Faculty Excellence Speaker Series

UCF

MICROBIOMES AND MICROBIAL FUEL CELLS FOR SUSTAINABLE SANITATION

Presented by Dr. Orianna Bretschger

DATE
Monday,
December 5, 2016

TIME
1:15 – 2:15 p.m.

LOCATION
Teaching Academy,
Room 201

HOSTED BY
Faculty Excellence, the Office of the Provost, Genomics and Bioinformatics Cluster, and the Department of Computer Science

Microbial extracellular electron transfer is a process whereby microbes can respire solid-phase electron acceptors, or use solid-phase electron donors as an energy source. The energy derived from extracellular electron transfer into, or out of, a cell is used to facilitate growth and other microbial functions. Microbial extracellular reactions have been shown to drive geochemical cycling in soils, sediments and water columns; and these processes can also be applied to biotechnology applications for energy recovery and wastewater treatment using systems called microbial fuel cells.

To better understand how extracellular electron transfer may occur and be regulated within mixed microbial communities, a stimulus-induced metatranscriptomic approach has been developed to characterize the dynamic responses of key genes associated with electron transfer reactions in complex consortia. Results suggest a high diversity of microbes able to catalyze extracellular electron transfer reactions; and preferential syntrophic relationships between taxa that arise as a function of specific surface potentials.

Building on these results, we have designed microbial fuel cell systems to select for 'electrogenic' microbes that can convert the chemical energy bound in waste organics into direct electricity. This presentation will cover how pilot-scale installations of these systems for the treatment of swine and human waste have shown that microbial fuel cells can provide a sustainable mechanism for improved sanitation and water recycling.

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Orianna Bretschger, Ph.D.
Associate Professor in the Electromicrobiology group at the J. Craig Venter Institute

Orianna Bretschger, Ph.D., received her B.S. in Physics and Astronomy at the University of Northern Arizona, and after a five year career in aerospace and consulting, she completed a Ph.D. in Materials Science at the University of Southern California. Dr. Bretschger joined the J. Craig Venter Institute in 2008. Over the course of her research tenure, she established a productive team of researchers dedicated to understanding the fundamental mechanisms associated with extracellular electron transfer (a process that enables microbes to respire solid surfaces, i.e., "breathe rocks") and applying that understanding to technology development for bioremediation, bioenergy, and water recycling.