

FECB: A Functional Encyclopedia of Cyanobacteria - Building the Knowledge Framework for an Enhanced Understanding of Carbon and Nitrogen Cycling

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Abstract: There has been a great interest by the Department of Energy (DOE) to increase the phylogenetic coverage of genome sequences from across the phyla archaea and bacteria – including cyanobacteria. The Genomic Encyclopedia of Bacteria and Archaea (GEBA) project, which is an ongoing project at DOE's Joint Genome Institute (JGI), has been filling the genomic gaps in the prokaryotic tree of life. The recently launched GEBA-cyano project, led by Dr. Cheryl Kerfeld at the JGI, was designed to improve the understanding of the genetic basis of cyanobacterial ecophysiology by sequencing the genomes of 54 phylogenetically diverse strains of cyanobacteria that could be grown under axenic conditions. Cyanobacteria are eminently DOE mission relevant organisms, playing key roles in global carbon and nitrogen cycling, as platforms for green biotechnology, and as biofuel feedstock. Here we propose to extend and complement the GEBA and GEBA-cyano projects by performing phylogenetic and functional analyses of mixed populations of cyanobacteria and heterotrophic prokaryotes collected from extreme environments. Extremophilic communities that possess a relatively low complexity will be used to establish a workflow designed to isolate and cultivate individual microorganisms that have been recalcitrant to prior attempts to grow them in axenic culture. To achieve our goals, we will utilize specimens from the Culture Collection of Microorganisms from Extreme Environments (CCMEE), which consists of over 1,200 samples of cyanobacteria-dominated communities, collected over the period of four decades by senior members of our team. The CCMEE provides a unique resource for the scientific community by providing samples of cyanobacteria isolates and consortia composed of photoautotrophic cyanobacteria and heterotrophic prokaryotes.