Energetics of Extracellular Electron Transfer in *Shewanella*

JEFFREY A. GRALNICK[1]

[1]University of Minnesota – Twin Cities, gralnick@umn.edu

Dissimilatory metal reducing bacteria couple growth and persistance to reduction of extracellular substrates that are often insoluble, such as iron and manganese oxide minerals. Electrons generated from an oxidized carbon source are used to reduce lipid-soluble quinone compounds present in the cytoplasmic membrane. Electrons from the quinone pool are moved into the periplasm by quinone oxidoreductases such as CymA from *Shewanella oneidensis* then transferred to multi-heme *c*-type cytochrome periplasmic electron carriers ultimatly arriving at the outer-membrane complex MtrABC, which acts as a conduit to move electrons from the periplasm across the outer-membrane. Electrons move from this complex on the surface of the cell either directly to a mineral or indirectly via flavin electron shuttles. Here, I will first describe the energetics of ATP production in *S. oneidensis* under metal-reducing conditions using a variety of mutants and observations related to anaerobic metabolism. Second, using competition assays between cells proficient in shuttle secretion and cells where this activity is blocked, we will present evidence that the metabolic burdon of electron shuttle production is neglegible under conditions where electron shuttles are unimportant for respiration. Enhanced respiratory activity against a variety of insoluble substrates, combined with cells experiencing ATP-excess may explain the evolution of flavin electron shuttling in *Shewanella*.