A revised bioenergetic model of *Desulfovibrio vulgaris* strain Hildenborough

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Project Goals: The ENIGMA (Ecosystems and Networks Integrated with Genes and Molecular Assemblies) project seeks to elucidate the mechanisms and key processes that enable microorganisms and their communities to function in metal-contaminated soil sites. One goal is to understand the bioenergetic processes that enable ENIGMA-relevant microorganisms to thrive in such environments.

Abstract: Sulfate reducing bacteria (SRB) play important roles in global sulfur and carbon cycling through their ability to completely mineralize organic matter while respiring sulfate to hydrogen sulfide. They are ubiquitous in anaerobic environments and have the ability to reduce toxic metals such as Cr(VI) and U(VI). While SRB have been studied for over three decades, bioenergetics of this clade of microbes is poorly understood. *Desulfovibrio vulgaris* strain Hildenborough (DvH) has served as a model SRB for the last several years with the accumulation of transcriptomic, proteomic and metabolic data under a wide variety of stressors. To further investigate the three proposed modes of energy generation in this anaerobe we conducted a systematic study involving multiple electron donor and acceptor combinations for growth. DvH was grown at 37°C in a defined medium with (a) 60mM Lactate + 30mM Thiosulfate, (b) 60mM Lactate + 40mM Sulfite (c) 60 mM lactate, 30 mM sulfate, (d) 120mM Pyruvate + 30mM Sulfate, (e) H_2 + 10mM Acetate + 30mM Sulfate, (f) formate 100mM + 10mM acetate + 25mM sulfate. g) no lactate, 5 mM acetate, 30 mM sulfate. Cells were harvested for transcriptomics at mid-log phase of growth for all conditions, when the optical density at 600nm was in the range 0.42-0.5. Initial results indicate that in spite of different electron donors, cells grown with sulfate, thiosulfate or sulfite as the electron acceptor show commonalities in gene expression and cluster together. Cells grown with H_2 and formate as electron donors as well as by pyruvate fermentation form a separate cluster consistent with differential pathway utilization. It was also observed that the ability of DvH to reduce metals like Cr(VI) when grown with lactate was greater than with formate as electron donor.

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