# CMOP Undergraduate Intern Mentoring Opportunity

Deadline: **March 28, 2011**
Selections Announced: **April 1, 2011**

Name/Title/Institution(s) of senior mentor(s): **Holly M. Simon**, Assistant Professor, OHSU

Name/Title/Institution(s) of frontline mentor(s): **Mariya Smit**, Senior Research Associate, OHSU

**Project Title: Isolation of total DNA and RNA for microarray analysis and high throughput sequencing of environmental metagenome and metatranscriptome of the Columbia River Ecosystem**

**Context for Project:** A major goal of CMOP is to characterize microbial activity and microbial community composition with respect to environmental gradients and changes in physical and chemical properties along coastal margins. The proposed summer intern project will be a part of our ongoing research on analysis of metagenome (total DNA) and metatranscriptome (total RNA) of the microbial communities of Columbia River and coastal ocean using DNA oligonucleotide microarrays and high throughput sequencing.

**Brief Description.**

This project is related to the following topics from CMOP Research Roadmap and Strategic Implementation Plan:

| Project Name: **DNA microarrays** | |
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| Project number #: III.1.2 | Charter #): 040 (formerly, 037, 038) |

Contribution to CMOP vision, central questions, and hypotheses: central questions, Q1, the roles of microbial assemblages relative to ecological function and energy transfers in the CRCM, and Q4, environmental sentinels.

FH1a-c, FH2b

Currently, the DNA microarrays are being used to analyze phylogenetic composition of microbial groups of interest in the CRCM, and to elucidate gene expression patterns associated with environmental gradients and seasonal changes of physical and chemical factors. The mid-density (2240 features) platform of the CombiMatrix arrays allows for hundreds to thousands of probes to be tested and the most suitable probes among them to be identified. In addition, the data allow for analysis of variations in microbial community compositions and functioning along the E-GRs of the CRCM. One manuscript focused on gene expression changes has been published, and another one on the phylogenetic composition of microbial communities is in preparation.

The next stages of the proposed research will (i) expand the analyzed sample set to analyze year-to-year and seasonal variation, (ii) provide a fine-resolution time-scale snapshots of microbial community composition and gene expression; (iii) generate sufficient amounts of total DNA and RNA for high throughput sequencing of environmental metagenome and metatranscriptome. We will select a set of 32 samples from May and September cruises of 2010 and compare them with the existing data from 2007-2009.

The project developed for a CMOP undergraduate summer intern is one that will expand our collection of total DNA and RNA samples. This will be accomplished through total DNA and RNA isolation from 32to filtered water samples from 2010 cruises. The intern will learn state-of-the-art molecular biological techniques by performing isolation, purification, and quality control of total nucleic acid fractions. The summer intern will also learn techniques involved in microarray hybridization, and participate in data acquisition and analysis.

**Synergy with other CMOP projects/programs**: II.2.3 Characterizing communities (Zuber, Crump), II.2.6 Biogeochemical variability and microbial activity associated with E-GRs (Prahl, Needoba and Peterson); III.1.3 Low-cost biosensors (Smit and Simon), III.1.10 Environmental sample processor (ESP) (Smit and Simon).

**Proposed Outcomes/Broader Impact:**

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. The final report will summarize the results of nucleic acid isolations, including an EXCEL spreadsheet that will serve as the sample database. An additional effort will be necessary to complete and organize the laboratory notebook. The final report will also include some analysis of nucleic acid isolation data in the context of environmental parameters provided by other CMOP researchers, including sampling location, salinity, chlorophyll A content, bacterial production, oxygen concentration, water temperature, etc.

**Proposed timeline (within a 10 week span):** For each of the first 8 week, 3 full days will be used for DNA or RNA isolation from environmental water samples (8 samples per week), and the rest of the week will be used for QC of the isolated samples and PCR amplification of microarray targets. The last 2 weeks will be devoted entirely to data analysis and the final report preparation.

**Intern academic experience and skill set should include:** We would prefer a more experienced candidate with at least some laboratory experience. Advanced laboratory skills with the special emphasis on RNA handling (such as creating a ribonuclease-free lab environment) will be developed in the course of this project. We would consider majors in microbiology, biochemistry, genetics/genomics, molecular biology, bioengineering/chemical engineering.