Dynamics, structure and biocompounds production in microalgal biofilms (Post-doctoral fellowship)

Microalgae have been identified as a promising biomass feedstock for the production of biofuels, feeds, foods and high-value with applications in markets such as cosmetics, pharmaceutical, nutritional, and aquaculture. They are mostly cultivated as planktonic cells suspended in liquid nutrient medium in open and closed systems, raceways and photobioreactors, respectively. Despite the great potential of microalgae to produce high-valuable products, these systems are generally characterized by low productivities, high energy demand and high operating costs. Lately an increasing interest in biofilm-based microalgae technology has been reported due to its potential to improve the sustainability and cost effectiveness of the bioprocess compared to those of suspended cultures. A biofilm is an assemblage of microbial cells that are irreversibly associated with a surface and enclosed in a matrix of extracellular polymeric substances. Biofilms are ubiquitous in nature and are highly used for bioremediation and industrial bioprocess purposes. In addition, new compounds can be produced by photosynthetic biofilms for heath and cosmetics markets.

The aim of this post-doc position is to develop multi-scale imaging approaches to fully characterize photosynthetic biofilms at lab and industrial scales. The hired post-doc fellow will work in the context of the national project PhotoBiofilm Explorer (ANR) which is focusing on the production of antimicrobial metabolites in microalgae growing in biofilm-based reactors. The first task consists of optimizing methodologies involving Confocal Laser Scanning Microscopy (CLSM) and Optical Coherence Tomography (OCT) tools and the associated image analysis to decipher the spatial complexity of such multispecies communities (microalgae, bacteria, extracellular matrix). The activity of biocompounds secreted by photosynthetic biofilms will be explored both *in vivo* (in biofilm reactor in presence of invading bacteria) and *in vitro* (on a panel of target pathogenic bacteria).

This project will be carried out in the Laboratory of Chemical Engineering and Materials (*LGPM, http://lgpm.centralesupelec.fr/ - Bioprocess team*), CentraleSupélec/University Paris-Saclay, Gif-sur-Yvette, and in the MICALIS>B3D (Biofilms and Spatially Organized Communities) team of INRAE/AgroParisTech/University Paris-Saclay, Jouy-en-Josas, in close collaboration to the other partners of the ANR project.

Required skills: The candidate must have a PhD with recognized experience in microalgae cultures and/or biofilm analysis. Knowledge of laser scanning confocal microscopy and image analysis is highly appreciated.

Fellowship duration: 2 years starting in autumn 2021.

Contact: Please contact Filipa Lopes (filipa.lopes@centralesupelec.fr), Romain Briandet (romain.briandet@ inrae.fr) for further information.

How to apply? Please send a CV, a cover letter and recommendation letters to Filipa Lopes and Romain Briandet using the above mentioned contact information.

References:

Fanesi, A., Lavayssière, M., Breton, C., Bernard, O., Briandet, R., & Lopes, F. (2021). Shear stress affects the architecture and cohesion of *Chlorella vulgaris* biofilms. *Scientific reports*, *11*(1), 1-11.

Fanesi, A., Paule, A., Bernard, O., Briandet, R., & Lopes, F. (2019). The Architecture of Monospecific Microalgae Biofilms. *Microorganisms*, *7*(9), 352.

Grenier, J., Bonnefond, H., Lopes, F., & Bernard, O. (2019). The impact of light supply to moving photosynthetic biofilms. *Algal Research*, *44*, 101674.

Bridier A, Piard JC, Pandin C, Labarthe S, Dubois-Brissonnet F, Briandet R. (2017) Spatial Organization Plasticity as an Adaptive Driver of Surface Microbial Communities. Front Microbiol. Jul 20;8:1364. doi: 10.3389/fmicb.2017.01364.