DOCTORAL NETWORK

PhD POSITION N°5

Project title	Dissemination routes of antimicrobial resistance and pathogens among terrestrial and freshwater ecosystems in agri-urban catchments.
Recruiting institution	BETA Technological Centre – University of Vic–Central University of Catalonia (Spain)

BACKGROUND

This doctoral position is 1 of 10 doctoral positions offered within the he HORIZON Marie Sklodowska-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

The main objective of the PhD project is to elucidate the pathogens and antimicrobial resistance (AMR) flows between terrestrial and freshwater ecosystems in agri-urban catchments focusing on soil and periphytic microbial communities. This will be achieved through the following specific sub-objectives:

1) Study the AMR and pathogens spread from soils to freshwater ecosystem communities as a consequence of manure application in agriculture;
2) Investigate the AMR and pathogen spread from urban waste water treatment plants (WWTPs) to freshwater communities;
3) Evaluate the AMR and pathogen occurrence in surface waters used for irrigation purposes and in reclaimed water obtained from wastewater to assess its potential role in AMR spread from water to soils.

To this end, a multi-scale approach, combining a long-term field study and 2 laboratory experiments in mesocosms, will be used. A wide range of methodologies will be employed to fulfill the main and specific objectives of the project combining classical microbiology cultivation methods with state-of-the-art molecular ecology/biology tools. These will include generation of datasets from qPCR/ddPCR assays which can enable a tracking of exogenous taxa such as those emitted by animals or contaminating organic wastes (e. g. the microbial source tracking (MST) qPCR assays, those enabling pathogen-specific trackings), and the production of DNA sequence libraries from PCR amplicons through DNA meta-barcoding analytical schemes, and global approaches such as metagenomics. These large datasets will imply using bioinformatics/biostatistics approaches to test the hypotheses of AMR and exogenous bacterial transfers among the 3 main microbial compartments considered in this thesis: the soils, benthic and planktonic communities. Briefly, the field study will be carried out in a nearby agri-urban catchment and will be focused on understanding the relative contribution of punctual and diffuse sources of pollution (urban WWTPs and manure application in agriculture) to the resistome and pathogens occurrences in river compartments.

The two experiments planned will be dedicated to investigating:

1. the role of runoff from agricultural soils fertilized with animal manure (and derived organic amendments) as a potential source of AMR and pathogens to freshwaters ecosystems;
2. if reclaimed wastewater can be safer than surface water (for irrigation) in terms of AMR and pathogens risk spread from water to soil, depending on treatment technologies applied in WWTP regeneration plants and river catchment/s considered.

The fellow will be involved in joint research activities with (at least) 3 other PhD projects of the Pharm-ERA Doctoral Network.

PRACTICAL INFORMATION

Recruiting institution	BETA Technological Centre – University of Vic–Central University of Catalonia (Spain)
Doctoral school	Experimental Sciences and Technology, University of Vic, Spain
Supervisors	Dr. Lorenzo Proia and Dr. Sergio Martinez-Campos (BETA-UVic-UCC), Dr. Sotirios Vasileadis (UTH, Greece)
Non-academic mentor	Dr. Alexandra Meziti (SMALLOMICS; Athens, Greece)
Main host laboratory	BETA Technological Centre – University of Vic–Central University of Catalonia (Spain), Dr. L. Proia and Dr. Sergio Martinez-Campos to perform lab and field experiments
Secondments (1 to 6 hosting months)	1) VetAgro-Sup CNRS, Lyon veterinary school, France, to get training on pathogens detection and quantification under the supervision of Dr. Benoit Cournoyer and Dr. Wessam Gallia; 2) SMALLOMICS, Athens, Greece, to get training on bioinformatics under the supervision of Dr. Alexandra Meziti; 3) UTH, Larisa, Greece, to get training of and perform molecular analyses: qPCR screening of ARG marker genes (marker selection, assay set-up for absolute quantification - including amplicon validation and standard curve generation with cloning and sequencing - and results interpretation), amplicon high throughput sequencing assay setup (choice of marker loci, sequencing strategy setup, multiplex library prep), data generation (sequencing methodologies) and data analysis (dataset cleanup, choice of taxonomic units/variants, noise removal), under the supervision of Dr. Sotirios Vasileadis.

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 PhD5

- Knowledge in Environmental microbiology, Microbial Ecology, Molecular Biology, Biostatistics and/or Bioinformatics
- Master degree in Biotechnology, Microbial Ecology, Environmental Sciences, Bioinformatics, or Ecotoxicology

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