in block 15, also 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 Catalog of Federal Domestic Assistance Number for this program is 81.049, and the solicitation control number is ERFAP 10 CFR Part 605.

John Rodney Clark
Associate Director of Science
for Resource Management

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