Toulouse Biotechnology Institute
Bio & Chemical Engineering

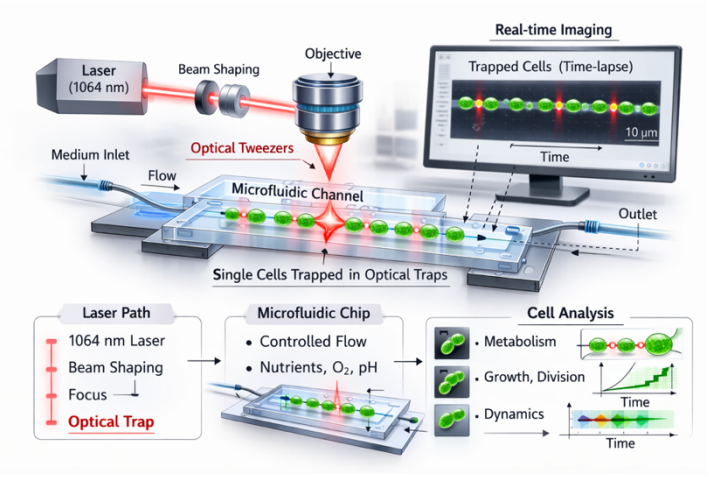
PhD POSITION

INNOVATIVE MICROFLUIDIC PLATFORM TO UNDERSTAND AND OPTIMIZE BIOTECH PROCESSES

Laboratory:	Transfer-Interface-Mixing of TBI at INSA Toulouse
Period:	Starting period between October 2026 (duration: 36 months)
Funding:	ANR **SCUBA** (https://anr.fr/Projet-ANR-25-CE51-7100)
Gross salary:	≈2300€/month (INSA contract) with possibility to teach (extra ≈200€/month)

Bioreactors are multiphase systems in which mass transfer between phases plays an important role in determining biological reaction rates. Microorganisms growing in such industrial bioreactors face changing conditions such as variations in oxygen availability, nutrient concentration, pH, and temperature. While industrial bioreactors operate under highly dynamic conditions, the physiological responses occurring at the single-cell level remain largely unexplored. This PhD project will develop cutting-edge experimental tools to reveal microbial adaptation and metabolic dynamics at the single-cell scale, bridging the gap between cellular physiology and bioreactor-scale processes.

You will work at the intersection of optics, microfluidics, and cell biology to develop an original platform combining holographic optical tweezers, which trap and manipulate several individual cells without contact, with a microfluidic chip that delivers controlled environmental conditions, and laser-induced fluorescence to measure oxygen, CO_2, and pH directly around living cells. Your experimental work will unfold across three interconnected phases: (i) measuring metabolic activity with innovative optical technique (ii) tracking growth & morphology under step-change environments, and (iii) probing dynamic responses by exposing single cells to periodic fluctuations mimicking real bioreactor gradients. The data you generate will directly feed into bioreactor simulation models developed in parallel by a second PhD in the group.



CANDIDATE PROFILE

This PhD sits at a rare/unique intersection: optical physics, microfluidics, fluid mechanics, (bio)chemical engineering, and microbiology. Missing skills can be acquired: the group has the expertise to train you on microfluidic fabrication, fluorescence techniques, image processing and cell biology. A taste for coding is also essential: data acquisition, image processing, and signal analysis will all require scripting throughout the project.

HOW TO APPLY ?

Application:	Send a cover letter, a detailed CV, transcript of Master diploma and one contact reference.
Contacts:	**Mickaël CASTELAIN (principal director):** mickael.castelain@insa-toulouse.fr
	Nicolas DIETRICH (co-director): nicolas.dietrich@insa-toulouse.fr

The interview will operate under rolling basis. Deadline of submission: 15th May 2026

Université de Toulouse
135 Avenue de Rangueil | 31077 Toulouse Cedex 4
Tél. : 05 61 55 94 01 |
www.toulouse-biotechnology-institute.fr