HIGH-SPEED MULTI-FUNCTIONAL OCT IMAGING SYSTEM FOR THREE DIMENSIONAL IMAGING OF BIOLOGICAL SAMPLES

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We report the development of high-speed OCT imaging systems that can perform video-rate imaging of biological tissue samples with a few millimeters imaging depth. The system combines standard OCT with Doppler OCT and OCT angiography functions to image the biological sample structure and blood flow simultaneously in real-time.

The OCT imaging system has been designed to use either a high-speed swept source laser or a high speed spectrometer to acquire depth resolved OCT signals from the sample and support both 2-D and 3-D imaging capabilities. The 1300 nm center wavelength allows 1-2 mm imaging depth in most biological samples deeper than multi-photon microscopy. Three-dimensional OCT data provides coherence gated *en-face* images similar to optical coherence microscopy (OCM), and also enables the generation of images similar to confocal microscopy by summing signals in the axial direction. High-speed 3D OCT imaging can provide comprehensive data that combines the advantages of optical coherence tomography and microscopy in a single system.

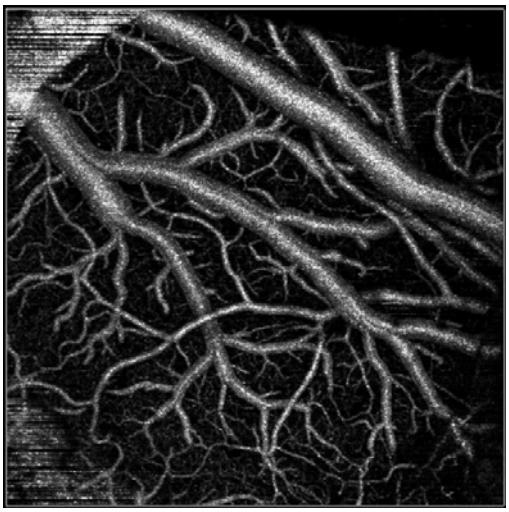

Figure 1, In-vivo imaging of rat brain vasculature using a recently developed 1300 nm OCT imaging system.

The high-speed OCT system has been developed as a new imaging tool for non-contact, non-destructive imaging of tissue structure and physiology. Compact imaging probe and microscope add-on modules are also developed. By optimizing system design, scanning protocols, and algorithms, the system can be used for rapid imaging of the cortical vasculature in rat brain and cardiac dynamics in tadpole heart with movies and images are also demonstrated.

References:

[1] Rapid volumetric angiography of cortical microvasculature with optical coherence tomography,V. J. Srinivasan, J. Y. Jiang, M. A. Yaseen, H Radhakrishnan, W. Wu, A. E. Cable, and D. A. Boas, Optics Letters Vol. 35, Iss. 1, pp. 43–45 (2010)