Proposition de stage

Parcours Master 2 « Microbiologie, Environnement, Santé »

1. **Laboratoire / Entreprise d'accueil :**

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Perspectives de poursuite de thèse :

x oui
onon

avec une bourse spécifique
o oui
x non

2. **Titre, description du sujet, approches utilisées, références** (2 pages maximum) **:**

Unravelling the microbial carbon pump in the ocean: production and recycling of dissovled organic matter by marine bacteria

Heterotrophic prokaryotes (HP) play a key role in organic matter processing in all aquatic ecosystems, with consequences on the cycling of carbon and other elements. For example, roughly 50% of organic carbon fixed by phytoplankton are processed by HP (Azam et al., 1983). Part of this dissolved organic carbon is respired to CO_2 and part is used to build new biomass, processes that were thoroughly studied for the past 30 years. However, it was only recently discovered that HP also release dissolved organic matter (DOM). This prokaryote-derived DOM can be largely resistant to further remineralization and it is sequestered in the ocean's interior through the so-called microbial carbon pump (Jiao et. al. 2010). However, the underlying mechanisms that lead to DOM production by HP are unknown thus far, as we do not know whether prokaryote-derived DOM compounds are ubiquitous or strain-specific. Furthermore, it is unclear whether all prokaryote-derived DOM is resistant to further utilization or if this depends on local conditions. If DOM transformation processes depend on the ecological strategies present in the

natural prokaryotic communities and these vary among taxa, we can predict that what is released by specific strains as recalcitrant may be accessible to other bacterial communities.

To answer these questions, the M2 student will collaborate in a two-step experimental approach done in the home laboratory. First, prokaryote-derived organic matter will be characterized from different single strains initially growing in a simple carbon source (i.e. glucose). Organic matter will be characterized using a suite of techniques (D-L amino acids by HPLC, spectroscopic techniques, glucose concentration by colorimetry). Second, biodegradation experiments will be performed adding prokaryote-derived organic matter from the cultures to natural microbial communities sampled from the MOLA (Microbial Observatory Laboratoire Arago) station. Changes in HP abundance, activity and diversity will be followed in combination with dissolved organic carbon consumption and organic matter changes in the biodegradation essays. The student will get familiarized with techniques such as flow cytometry (prokaryote abundance), fluorogenic substrate incorporation (bacterial activity), 16s Illumina sequencing (prokaryotic diversity in the biodegradation experiments), organic matter spectroscopic characterization (DOM absorbance and fluorescence) and D-L amino acid quantification (HPLC)

References

Azam F, Fenchel T, Field JG, Gray JS, Meyerreil LA, Thingstad F (1983) The ecological role of water-column microbes in the sea Mar Ecol-Prog Ser 10: 257-263

Jiao N, Herndl GJ, Hansell DA, Benner R, Kattner G, Wilhelm SW, Kirchman DL, Weinbauer MG, Luo TW, Chen F, Azam F (2010) Microbial production of recalcitrant dissolved organic matter: long-term carbon storage in the global ocean. Nature Reviews Microbiology 8: 593-599