Toulouse Biotechnology Institute
Bio & Chemical Engineering

PhD position

Microbial ecology, Microbial interactions & Microfluidics

Toulouse Biotechnology Institute, France.
Starting October-November 2023

The presence in the natural environment of single microbial strains responsible of a particular bioconversion process is a rather rare event: complex microbial consortia carry out most environmental transformations. However, most biotechnological processes still rely on the use of single microbial strains. In order to expand the use of **microbial consortia** in biotechnological process, the objective of this PhD project is to investigate new approaches to build simplified microbial consortia that efficiently perform complex tasks, instead of using monocultures, and to develop new cell factories. With this approach, it will also be possible to develop an innovative method to study microbial interactions.

Objectives:
The main goal will be to determine and optimize the conditions to screen in microfluidic droplets the lignocellulolytic activities of microbial consortia to study the complementarities and interactions existing between microbial populations. This information is fundamental to design artificial microbial consortia with multiple activities.
The selected PhD candidate will apply this screening platform to build simplified functionally defined microbial consortia, with a minimal number of species, designed to target specific lignocellulose substrates, and study them in micro-reactors.

The project will combine current "top down" and "bottom up" approaches for microbial consortia simplification by making use of the recent progresses in microfluidic technology. Microfluidics will enable us to encapsulate single cells or minimal consortia in micro-droplets to study their activity. The functional performance of these encapsulated-organisms will be revealed using the last progress in fluorescent polymer design and synthesis, combined to the ultra-high throughput capacity of fluorescence-activated droplet sorting. This microfluidic approach will also be used to better understand the interactions occurring between microbial populations.

Context:
This PhD project will be realized in the framework of the **COLLIMATOR** project which is part of the **PEPR** (Priority Programs and Equipment for Research) funded by the French Agency for Research (ANR) and the **ECoDrop project**, funded by the Carnot Institute 3BCAR. Both projects focus on the engineering of microbial consortia in microfluidic droplet bioreactors to study microbial interactions and develop new biotechnological processes based in microbial consortia.

The selected candidate will work at the Toulouse Biotechnology Institute (TBI) in the Microbial Ecosystems and Bioprocess Engineering (EAD9) research team, in collaboration with the PICT-ICEO screening facility (TBI), the laboratory Fractionation of AgroResources and Environment (FARE) of INRAE-Reims, Toulouse White Biotechnology (TWB) and the laboratory of Bioenergetics and Protein engineering (BIT-CNRS).

Lab Host:

The Toulouse Biotechnology Institute is a leading French laboratory in microbial biotechnology, enzymatic catalysis and bioprocess engineering. TBI is supported by the French National Research Institute for Agriculture, Food and Environment (INRAE), the French National Council of Scientific Research (CNRS) and the National Institute of Applied Sciences of Toulouse (INSA).

Expertise and conditions:
We are looking for a highly motivated PhD candidate with :

- a Master's degree in microbiology, industrial microbiology, environmental microbiology, biochemical engineering, or biotechnology,
- experience in microbiology and bioreactor implementation/operation,
- experience in basic molecular biology methods (DNA/RNA extraction-purification, PCR, qPCR, sequencing),
- a background in bioinformatics and biostatistics (using R). Knowledge on NGS data analysis and on microbial ecology will be appreciated,
- good writing and communication skills,
- creative, out-of-the-box thinker,
- excellent interpersonal skills to work effectively and closely with different team members and partners.
- A good knowledge of spoken and written English is a highly valuable asset.
- A good knowledge of spoken French is also appreciated. If needed, training can be provided.

Applications should include a short CV, and a letter of motivation with a brief description of research interests, past research experiences and reasons why you are interested in this PhD position (1 page), a summary of Master's thesis (1 page). The candidates are encouraged to provide reference letters. The evaluation of candidates will begin September, 2023 and will proceed until the position is filled.

Starting : November-December 2023

Salary depends on the experience and on the salary scale of French universities (~1700€ net/month).

Address your application by e-mail to:
Guillermina Hernandez-Raquet
Senior Scientist (DR INRAE)
hernandg@insa-toulouse.fr

Sophie Bozonnet
Research Engineer (IR INRAE)
sophie.bozonnet@insa-toulouse.fr