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# Characterizing novel mechanisms of extracellular electron transfer in marine sediment microbes

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Though mineral oxidation is thought to play an important role in microbial food webs—for example driving dark carbon fixation—the microbes capable of these metabolisms, and/or the mechanisms used, remain poorly characterized. To better understand the mechanisms of microbe-mineral interactions from marine sediments, we developed electrochemical cultivation techniques, to target enrichment and isolation of microbes capable of oxidative extracellular electron transfer (EET). Using these techniques in a marine sediment (Catalina Harbor, USA), we isolated a variety of electrode oxidizing microbes from the genera *Thioclava*, *Marinobacter*, *Halomonas*, *Idiomarina*, *Thalassospira*, and *Pseudomonas*; organisms commonly detected in marine sediments but not generally associated with mineral, sulfur and/or iron oxidation. This presentation will discuss the electrochemical and genomic evidence for EET mechanisms in these isolated strains. Several of these isolates are facultatively heterotrophic, and we have recently used high throughput genetic screens to identify genes involved in EET. One such screen, applied to the Alphaproteobacteria strain *Thioclava electrophaga* ElOx9, identified 14 genes exclusively essential for growth under electrode-oxidizing conditions. From these genes, several poorly characterized oxidoreductases and hypothetical proteins point to a novel mechanism of electron uptake in *Thioclava*. In addition to discussing the electrochemical and genetic basis for EET, we will also discuss the ecological insights provided from our genomic investigations and lab cultivations studies. Specifically, our work points to the importance of elemental sulphur as a source and potential sink for electrons in the environment these microbes were isolated from. Additionally, microbe-microbe interactions using EET likely play an important role in the ecology of these microbes, allowing them to bridge spatial gaps between oxidants and reductants, which has important implications for understanding and predicting the geochemical conditions where mineral oxidation is occurring.