

EBS/CMOP Undergraduate Intern Mentoring Opportunity

Project Title: The Microbial Diversity of Dark Antarctic Ice Caves

Context for Project:

This project will focus on molecular microbiological and bioinformatic analyses of Antarctic samples collected as part of our funded NSF proposal “Microbially mediated alteration of volcanic glass using McMurdo extreme environments as natural laboratories”. The increased affordability of next-generation sequencing has allowed us the opportunity to generate an environmental genomic (metagenomic) library of a Mt. Erebus ice cave soil sample. This project will support a student to acquire in-depth bioinformatic and microbiological training as part of analyzing this sample as well as develop an understanding of research science sufficient to contribute to publications arising from this research.

Brief Description.

The project will involve analyzing the presence and phylogenetic diversity of key metabolic genes, such as those involved in carbon fixation and nitrogen fixation, in a metagenomic library constructed from a Mt. Erebus ice cave sample that was collected by this project during the last field season. The lab has developed a bioinformatics pipeline that can screen millions of small (~100bp) DNA sequences using a database of homologous sequences as a query. The student will identify key sequences in chemoautotrophic metabolic pathways which are potentially utilized by the microbial communities within the cave and construct an aligned database of homologous genes for each pathway. The student will then use this database as a query to identify potential homologous sequences in the metagenomic library, extract those sequences, and construct contiguous reference sequences from the fragments. These sequences can then be aligned with the original database to determine the phylogenetic placement of sequences from the Antarctic cave sample with sequences from described species, PCR-based environmental studies, and from other metagenomic libraries. The results of this analysis will provide new insights into the metabolic potential of microbial communities in dark, oligotrophic environments.

Proposed Outcomes/Broader Impact:

Over the course of the summer, it is expected that the student will learn advanced bioinformatic, microbial, ecological and data analysis skills. Our goal is to have the student develop a data set suitable for publication in a peer reviewed journal, as well as provide framework for a targeted culturing strategy for use in Mt. Erebus fumarolic ice caves during the upcoming field season.