Extremophilic Bioprocess Development

Our vision is to establish extremophiles in the field of applied biotechnology. Thereby, our focus lies on the development and optimization of high temperature bioprocesses with crenarchaea and in the sustainable generation of high value products from extremophiles. We create platform knowledge in strain generation, cultivation, monitoring and control, and product recovery.

FWO-FWF Project "CO_2 Fixation in extreme conditions"

Motivation

Both in society and industry, awareness is raised that a transition from a petrochemical industry towards more sustainable bio-based processes is urgent. In this context, the use of microorganisms with autotrophic metabolism as cell factories for the direct conversion of CO_2 into high-added value chemicals or fuels is a promising approach. While the genetically amenable and industrially promising species *Sulfolobus acidocaldarius* was originally described as autotrophic sulfur oxidizer and encodes genes for the 3HB-4HP cycle for CO_2 fixation, it has lost the capability to grow autotrophically.

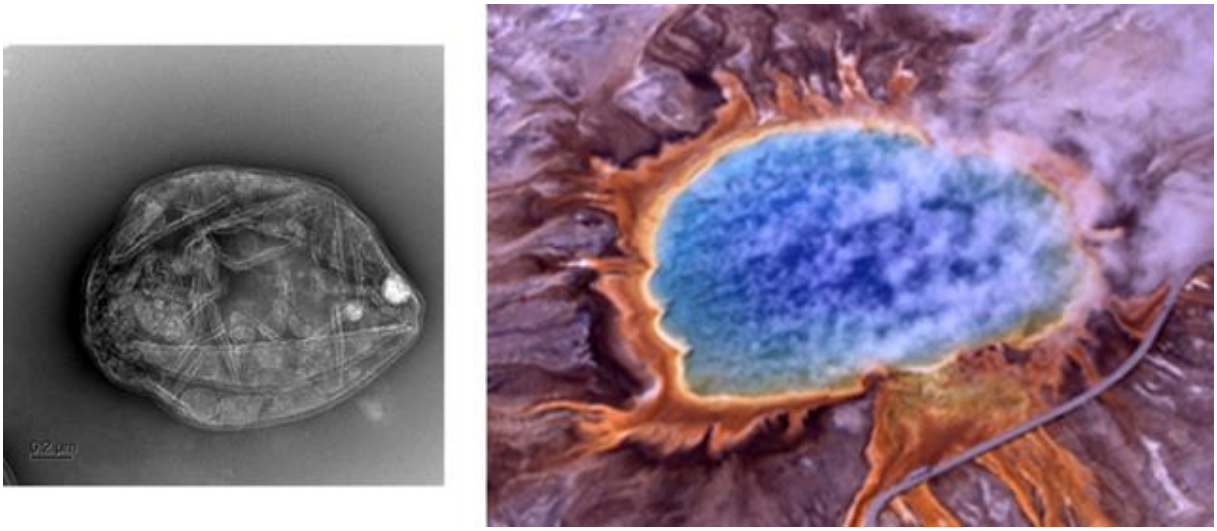

Figure 1. The thermoacidophile *Sulfolobus acidocaldarius* (left) was isolated in hot solfataric springs in the Yellowstone national park, USA (right). It was originally described as sulfur oxidizer, but for unknown reasons today´s lab-strains seem to have lost the ability of autotrophic growth

Goal

In this project we aim to investigate the cause for loss of CO_2 fixation: either one or several of pathway enzymes are dysfunctional or the expression and transcriptional regulation of the pathway is defect. Advanced bioprocess techniques and -OMICs studies will be combined with detailed biochemical analyses to generate deep insights into the functioning of the 3HB-4HP cycle in *S. acidocaldarius*.

Approach

S. acidocaldarius and known chemolithoautotrophic organisms like *Metallosphaera sedula* will be grown in shake flasks and bioreactor cultivations under heterotrophic, mixotrophic and autotrophic conditions. Together with our partners in Brussels (Prof. Eveline Peeters´ lab) we will perform comparative -OMICs analyses to gain deeper insight in requirements for autotrophic growth and potentially reestablish the CO_2 fixation cycle in *S. acidocaldarius*.

Links

https://m.pf.fwf.ac.at/en/research-in-practice/project-finder/47655

Contact

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Finished Projects

CrossCat - Symbiosis of bio- & chemo-catalysts for the sustainable conversion of hemicelluloses

FFG Spin-off Fellowship "NovoSome": Forget injections, just take a pill!