MSc thesis subject: Exploring the genomic diversity of the Dead Sea shores : metabolic potential and biotechnology applications

Supervisors : Dr. Camille Thomas (Sedimentary Geochemistry, UniBE), Dr. Danny Ionescu (Leibniz Institute of Freshwater Ecology and Inland Fisheries, Stechlin, Germany), Prof. Hendrik Vogel (Sedimentary Geochemistry, UniBE)
Earliest starting date : summer/fall 2023 (flexible)

A system of sinkholes and ponds has been formed by the Western shore of the rapidly retreating hypersaline Dead Sea (Levant). It consists of saline pools and streams filled with microbial mats of varied colors and textures. This hydrosystem has also been identified as contaminated by arsenic, and a large metagenomic dataset has been acquired by Camille Thomas (University of Bern), in collaboration with Dr. Danny Ionescu (Leibniz Institute of Freshwater Ecology and Inland Fisheries, Stechlin, Germany) and Daniel Ariztegui (University of Geneva, Switzerland) to better understand how microbes can survive and develop in the hypersaline and contaminated conditions of this weird environment.

The goal of this MSc project is to explore this genomic dataset in search for mechanisms allowing microbial communities to develop and thrive in these extreme environments, protect from potential contaminants and interact within their ecosystems.

Work overview :

1/ The raw dataset has already been acquired and consists of 12 samples collected from the western shore of the Dead Sea (Israel) that were deeply sequenced. Geological and microbiological context for these samples will be provided through the study of field photography, water and sediment physico-chemical data and microbial profiling by 16S rRNA gene sequences. (summer 2023)

2/ Under the supervision of Danny Ionescu, the student will learn downstream analysis using bioinformatic tools to profile the community in these microbial mats, obtain high quality genomes, annotate them and compare them to known organisms. The work can be done remotely with regular online meetings and can be coupled with visit to Lake Stechlin. (autumn-winter 2023-2024)

3/ Data mining and data visualization using state of the art bioinformatic tools will be done jointly with Danny Ionescu and Camille Thomas, and will be put in context of the available specificity of the chemical, physical and geological environment investigated. (winter-spring 2024)

4/ Thesis writing : microbiological and geological context will be introduced, step by step description of the methods selected for data analysis and interpretation will be provided in an open manner, and an exploration of the metabolic potential of microbial communities in association with their environment will set the stage to further explore unique features discovered in this poorly known setting. A particular attention shall be given to potential applications in astrobiology (?) and/or biotechnology-bioremediation applications. (summer 2024)

We are looking for a curiosity-driven MSc student willing to learn and/or develop the skills described below. Interest in microbiology, biostatistics, big data, programming is a plus. Ability to evolve independently but collaborate within a team is necessary.

Skillsets: English reading and speaking, computational orientation, biostatistics, report and thesis writing, scientific discussion, oral presentation
For more, get in touch with Camille Thomas: cmll.thomas@gmail.com