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Joint Meeting

Genomics:GTL Awardee Workshop VI

and

Metabolic Engineering Working Group

Interagency Conference on Metabolic Engineering 2008

Bethesda, Maryland
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Welcome

Welcome to the 2008 Joint Genomics:GTL Awardee Workshop and the eighth Metabolic Engineering Interagency Working Group Conference. The Genomics:GTL program supports fundamental research on microbes and plants with an emphasis on understanding systems biology across multiple scales of organization. Molecular interactions among proteins, regulatory networks and metabolic pathways of individual organisms, and multicellular interactions in complex microbial communities are explored using advanced molecular and computational biology approaches enabled by genome sequencing. Research supported by the Genomics:GTL program addresses critical DOE missions in bioenergy, bioremediation of environmental contaminants, and biogeochemical cycling and biosequestration of carbon.

The past year has seen many exciting new developments for the Genomics:GTL program. In June of 2007, Secretary of Energy Samuel Bodman announced the funding of three multidisciplinary Bioenergy Research Centers aligned with the GTL program. Each center represents a multidisciplinary, collaborative effort between DOE national laboratories, universities, and private companies aimed at improving digestibility of lignocellulosic biomass from bioenergy feedstocks, discovery and bioengineering of new microbes and enzymatic systems capable of breaking down cellulose, and conversion of cellulose-derived sugars to ethanol or other biofuels. Genomics:GTL continues to support groundbreaking research by individual investigators and interdisciplinary research teams, and new efforts in technology development for imaging lignocellulose degradation, validation of genome sequence annotations, characterizing complex microbial communities, and quantitative biochemistry and metabolic engineering for biological hydrogen production were funded in 2007. The Genomics:GTL program in Ethical, Legal, and Societal Issues (ELSI) also continued to expand in 2007, incorporating new projects that address societal and sustainability issues associated with bioenergy development. The diverse array of approaches represented by these new projects and the existing Genomics:GTL community form a robust and highly complementary research program that engages some of our most pressing national priorities.

For the third year, this meeting brings together researchers supported by the Genomics:GTL program and the Interagency Metabolic Engineering Working Group. The goal of the Metabolic Engineering Working Group is the targeted and purposeful alteration of metabolic pathways found in an organism in order to better understand and use cellular pathways for chemical transformation, energy transduction, and supramolecular assembly. In addition to overlapping technological approaches, these two programs share an underlying conceptual goal of advancing understanding of organisms at the systems level.

We look forward to an exciting and productive meeting and encourage you to exchange ideas and share your expertise with other researchers. We thank you for lending your knowledge, creativity, and vision to Genomics:GTL and the Metabolic Engineering Working Group and wish you continued success in the coming year.

Jerry Elwood
Acting Associate Director of Science for
Biological and Environmental Research
Office of Science
U.S. Department of Energy

Michael Strayer
Associate Director of Science for
Advanced Scientific Computing Research
Office of Science
U.S. Department of Energy

Fred Heineken
Chair of the Interagency Metabolic
Engineering Working Group
National Science Foundation

See page 169 for additional abstracts and agenda. Addendum abstracts not included in index.

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Molecular Interactions and Protein Complexes

Validation of Genome Sequence Annotation

Addendum of late abstracts and agenda available starting page 169. Late abstracts not indexed.

* Presenting author

Introduction to Workshop Abstracts

Genomics:GTL Goal and Objectives

Ultimate Scientific Goal
Achieve a predictive, systems-level understanding of plants, microbes, and biological communities, via integration of fundamental science and technology development, to enable biological solutions to DOE mission challenges, including energy, environment, and climate.

Objective 1: Determine the genomic properties, molecular and regulatory mechanisms, and resulting functional potential of microbes, plants, and biological communities central to DOE missions.

Objective 2: Develop the experimental capabilities and enabling technologies needed to achieve a genome-based, dynamic systems-level understanding of organism and community functions.

Objective 3: Develop the knowledgebase, computational infrastructure, and modeling capabilities to advance the understanding, prediction, and manipulation of complex biological systems.

Abstract Organization

Abstracts associated with the Metabolic Engineering Working Group (MEWG) are identified as such and are intermixed with GTL abstracts in relevant categories. The Genomics:GTL and MEWG program abstracts and posters are organized according to the following research areas important to achieving the ultimate GTL scientific goal and objectives.

Systems Biology for DOE Energy and Environmental Missions

Bioenergy

- Biofuels: Bioenergy Research Centers
- Biofuels: Analytical and Imaging Technologies for Studying Lignocellulosic Material Degradation
- Biofuels: Metabolic Engineering for Biofuels Production
- BioHydrogen: Quantitative Microbial Biochemistry and Metabolic Engineering for Biological Hydrogen Production

Systems Environmental Microbiology

Systems Biology Research Strategy and Technology Development

Genomic and Proteomic Strategies

Molecular Interactions and Protein Complexes

Validation of Genome Sequence Annotation

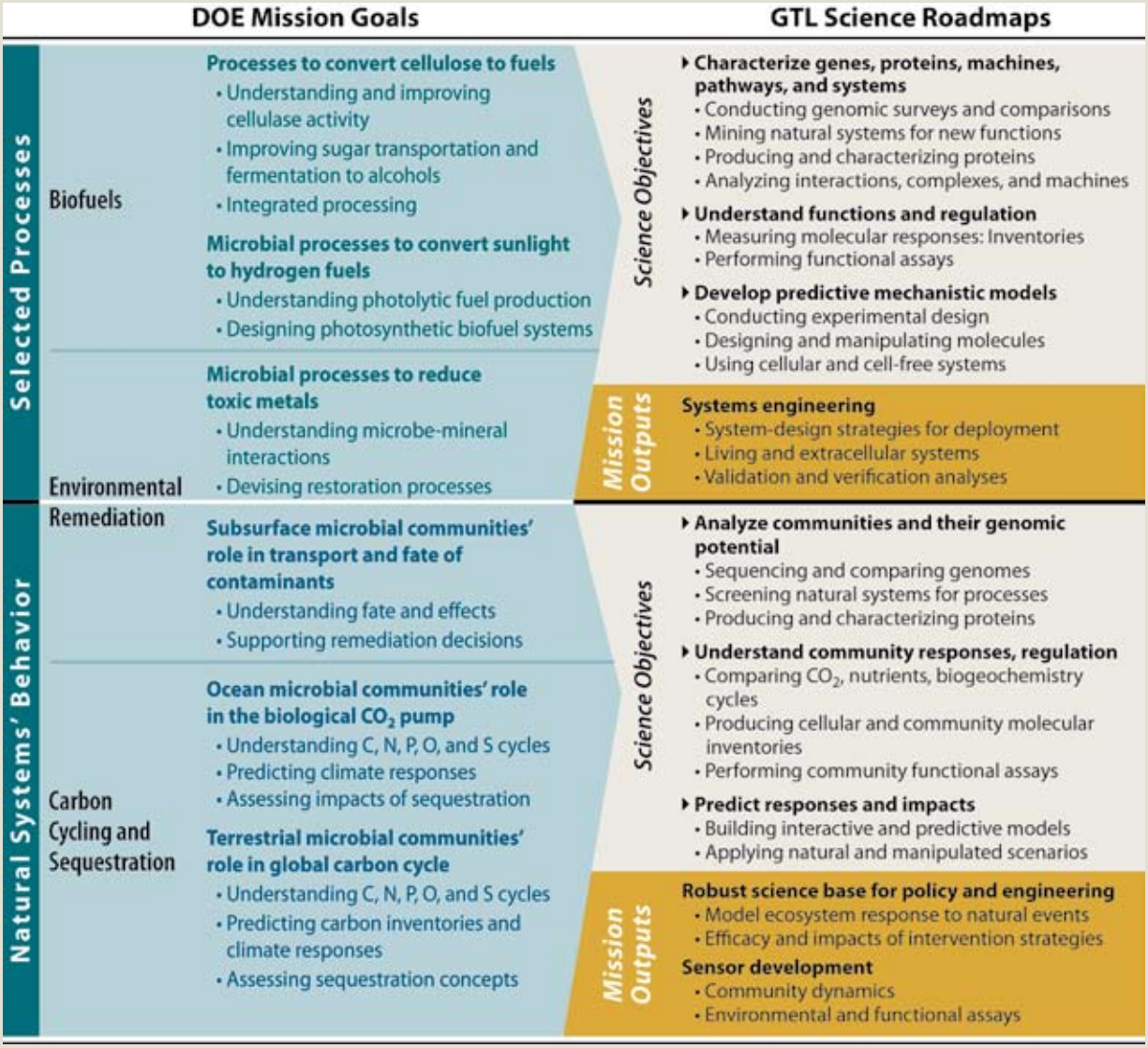
Computing Resources and Databases

Communication

Ethical, Legal, and Societal Issues

The following table is a summation of how GTL science and DOE missions align (*DOE Genomics:GTL Roadmap: Systems Biology for Energy and Environment*; October 2005, p. 40). (GenomicsGTL.energy.gov)

Summary Table. GTL Science Roadmap for DOE Missions



A capsule summary of systems being studied, mission goals that drive the analysis, generalized science roadmaps, and outputs to DOE missions. To elucidate design principles, each of these goals entails the examination of thousands of natural primary and ancillary pathways, variants, and functions, as well as large numbers of experimental mutations.