



BioSystems Science and Engineering

STUDENT - WORK PRESENTATION

4:00 pm, OCT 23, 2017
MRDG Seminar Hall



BIOMOLECULAR PROFILING OF SEPSIS USING RAMAN SPECTROSCOPY

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Abstract

The last few decades have been witness to the tremendous technological advancements in biology. Several new techniques have contributed to better understanding of diverse biological systems. Raman spectroscopy is an excellent example of one such technique. It is a well-established tool to understand molecular structures and chemical compositions of heterogeneous systems. Although Raman Spectroscopy has traditionally been a chemist's tool, there has been a notable rise in its use in addressing biological questions. Its usefulness stems from the fact that it is non-invasive, label free and non-destructive. Biological samples are complex and are made up of several biomolecules like proteins, lipids, carbohydrates and nucleic acids. These molecules have unique structures and therefore yield unique spectral fingerprints which can be tracked during disease or any other biological process.

In the present work, one such application of Raman spectroscopy will be discussed, where we show biomolecular profiling of inflammatory scenarios in three different mice models: *Salmonella* Typhimurium-induced sepsis, Lipopolysaccharide-induced endotoxic shock and Thioglycollate-induced peritonitis. Notably, the first two models invoke a systemic inflammatory response while the third model generates a localized inflammation. The Raman spectra obtained in a kinetic manner from the sera of these three mice models show changes in various biomolecules, including cell-free DNA, aromatic amino acids and lipids. This study highlights the potential of Raman spectroscopy as a novel diagnostic tool for timely detection of inflammatory responses, including sepsis.

Bio of Student

Taru Verma did her Masters in Biotechnology from Nagpur University and joined BSSE as a Ph.D. student in 2013. Currently, she is working on the diverse applications of Vibrational Spectroscopy (Infra-red and Raman Spectroscopy) in the field of biology. Some of these applications include early detection of sepsis in mice as well as human patient samples, studying antibiotic resistance in bacteria and differentiation of closely related bacterial strains.

Publications

- 1) Bhaskarla C, Das M, Verma T, Kumar A, Mahadevan S, Nandi D. Roles of Lon protease and its substrate MarA during sodium salicylate-mediated growth reduction and antibiotic resistance in *Escherichia coli*. *Microbiology*. 2016 May;162(5):764-76. doi: 10.1099/mic.0.000271.
- 2) Kumar S, Verma T, Mukherjee R, Ariese F, Somasundaram K, Umopathy S. Raman and infra-red microspectroscopy: towards quantitative evaluation for clinical research by ratiometric analysis. *Chem Soc Rev*. 2016 Apr 7;45(7):1879-900. doi: 10.1039/c5cs00540j.
- 3) Gautam R, Deobagkar-Lele M, Majumdar S, Chandrasekar B, Victor E, Ahmed SM, Wadhwa N, Verma T, Kumar S, Sundaresan NR, Umopathy S, Nandi D. Molecular profiling of sepsis in mice using Fourier Transform Infrared Microspectroscopy. *J Biophotonics*. 2016 Jan;9(1-2):67-82. doi: 10.1002/jbio.201400089.