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Neural Prosthesis Seminar

Interrogating Neural Circuits with Electronic, Optical and Magnetic Materials

Friday, November 13th, 2015 • 8:30 AM

Biomedical Research Building 105
Case Western Reserve University

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Abstract

The mammalian nervous system is often compared to an electrical circuit, and its dynamics and function are governed by ionic currents across the membranes of neurons. Many neurological disorders are characterized by inhibited/amplified neural activity in a particular region or lack of communication between the two regions of the nervous system. Current approaches to treatment of these disorders have limited effectiveness, and often rely on mechanically invasive and bulky devices. There is a pressing need for biocompatible materials and devices allowing for precise minimally invasive manipulation and monitoring of neural activity.

In Bioelectronics Group, we are taking two complimentary materials approaches to neural recording and stimulation: (1) Flexible polymer and hybrid optoelectronic fibers for intimate neural interfaces; (2) Magnetic nanomaterials for minimally invasive manipulation of neural activity. In my talk, I will illustrate how a fabrication process inspired by optical fiber production yields flexible multifunctional probes capable of optical, electronic and pharmacological interfaces with neural tissues in vivo1,2. I will then demonstrate how these fiber-based neural probes can be tailored to applications within a specific part of nervous system such as the brain or spinal cord. Finally, my talk will cover materials synthesis and physics that enable minimally invasive neural stimulation via functional fusion of magnetic nanomaterials and ion channels on neuronal membranes3. I will describe applications of the remote magnetothermal paradigm in stimulation of intact brain circuits, and illustrate how materials design can enable multiple interrogation modalities with alternating magnetic fields.

For more information, please contact Cheryl Dudek
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