

## Deciphering and exploiting bacteria-fungi dialogues to identify new bioactive metabolites

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The PhD project is a collaboration between two research units located on the campus of the Faculty of Sciences and Technologies of University of Lorraine in Nancy (France): UMR INRA 1128 Genome dynamics and microbial adaptation (DynAMic) and UMR INRA 1136 Tree-Microorganisms Interactions.

The project belongs to a larger research program launched in 2017 at University of Lorraine (project IMPACT 'Biomolecules') gathering research teams involved in complementary disciplines (microbiology, biochemistry, plant sciences, processes, process engineering...) and will benefit from the technological platforms developed by this consortium (genomics, protein engineering, analytic chemistry, screening).

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At the microscopic scale, with an average  $10^6$  to  $10^9$  microbial cells per gram, the soil constitutes a highly competitive environment. Such density implies numerous interactions among the microbes sharing the same niche. These interactions (antibiosis, symbiosis...) are for the most part driven through the production of secondary metabolites that participate to the soil homeostasis. However, most of these molecules are not expressed in laboratory conditions where the microorganisms are cultivated alone (pure cultures). Hence, the development and application of strategies that simulate the natural habitat of cluster-bearing microorganisms, e.g. by co-cultivation of microorganisms from the same ecosystem, are required and have already demonstrated their potential to induce the expression of cryptic pathways.

The aim of this project is to identify new metabolites with antibiotic or antifungal activities induced during biotic interactions between soil microorganisms (*Streptomyces*, fungi). To do so, bacterial and fungal collections (hundreds of isolates) already existing in the units of the project will be studied. Different interaction types will be tested either with a physical contact in liquid or solid media or without contact by the emission of signal molecules (diffusive or volatiles). Co-cultures in soil microcosms will be also tested to take into account the putative effect of the chemical environment of the microorganisms on their molecular dialogue. The new metabolite will be detected by its direct effect on one of the two interacting partners or on a third one that could be a target of interest (e.g. pathogenic bacteria or fungi and/or drug resistant strain...). On one hand, the activity will be characterized with analytic chemistry approaches of the compound(s) (HPLC and Mass Spectrometry, *in situ* IMS). On the other hand, the involved genes and biosynthetic pathways will be identified by transcriptomics (e.g. RNAseq). The correlation between the biological activity and the candidate genes will be confirmed with genetic approaches. The identified genes as well as the networks of regulation and of the signal transduction will be studied. This work will benefit of technical platforms (genomics, metabolomics...) developed in the local research environment (Fédérations de Recherche, INRA).

*The candidate will have a master degree in microbiology and cellular biology or molecular biology. He/she will have technical competences and knowledge in cellular and molecular microbiology. Experience in genomics and/or transcriptomics will be appreciated.*

**Please mail your CV, letter of motivation, references simultaneously to Christine Fivet, Ecole Doctorale RPPE, ([Christine.fivet@univ-lorraine.fr](mailto:Christine.fivet@univ-lorraine.fr)) for registering your application, and to both Pierre Leblond, ([pierre.leblond@univ-lorraine.fr](mailto:pierre.leblond@univ-lorraine.fr)) and Eric Gelhaye ([eric.gelhaye@univ-lorraine.fr](mailto:eric.gelhaye@univ-lorraine.fr)) supervising the scientific project. Deadline application is May 30<sup>th</sup>. Selected candidates will be convened for an interview by Jun 15<sup>th</sup>. The PhD contract will start in September.**