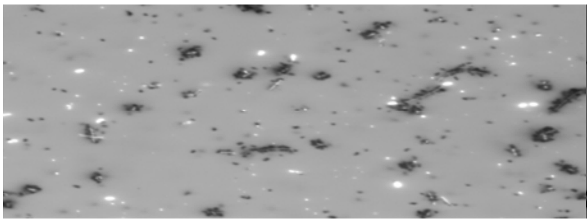
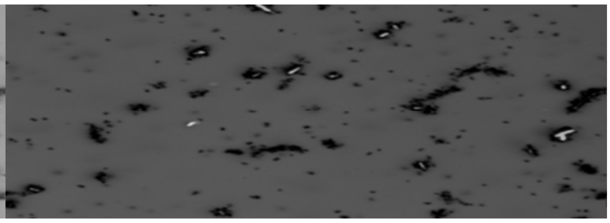
 

**FWF P24098-B22**

**Heterotrophic freshwater bacterial groups and the biogeochemical cycle of phosphorus in mountain lakes**

Alpine lakes are very oligotrophic systems characterized by low dissolved organic carbon and nutrient concentrations. Inorganic phosphorus is particularly scarce, but also total dissolved phosphorus concentrations are generally < 0.1 µM. Bacterial production in these systems has been found to be limited by phosphorus and the ubiquitous R-BT subgroup of *Betaproteobacteria*, to dominate the bacterial community when the phosphorus supply increases. Nonetheless, knowledge on how different freshwater bacterial groups/lineages cope with phosphorus (scarcity) in these ecosystems is very limited.

In this 3 years project, we want to investigate the strategies used by different heterotrophic bacterial groups to deal with the low phosphorus ambient concentrations. The project will cover four different, but closely interrelated, objectives. The first one aims to determine which bacterial groups are responsible for inorganic *versus* organic phosphorus uptake. The second one is the characterization of bacterial groups utilizing different dissolved organic phosphorus compounds, which represent different transport and uptake mechanisms (direct *versus* enzymatic breakdown). Our third objective aims to assess which enzymes are expressed by bacterial groups *in situ*, as well as after the addition of model phosphorus sources differing in their stoichiometry (e. g., wet deposition). The last objective is to understand how the elemental composition of dissolved organic matter (DOM) sources affects the stoichiometry of bacteria in mountain lakes situated both below and above the treeline.

To fulfill these objectives, we will conduct field and laboratory research employing a variety of single-cell and molecular methods as microautoradiography (MAR), fluorescent *in situ* hybridization with catalyzed reporter deposition (CARD-FISH), flow cytometry/cell sorting and metatranscriptomics in order to tighten the link between community composition and function. Significant progress will be made in characterizing which bacterial groups/clades are key for the cycling of inorganic phosphorus and diverse organic phosphorus compounds in alpine lakes, in understanding the underlying transport and enzymatic mechanisms, as well as how bacterial stoichiometry is affected by phosphorus sources. Results from this project will fundamentally contribute to a better understanding of the biochemical cycle of phosphorus in mountain lakes and freshwaters systems, in general.

**Project participants**

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