

Connecting Electron Flow and Gene Expression in Cells for Multi-Channel Electrogenetics

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Project Summary: The DoD has recognized that biotechnology and synthetic biology are poised to revolutionize the world in the coming decades. Some of the most exciting game-changing technologies aim to seamlessly integrate living and non-living components, for which we must develop key capabilities such as fast, dynamic, and remote cell-device communication. With these goals in mind, we have pioneered electrogenetics - synthetic biology constructs that utilize electronic signals to control engineered gene expression. Reaching this technology's exciting potential relies on a thorough understanding of redox and electron flow inside of cells and between cells and electrodes. In this LUCI, we therefore propose to develop this greater understanding by 1) integrating extracellular electron transfer (EET) proteins into electrogenetic circuits and 2) investigating the kinetics of bio-electronic interactions in these systems. The insights gained from this project will provide significantly better understanding of bioelectronic interactions and provide fundamental contributions to the field of synthetic biology, a key area for biotechnology modernization in the DoD.
