Mr. Nicholas Reichart

PhD Defense in Biochemistry

Titled:

“Identification of Cellulolytic Hot Spring Organisms Through Bioorthogonal Labeling”

10:00 am Thursday, July 8, 2021

Byker Auditorium, Chemistry & Biochemistry Bldg.,

Advisor: Dr. Roland Hatzenpichler, Assistant Professor, Chemistry & Biochemistry

Abstract:

Microbial physiology is the study of the metabolism and function of microorganisms. The recent expansion of genomic diversity has outpaced the description of physiology. To better understand microbial metabolisms and environmental processes, more detailed research is needed for both novel and undescribed microbes. While many new methods are being developed to describe in situ microbial activity, this dissertation implements bioorthogonal non-canonical amino acid tagging as a proxy to track metabolic activity of microbes under close to environment conditions. Using differential analyses on hot spring microbial communities, we were able to show that certain microbial taxa had preferential activity towards specific incubation amendments. Previous activity-based studies had shown that hot springs were a unique environment for discovering cellulolytic microbes that could be used in industrial processing of plant biomass. Herein, we used computational analysis to screen publicly available metagenomic datasets to identify the enzymatic potential of hot springs worldwide. The wide diversity of taxa and biomass degrading enzymes were investigated and hot springs were further highlighted as a system that could be used to find improvement for the industry of plant biomass degradation and processing. To build upon the cellulolytic potential found in hot spring metagenomic datasets, bioorthogonal non-canonical amino acid tagging coupled with fluorescence-activated cell sorting was applied to the biotechnological relevant field of plant biomass degradation to identify microbes involved in the cellulolytic process. Examination of the active microbes revealed difference in the community when supplemented with cellulose. Taken together, the work in this dissertation served to expand and apply the recent development of activity-based studies used to describe environmental microbial populations, with a focus on plant biomass degradation.