IEH Undergraduate Intern Mentoring Opportunity

Deadline: **February 22, 2013**
Selections Announced: **mid-March, 2013**

Name/Title/Institution(s) of senior mentor(s):

Dr. Brad Tebo

Name/Title/Institution(s) of frontline mentor(s):

Rick Davis

Project Title: Comparison of microbial communities in 10 different pristine fumarolic ice caves

Context for Project:

Our lab studies microbial communities in soils found deep in fumarolic ice caves near the summit of Mt. Erebus volcano, Antarctica. We study these communities to gain understanding of how microbial communities survive in ultra-oligotrophic (carbon starved) environments. These caves are isolated from human or other plant/animal contamination which allows us to study the autotrophic and oligotrophic communities in a pristine environment.

The proposed project for this summer involves both culture- and molecular-based microbiology, giving the student both traditional skills required by any microbiology laboratory and also cutting-edge molecular work utilizing bioinformatics. Fresh samples from the 2012-2013 field season will be used to contrast the microbial communities from at least 10 different caves, each with different temperature, light, and fumarolic inputs. Novel culture media will be developed based on the bacterial metabolic pathways deduced from a metagenomic library we have already analyzed. Cultures that grow will be characterized using both traditional microbial physiology along with modern molecular techniques. Cell-independent community analysis will be performed by using quantitative PCR and deep ribosomal sequencing using Illumina sequencing.

Proposed Outcomes/Broader Impact:

The project should provide new insights into microbial communities in oligotrophic communities, which are very common on Earth but not well understood. Molecular data suggests these microbes utilize metabolic pathways that have not been studied in detail, especially aerobic carbon monoxide oxidation coupled with carbon fixation. New isolates found in this environment may act as model organisms for future studies of volcanic and desert-based systems.

Proposed timeline (within a 10 week span):

Weeks 1 & 2: Gain familiarity with the lab, including media preparation, DNA extraction, and aseptic technique. The student should also spend time familiarizing him/herself with relevant primary literature during this time.

Weeks 3 & 4: Quantify DNA extractions, PCR amplify small subunit ribosomal RNA (SSU rRNA) genes for deep sequencing. Begin isolating cultures from inoculations.

Weeks 4 & 5: Finish PCR amplifications, prepare samples for Illumina sequencing. Begin QPCR assay to quantify Bacteria / Archaea in the samples. Continue isolating bacteria-- hopefully achieving pure cultures.

Weeks 6 & 7: Submit PCR samples for deep sequencing, begin analysis of sequences when data is received. Extract DNA from isolates & sequence the SSU rRNA gene to identify the bacterium.

Weeks 7 & 8: Continue analysis of Illumina sequencing, applying statistical analysis to each cave environment. Continue culture isolation and identification.

Weeks 9 & 10: Finish analysis of Illumina sequences and cultures. Cryofreeze cultures in our culture collection, and submit sequences to Genbank. Submit important isolates to national culture collections, write short proposal to sequence the genomes of these isolates.

Intern academic experience and skill set should include:

The student should have experience in microbiology, including lab work. Experience in molecular biology is also preferred, but not required.