Postdoctoral position: Molecular mechanisms of iron acquisition in biofilms of heterotrophic bacteria degrading particulate substrate in marine environments

From January 22, 2020 to March 31, 2020

Context

In oceans, remineralization of the organic carbon into CO$_2$ occurs mostly through the respiration of heterotrophic bacteria that degrade the organic matter released by lysed or decaying phytoplankton cells (1). The greatest part of the heterotrophic activity resides in the particulate fraction of the organic matter (POM) consisting of aggregated compounds (mostly proteins, polysaccharides and lipids) that is colonized by biofilm-forming bacteria (2). Metal availability, particularly iron, is expected to have a strong impact on organic carbon remineralization since heterotrophic bacteria have higher iron content than eukaryotic phototroph and respiration is a highly iron demanding process, the respiratory chain alone containing approximately 94% of the cellular iron (3) (4).

In response to the challenge of metal acquisition, marine bacteria have evolved very efficient pathways designed to extract trace amount of iron and most likely other metals from their surrounding environment. The best-documented acquisition pathway is the siderophore-mediated iron uptake. Siderophores bind iron with a very high affinity and hence are able to scavenge iron at low concentration or to displace iron from other ligands having a lower affinity. Siderophore-Fe(III) complexes are then recognized and transported across the cell membranes through an energy dependent process involving outer membrane receptors, periplasmic binding proteins and inner membrane transporters. Relatively few siderophore structures from marine bacteria have been elucidated in comparison with those of terrestrial or pathogenic bacteria (5). The majority of marine siderophores identified to date are amphiphilic or/and photoreactive (6). Some bacterial species produce several siderophores or suite of siderophores with various hydrophobic tails(7) (8). The eco-physiological role of the different siderophores produced by one strain as well as the function of the amphipathy and photoreactivity are not understood.

References

Objectives

We will focus on the acquisition of iron by *Marinobacter hydrocarbonoclasticus* SP17 that degrades, through biofilm formation, particulate substrates like lipids and alkanes. This strain produces the photoreactive siderophores petrobactin as well as sulfonated derivatives of petrobactin. The main objective of this project is to gain insight into the significance of the suite of siderophores (petrobactin, its sulfonated forms and its photoproducts) in biofilm development on particulate substrates.

The general intended strategy is:

1. Identification and quantification of the different forms of petrobactin produced in biofilm and determine if they are specifically produced in this mode of growth. The siderophores and their iron-complexes will be determined by HPLC- high-resolution high mass accuracy MS in collaboration with chemists of the institute. The siderophores profiles will be established in different growth conditions, biofilms on alkanes or lipids vs planktonic cells growing on acetate.
2. Identification of the genes involved in iron acquisition by Tn-seq and / or miniTn5 mutagenesis and investigation of the mutants phenotype and of the regulation of expression of the corresponding genes in relation to biofilms formation.

**Keywords:** Microbiology, biofilms, marine bacteria, particulate substrates, iron acquisition, siderophores, molecular genetics, biochemistry, Tn-seq.

**Hosting laboratory:** IPREM

The proposed post-doctoral position is part of the project 'MesMic' (Metals in Environmental Systems Microbiology) funded by E2S UPPA from 2018 to 2022 ([http://e2s-uppa.eu/en/index.html](http://e2s-uppa.eu/en/index.html)). MesMic is a collaborative and transdisciplinary project involving microbiology and analytical chemistry. The objective of the project is to unravel metal ion interactions with...
microbial ecosystems at the molecular, cellular and community levels. 6 PhD and 6 Post-Doctorates are funded by MesMic project.

**Post-doc Supervisor:** Régis Grimaud

**Scientific team:**

Nolivos (molecular biology), P. Sivadon (molecular biology), F. Hakil (molecular biology), L. Urios (microbiology), L. Ouerdane (analytical chemistry), R. Lobinski (analytical chemistry), O. Donard (analytical chemistry), M. Sebilo (biogeochemistry), D. Amouroux (biogeochemistry).

1 PhD students and 3 post-doc.

**Localisation address:** IPREM, Université de Pau et des Pays de l’Adour, Pau, Nouvelle-Aquitaine, France

**Starting period:** spring 2020 to summer 2020

**Duration:** 3 years (full-time)

**Teaching duty** (in English or French): 64 hours / years

**Gross salary:** 2960 euros/month (including teaching)

**Funding:** This postdoc position is funded by the project E2S UPPA (Energy Environment Solutions) which has a core scientific domain focused on Environment and Energy to meet challenges related to the energy transition, geo-resources, aquatic habitats and the environmental effects of natural and anthropogenic changes.


**Some research group references:**

Requirements

Required competences:

* Good knowledge in physiology, molecular genetic (Tn-seq Transposon mutagenesis) and biochemistry of bacteria are required. Skills in bioinformatics (genome analysis, Tn-seq data analysis) would be an advantage.
* Taste and aptitude for multidisciplinary work, the candidate will have to be interested in microbiology and analytical chemistry.
* Scientific rigor
* Good ability to communicate and write in French and English.

Application procedure

Applications must be sent as a single pdf file and must include:

* a CV (max 2 pages)
* a cover letter describing the candidate's motivations, previous research experience and how it is related to the present position (one, or maximum two pages)
* a copy of the candidate's PhD thesis diploma
* candidate's PhD abstract and publications
* two reference letters
* contact details (2 referees, including the PhD supervisor and post-doc supervisor (if applicable))

Selecion criteria and Evaluation
Two steps selection process:

1st step:
* Evaluation of the applicants’ files
* Candidates will be contacted by e-mail

2nd step: (date to be determined)
* Interview of the selected candidates (either at the IPREM or by videoconference)
* Candidates will have 5 min to present their CV, 5 min to present their PhD and 5min to present their views on the post-doc subject
* Discussion with the candidates for at least 20min

Criteria used during the selection of the candidates:
* The candidate’s motivation, scientific maturity and curiosity.
* Candidate’s knowledge on microbial ecophysiology and metabolism
* Candidate’s publications
* English proficiency
* Candidate’s ability to present his work
* Experimental proficiency

Application deadline

Please submit your application to Pr. Régis GRIMAUD regis.grimaud@univ-pau.fr and Dr. Sophie NOLIVOS sophie.nolivos@univ-pau.fr before March 31st, 2020, mentioning [Postdoc] in the subject of your email.