"Genetic Engineering of *Streptomyces* Bacteria as Lignocellulose Biorefineries"

Jason K. Sello

Department of Chemistry, Brown University, Providence, RI, U.S.

The search for a renewable energy source to act as an alternative to fossil fuel is of global importance. The use of plant biomass as a source of low-value carbon that can subsequently be used to produce high-value biofuels has shown great potential. Most attention is focused on the conversion of the cellulose component of plant biomass, however, this process is impeded by the presence of lignin, a complex aromatic polymer found in the cell walls of plants. The means to effectively and efficiently degrade lignin would enhance the ability to harness the energy stored in plant biomass into a usable fuel. Several ligninolytic species of *Streptomyces* bacteria have been identified, including *S. viridosporus* and *S. badius.* Although it is known that members of the *Streptomyces* genus are able to degrade lignin, little is known about the underlying genetics and biochemistry. In collaboration with the Joint Genome Institute (JGI), the genome of *S. viridosporus was* recently sequenced. Through this effort, we hope to identify genes encoding novel peroxidases, laccases, and oxidases. The major utilization pathway for lignin-derived aromatic compounds in microorganisms is the β-ketoadipate pathway. Through this pathway, the aromatic compounds (*i.e.,* protocatechuate and catechol) are converted to acetyl coenzyme A and succinyl coenzyme A. We have found that transcription of genes encoding enzymes of the protocatechuate branch of the β-ketoadipate pathway are induced by protocatechuate in *Streptomyces coelicolor* and *Streptomyces viridosporus*. In a series of genetic and biochemical analyses, we have identified the mechanism by which transcription is regulated. In keeping with our larger objective of converting lignin derived aromatic compounds to biofuels, we have new evidence that *S. coelicolor* can convert the carbon of protocatechuate into the triglyceride precursors of biodiesel.