Out of the Electric Box: Optical Stimulation of Neural Tissue
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The goal for neuroprostheses is to restore neural function to the fidelity of a healthy system. Contemporary neural prostheses aim to achieve this via electrical stimulation of the remaining neurons. Despite the research advances and clinical implementation of neuroprostheses, there are several challenges that face neurostimulation. One of the main hurdles for neuroprostheses is achieving spatially and temporally selective stimulation. Several strategies have been employed to increase the spatial selectivity of electrical stimulation (ES). Multipolar electrode configurations have been employed to increase the selectivity of stimulation. Cuff electrodes have been successfully used in several chronic animal and human studies to stimulate motor neurons, and the optic nerve. Penetrating electrodes also allow for more spatially focused stimulation by inserting the stimulating source into the nerve tissue.

A key emerging technology in the field of neural excitation is the application of pulsed infrared (IR) light to precisely stimulate small populations of neurons. Laser light, of the appropriate parameter set, can reliably elicit neural action potentials in a non-contact manner. This technology, due to the inherent ability to focus light to micron-level spots, presents a fundamental paradigm shift in the field of neural stimulation. Unlike in ES, infrared neural stimulation (INS) contains no stimulation artifact. INS also eliminates potentially harmful by-products of the electro-chemical reactions involved in electrical stimulation.

The presentation will review the current status of INS and will give results of recent efforts to build and test a small chronically implantable device.

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