

DOCTORAL NETWORK

European
Commission

Marie
Skłodowska-Curie
Actions

Grant agreement
101119261



PhD POSITION N°8

Project title	Kinetic of metabolomic fingerprints of periphyton exposed to pharmaceutical compounds: towards the discovery of early molecular biomarkers
Recruiting institution	INRAE, Cestas (France)

BACKGROUND

This doctoral position is 1 of 10 doctoral positions offered within the [HORIZON Marie Skłodowska-Curie Action \(MSCA\) Doctoral Network Pharm-ERA: "Improving monitoring and Environmental Risk Assessment of PHARMaceuticals, antimicrobial resistance and pathogens from terrestrial to aquatic environments"](#).

Global contamination of soil and aquatic ecosystems by pharmaceutical and microbiological pollutants (such as antimicrobial-resistant microorganisms and/or pathogens) raises severe concerns about impacts on ecosystem health and repercussions on humans and animals. Preserving ecosystems from adverse ecotoxicological effects of pharmaceuticals and their transformation products, and limiting the environmental spread of antimicrobial resistance and pathogens is imperative to reach several UN Sustainable Development Goals as well as the European Green Deal, Water Framework Directive and Biodiversity Strategy for 2030. In this context, the main scientific objective of Pharm-ERA is to develop and implement innovative concepts, methods and strategies to improve the monitoring and assessment of the environmental effects and risks of pharmaceuticals, their transformation products, antimicrobial resistances and pathogens from terrestrial to aquatic environments. The ultimate goal is to provide scientific evidence and expertise to contribute to reducing the environmental spread and impact of these chemical and microbiological contaminants and to preserve microbial diversity and functions across the soil-water-sediment continuum.

By joining Pharm-ERA, you will integrate a high-level interdisciplinary and intersectoral research and training network based on 10 doctoral projects covering scientific disciplines including environmental and analytical chemistry, microbial ecology, ecotoxicology, molecular biology (incl. multi-omics approaches) and chemical fate/effect modelling. Pharm-ERA involves 9 Beneficiaries (including 2 non-academics) and 6 Associated Partners (including 5 non-academics), committed to contribute to research, training, dissemination, communication and exploitation of results targeting end-users such as environmental consultancies and agencies.

DESCRIPTION OF THE PhD PROJECT

On river rocks and solid substrates, complex microbial communities are developing. These communities, also known as periphyton, harbours thousands of different species: microalgae, cyanobacteria, bacteria, hyphomycetes, protists, etc., and play an essential role in headwater streams, ensuring primary production and nutrients recycling. Chemical contaminants, among which pharmaceutical residues, have been shown to modify microbial structure and deteriorate microbial functions. In this context, the main aim of this PhD is to identify and validate metabolic biomarkers of periphyton response to pharmaceuticals and to link those biomarkers with potential further changes in microbial functions. Therefore, PhD 8 will :

- (i) establish functional sensitivity thresholds for classical functions in periphyton exposed to selected pharmaceuticals from different therapeutics classes,
- (ii) identify early metabolomics signature of periphyton exposure below the functional sensitivity thresholds previously determined,
- (iii) investigate the influence of selected confounding factors on early metabolomics signatures and finally
- (iv) validate metabolomics biomarkers for periphyton exposed to the selected pharmaceuticals.

To do so, PhD8 will conduct experimental studies in micro and mesocosms setups allowing to mimic river environment under controlled conditions. A first screening of periphyton functional response (photosynthetic efficiency, extracellular enzymatic activities, respiration, etc.) to pharmaceuticals will be done on about 15 pharmaceuticals including antibiotics (e.g. sulfamethoxazole), non-steroidal anti-inflammatory drugs (e.g. diclofenac). Thereafter, metabolomic response to selected pharmaceuticals will be investigated along exposure (from hours to several weeks) by LC-HRMS and chemometric data analyses (e.g. multivariate analyses, trend analysis) to identify relevant signals according to pharmaceuticals exposure. Specificity of those identified signals to pharmaceuticals will be tested by investigating periphyton metabolome dynamics under variable confounding factors (e.g. temperature, drought...). Finally innovative data analyses (priorisation of signals by chemometrics tools, meta-analysis...) will be used to compare the different metabolomic profiles obtained and identify key metabolites involved in pharmaceuticals response, *i.e.* biomarkers. PhD8 will work in close collaboration with PhD7 to better link metabolomic responses with other -omics level (e.g. metatranscriptomics or metaproteomics) and microbial functions.

PRACTICAL INFORMATION

Recruiting institution	INRAE, Cestas (France)
Doctoral school	Bordeaux University (France)
Supervisors	Dr. Chloé Bonnineau (INRAE, France), Dr. Mechthild Schmitt-Jansen (UFZ, Germany)
Non-academic mentor	Dr. Benoît Ferrari (Centre ecotox, Switzerland)
Main host laboratory	INRAE, Cestas, France, Dr. Chloé Bonnineau and Dr. Nicolas Creusot (Ecovea team, UR EABX) to perform experimental studies and metabolomic analyses
Secondments (1 to 6 hosting months)	1) UFZ (Germany) to get training on and perform periphyton diversity analyses via metabarcoding under the supervision of Dr. Mechthild Schmitt-Jansen 2) Centre Ecotox (Switzerland) to get training on standard toxicity tests development under the supervision of Dr. Benoît Ferrari.

RECRUITMENT CRITERIA

General criteria

- MSCA Mobility Rule: researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting beneficiary for more than 12 months in the 36 months immediately before their date of recruitment
- All researchers recruited in a DN must be doctoral candidates (i.e. not already in possession of a doctoral degree at the date of the recruitment)
- Scientific excellence to fit the PhD project
- Fluent (oral and written) English skills as the project operates in English language
- Knowledge of the language of the host country may be considered a merit
- Team-mindedness

Criteria specific for PhD8

- Master degree in Molecular Biology, Microbial Eco(toxico)logy, Environmental Sciences or similar programs
- Good knowledge in molecular biology techniques and microbial aquatic ecology
- Basic knowledge in bioinformatics and statistical tools
- Liking for experimental work

APPLICATION

Documentation to be sent in by the applicants

- Application form completed
- CV + Letter of motivation
- Contact of two reference persons to be contacted by the selection committee (name, relation to the candidate, e-mail address and phone number)
- Complete list of publications and academic works
- Proof of language proficiencies
- Proof of master diploma or 2024 registration to master degree

How to apply?

- Download application form and fill it indicating all the offers you wish to apply for
- Send your application by email to pharm-era@inrae.fr. **The title of your email MUST be : Pharm-ERA PhD x, x, x application** (x, x, x being the number(s) of the PhD position(s) you want to apply for)
- **Be careful to join all documentation required** (see list above)

Deadline for application

April 2024, 14th - 6:00 pm French time

Contact

pharm-era@inrae.fr