TSF16-2016-000028

Abstract for an Invited Paper
for the TSF16 Meeting of
the American Physical Society

Label-free Optical Detection of Bioanalytes for Cancer and Neurodisease Monitoring[1]

FELICIA MANCIU, Department of Physics, Border Biomedical Research Center, The University of Texas at El Paso

Although not yet ready for clinical application, methods based on Raman spectroscopy have shown significant potential in identifying, characterizing, and discriminating between bioanalytes responsible for cancer and neurodiseases. Real-time and accurate diagnosis achievable through this vibrational optical method largely benefits from improvements in current technological and software capabilities. Not only is the acquisition of spectra now possible in milliseconds and high throughput data analysis in minutes, but Raman spectroscopy also allows simultaneous detection and monitoring of all biological components. Besides demonstrating a significant Raman signature distinction between cancerous and noncancerous breast epithelial cells, we demonstrate that Raman can be used as a label-free method to evaluate epidermal growth factor (EGF) activity in tumor cells. Comparative Raman profiles and images of specimens in the presence or absence of EGF show important differences in regions attributed to protein and nucleic acid vibrations. Parallel Western blotting analysis reveals EGF induction of phosphorylated Akt protein, corroborating the Raman results of signal transduction from membrane to nucleus, with concomitant modification of DNA/RNA structural characteristics. We also demonstrate that confocal Raman mapping provides rapid, detailed, and accurate neurotransmitter monitoring, enabling analysis of biochemical dynamics. As a prototypical demonstration of the power of the method, we present real-time *in vitro* serotonin, adenosine, and dopamine detection, and dopamine diffusion in an inhomogeneous organic gel, which was used as a substitute for neurologic tissue. With the ultimate goal of clinically implementing Raman-guided techniques for diagnosis of tumors and neurodiseases, the current results lay foundations for developing label-free optical tools.

[1]This work was supported by a research agreement between the University of Texas at El Paso and the Mayo Clinic and by NIMHHD/NIH grant 2G12MD007592.