



PhD research project: Discovery, characterization and engineering of plant metabolic pathways of pharmaceutical and cosmetic interest

Institut de Biologie Moléculaire des Plantes - Evolution and diversity of plant metabolism

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Terpenes metabolism, with more than 30,000 molecules known in plants, is essential for the development, reproduction and defense of plants against environmental stresses and is the basis of many bioactive molecules used by the pharmaceutical industry. The chemical synthesis of these complex molecules is often impossible and their exploitation put significant pressure on natural resources. Understanding the biosynthetic pathways of terpene compounds can lead to better management of the resource thanks to the determination of optimal production conditions by the plant and metabolic engineering approaches allowing the production of molecules in an optimized recombinant system (bacteria, yeast). The doctoral student will participate in the development of these themes in a non-model species. The project is based on previous basic and applied research by the host team on the metabolism of terpenes in thale cress, vine, and Madagascar periwinkle (*Catharanthus roseus*). The objectives of the thesis work will be articulated around the understanding of the iridoid biosynthesis pathway, its regulation and its importance in plant-environment relationships, as well as the development of innovative genetic approaches for their production.

The first stage of this work will consist in the profiling of the iridoids produced by the target plant under different experimental conditions, making it possible to assess the metabolic diversity present as well as to define precise conditions under which the metabolic pathway is “switched on” and the compounds of interest accumulated. The validated genes for each step of the pathway will be used to reconstruct by a metabolic engineering approach in yeast or in tobacco (transient expression) the biosynthetic pathway leading to the targeted compounds. This bioengineering approach aims to set up a robust alternative to field crop cultivation for the production of the target molecules. This work will be further complemented by a chemical ecology approach whose objective will be to study the impact and importance of target molecules on the relationship between the plant and phytophagous insects under controlled or natural conditions. The project builds on previous research and expertise within the host team as well as on state-of-art facilities (metabolomics, protein production, imaging, ...) at the Institute of Plant Molecular Biology (IBMP). The project is an extension of the ANR LabCom Terpfactory joint laboratory with the company Plant Advanced Technologies (Vandoeuvre-lès-Nancy) dedicated to the study of terpene metabolisms in plants (2013-2019).

The candidate must hold a Master degree in plant biology, specializing in phytochemistry, biochemistry, bioinformatics, molecular biology or analytical chemistry. A solid theoretical and ideally practical basis in molecular biology as well as in biochemistry of proteins is required. Proficiency in basic bioinformatics and scientific English is recommended. Basic practical skills in enzymology or analytical chemistry are advantageous for this project.

- Wished skills: DNA sequences cloning. Enzyme assays. Extraction and analysis of plant substances (theory and possibly practical). English read and spoken. Good listening and interaction skills.
- Funding: PhD national grant, to be obtained by the candidate and the research group through Doctoral School Funding program (Online application in June 2020, oral exam beginning of July). More details and application form : <http://ed.vie-sante.unistra.fr/appel-a-candidature-au-contrat-doctoral/dossier-de-candidature/>
- Please send your CV, letter of interest, reference letters if any, as well as Master grades for the 3 first semesters.