

AbstractID: 5572 Title: Optical-Computed-and Emmission Tomography: applications in cancer research

Purpose: This work explores the potential of optical-computed and emission-tomography (OCT/OET), when coupled with optical clearing techniques, for imaging aspects of biological structure and function for cancer research. OCT/OET are the optical analogues to x-ray-CT and SPECT respectively, and can yield high resolution high contrast 3D images of a variety of inherent or applied absorbing and fluorescing stains.

Materials and Methods Several methods of staining tissue have been explored and applied to a range of tissue types. Xenograph tumor micro-vasculature was labeled with both passive absorbing stain and fluorescing active probes (e.g. lectin conjugated with FITC) by tail vein injection. Murine vasculature in major organs (lung, heart, brain) were stained with absorbing dye in a similar manner. OCT/OET imaging was performed using an in-house custom built scanner. Isotropic 3D transmission and emission data were reconstructed using tomographic algorithms from equi-angularly spaced projection images.

Results Isotropic high resolution 3D image data of the xenograph tumor showed extensive peripheral micro-vasculature with the occasional larger vessels penetrating to the tumor core. High-quality 3D images of the lungs were achieved showing clear differences in perfusion between irradiated and unirradiated lung regions. Exquisite high contrast images were acquired of the vasculature and myo-cardial perfusion of the murine heart.

Conclusion Primary advantages of OCT/OET include the preservation of tissue structure in 3D (tissue sectioning is not required), and the ability to acquire co-registered images of both structure (e.g.micro-vasculature) and function (e.g. perfusion, gene expression). Higher spatial resolution and higher contrast is achieved when compared with alternative modalities like micro-CT and micro-MRI. The techniques are versatile as imaging can be performed on a wide variety of absorbing and fluorescing stains.