



INDIAN INSTITUTE OF TECHNOLOGY KANPUR

Centre for Laser Technology/Laser Technology Program



IV

Ramachandra Rao Dasari Distinguished Lecture



(<http://web.mit.edu/spectroscopy/people/dasari.html>)

SPEAKER



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TOPIC: Cancer pathology using infrared spectroscopic imaging

DATE/TIME: February 29, 2008 (**Friday**)/ 5 PM

PLACE: L-13

All interested are cordially invited

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ABSTRACT

Fourier transform infrared (FTIR) spectroscopic imaging is a strongly emerging technique that combines the molecular selectivity of spectroscopy with the spatial specificity of optical microscopy. Hence, the technique is capable of providing molecularly specific imaging without the use of probes or specialized reagents. The data recorded being quantitative, numerical methods can be used to extract information objectively and reproducibly. We first demonstrate a new concept in obtaining high fidelity data using commercial array detectors coupled to a microscope and Michelson interferometer. Next, we apply the developed technique to automate human cancer diagnoses and grading. Traditionally, disease diagnoses are based on optical examinations of stained tissue and involve a skilled recognition of morphological patterns of specific cell types (Histopathology). Utilizing endogenous molecular contrast inherent in vibrational spectra, we employed specially designed tissue microarrays and pattern recognition to develop algorithms for automated classifications. The developed protocol is objective, statistically significant and, being compatible with current tissue processing procedures, holds potential for routine clinical diagnoses. We present the application of the concept to detection and grading of in biopsies for different tissue types. We first demonstrate that the classification of tissue type (histology) and that of disease (pathology) can be accomplished in a manner that is robust and rigorous. Since we employ a classifier based on linear combinations of spectral features, the biochemical basis of tissue recognition is apparent. Since data quality and classifier performance are linked, we quantify the relationship both analytically and empirically through our analysis model. We demonstrate that the classification of tissue is both possible and statistically controllable by using simple parameters to determine operating points. Last, we introduce a systems concept to the idea of automated pathology for prostate, breast and colon tissues. In particular, we demonstrate human competitive capability in recognizing histopathology and in automating disease diagnoses.