UNIVERSITÉ SAVOIE MONT BLANC

INRAΣ

CARRTEL
CENTRE ALPIN DE RECHERCHE
SUR LES RÉSEAUX TROPHIQUES
ET ÉCOSYSTÈMES LIMNIQUES

Effects of chronic exposure to pharmaceutical substances on microbial community structure and diversity

Master thesis internship in microbial ecotoxicology, starting in January (or February) 2024

Project description

Aquatic environment contamination by the most widely used pharmaceutical substances is now widely documented. In receiving ecosystems, these substances can reach concentrations as important as several hundreds of ng L^{-1} to up to several µg L^{-1} in surface waters, and ranging from a few µg kg^{-1} up to several hundreds of µg kg^{-1} in the sediment compartment. As a consequence, such a contamination level is likely to alter the structure and diversity of the microbial communities present in the different compartment of the aquatic ecosystems. More specifically, in this contamination context, a selection pressure is also expected, leading to community adaptation, for instance through the acquisition of resistance properties.

The PharmOneHealth project (ANSES funding) aims to assess the influence of increasing exposure levels to pharmaceutical substances on the settlement and development of antibiotic-resistant microorganisms within natural microbial communities. To reach this objective, two experiments in laboratory channels have been planned. The first experiment took place in May-June 2023: it was designed to assess the response of river sediment microbial communities to the chronic exposure (7 weeks) to 3 model substances (diclofenac, sulfamethazine and ofloxacin) all tested individually at 5 concentrations. For this experiment, all samples have been collected, and most of the analyses are completed or under process. The second experiment will take place in November 2023, to assess the response of the chronic exposure of river epilithic biofilm communities to the same 3 substances at different concentrations.

Based on the first (completed) and second (to be done) experimental channel experiments, the master thesis candidate will:
(i) characterize, for river sediments, the changes in bacterial structure and diversity associated with these chronic exposures, using data obtained by the Illumina sequencing of the 16S rRNA gene;
(ii) prepare the epilithic biofilm samples from the second experiment for 16S rRNA gene sequencing.

The master thesis candidate will have to perform the following tasks;
For the 1st experiment results:
- carry out the bioinformatics analysis of the sequencing dataset,
- run the bio-statistical analysis of the data,
- organize and share the results with the collaborating research teams.
For the 2nd experiment:
- prepare the epilithic biofilm samples and extract DNA,
- prepare a sequencing library by amplifying the DNA barcodes targeting 16S rRNA genes (Illumina sequencing will be performed by an external service provider),
- carry out some preliminary bioinformatics analyses of the sequencing dataset.

The selected candidate will be co-supervised by Dr. Emilie Lyautey (UMR CARRTEL, Université Savoie Mont Blanc) and Dr. Stéphane Pesce (UR RiverLy, INRAE). He/she will be based within the CARRTEL laboratory research facilities, located on Le Bourget-du-Lac university campus (Savoie, France). Regular meetings and workshops with the different project partners are to be expected. Regular meetings are likely to be organized within the Aquatic Microbial Ecotoxicology (EMA) team in the INRAE UR RiverLy located in Villeurbanne (France). For these meetings and workshops, travel and accommodation expenses will be covered by the host laboratory.
Scholarships are awarded to all students during the master thesis internship. Their amount is higher than EUR 600/month.
Applications from students currently based outside France are welcome and strongly encouraged.

To apply, or for more information on this research project, please contact emilie.lyautey@univ-smb.fr and stephane.pesce@inrae.fr.

Application deadline: 13 October 2023