ELSC Seminar: Noam Shemesh

October 24, 2013

On the topic of: "Noninvasively Probing Complex Neural Tissue Micro-Architecture and Metabolic Confinements in-vivo"

ELSC & ICNC cordially invite you
to the lecture given by:

Noam Shemesh
Chemistry Faculty, Weizmann Institute of Science.

On the topic of:

"Noninvasively Probing Complex Neural Tissue Micro-Architecture and Metabolic Confinements in-vivo"

The lecture will be held on Thursday, October 24, 2013
at 17:00, at ELSC-ICNC: Silverman Bldg., 3rd Wing, 6th Floor, Edmond J. Safra Campus

Light refreshments at 16:45

Abstract:

Neuronal tissue architecture is highly complex, encompassing myriad structures and sub-structures which vary in size, shape and degrees of organization. Identifying these structures in-vivo is paramount for understanding development, connectivity, and disruption of brain function. Magnetic Resonance Spectroscopy (MRS) and Imaging (MRI) can be sensitized towards molecular diffusion, which can be used to resolve the orientation of highly ordered white matter fibers (e.g., via DTI); however, such methods are inherently tenuous when applied to more heterogeneous systems. Prominently, in most gray matter (GM) tissues, cellular components generally lack a principal orientation director; thus, inferring the underlying micro-architecture (for example the eccentricity of randomly oriented components) is highly challenging. Furthermore, obtaining information on compartment sizes (rather than orientations), is inherently difficult. In the lecture, we shall discuss the development and application of two novel MRS and MRI techniques (double-Pulsed-Field-Gradient (dPFG) and Non-uniform-Oscillating-Gradient-Spin-Echo (NOGSE)), that provide unique noninvasive insights into tissue micro-structure. We shall see how dPFG MRS and MRI experiments can reveal compartment eccentricities in model systems, cells, isolated neuronal tissues, and in ex- and in-vivo rat brains. The new contrasts that were developed can be used to characterize, for example, cortical layers in brain GM. We will then show that NOGSE-MRI ? a technique developed to enhance sensitivity to compartment sizes ? can reveal cellular size distributions in cells and brains. In the
final part of the lecture, a new spectral phenomenon termed Longitudinal Relaxation Enhancement (LRE) will be presented for several CNS metabolites, which can be used to significantly enhance the fidelity of MR Spectra. A combination of LRE and dPFG MRS will be shown, revealing, for the first time, metabolic confinements in stroked rats in-vivo at ultrahigh (21.1T) magnetic field.

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