

Master or Bachelor Thesis - Investigating the Effects of Environmental Stress on *E. Coli* Metabolism and Isotopic Signatures

Rationale

Understanding the metabolic responses of microorganisms to environmental stressors is crucial in microbial ecology. Recent studies have highlighted the potential of measuring isotopic signatures, particularly $\delta^{18}\text{O}(\text{PO}_4^{3-})$, as indicators of metabolic changes in microbial communities. Here we see a need to investigate the effects of specific stressors on the metabolic pathways and isotopic signatures of model organisms, such as *Escherichia coli* (*E. coli*), under controlled laboratory conditions.

Project work

The aim of this master's thesis is to examine the effects of environmental stressors on *E. coli* metabolism and its impact on isotopic signature of phosphate. The research will focus on comparing two or three specific growing conditions to assess the metabolic responses of *E. coli* under various stressors. The project involves growing the bacteria, extracting phosphate, and preparing it for isotopic analysis.

Tasks

- Conduct a literature review on microbial responses to environmental stress and the metabolic pathways of *E. coli*.
- Design and perform growth experiments with *E. coli* under specific stress conditions, such as temperature shifts or nutrient limitations.
- Monitor and quantify the growth dynamics of *E. coli* using appropriate analytical techniques.
- Collect samples, perform extractions, and prepare cytosolic phosphate for analysis.
- Collaborate with experts to conduct isotopic analysis, such as Isotope Ratio Mass Spectrometry (IRMS) and High Resolution Mass Spectrometry (HRMS).
- and compare the metabolic responses of *E. coli* under different stress conditions.

(The scope of the project can be adapted based on a bachelor or master thesis)

Contact

maria.evertz@usys.ethz.ch

Website of the project: <https://sae.ethz.ch/people/AssociatedStudents/elena-evertz.html>