

PhD Thesis title: 'Computer-Aided, Multi-Modal, and Compression Diffuse Optical Studies of Breast Tissue'

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ABSTRACT:

Diffuse Optical Tomography and Spectroscopy permit measurement of important physiological parameters non-invasively through ~10 cm of tissue. I have applied these techniques in measurements of human breast and breast cancer. My thesis integrates three loosely connected themes in this context: multi-modal breast cancer imaging, automated data analysis of breast cancer images, and microvascular hemodynamics of breast under compression.

As per the first theme, I describe construction, testing, and the initial clinical usage of two generations of imaging systems for simultaneous diffuse optical and magnetic resonance imaging. The second project develops a statistical analysis of optical breast data from many spatial locations in a population of cancers to derive a novel optical signature of malignancy; I then apply this data-derived signature for localization of cancer in additional subjects. Finally, I construct and deploy diffuse optical instrumentation to measure blood content and blood flow during breast compression; besides optics, this research has implications for any method employing breast compression, e.g., mammography.

References to author publications that relate specifically to the dissertation:

Busch DR, Guo W, Choe R, Durduran T, Feldman MD, Mies C, Rosen MA, Schnall MD, Czerniecki BJ, Tchou J, DeMichele A, Putt ME, Yodh AG. 'Computer aided automatic detection of malignant lesions in diffuse optical mammography.' Med Phys. 2010 Apr;37(4):1840-9.