PIONEERS IN BIOMEDICAL RESEARCH SEMINAR

Presented by the Fralin Biomedical Research Institute at VTC and co-sponsored by the institute's Executive Director

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Three-photon Imaging of Neurons, Synapses, and Blood Vessels Reveals the Neural Basis of fMRI across Cortical Layers and the White Matter

The primary visual cortex (V1) is ideally suited to study the spatial organization of neurovascular coupling at the level of synapses, neurons, individual blood vessels and laminar-resolution fMRI. This is because, at least in layers 1 and 2/3 of V1, the functional micro-architecture for neurons, synapses and blood vessels has been determined using 2-photon imaging. Hence, feature selectivity, e.g., orientation and direction selectivity of spiking, synaptic and hemodynamic activity in layer 2/3 is known. However, the micro-architecture of layer 4 neural activity (spiking and synaptic) along with individual blood vessel responses is unknown because conventional 2-photon imaging cannot access deeper cortical layers. The organizing principles of neural maps and the selectivity of hemodynamic responses is of paramount importance for laminar processing because the thalamic inputs arriving into layer 4 are untuned. 3-photon imaging triples the imaging depth compared to 2-photon imaging. Using this optical technique and high-resolution fMRI, Dr. Kara and his lab have determined the extent to which different types of neural (spiking, synaptic) and vascular signals (blood flow from individual vessels and fMRI voxels) are coupled across cortical layers and the white matter. The team's data show systematic changes in selectivity of hemodynamic signals across cortical depth that have clear underpinnings in neural circuitry and the propagation of hemodynamic signals.

FRIDAY, MAY 31, at 11 a.m.

Room G101 A/B, 4 Riverside Circle

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