



Exploring the potential of *Bacillus Methanolicus*

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Type of thesis: Computational

Required competences: None

Acquired competences:

Programming skills (Python/Matlab)

Metabolic modelling skills (COBRApy, COBRA Toolbox)

Genome-scale metabolic reconstruction (ModelSEED/ CarveMe)

Microbial Physiology

Date: 03-10-2019 date the project was proposed

Description

Bacillus methanolicus is a gram positive, thermophilic and methylotrophic member of the genus *Bacillus*. Methylotrophs are able to grow on C1 compounds as sole carbon and energy source. This is why, scientific studies have focus on the potential of *B. methanolicus* as cell factory for industrial production of L-lysine and L-glutamate from methanol at high temperatures (Heggeset, et al., 2012).

B. methanolicus was isolated from soil samples in Minnesota (Schendel et al., 1990) and genome sequences of the strain MGA3 (ATCC 53907) and the alternative wild-type strain PB1 (NCIMB13113) were also characterized (Heggeset, et al., 2012).

Genome scale metabolic models (GEM) reconstruction is a natural step after sequencing a genome. GEMs and constraints-based analysis techniques are useful tools to understand the metabolism or to study the potential of species to produce a product of interest. Due to the availability of its genome sequence, we aim to generate an automatic reconstruction of the genome scale metabolic model of the strain *B. methanolicus* MGA3 (ATCC 53907) to explore its ability to produce amino-acids or other products of interests. ModelSEED or CarveMe will be implemented as possible automatic reconstruction tools



and COBRA Toolbox (MATLAB) or COBRApy (Python) will be used as the constraint-based analysis techniques to study the GEM.

References

Heggeset, T. M. B., Krog, A., Balzer, S., Wentzel, A., Ellingsen, T. E., & Brautaset, T. (2012). Genome Sequence of Thermotolerant *Bacillus methanolicus*: Features and Regulation Related to Methylophony and Production of L-Lysine and L-Glutamate from Methanol. *Applied and Environmental Microbiology*, 78(15), 5170–5181. doi: 10.1128/aem.00703-12

Schendel FJ, Bremmon CE, Flickinger MC, Guettler M, Hanson RS. (1990). L-Lysine production at 50 degrees C by mutants of a newly isolated and characterized methylophytic *Bacillus* sp. *Appl. Environ. Microbiol.* 56:963–970