Research Experience for Undergraduates (REU) summer 2017 position:

What happens to carbon that moves between stream and groundwater ecosystems?

Mentors: Joe Lee-Cullin (PhD Candidate – Department of Earth and Environmental Science, Michigan State University) and Dr. Jay Zarnetske (Assistant Professor – Department of Earth and Environmental Science, Michigan State University). **All application materials must be submitted to cullinjo@msu.edu and jpz@msu.edu by March 10, 2017.**

Background: Carbon, particularly organic carbon, is a master variable in aquatic ecosystems, controlling nutrient and contaminant cycling, food webs, and drinking water quality. Organic carbon composition is complex and varies dependent upon its origin, and therefore what it does and where it ends up streams is still poorly understood. The area where surface and subsurface waters mix, called the stream-groundwater interface, is an important ecological environment that may play a significant role in how stream carbon moves and what it actually does. To date, this has not been studied much by scientists. This stream-groundwater interface creates strong physical and biological gradients that lead to a great deal of biological and geochemical activity that transforms and moves organic carbon, nutrients, and contaminants. In general, the organic carbon acts as an important energy source for microbial organisms existing in this interface, particularly those organisms involved in removing nutrients from the freshwater streams (for example, denitrification that can remove nitrate from streams). The result is that this interface has extremely large rates of solute transformation compared to other parts of the landscape. Our research group tries to understand the reactions that occur in the stream-groundwater interface, particularly the reactions that regulated the organic carbon entering and leaving this interface.

Research Project: The student will spend the summer helping to develop and carrying out stream experiments in the Augusta Creek, a beautiful, mixed land use watershed near to the W.K. Kellogg Biological Station (KBS) in Hickory Corners, MI, part of Michigan State University. This project will assess how carbon from different land use areas (for example, an agriculturally dominated stream vs. a forested stream) is processed at the stream-groundwater interface. Specifically, a series of stream tracer experiments, using carbon treatments, will be completed in multiple sections of Augusta Creek. Throughout the course of this project the student will learn valuable theory about streams ecosystems and biogeochemistry and be responsible for, with mentorship, their own research project.

Through this project we will obtain some of the first evidence for how the stream-groundwater interface processes carbon from different sources and what it might mean for downstream ecosystems and water quality.

Student Experience & Responsibilities: In addition to learning about streams ecosystems, the student will learn valuable field techniques, laboratory analyses, and simple modeling. Field work will include significant time in streams, conducting manipulation experiments and making hydrologic and biogeochemical measurements. Laboratory work will include dissolved organic carbon and dissolved ion quantification and characterization using state of the art chromatography and spectrometry instruments. The student will also have the opportunity learn simple numeric models that turn field experiments, such as tracer test data, into physically

meaningful information. There will be multiple opportunities for the selected student to develop their own independent project and network with the students and faculty across the main and KBS campuses of MSU.

This research project lasts for 11 weeks, starting Monday, May 22 through Friday, August 4, 2017, working at least 40 hours a week. The student will be responsible for 1) meeting all requirements of their mentor, 2) writing a blog post about their research for the KBS LTER website, and 3) presenting a professional research poster at the KBS summer research symposium on August 2, 2017 at KBS.

The student will be based on, and live near, Michigan State University's main campus in East Lansing with frequent trips to KBS for sampling. The student is responsible for securing housing in or near East Lansing, MI. The student will receive an $8,000 stipend to support living expenses, travel to Michigan, and up to $500 for research supplies. The stipend will be paid in two payments, June 15 and July 15. Travel to the sampling stations will be covered by the mentor's lab.

This project is funded by the National Science Foundation's Kellogg Biological Station Long-term Ecological Research (KBS LTER) program. Priority will be given to non-MSU students who may not have many research opportunities at their college or university and under-represented minority students. Please note, students must be a U.S. citizen to apply.

To apply for this position, please submit:

1. A detailed resume (or Curriculum Vitae)
2. A cover letter that includes a personal statement of less than 1 page in length that discusses career goals, research experiences and aspirations, and your skills/attributes that are suited to support this research project, and
3. Contact information for 3 professional references.

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