# Ph.D. Position in Environmental Microbiology at LCPME (University of Lorraine-CNRS, Nancy, France)

**SUBJECT : Identification of bacterial functions that dominate the transfer and persistence of conjugative plasmids and their antibiotic resistance genes in the environment.**

The Laboratory of Physical Chemistry and Microbiology for Materials and the Environment (LCPME - UMR 7564 CNRS-University of Lorraine) is opening a 3-year Ph.D. position to study the invasion of environmental microbial communities by conjugative plasmids carrying antibiotic resistance genes, in a project combining microcosm manipulation, bacterial genetics and bioinformatics analyses. The thesis will start in November 2025 and the gross salary is approximately € 2100 per month.

**PROJECT:**

With a direct implication in 1.3 million deaths every year, antibiotic resistance has become a major challenge for humanity. The emergence and spread of antibiotic resistance rests on two pillars: (i) the selection and enrichment of resistant variants, and (ii) the spread of these variants and their resistance genes in naïve microbial communities. This dissemination involves not only human-to-human transmission, but also the environment, which acts as a transmission belt by being both contaminated by antibiotic-resistant bacteria and a source of exposure for humans and animals.

Although bacteria from the human or animal microbiota are generally poorly adapted to environmental conditions, they can transfer their resistance genes to indigenous bacteria via mobile genetic elements such as conjugative plasmids. These indigenous bacteria, better adapted to the environment, can then form environmental reservoirs of resistance and become sources of exposure. This project focuses on the invasion of natural bacterial communities by conjugative plasmids. This invasion is a complex process involving a succession of steps, from the introduction of a contaminating plasmid-vector bacterium to the establishment and maintenance of the plasmid within indigenous communities. Each step has its own dynamics and limits, and the role (even if fortuitous) of each of the functions encoded by plasmids or their hosts in the invasion process remains to be defined.

The project will be organized into three interconnected parts, centered on the natural plasmid pB10 (IncP-1 family). The first part will involve the construction of fluorescently labelled bacteria (genetic engineering) enabling each steps the natural bacterial community invasion by the plasmid to be visualized by microscopy and cytometry. The second part will involve using a high-throughput Tn-seq mutagenesis approach to identify the bacterial functions that dominate the behavior of plasmid pB10 in environmental matrices (e.g. natural biofilms). This part of the work will involve molecular biology combined with bioinformatics analysis. Finally, the third part will aim at understanding the role of the bacterial (or plasmid) functions identified in part two using mutants and the tools developed in the first part.

Basically, knowledge of the steps in which these functions are involved will provide a better understanding of the spread of antibiotic resistance in the environment, and a better management of the environments likely to be invaded.

**PROFILE:**

The successful candidate should have a solid background in microbiology and molecular biology, and a strong interest in environmental microbiology. An interest in bioinformatics will be favorably considered.

**CONTACT:**

Motivated candidates should submit a detailed curriculum vitae and a covering letter to Christophe Merlin and Kévin Huguet by 1/06/2025. The successful candidate will then be auditioned by the BioSE Doctoral School for a final decision. For further information or to apply, please contact Christophe Merlin (christophe.merlin@univ-lorraine.fr, Tel.: +33 (0)3 72 74 72 40) and Kevin Huguet (kevin.hughuet@univ-lorraine.fr, Tel.: +33 (0)3 72 74 72 55). Administrative applications must be made on the ADUM website: https://adum.fr/as/ed/voirproposition.pl?site=adumR&matricule_prop=64383

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