**PhD SUBJECT**

**TITLE:** Physiology of mercury methylation by microorganisms, role of ligands and competition with metals

**ABSTRACT:**
Mercury (Hg) is a persistent pollutant, highly volatile that can be converted into highly toxic methylmercury (MeHg). MeHg is a serious threat as it is a neurotoxic compound, which is bioaccumulated and bioamplified in food webs. Microorganisms play a central role in MeHg conversion, by controlling Hg methylation and MeHg degradation. However, little is known about the cellular and environmental mechanisms favouring Hg transformations.

The understanding of the cellular uptake and biotic transformations is central for the elucidation of the role of microorganisms in Hg biogeochemical cycles, as well as for the evaluation of the toxicity and the trophic transfer of the accumulated Hg species (Hg(II) and MeHg). Nevertheless, the role of microorganisms in biotic transformations of mercury species and their significance with respect to different microorganisms in the same community has to be clearly established. Actual knowledge relies on the study of few microorganisms models, since they can have different roles in Hg transformations; it is now essential to rely Hg transformations to environmental relevant microorganisms. Because biotic transformations of Hg are considered to be intracellular processes, the uptake of Hg(II) and MeHg species is an important first step in the overall transformation process. Preliminary studies have demonstrated the important role of thiol-compound in mercury transformation, probably linked to the mercury uptake.

This proposal will focus on mercury transformation by microorganisms and will decipher the role of natural produced thiols as well as other metals in the handling of Hg(II) and MeHg, in order to understand the underlying mechanisms and the interplay between Hg(II) and MeHg transformation and thiol ligands and other metal competitors.

**Keywords:** mercury speciation, microbial physiology, autotrophs, heterotrophs, sulfate-reducing bacteria, iron reducing bacteria, anoxygenic phototrophs, fermentative, sulphide oxidizers, and metal competition

**CONDITIONS D’EXERCICE / WORKING CONDITIONS**

Laboratoire: Institut des Sciences Analytiques et de Physico-chimie pour l’Environnement et les Matériaux (IPREM UMR 5254, Pau)

Site web: [https://iprem.univ-pau.fr/fr/index.html](https://iprem.univ-pau.fr/fr/index.html)

Directeurs de thèse (PhD Supervisors): Marisol Goñi Urriza and Bahia Khalfaoui-hassani

The proposed PhD is part of the project ‘MesMic’ (Metals in Environmental Systems Microbiology) funded by E2S-UPPA from 2018 to 2022. MesMic, selected as a ‘Hub E2S-UPPA’ (http://e2s-uppa.eu/en/index.html) 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 for MesMic project.


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<th>Lieu (Place)</th>
<th>Duration</th>
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<td>IPREM, Pau</td>
<td>3 years</td>
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**Date début (start):** Spring-Summer 2019

**Employeur (employer):** Université de Pau et des Pays de l’Adour (UPPA)

**HOST LABORATORY PROFILE**

Microbiology, Physiology, Molecular Microbiology, Microbial Ecology, Analytical chemistry
MISSION – PRINCIPAL ACTIVITIES

Bacteria are known to be able to produce molecules with thiol functional groups, however their role in Hg speciation and uptake are unknown. Using a combination of analytical chemistry and physiological approaches, we will identify and quantify extracellular thiols produced under various metabolic conditions (respiration, fermentation, photosynthesis) and how specific ligands would affect mercury transformations. The PhD candidate will work with strains belonging to different metabolic groups, including Desulfovibrio (sulfate reducer), Geobacter (iron reducer), Syntrophobacter (fermentative), Rhodobacter (anoxygenic phototroph) and, Thiobacillus (chemolithoautotroph) affiliated strains. These bacteria are often associated in the environment and are involved in different reactions in mercury cycle. The selected strains have their genome sequenced, and several among them can be used for genetic purposes.

Bacterial mercury transformations will be studied under different physiological conditions, allowing the production of different ligand/metabolites. The relationship between mercury methylation and production of mercury ligands will be determined. Impact of metals (Zn, Cu, Mo and others) will be investigated in mercury transformation kinetics.

Candidate will perform physiological studies to understand the changes in growing, gene expression and mercury methylation and speciation. The student will work with another PhD student, specialist on analytical chemistry. The candidate should have skills in microbial physiology and genetics.

REQUIRED COMPETENCES

- Microbial Physiology
- Molecular Biology
- Microbial Genetics

SELECTION CRITERIA

Two steps selection process:
1st step:
- Evaluation of the applicants' CV
- Selected candidates will be contacted by e-mail before February 11th 2019

2nd step: (February 20-21)
- Candidates will have 5 min to present their CV, 5 min to present their Master 2 thesis and 5 min to present the PhD subject
- Discussion with the candidates for 20 min

Criteria used in selection of the candidate:
- The candidate’s motivation, scientific maturity and curiosity.
- Candidate's knowledge on microbial physiology and genetics
- Candidate's marks and rankings in M1 and M2.
- English proficiency
- Candidate's ability to present his work
- Professional experience of internship (s) in laboratory or any other research work already carried out (reports, publications).

APPLICATION, DEADLINE

Application should be send by e-mail. The application should contain:
- CV
- Cover letter detailing candidate's motivations
- Candidate's MSc marks and ranking
- Letters of recommendation
- Contact details (for 2 referees, including the Master thesis supervisor)

DEADLINE: February 4th 2019

CONTACT

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