



## Master 2 Internship in molecular microbiology- 6 months

**Project title:** Chassis strain engineering for heterologous production of cyclic lipopeptides (CLiPs)

**Laboratory:** Résistance Induite et Bioprotection des Plantes

The selected candidate will work on the HeteroCLiPs project, a multidisciplinary innovative project contributing to plant health

**Key words:** CLiPs, secondary metabolites, biocontrol, heterologous production

### Project description

Cyclic lipopeptides (CLiPs) represent a unique and major class of microbial amphiphilic secondary metabolites. Most of the structural and functional diversity relies on CLiPs produced by 3 main bacterial genera *Bacillus*, *Pseudomonas* and *Burkholderia*. CLiPs are non-ribosomally synthesized by modular mega-enzymes so-called NonRibosomal Peptide Synthetases (NRPSs) that are encoded by large biosynthetic gene clusters (BGCs) spanning over dozens of kb in the genomes. They hold vast potential as active compounds with diverse applications, mainly as biocontrol agents. However, native strains typically produce CLiPs in limited quantities, often as mixtures of two or three structurally distinct CLiPs. Some BGCs remain cryptic, showing no expression under laboratory conditions. Efforts are required to engineer strains to enhance expression rates, optimize production and purification processes, and obtain pure CLiPs for exploring their biological activities and unraveling their mechanisms of action.

One effective approach to surmount these challenges is through heterologous production, where BGCs containing biosynthesis genes are introduced into a host strain. Additionally, this strategy is pertinent for awakening cryptic or silent BGCs identified via genome mining.

### Internship Goals:

As part of the ANR HETEROCLIPS project, the intern will contribute to project objectives. This includes cloning the gene cluster responsible for cyclic lipopeptide synthesis from *Pseudomonas* and subsequently heterologously expressing this gene cluster in a host strain.

### Requirements:

We are looking for a master's level intern for a 6-months (February-August 2024). The ideal candidate should possess technical skills in microbiology and molecular microbiology. Applicants with prior experience in bacterial transformation, mutant construction, and cloning are strongly encouraged to apply. We are seeking a highly motivated and enthusiastic student with excellent writing and communication skills. The qualified candidate will benefit from having access to bacterial collection of CLiPs, access to novel tools, working with a dynamic and multidisciplinary group in a highly collaborative and stimulating environment, and access to state-of-the-art laboratories.

### How to Apply:

Interested applicants should submit a letter of interest and a curriculum vitae to Essaid Ait Barka ([ea.barka@univ-reims.fr](mailto:ea.barka@univ-reims.fr)) and Qassim ESMAEEL([qassim.esmaeel@univ-reims.fr](mailto:qassim.esmaeel@univ-reims.fr)).