**DENIN Environmental Scholars Internships**

Dates of internship: June 8-August 13, 2020

Location: Sharp Campus, University of Delaware, Lewes, DE 19958

Number of positions available: 1

Faculty Mentor: Andrew S. Wozniak

Graduate Student Mentor: Jessica I. Czarnecki

**Project Title:** DOM Fingerprinting in the Murderkill estuary using 3-D fluorescence spectroscopy

**Research Description:**

Water quality is monitored in Delaware Bay and its tributaries so citizens can confidently use these waterways and their natural resources without fear of negative health effects. Waterways can be closed to recreational fishing or swimming if so-called total maximum daily loads (TMDLs) of pollutants are exceeded or dissolved oxygen is below a certain threshold concentration. The Murderkill River experiences low dissolved oxygen events periodically during the summer resulting in such closures. Low dissolved oxygen events are associated with microbial respiration which utilizes oxygen to break down dissolved organic matter when it is delivered in excess. The source of the dissolved organic matter is important for understanding and managing these low dissolved oxygen events. Dissolved organic matter is derived from primary production in the waterways and from sources within the watershed including runoff from agriculture, forested, and urban land use as well as from septic system-contaminated groundwater and wastewater treatment plant effluent. This project proposes to sample both the probable dissolved organic matter sources and several stations in the Murderkill River in hopes of developing a framework for "fingerprinting" dissolved organic matter sources. Such a framework would be invaluable for understanding the sources of dissolved organic matter that microbes use to draw down oxygen resulting in closure of these waterways.

**Research Questions:**Can 3-D fluorescence spectroscopy be used to identify sources of organic matter in the Murderkill estuary?

1. Are the various watershed sources of organic matter distinguishable from one another?

2. Can low dissolved oxygen events be traced to specific organic matter sources?

**Student Learning Objectives: Professional and Research Skills**

This internship focuses on the development of the following professional and scientific skills.

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| Broad Professional Skills | Specific Skills |
| Planning and time management | Ability to set and complete specific goals of varying scope |
| Work independently | Independent work ethic - work independently to problem-solve |
| Collaborative skills | Learning to complete tasks efficiently and effectively with others |
| Express ideas in writing and verbally | Communicate with diverse audiences - Development of impactful poster and oral presentations. Honing ability to deliver scientific results/impacts to people of interdisciplinary background. |
| Broad Scientific Research Skills | **Specific Skills** |
| Understand scientific terms  | Mechanistic and applied concepts regarding estuarine carbon cycling, analytical chemistry techniques |
| Literature analysis | Ability to effectively find and utilize scientific manuscripts related to environmental chemistry |
| Use scientific tools | Excitation-emission matrix spectroscopy, dissolved organic carbon analysis, particulate organic carbon analysis, parallel factor analysis, and additional advanced physical, chemical, and statistical techniques |
| Recognize simple patterns in research data | Evaluate relationships among quantitative and qualitative environmental, land-use, and water quality data streams. |
| Apply research tools and techniques in research experiments  | Selective extractions, perform experimental manipulations, field collections, wet laboratory techniques. |
| Analyze research data  | R, Excel, and instrument-specific software utilization to form effective figures and tables. |
| Understand, apply, and explain scientific concepts and theories | Freedom to form questions and plan methods for addressing challenges. Learning to effectively communicate results through oral presentations and manuscript writing. |

**Prerequisites:**

Introductory experience with chemistry, some environmental coursework.

**Work Environment and Expectations:**

Laboratory environment: Cannon laboratory on the Sharp Campus in Lewes. Hours are approximately 9AM to 5PM. Student will work full time during the summer June to August. Students will participate in activities associated with the DENIN Scholars program and have the opportunity to participate in those of SMSP’s NSF REU program.

**Stipend:**

$4,500 Direct deposit is required.

**Funding Source:**

National Science Foundation, Delaware EPSCoR RIITrack I

**How to apply:** <https://ugresearch.udel.edu/PUB_Program.aspx>