



CMOP Undergraduate Intern Mentoring Opportunity

Deadline: **March 28, 2011**

Selections Announced: **April 1, 2011**

Name/Title/Institution(s) of senior mentor(s): Holly Simon, OHSU/CMOP

Name/Title/Institution(s) of frontline mentor(s): Vena Haynes, OHSU/CMOP and Mariya Smit, OHSU/CMOP

Project Title: Assay development for SLA sensor array format for rapid detection of microorganisms in environmental water samples

Context for project:

A major goal of CMOP is to characterize microbial activity with respect to changes in physical and chemical properties along coastal margins. The proposed summer intern project will be a part of our ongoing research on development of a technology for rapid and inexpensive detection of microbial sentinel species in environmental water samples.

Brief Description:

SHARP Laboratories of America (SLA) has developed a biosensor platform: the impedance-based sensor array. Each array is composed of fifteen gold interdigitated microelectrodes enclosed in a plastic, triple microfluidic chamber. Detection is achieved by impedance spectroscopy, for fast and label-free measurements in real time, and this technology is inexpensive and mass-produced by SLA. One major goal has been to show the applicability of the SLA sensor array to be used for genomic assays. To detect individual microorganisms of interest, we chose three model genes present in *Escherichia coli*, two of which are present only in pathogenic strains. PCR amplification was performed to generate DNA targets ranging from 300 to 500 nucleotides in length. The sensor array surface was functionalized with DNA oligonucleotide probes complementary to the targets of interest. Target-probe hybridization on the sensor surface was detected in real time (5-10 min) by changes in sensor impedance, providing kinetic measurements for accurate target quantification. The assay conditions were optimized and the sensor array showed hybridization selectivity for double-stranded DNA specific targets.

The SLA sensor array format needs to be tested for a comparison of double-stranded and single-stranded DNA target:probe hybridization, as well as RNA target:probe hybridization. We also need to perform calibration of the SLA sensor array response to DNA-DNA hybridization by using quantitative PCR experiments to determine corresponding gene copy numbers. In addition, we are just beginning quantification of the hybridization response and data analysis of specific versus non-specific hybridization needs to be performed. A data analysis algorithm has been incorporated into the new SLA sensor Reader,

both of which need to be tested. Another important goal is to further develop target preparation protocols for microbes of interest, starting from DNA isolation, PCR amplification of targets, all the way to SLA sensor response calibration.

Proposed Outcomes/Broader Impact:

This project, developed for a CMOP undergraduate summer intern, will expand our collaboration with Sharp Labs of America. The intern will learn state-of-the-art molecular biological techniques by performing nucleic acid isolation, purification, PCR, nucleic acid hybridizations, and biosensor data acquisition and analysis. Results from this project will contribute to our overall goals in CMOP, which are to understand biological changes with respect to chemical and physical parameters along the Columbia River coastal margin, and to educate undergraduate students about science and the environment using hands-on research. This project will also contribute to the future CMOP goal of developing a fully automated, deployable biosensor.

The final report will summarize the results of target preparation and target-probe hybridizations. An additional effort will be necessary to complete and organize the laboratory notebook. The final report will also include some analysis of biosensor performance for the new platform developed by SLA. The report will be shared with the SLA researchers.

Proposed timeline (within a 10 week span):

From mid-June until the end of August.

Intern academic experience and skill set should include:

Basic laboratory skills will be developed during the project, with the special emphasis on nucleic acid handling and quality control. To develop and apply these skills within the framework of a 10-week summer internship, the student should possess a strong background in biology and chemistry: biology, chemistry, microbiology major, junior or senior level.