AbstractID: 5563 Title: 3D Optical Imaging of Tumor Microvasculature and Viable Cell distribution

Purpose: The ability to image 3D global structure (e.g. microvasculature) and function (e.g. gene expression) in whole unsectioned tumors, in high-resolution and with high-contrast, is of significant present interest in cancer research. We have developed novel optical imaging techniques capable of reconstructing the 3D distribution of absorbance or fluorescence-emitting sources in tumor tissue. Primary advantages include high spatial resolution and contrast, and ability to image a wide range of molecular probes.

Method and Materials: Constitutive RFP expressing HCT116 (human colon carcinoma) xenograft tumors were implanted in hind legs of nude BALBC mice. The tumor microvasculature was dual-stained by *in vivo* tail vein injections of light attenuating isotonic ink and FITC lectin. The tumor was excised post-staining and subjected to a fluorescence-friendly clearing procedure to render it amenable for optical imaging. Quantitative images of microvascular density and viable-cell distribution were reconstructed using tomographic algorithms from a set of transmission and fluorescent projection images acquired at multiple angles using appropriate filters, focusing optics and a CCD camera.

Results: Co-registered, multimodal, high-resolution and high-contrast 3D reconstructions were achieved through large, (~1cm) whole mount, murine tumor samples. Quality assurance tests indicated encouraging accuracy of reconstructed attenuation coefficients and geometry. The 3D reconstructed slices were juxtaposed with histological slices of the same tumor to reveal striking correlation between viable-cell distribution and well-perfused regions. A fluorescence friendly clearing procedure was identified.

Conclusion: We present a novel technique for multi-modality optical imaging of 3D microvasculature and/or viable cell distribution in tumor tissue with unprecedented image resolution and contrast. The technique has potential to image a wide variety of tumor and normal tissue structure and function. Of particular interest is the potential to analyze the effect of anti-angiogenic agents and radiation therapy on the response of the entire 3D tumor microvasculature network.

Conflict of Interest (only if applicable):