Abstract Submitted
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The impact of shearing flows on electroactive biofilm formation, structure, and current generation[1] A-ANDREW JONES, CULLEN BUIE, Massachusetts Institute of Technology — A special class of bacteria exist that directly produce electricity. First explored in 1911, these electroactive bacteria catalyze hydrocarbons and transport electrons directly to a metallic electron acceptor forming thicker biofilms than other species. Electroactive bacteria biofilms are thicker because they are not limited by transport of oxygen or other terminal electron acceptors. Electroactive bacteria can produce power in fuel cells. Power production is limited in fuel cells by the bacteria's inability to eliminate protons near the insoluble electron acceptor not utilized in the wild. To date, they have not been successfully evolved or engineered to overcome this limit. This limitation may be overcome by enhancing convective mass transport while maintaining substantial biomass within the biofilm. Increasing convective mass transport increases shear stress. A biofilm may respond to increased shear by changing biomass, matrix, or current production. In this study, a rotating disk electrode is used to separate nutrient from physical stress. This phenomenon is investigated using the model electroactive bacterium *Geobacter sulfurreducens* at nutrient loads comparable to flow-through microbial fuel cells. We determine biofilm structure experimentally by measuring the porosity and calculating the tortuosity from confocal microscope images. Biofilm adaptation for electron transport is quantified using electrical impedance spectroscopy. Our ultimate objective is a framework relating biofilm thickness, porosity, shear stress and current generation for the optimization of bioelectrochemical systems

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A-Andrew Jones
Massachusetts Institute of Technology

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