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SANDIA NATIONAL LABORATORIES**

**FRIDAY APRIL 13, 2012
9:30 - 10:30 AM
WCH 205/206**

LAB-ON-A-CHIP PLATFORMS FOR SINGLE CELL ANALYSIS

I will present advances made in my laboratory in analysis of single cell proteome and genome as described below.

1. Interrogating Cell Signaling with Single Cell Resolution: Cell signaling experiments currently are done using large number of cells and hence, provide population-averaged data that in many instances may be misleading. We are developing a “one-stop shop” platform that integrates cell handling and analysis with high-resolution imaging and flow cytometry to provide spatio-temporal measurement of signaling pathways with single-cell resolution. The platform is capable of imaging single cells to obtain dynamic translocation data as well as high-throughput acquisition of quantitative protein expression and phosphorylation information of selected cell populations. The platform consists of multiple modules such as single-cell array, cell sorter, and phosphoflow chips to provide confocal imaging, cell sorting, and flow cytometry-based phosphorylation assays. The various modules have been integrated into a portable package that can be mounted on a typical inverted microscope.
2. Single cell genomic analysis: Current metagenomic techniques (e.g., microarray or 16s rRNA sequencing) relying on pooled nucleic acids from lysed bacteria can independently measure metabolic activity and the species present, but can not link the activity deterministically to the species. We are developing high-throughput tools for studying bacteria one cell at a time, allowing us to unravel the complicated dynamics of population, gene expression, and metabolic function in mixed microbial communities (e.g., human microbiome). Our approach includes FISH-based identification of desired species, enrichment by cell sorting, followed by single-cell encapsulation, whole genome amplification and sequencing. Encapsulation of bacteria in pico-liter plugs in particular allows us to scale down conventional (microliter-volume) assays, such as WGA, into much smaller reaction volumes better suited to the size of an individual microbe.