Postdoctoral position in biomicrofluidics

Spatially-resolved efficacy of quorum-sensing inhibitors in microchannel flows

Project overview. This interdisciplinary project investigates the efficacy of quorum-sensing inhibitors (QSIs) in microfluidic models of bacterial biofilms. We aim to address antimicrobial resistance by developing novel approaches to prevent biofilm formation in mixed bacterial communities of *Pseudomonas aeruginosa* and *Staphylococcus aureus*, which are particularly problematic in cystic fibrosis patients. By combining advanced microfluidic techniques with expertise in drug development, we will evaluate how flow conditions affect QSI efficacy and biofilm properties, ultimately contributing to new therapeutic strategies against resistant infections.

Research highlights.

- Develop and use microfluidic chips
- Evaluate efficacy of QSIs under flow conditions that better mimic *in vivo* environments
- Characterize mixed-species biofilms using imaging and analytical techniques
- Contribute to the development of new therapeutic approaches for cystic fibrosis patients
- Work at the interface of physics, engineering, chemistry, and microbiology

Required qualifications.

- PhD degree in Physics, Biophysics, Engineering, or related fields
- Experience with experimental work and data analysis
- Demonstrated ability to work in an interdisciplinary environment
- Proficiency in English (writing and speaking)
- Programming skills are an advantage (e.g., MATLAB, Python)

Research environment. The postdoctoral research will be conducted at the Institut de Mécanique des Fluides (IMFT) and at the Laboratoire de Génie Chimique (LGC), with experiments performed in a level 2 biosafety laboratory at the Centre Hospitalier Universitaire (CHU) de Toulouse. The candidate will benefit from state-of-the-art facilities and equipment for microfluidics (including at the LAAS-CNRS platform) and bacterial culture.

Supervision and collaborations.

- **Principal Supervisors**: Dr. Yohan Davit (IMFT). Expertise: Fluid mechanics, transport in biological and porous media, biophysics of bacteria. Dr. Fatima El Garah (LGC). Expertise: Chemical synthesis, molecular modeling, structure-activity relationship, and evaluation of bioactive compounds.
- **Key Collaborators**: This position is part of the ANR-funded project PRC TARGET-QS, involving researchers from the Institut de Pharmacologie et de Biologie Structurale (IPBS, Hedia Marrakchi) and Centre International de Recherche en Infectiologie (CIRI, Anne DOLÉANS-JORDHEIM).

The project includes regular scientific exchanges through regular online meetings and annual in-person gatherings with the entire team, offering excellent networking opportunities and multidisciplinary training.

Project details. Antimicrobial resistance (AMR) causes 1.2 million deaths worldwide yearly. Bacterial biofilms are particularly resistant to antibiotics, constituting a major medical challenge. TARGET-QS aims to develop inhibitors effective against mixed biofilms of *P. aeruginosa* and *S. aureus*, pathogens causing persistent infections in cystic fibrosis patients. Our approach targets Quorum Sensing (QS), a cellular communication system that, when inhibited, can prevent biofilm formation and thus increase antibiotic efficiency. We have developed QS inhibitors that prevent biofilm formation in *P. aeruginosa* without cytotoxic effect on lung cells. TARGET-QS will develop inhibitors optimized for multi-species biofilms through: (i) drug-design by structure-activity studies, (ii) preclinical ADME-Tox studies, and (iii) real-time evaluation on mixed biofilms in microfluidic systems.

This postdoc project specifically focuses on spatially-resolving efficacy of QSIs in *in vitro* dynamic microfluidic models, characterizing:

- differences between static and dynamic conditions on the efficacy of QSIs,
- the effect of QSIs on the relative fitness of *P. aeruginosa* and *S. aureus* in flow conditions,
- the effect of QSIs on the growth/detachment dynamics and viscoelastic properties of the biofilm,

Practical information. Duration: 2 years (expected start date: September/October 2025). Funding: Fully funded position (including salary and research expenses). Location: Toulouse, France.

Application process. Interested candidates should submit their application by email following these guidelines:
Email subject: postdoc_target_qs_toulouse
To: yohan.davit@imft.fr
Email body: Brief self-introduction and motivation statement
Required attachments: CV (including contacts for references)
Application deadline: Review of applications will begin immediately and continue until the position is filled, with a final deadline in September 2025. Early application is encouraged as the position may be filled before the final deadline.

For additional information or informal inquiries, please contact Dr. Yohan Davit (yohan.davit@imft.fr).