Toulouse Biotechnology Institute
Bio & Chemical Engineering

Thesis Offer

October 2022

anr

Controlled spatial prOximity for iNnovating enzymatic Cascades to Enhance biomass deconstRucTiOn - CONCERTO

Supervisor: Claire Dumon (INRAE)
Co-supervisor: Cédric Montanier (INRAE)
Doctoral School : Sciences Ecologiques, Vétérinaires, Agronomiques et Bioingéniéries (SEVAB, ED 458)
Funding: Agence Nationale de la Recherche (ANR)

CONTEXT

The valorization of plant biomass represents a considerable environmental and industrial challenge in view of our growing demand for renewable energy and molecules of interest to the chemical industry. Accessing this resource requires the controlled deconstruction of this particularly recalcitrant biomass. This step remains to this day a major obstacle to the development of viable and economically relevant processes. In nature, bacteria and fungi have developed a whole panel of enzymatic complexes with very variable modularity, allowing to metabolize the carbonaceous molecules present in the plant walls. The ambition of this thesis project is to improve our understanding of the biochemical and biophysical mechanisms involved in the enzymatic degradation of plant biomass.

WORKING PROGRAMM

This thesis is part of a collaborative project between three laboratories: Toulouse Biotechnology Institute (TBI) hosting the thesis, the Institute of Pharmacology and Structural Biology (IPBS, Toulouse) and the Bioresources: Imaging, Biochemistry platform (BIBS, Nantes). In a dynamic and highly skilled environment, the PhD student will design and build protein variant libraries and participate in their screening and characterization. He/she will have the mission to build multi-enzymatic assemblies, to characterize them by biochemical and enzymological approaches and to study the spatial proximity relationships within these assemblies by a structure/function approach. The originality of this project lies in the development of multi-enzymatic complexes with a controlled spatial geometry and to study their impact on the profile of products resulting from the hydrolysis of complex plant biomass. The aim is to establish a link between spatial proximity, activity and hydrolysis product.

REQUIRED PROFILE

With a Master's degree in biochemistry, biocatalysis and/or structural biology or equivalent, the candidate should have strong skills in molecular biology, protein biochemistry and enzymology. A strong interest in protein structure will be appreciated. Fluency in English and good communication and teamwork skills are essential. But beyond these skills, the candidate will have to show a great scientific curiosity and a rigorous analysis allowing him/her to lead the project at the highest level.

APPPLICATION FORM

For more information and/or to apply, contact Claire Dumon (calire.dumon@insa-toulouse.fr) and Cédric Montanier (cedric.montanier@insa-toulouse.fr). A letter of motivation and a CV should be sent before June 1st, 2022 for a start of the thesis in the last quarter of 2022.

References: Cox et al. *The covalent complex of Jo-In results from a long-lived, non-covalent intermediate state with near-native structure*. Biochemical and Biophysical Research Communications, 2022, 589, 223-228, (10.1016/j.bbrc.2021.12.028). Badruna et al ; *The Jo-In protein welding system is a relevant tool to create CBM-containing plant cell wall degrading enzymes*. New Biotechnology, 2021, 65, 31-41. (DOI: 10.1016/j.nbt.2021.07.004). Enjalbert et al. *Characterisation of the Effect of the Spatial Organisation of Hemicellulases on the Hydrolysis of Plant Biomass Polymer*. Int. J. Mol. Sci. 2020, 21, 4360. (DOI: 10.3390/ijms21124360).