Ecophysiology and Extracellular Electron Transfer by the Metal-Reducing Bacterium *Geobacter daltonii* FRC32^T

University-Led Research

Y. Gorby (University of Southern California) and M. Fields (Montana State University)

Geobacter daltonii FRC32^T is an iron(III) and uranium(VI)-reducing bacterium isolated from uranium-contaminated subsurface sediments at the DOE ORFRC. Structural and functional gene analysis has confirmed that strain FRC32^T is abundant and active in those sediments. *G. daltonii* was cultivated in bioreactors using a chemically defined medium with acetate as the electron donor and fumarate as the electron acceptor. Under electron acceptor limited conditions, FRC32^T produced branched extracellular appendages that are morphologically similar to conductive nanowires those produced by *Geobacter sulfurreducens* strain PCA. *G. daltonii* also grew in chemostat cultures with oxygen as the sole terminal electron acceptor, but only when provided at growth-limiting concentrations. Amending the medium with amino acids to support the production of protein increased the production of extracellular filaments under electron acceptor limitation and increased the ability of this organism to reduce and transform solid phase iron oxide and dissolved forms of oxidized uranium.

This presentation provides an update on the molecular and electronic properties of extracellular filaments produced by *G. daltonii*. Novel cultivation methods will be described that can be used to more fully evaluate the enzymatic transformation of heavy metals and radionuclides across defined redox gradients. Information gained from this research will be used to better understand the biogeochemical processes that influence the fate and transport of uranium and other contaminants at the Oak Ridge Integrated Field Research Center. Understanding the components and mechanisms of charge transfer to extracellular electron acceptors by this and other environmentally-relevant organisms is an important step in realizing their full potential as tools for remediation of contaminated subsurface systems.