

Emily Gardel



Graduate Institution: Harvard University

Location: Cambridge, MA

Graduate Discipline: Applied Physics

Hometown: Acton, MA

Research Interests:

Broadly, I am interested in how microorganisms interact with their surroundings and subsequently play a major role in our Earth's biogeochemistry. Metabolic pathways in microorganisms utilize pairs of reduction-oxidation reactions to gain energy through the transport of electrons within the cell, and eventually, across the cellular membrane. The variety of substrates used as electron donors and the compounds used as terminal electron acceptors is as broad as the diversity of microorganisms themselves. During respiration, a microorganism oxidizes organic material to carbon dioxide, producing electrons that require a terminal electron acceptor to complete the process. For aerobic respiration this electron acceptor is oxygen, but for the majority of microorganisms on Earth that are anaerobes a variety of oxidants, including solid-phase oxidants, are used instead of oxygen. There is tremendous potential for utilizing this phenomenon for industrial bioprocessing such as anaerobic digestion and enzyme production, as well as the generation of energy from natural and anthropogenic carbon. This potential has spurred significant research in the field of microbial fuel cells (MFC) which are systems that harness electricity from anaerobes by separating the locations of oxidation and reduction reactions. Since MFCs are able to generate electricity through the process of breaking down organic material, there are diverse applications for MFCs ranging from energy production or co-generation, bioremediation of toxins including radioactive materials such as uranium, and industrial bioprocessing such as enzyme production.

About me:

My interest in microbe material interactions is motivated by my desire to contribute to learning more about our environment and finding solutions to energy issues. As a student co-advised by Peter Girguis, a marine microbiologist, and Joanna Aizenberg, a materials scientist, I am very excited about the prospects of this research as it pertains to understanding microbial physiology as well as the technological advances. I have been involved in Harvard Graduate Women in Science and Engineering (HGWISE) as a co-chair, Harvard's Consortium on Energy and the Environment, and mentored several undergraduates. My interest in the environment extends to outdoor activities including camping, bicycling and gardening.



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