Sandeep P. Ravindranath is a PhD student in Agricultural & Biological Engineering (ABE) department at Purdue University. He joined the department as a Master's student in 2007, worked on development of spectroscopic sensors for food-borne pathogen detection and received his MS degree in 2010. He continued his research towards his doctoral degree on bacterial chemical fingerprints using Raman spectroscopy for ultrasensitive detection of multiple chromate species in remediating bacteria. Upon graduation, he will continue his education in a business school in India.

Agricultural & Biological ENGINEERING

Dissertation Defense

Speaker: Sandeep P. Ravindranath

Title: Raman Chemical Imaging and Fluorescence Lifetime Microscopy Studies of Chromate Uptake, Localization, and Reduction in remediating bacteria.

Major Professor: Dr. Joseph Irudayaraj

Date: May 31, 2011

Time: 10:30 am

Place: ABE 212

Abstract:

Bioremediation, a natural process of detoxifying environment has the potential to be incorporated for effective treatment of toxic 'superfund' sites. One of the major challenges in effective implementation of bioremediative strategies is the current lack of a thorough understanding of the microbial processes that are responsible for the remediation of contaminated sites. This project aims to develop novel approaches, involving effective integration of ultrasensitive Raman spectroscopy and Fluorescence Lifetime imaging techniques with nanobiotechnology, to study intracellular chemical activities within single microorganisms.

Two unique methods of delivering nanoprobes into the usually inaccessible intracellular microenvironment of cells are used to study cellular chromate reduction activities in a ubiquitous metal reducer *S. oneidensis* MR-1 at single cell level. After careful optimization of SERS substrate delivery, sulfate and nitrate competition assays were detailed at single cell and multi-cell resolutions. Given the potential use of this environmentally important strain for biotechnological and bioremediation purposes, it is necessary that we increase our understanding of the fundamental biological processes enabling chromate reduction before improving environmental applications of *S. oneidensis* MR-1. The significance of this strain is reflected in the formation of the "*Shewanella* Federation", a multi-conglomerate Department of Energy (DOE)-funded group that applies bioinformatic, genomic and proteomic techniques to define the systems biology of *Shewanella*. The ability to map processes through the use of sensitive spectroscopic tools will complement these efforts by defining not only what processes are occurring, but also where they are occurring within the cell.