PENNSTATE PRINCETON THE UNIVERSITY OF UTAH HAWAII

Research opportunities supported by the US Air Force Office of Scientific Research initiative:

"Water Based Photobiological Production of Hydrogen Fuel"

On May 1, 2005 a multi-disciplinary team of researchers from Princeton University, the Pennsylvania State University, the Colorado School of Mines, the University of Utah, and the University of Hawaii will launch a five-year research & development study entitled:

Renewable Bio-solar Hydrogen Production from Robust Oxygenic Phototrophs

The co-investigators are Professors Donald A. Bryant, G. Charles Dismukes, Edward I. Stiefel, Matthew Posewitz, Eric Hegg, and Robert Bidigare

For further information and fellowship opportunities: see forthcoming URL BioSolarH_2
Email: mendenko@princeton.edu
Principal Investigator: G. C. Dismukes <dismukes@princeton.edu>

Summary

Four approaches aimed at achieving microbial H_2 photoproduction from water will be developed in this proposal: novel H_2 sensing technologies, high throughput screening protocols, optimal selection of cyanobacteria and microalgae strains from extreme environments, and genetic optimization of microbial H_2 photoproducers. These approaches will be applied to five primary objectives: 1) to develop rapid and sensitive sensors for the determination of extracellular H_2 concentrations in cell cultures and in the gas phase; 2) to apply these tools in the high-throughput screening of large numbers of microbes for the purpose of rapid discovery of new photo H_2 producers within existing and emerging collections of diverse oxygenic phototrophs; 3) to engineer selected microbes genetically, identified from these screens and the newly developed H_2-sensing technology, using both rational and random genetic techniques; 4) to examine the possibility of stimulating H_2 photoproduction by ameliorating the O_2–induced inactivation of hydrogenase activity from photosynthetically generated O_2 by using wild strains of high carbonate-requiring cyanobacteria (originating from alkaline soda lakes) that exhibit the unique property of reversible inhibition of the O_2-evolving complex upon withdrawal of bicarbonate/carbonate from the medium; 5) to isolate and sequence the genes of a few hydrogenases selected from the most active strains that are not analogous to currently studied organisms or that exhibit unique expression control for the purpose of understanding their functional advantage. Comparative genomic analyses will be used to identify genes encoding the most active or novel enzymes for protein isolation, purification, and mechanistic studies**.** These studies are expected to produce new methods for optimizing the yield of photosynthetic H_2 and will identify new wild strains and engineer new hybrid strains of photosynthetic microorganisms capable of more efficient and more economical H_2 production as a renewable fuel source derived from water.