Understanding Spatio-Temporal Information Processing in the Brain Using Flexible Opto-Electronics and Genetic Engineering

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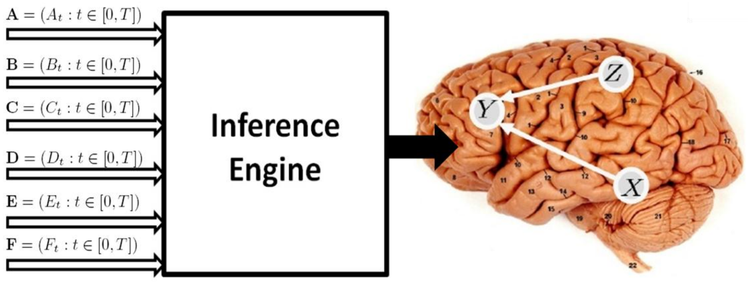
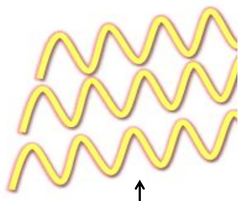
Introduction

We seek to develop a technology that allows us to merge genetic engineering and molecular biology with advances in bio-integrated flexible electronics so that we can interrogate normal brain function with specificity, resolution, and precision better than we can today. Employing the tools of optogenetics, we can interrogate individual neurons in order to better understand the function of specific neurons as well as wider neural circuitry. Integrating this method with our flexible, biologically compatible electronics will allow us to engineer and control specific cell types, allowing for a better understanding of the function of specific cells as well as the spatiotemporal dynamics of the neural code. We seek to characterize information flow in the brain and properties of the individual modules.

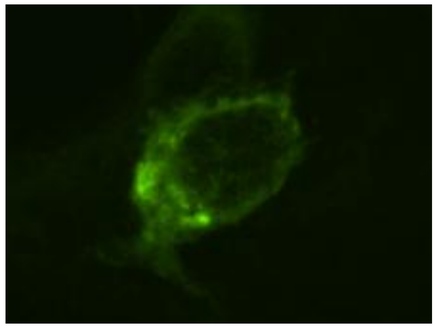
Purpose: Understanding Neural Connectivity and Brain Function



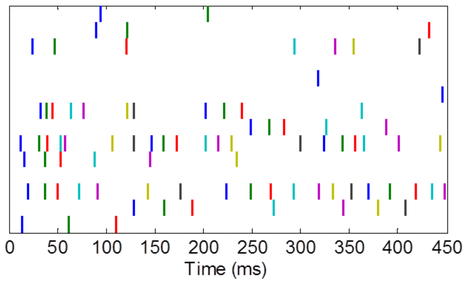
Optogenetics



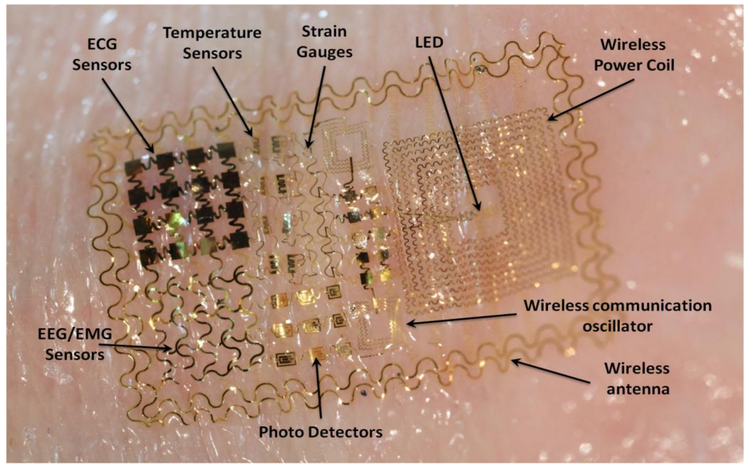
Specific wavelength of light



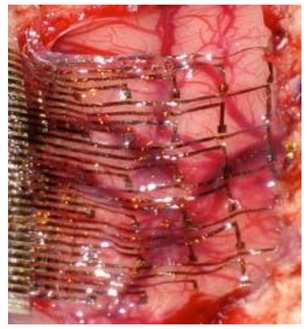
Activate: Channelrhodopsin
Inhibit: Halorhodopsin



Flexible, Biologically Compatible Electronics



Characterizing Neural Circuits



Questions to Address

- Specification and identification of modules (functional, spatial, temporal, etc.) from data
- Quantitative and qualitative comparison of modules
- Understanding spatio-temporal information processing

References:
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