18 months Post-doctoral position in France
Aix Marseille University

- **JOB TITLE**

Identification of proteins involved in the metabolism of Rare Earth Elements in *Pseudomonas putida*

- **JOB PROFILE/TYPE :**

Contract : temporary Post doctoral position (18 months) starting on Nov 2021

Employer : Aix-Marseille Université

Gross salary depending on your professional background : the first year ranging from 2466 to 2891 €/month and the second year (last 6 months) between 2744 to 3169 €/month

- **KEYWORDS**
- Metalloproteomics, Rare Earth Elements, Biochemistry, *Pseudomonas putida*

- **JOB LOCATION**

Aix Marseille University (France):
Biosciences and Biotechnology Institute Aix Marseille (BIAM) Research team: Interactions Protéine Métal, at CEA-Cadarache, located at circa 35 km north east from Aix-en-Provence

- **ADVISORS**

Catherine Berthomieu and Patrick Billard

- **PI of the ITEM project**

Blanche Collin

- **JOB DESCRIPTION**

This 18-months' post-doctoral fellow is funded by the new **Mediterranean Institute for Environmental Transition** (A*Midex), an interdisciplinary initiative aiming to tackle the challenges of the ongoing climate nexus, and will begin on November 2021

Description of the position:

With the development of advanced technologies (e.g. microelectronics, photovoltaics, electric mobility ...), the number of metals used by industry has exploded, some of which are called "critical", given their economic importance and supply risk. This is the case of

rare earth elements (REE), whose success lies in their magnetic, optical and electrical properties. One challenge is to find secondary sources of REE in the near future. Many wastes produced in large quantities are potentially good candidates for recycling these critical metals such as bauxite residues (residues from alumina extraction) or residues from phosphate processing (Westerhoff et al. 2015).

In this context, the recent discovery of the biological utilization of some REE first by methylotrophic bacteria (for review Daumann, 2019; Cotruvo, 2019) and then by other bacteria, such as the rhizospheric bacterium *P. putida*, by the teams of P. Billard (Univ. Lorraine) and J. Klenbensberger (Wehrman et al., 2017), offers interesting perspectives. Light REEs (La to Nd) are essential for the activity of a family of key enzymes in the metabolism of methylotrophic bacteria (Nakagawa et al., 2012; Pol et al., 2014) as well as for that of an alcohol dehydrogenase, PedH, in *P. putida*. The biological use of the REEs involves efficient detection, transport and chelation systems that are still largely unknown. The aim of this project is to develop a metalloproteomics approach to identify REE-chelating proteins in *P. putida*.

This project will involve the analysis of proteins secreted in the culture medium, likely to play a role in REE acquisition, of periplasmic proteins such as PedH, and of cytoplasmic proteins, extracted from REE-dependent cultures of *P. putida*. On these three pools, we will combine separations on anion exchange resins and by size exclusion chromatography. Fractions containing REEs will be identified by ICP-MS.

To mitigate the risk of having complex protein pools for the identification of the REE-binding proteins, the project involves in parallel a separation by acrylamide gel electrophoresis in native conditions, followed by the analysis of RT profiles by laser ablation coupled to ICP-MS at the CEREGE. The nature of the proteins in the REE-containing fractions will be determined by proteomic analysis (in frame of a collaboration with J. Armengaud, CEA-Marcoule).

The most promising proteins will be produced in *E. coli* and their interaction properties with REEs characterized *in vitro*.

This project implies the use of a multidisciplinary approach of molecular biology, biochemistry, spectroscopy (optical, fluorescence) and ICP-MS. It will occur in frame of a close collaboration with Patrick Billard (LIEC, Univ-Nancy), Blanche Collin and Clément Levard (CEREGE, Aix-Marseille Univ.) and will involve work missions in their laboratories

- **QUALIFICATIONS/SKILLS/EDUCATION & RESEARCH REQUIREMENTS/DUTIES**

The post-doc will be hired for *18 months* with the following preferred skills:

• master degree and PhD in microbiology – biochemistry.

Knowledge in protein separation techniques in techniques for the characterization of metal-protein interactions.

- **APPLICATION DEADLINE** (If applicable)

August 30th 2021

- **REQUESTED DOCUMENTS OF APPLICATION AND CONTACT TO APPLY**

Curriculum vitae, two references, and a motivation letter. The application should be sent to: catherine.berthomieu@cea.fr; patrick.billard@univ-lorraine.fr and collin@cerege.fr.