Abstract for an Invited Paper
for the SES09 Meeting of
The American Physical Society

The Development of Combined Raman Spectroscopy-Optical Coherence Tomography and Application for Skin Cancer Diagnosis[1]

CHETAN PATIL, Vanderbilt University

Optical spectroscopy and imaging have shown promise for performing rapid, non-invasive disease detection and diagnosis *in vivo*. Independently, Raman Spectroscopy (RS) has demonstrated the ability to perform diagnosis of epithelial cancers such the cervix with excellent overall classification accuracy due to the inherent biochemical specificity of the technique, however relating features of tissue morphology with techniques such as Raman mapping is clinically impractical due to the weak nature of the scattering phenomena resulting in prohibitively long acquisition times. Optical Coherence Tomography (OCT), on the other hand, has demonstrated the ability to perform real-time, high-resolution, cross-sectional imaging of the microstructural characteristics of disease, but typically lacks molecularly specific information that can assist in classifying pathological lesions. We present the development of a combined Raman Spectroscopy-OCT (RS-OCT) instrument capable of compensating for the limitations of each technique individually and performing both biochemical and microstructural evaluation of tissues. We will include the design and development of benchtop RS-OCT implementations based on independent 785 nm Raman and 1310 nm time-domain OCT system backbones, as well as with a 785nm Raman / 850nm spectral-domain OCT setup employing an integrated detection arm. These systems motivated the ultimate design of a clinical RS-OCT system for application in dermatology. In order to aid in the development of our Raman spectral processing and classification methods, we conducted a simultaneous pilot study in which RS alone was used to measure basal and squamous cell carcinomas. We will present the initial results from our clinical experiences with the combined RS-OCT device, and include a discussion of spectral classification and the ultimate potential of combined RS-OCT for skin cancer diagnosis.

[1]NIH R21 CA133477