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(I) Quantitative label-free vibrational spectroscopic imaging and analysis in medical physics

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Label-free vibrational spectroscopic imaging based on inelastic (Raman) light scattering represents a rapidly emerging platform for biology and medicine. My research program in Medical Physics and Biomedical Engineering develops novel instrumentation and analysis methods based on Raman spectroscopy and Coherent Raman Scattering (SRS) imaging combined with other nonlinear optical imaging modalities such as Two-Photon Excitation Fluorescence (TPEF) and Second Harmonic Generation (SHG) imaging. This enables rapid chemical, structural and functional imaging with sub-cellular resolution, without the use of external chemical contrast agents. This talk will describe our recent work to advance new techniques that support the development of 1) quantitative optical imaging to measure the pathogen-specific single cell response, 2) high-resolution radiation dosimetry to assess exposure to ionizing radiation, and 3) optical biopsy to identify biomarkers of an aggressive variant of prostate cancer.

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