Office of Science
Financial Assistance
Funding Opportunity Announcement
DE-FOA-0000368

Genomic Science and Technology for Energy and the Environment

SUMMARY:

The Office of Biological and Environmental Research (BER) hereby announces interest in receiving applications for research that supports the Genomics Science Program and addresses DOE's missions in energy and the environment in the following research areas:

a) ***Microbial Environmental Processes****:* To develop a systems-level understanding of the functional processes used by microbes and microbial consortia that link the internal metabolic processes of microbial species to their external biogeochemical activities;

b) ***Microbial and Plant Processes for Bioenergy:*** To develop new approaches that advance our understanding of the systems biology of plant and microbes in producing biofuels including the utilization of lignocellulosic biomass and microbial synthesis of advanced biofuel;

c) ***Characterizing Key Molecular Species, Events, and Multicellular Processes for Genomic Science:*** To develop innovative technology approaches to characterize biological processes and networks at the subcellular, cellular and multicellular levels.

The proposed research is intended to fill critical knowledge gaps, including the exploration of high-risk approaches. BER also encourages the submission of innovative "high- risk" applications with potential for future high impact on Genomic Science Research. The probability of success and the risk-reward balance will be considered when making funding decisions.

PREAPPLICATIONS

Potential applicants are required to submit a brief preapplication, referencing Funding Opportunity Announcement (FOA) **DE-FOA-0000368** for receipt by DOE by **4:30 p.m., EDT, June 28, 2010**. Preapplications will be reviewed for conformance with the guidelines presented in this FOA and suitability in the technical areas specified. A response to the preapplications encouraging or discouraging formal applications will be communicated to the applicants by July 12, 2010. Applicants who have not received a response regarding the status of their preapplication by this date are responsible for contacting the program to confirm their status.

Only those preapplicants that receive notification from DOE encouraging a formal application may submit full applications. **No other formal applications will be considered.**

Potential applicants **must** submit a brief preapplication that consists of a cover sheet plus no more than **three** pages of narrative which: **(1) identifies the FOA research area (a, b, or c) that the preapplication addresses, (2) states the research objectives of the project, (3) describes the technical approach(s), and (4) identifies the proposed team members and their expertise.** The intent in requesting a preapplication is to save time and effort of applicants in preparing and submitting a formal project application that may be inappropriate for the FOA. Preapplications will be reviewed relative to the scope and research needs as outlined in the summary paragraph and in the SUPPLEMENTARY INFORMATION. The preapplication should identify on the cover sheet the title of the project, the institution or organization, name of the principal investigator, telephone number, fax number, and e-mail address. No budget information or biographical data need be included, nor is an institutional endorsement necessary.

Preapplications referencing **DE-FOA-0000368** should be sent as a text file or single PDF file attachment via e-mail to: genomicsGTL@science.doe.gov with **"Preapplication DE-FOA-0000368 Last name and Institution"** as the subject. **No FAX or mail submission of preapplications will be accepted.**

APPLICATION DUE DATE: September 10, 2010, 11:59 p.m. Eastern Time

Formal applications submitted in response to this FOA must be received by September 10, 2010, 11:59 p.m. Eastern time, to permit timely consideration of awards. **APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.**

IMPORTANT SUBMISSION INFORMATION:

The full text of the Funding Opportunity Announcement (FOA) is located on FedConnect. Instructions for completing the Grant Application Package are contained in the full text of the FOA which can be obtained at: https://www.fedconnect.net/FedConnect/?doc=DE-FOA-0000368&agency=DOE . To search for the FOA in FedConnect click on "Search Public Opportunities". Under "Search Criteria", select "Advanced Options", enter a portion of the title "Genomic Science and Technology for Energy and the Environment", then click on "Search". Once the screen comes up, locate the appropriate FOA.

In order to be considered for award, Applicants must follow the instructions contained in the Funding Opportunity Announcement.

WHERE TO SUBMIT: Applications must be submitted through Grants.gov to be considered for award.

You cannot submit an application through Grants.gov unless you are registered. Please read the registration requirements carefully and start the process immediately. Remember you have to update your CCR registration annually. If you have any questions about your registration, you

should contact the Grants.gov Helpdesk at 1-800-518-4726 to verify that you are still registered in Grants.gov.

Registration Requirements: There are several one-time actions you must complete in order to submit an application through Grants.gov (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contract Registry (CCR), register with the credential provider, and register with Grants.gov). See http://www.grants.gov/GetStarted. Use the Grants.gov Organization Registration Checklist at http://www.grants.gov/assets/OrganizationRegCheck.pdf to guide you through the process. Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in the CCR registration process. Applicants, who are not registered with CCR and Grants.gov, should allow at least 21 days to complete these requirements. It is suggested that the process be started as soon as possible.

IMPORTANT NOTICE TO POTENTIAL APPLICANTS: When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step (i.e. Grants.gov registration).

Questions: Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. Part VII of the FOA explains how to submit other questions to the Department of Energy (DOE).

GENERAL INQUIRIES ABOUT THIS FOA SHOULD BE DIRECTED TO:

Technical/Scientific Program Contact:

Program Manager: Dr. Arthur Katz
U. S. Department of Energy
Office of Biological and Environmental Research
Phone: 301-903-4932
E-Mail: Arthur.Katz@science.doe.gov

Program Manager: Dr. Dean Cole
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SUPPLEMENTARY INFORMATION:

The Genomic Science Program supports basic research aimed at achieving a systems level understanding of plants, microbes, and microbial communities relevant to DOE missions in bioenergy, carbon management, and environmental stewardship. Research supported by this

program addresses extremely complex questions that span all scales of biology, requires the collective expertise of scientists from many disciplines and the coordinated application of a wide range of technologies and experimental approaches—genome sequencing, gene expression profiling, proteomics, metabolomics, imaging, research technology development, and computational biology. The application of these tools to understand, for example, metabolic networks, cellular regulation, molecular physiology and genomics, provides foundational information to address some of the difficult and challenging biological questions in areas such as microbe-mineral and plant-microbe interaction and plant cell wall degradation.

Three topic areas of interest for this funding opportunity are described below:

a) Microbial Environmental Processes

Microbial activity plays a dominant role in numerous environmental processes of relevance to DOE. For example, microbial activity is well known to influence: (1) nutrient cycling in soils and sediments, specifically in association with plant growth; (2) contaminant mobility and transformation in the subsurface, and; (3) the cycling/sequestration of carbon in terrestrial environments. Yet, we still have limited understanding about how microorganisms actually function in the environment both individually and in communities. Only recently have the tools become available to mechanistically understand the functioning and activity of microorganisms and microbial communities in their own environments.

Constructing a systems level description of coupled cellular and community microbial processes that accurately characterize the interplay of the biotic and abiotic environment, particularly at the physical interface of cellular and abiotic surfaces, remains a fundamental challenge that underpins all BER missions. The transfer of energy, information and materials between organisms and their environment requires a detailed mechanistic understanding of how cells communicate, regulate genetic information in response to external cues and perturbations, respond to stress and change in the abiotic environment, and integrate individual and communal processes to perform higher order functions. This requires understanding how microorganisms respond to and modify their local biogeochemical environments by linking internal metabolic processes with external mineral and solute transformation. Cell-cell communication, biofilms formation, and quorum sensing are also examples of environmental signals of interest impacting shifts in microbial metabolism.

Ultimately DOE seeks a predictive understanding of microbial activity in the environment. BER is seeking applications that use Genomic Science approaches, tools and techniques to develop a systems-level understanding of the functional (physiological) networks used by microbes and microbial consortia involved in linking internal metabolic processes to external biogeochemical activities, and a systems-level understanding of coupled interfacial processes, for example, involving mineral and microbe as well as nutrients and microbes. See report: http://www.sc.doe.gov/ober/subsurfacecomplexity_03-05-10.pdf.

Applications should address one or more of the research topics below that support the following DOE-relevant environmental processes including: 1) nutrient cycling in soils and sediments in association with plant growth; and 2) metal and radionuclide contaminant mobility in subsurface environments. **Carbon sequestration/cycling was addressed in a previous FOA and is out of scope for this FOA.**

- Studies of the changes in physiology, metabolism, gene expression and regulation, and their functional effect in DOE-relevant microorganisms involved in nutrient cycling associated with plant growth or contaminant mobility in subsurface environmental systems, in response to variations in key environmental parameters.

- Studies to understand community level changes in composition, function and activity that result from varying biogeochemical conditions that impact nutrient cycling associated with plants or with contaminant mobility in DOE relevant environments.

- Studies of the genomic changes and biomolecular mechanisms to understand the link between DOE relevant model microbes or microbial consortia metabolic processes with external biogeochemical activities such as the reduction or oxidation of external minerals and/or contaminants (metals and radionuclides). Of particular interest are studies of the abiotic-biotic interface, where cellular metabolic processes impact mineral transformation across the microbe-mineral interface.

b) Microbial and Plant Processes for Bioenergy

The harnessing of plants and microbes for the production of biofuels is a high priority research activity. One path is utilization of cellulosic plant biomass. However, major scientific barriers must be overcome including a more comprehensive understanding of plant wall structure and the development of high-efficiency and low-cost methods to degrade the cellulosic biomass into useable sugars components for fermentation. Other strategies, altering or improving metabolic pathways in fermentative and phototrophic microbes, hold the potential of producing a broader range of molecules that can be used for next generation biofuels, including systems-level studies of regulatory and metabolic networks for microbial hydrogen production. See the DOE Office of Biological & Environmental Research: Biofuels Strategic Plan: http://www.sc.doe.gov/ober/Biofuels_Strategic_Plan.pdf.

In response to these scientific needs, BER is seeking applications that use systems biology approaches that advance the understanding of plant cell wall structural properties, microbial degradation of complex plant material, or microbial advanced biofuel synthesis.

Applications should address one or more of the following research areas:

- System biology studies of the metabolic and regulatory processes involved in the synthesis and degradation of the plant cell wall.

- Functional genomics characterization of microbes and microbial communities involved in lignocelluloses degradation or bioenergy production. These studies should exploit sequenced microbes and/or microbial communities from which some community-level metagenomic sequencing has been performed (**whole genome sequencing is not the focus of this FOA**).

- Experimental systems biology approaches to support the development of integrated, predictive functional modeling of the metabolic and regulatory networks of microorganisms that degrade complex biomass.

- Experimental systems biology approaches to support the development of integrated, predictive modeling of the metabolic and regulatory networks of phototrophic or fermentative biofuel-synthesizing microorganisms.

- Experimental synthetic biology approaches to study regulatory and metabolic networks of phototrophic and fermentative microorganisms.

c) Characterizing Key Molecular Species, Events, and Multicellular Processes for Genomic Science

The successful development of technologies that can rapidly and cost effectively determine genome sequences has enabled new research opportunities that focus on identifying and quantifying the essential biomolecular components of the cell involved in key processes and networks. A major challenge for the Genomic Science program is to characterize for a given biological function all the essential elements of cellular networks to determine how they respond to local physical and chemical changes in their natural environment and across the various scales that define their functions. Many significant components of the cell such as lipids and carbohydrates are also difficult to detect and/or quantify because reliable measuring techniques are not available. Furthermore, understanding the dynamics of multicellular or multiorganism interaction—how cells communicate, regulate their genetic information in response to other cells, combine their capabilities for higher order function, and interface with their microenvironments—is required to illuminate processes of programmatic interest.

Substantial progress has been made in characterizing biological processes and networks at the subcellular, cellular and multicellular levels; however, the integration of our understanding of biological processes across these spatial scales is difficult. Because predictive science requires an integrated understanding across multiple spatial scales, further innovation in biological approaches and advanced technologies are required. These challenges are discussed in the report "*New Frontiers in Characterizing Biological Systems,*" http://genomicscience.energy.gov/characterization/index.shtml.

In order to be responsive, applications for the development of technology in Section (c) must be applied to biological issue(s) of compelling interest to BER missions, specifically those described in Sections (a) and (b) of this solicitation.

Applications must focus on one or more of the following research areas:

- Approaches that identify and measure in real-time, the concentration(s), dynamics or spatial distribution of one or more important categories of biomolecular species such as metabolites, lipids and carbohydrates that are components of key processes and networks in cells and multicellular communities but currently cannot be quantitatively measured and spatially resolved with high precision.

- Approaches that combine advances in two or more technologies to improve the identification and characterization of small populations of molecules or cell types in complex, heterogeneous systems.

- Approaches that utilize a single or a combination of analytical and/or imaging techniques to simultaneously measure the real time dynamic behavior of two or more functionally important biomolecular species (particularly those that interact or are coupled), with temporal resolution of milliseconds to minutes and spatial resolution of nanometer to millimeters.

- Advanced analytical and imaging technologies that characterize functional multicellular or multiorganism (e.g. microbial communities) systems in their natural environment. Approaches that can generate and integrate data from different spatial and temporal scales are encouraged.

- Approaches using advanced analytical and imaging technologies to determine the environmental variables that influence microbial community structure and function and the relationships between microbial community structure and functional heterogeneity.

The development of improved experimental models of biological systems that simulate behavior in natural environments is encouraged. **However, these efforts must be an integrated subordinate component of a technology development application, not the primary focus of the planned research or a standalone activity.**

Organisms of Interest to DOE:

Candidate microbial systems for study should comprise archaea, bacteria, algae and/or fungi in communities that mediate or catalyze processes that are of importance to bioenergy or environmental stewardship related to subsurface terrestrial biogeochemical processes. Research with plant and plant/microbial systems should likewise focus on models that are relevant to bioenergy and environmental stewardship. **Proposed research in phytoremediation is not within the scope of the FOA.**

Genome or metagenome sequencing is outside the purview of this FOA. Applicants in need of high throughput sequencing are strongly encouraged to explore opportunities at the DOE Joint Genome Institute through its annual Community Sequencing Program (CSP) (http://www.jgi.doe.gov/CSP/index.html) or its Microbial Sequencing Program that accepts proposals at any time for quarterly review (http://proposals.jgi-psf.org/). All sequencing proposals must undergo a technical review by JGI staff to assess feasibility and resource requirements, but if linked to an accepted Genome Sciences project, do not need to undergo a separate scientific review. Applications that are directed mainly at the sequencing of microbial or plant species are not responsive to this FOA.

Please note that proposed research in municipal solid waste is not within the scope of the FOA.

Program Funding

It is anticipated that up to $10 million total will be available for multiple awards to be made in **FY 2011**. The number of awards will be contingent on satisfactory peer review, the availability of appropriated funds, and the size of the awards. Multiple year funding is expected. Applications may request project support for 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 $250,000 to $750,000 in total costs.

DOE is under no obligation to pay for any costs associated with the preparation or submission of an application. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this FOA.

Merit Review

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following evaluation criteria which are listed in descending order of importance 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; and
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 FOA and the agency's programmatic needs. It should be noted that external peer reviewers are selected on the basis of their scientific expertise and the absence of conflict-of-interest issues. Both Federal and non-Federal reviewers may be used, and submission of an application constitutes agreement that this review process is acceptable to the investigator(s) and the submitting institution.

The Catalog of Federal Domestic Assistance (CFDA) number for this program is 81.049, and the solicitation control number is ERFAP 10 CFR Part 605.

Posted on the Office of Science Grants and Contracts Web Site
May 20, 2010.