T_cSUH Bi-Weekly Seminar

Texas Center for Superconductivity at the University of Houston

Prof. Jack Wolfe

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Room 102, University of Houston Science Center
12:00 Noon – 1:00 p.m.

Probes for optogenetic interrogation and precise localization of neural circuits

Abstract

The function of a cortical neuron depends on its microcircuitry – the inputs it receives from local and long-range connections and the outputs it sends to other neurons.[1] Optogenetics[2,3] uses genetic manipulations to insert opsin containing ion channels into cells. Then light can be used to optically gate ion-transport across the plasma membrane to control spiking activity with millisecond precision. Coupled with virus-mediated RNA transfer, this capability enables the determination of neural circuits with greater cellular specificity and spatio-temporal resolution than previously possible. There is now a critical need in optogenetics for integrated probes with an optical channel for neural stimulation and an array of closely spaced, high resolution electrodes for 3-D mapping the neuronal response.

While planar silicon technology may be able to provide a solution in the shallow, cortical regions of the brain, fine wire-like probes will be needed for deeper structures, including the cortical sulci, the geniculate nucleus, and the brain stem. In this talk, we will discuss the development of the first optrode technology for deep brain studies to be compatible with high-throughput manufacturing. The central probe concept is a fine optical fiber with high-precision, thin film tetrodes and associated conductor wiring arranged in tiers on its surface. The fiber substrate enables lossless light delivery for optogenetic interrogation while the use of thin film conductors enables high electrode counts with no increase in diameter. A high density, 6-tetrode sensor promises high precision 3-D mapping of neuronal dipoles throughout the recording volume. *In-vivo* recordings of photostimulated neural activity in *galagos*, a prosimian primate, using a 2-channel prototype will be presented.

[1] R. Douglas and K. Martin, *Annual Review of Neuroscience* **27**, 419-451 (2004).
[2] K. Deisseroth, *Nat Methods* **8,** 1, 26-29 (2011).
[3] F. Zhang *et al*., *Nat Protoc* **5**, 439-456 (2010).

Bio

Dr. Jack Wolfe is Professor of Electrical and Computer Engineering and of Physics at UH. He received a Ph.D. in Mathematical Physics at the University of Rochester in 1973. Since joining UH in 1976, his work has focused on fabrication techniques for nanoelectronics. He thanks the Alliance for Nanohealth, the Texas Center for Superconductivity, and the Cullen Foundation for generous support for this project.

Persons with disabilities who require special accommodations in attending this lecture should call (713) 743-8213 as soon as possible.

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