Master 2 internship position (January-June 2021)

Title:

"Physiology and proteomics of hydrothermal microorganisms able to disproportionate inorganic sulfur compounds"

« Physiologie et protéomique de microorganismes hydrothermaux capables de réaliser la dismutation du soufre »

Scientific context:

Sulfur disproportionation is a metabolism rather original, rather poorly characterized and which has been recently discovered at high temperature. Microorganisms able to disproportionate inorganic sulfur compounds can use a same molecule as electron donor and acceptor (elemental sulfur, sulfite, thiosulfate) to produce energy. Sulfur-disproportionating anaerobic microorganisms known so far are all bacteria and are present in a wide diversity of environments (Slobodkin and Slobodkina, 2019). Moreover, sulfur disproportionation could be one of the first primitive microbial metabolism on earth according to some hypotheses (Ollivier et al. 2018). Hydrothermal ecosystems are particularly rich in sulfur compounds of diverse redox states and could also be related to origin of life, and then make a perfect environment to search for new sulfur disproportionating microorganisms and describe their metabolic routes. However, the genes involved and the metabolic pathways of sulfur disproportionation are still not well understood.

Objective of the internship:

The main goal of this Master 2 internship will be to better understand the physiology of microorganisms able to disproportionate inorganic sulfur compounds, especially elemental sulfur, in order to expand our knowledge about these microorganisms and their energy-producing pathways. In that purpose, the first goal will be to sequence the complete proteomes of different hydrothermal bacteria able to grow by sulfur disproportionation and other energetic metabolisms, by LC-MS/MS. The comparison of the proteomes will make it possible to detect the proteins involved and then the metabolic pathway associated with the disproportionation of sulfur. Chemical monitoring will also be carried out by ionic chromatography to confirm the new physiological hypotheses. Depending on the candidate's investment, these results will be integrated into a scientific article where he or she will appear as a co-author. Then, the disproportionation medium will have to be optimize in order to promote the growth of the microorganisms, which could lead to further studies and the discovery of new sulfur disproportionators. If motivated and based on his/her knowledge in

bioinformatics, the candidate will also have the opportunity to perform *in silico* analyses in genomics and proteomics..

Candidate profile:

Motivated student with training and interest in the fields of microbiology, metabolism and physiology.
Curiosity and interest in *wet lab* culture experiments and autonomy.
Experience with anaerobic microbial cultures would be an advantage but is not essential.

Contact:

This project is part of the NEPTUNE project, based on a French-Russian collaboration, which is focused on poorly documented metabolisms related to nitrogen and sulfur cycles in hydrothermal vents. It is also part of the Sino-French associated international laboratory MicrobSea. Internship will be made at the LM2E laboratory, at the IUEM institute, located in Plouzané (29) (https://wwz.ifremer.fr/umr6197/), under the supervision of Dr. Karine ALAIN and the 3rd year PhD student Maxime ALLIOUX.

Please send a motivation letter, a CV and transcripts from the last 3 years to
Maxime ALLIOUX : Maxime.Allioux@univ-brest.fr
And Karine ALAIN : Karine.Alain@univ-brest.fr

If you have any questions, please do not hesitate to contact us.

References:

Finster, K. (2008). Microbiological disproportionation of inorganic sulfur compounds. J. Sulfur Chem. 29, 281–292. https://doi.org/10.1080/17415990802105770

Ollivier, B., Zeyen, N., Gales, G., Hickman-Lewis, K., Gaboyer, F., Benzerara, K., & Westall, F. (2018). Importance of Prokaryotes in the Functioning and Evolution of the Present and Past Geosphere and Biosphere BT - Prokaryotes and Evolution (J.-C. Bertrand, P. Normand, B. Ollivier, & T. Sime-Ngando, eds.). https://doi.org/10.1007/978-3-319-99784-1_3

Slobodkin, A. I., & Slobodkina, G. B., 2019. Diversity of Sulfur-Disproportionating Microorganisms. Microbiology, 88(5), 509-522. https://doi.org/10.1134/S0026261719050138