

Master project & PhD in research Stage de M2 recherche & Thèse

Research topic	Biophysics of bacterial biofilms in porous micro-bioreactors.
Lab	Institute of Fluid Mechanics, Allée Camille Soula, 31400 Toulouse, France.
Salary	Master: monthly stipend of about 500-600 euros net (negotiable for foreigners). PhD: between 17.000 and 21.000 euros net / year (funding for 3 years).
Funding /Project	European Research Council. ERC Starting Grant. Project BEBOP.
Follow up	Funding is available for a PhD position after the master.
Main supervisor	Yohan Davit, yohan.davit@imft.fr , tel: +33 5 34 32 28 82.
Dates	Master: applications until December 2018. Internship of 4 to 6 months in 2019. PhD: applications until April 2019 or until fulfilled.
Example publication	Investigating the influence of flow rate on biofilm growth in three dimensions using microimaging. S Ostvar, G Iltis, S Schluter, L Andersson, BD Wood and D Wildenschild. <i>Advances in Water Resources</i> (2018).
Background	Biophysics, or chemical engineering, or microbiology.
Other	For more info about research activities @ IMFT, http://yohan-davit.com

Context. This Master/PhD is part of a large project (BEBOP, 2019-2024) funded by the European Research Council. The goal of BEBOP is to figure out how we can use bacteria to control the properties of porous structures (e.g. porosity, permeability). We envision that this will unlock a new generation of biotechnologies, such as self-repairing construction materials or self-cleaning bioreactors. The main scientific obstacle to this technology is the lack of understanding of the biophysical mechanisms associated with the development of bacterial populations within complex porous structures. Therefore, the first scientific objective of BEBOP is to gain insight into how fluid flow, transport phenomena and bacterial communities (biofilms) interact within connected heterogeneous structures. To this end, we will combine microfluidic and 3D printed micro-bioreactor experiments; fluorescence and X-ray imaging; high performance computing bringing together CFD, individual-based models and pore network approaches. The second scientific objective of BEBOP is to create the primary building blocks toward a control theory of bacteria in porous media and to construct a demonstrator bioreactor for permeability control.

Role. The successful applicant will use X-ray micro-tomography to study the influence of flow on biofilm growth in 3D printed porous micro-bioreactors. The idea of the PhD position following this Master is to study how the spatial distribution of biofilms in porous structures is affected by a variety of variables, such as flow, the presence of predators, quorum-sensing inhibitors or even biocides. The goal of the Master project is to improve our existing experimental setup, start exploring the effect of flow using X-ray tomography and perform image processing of 3D images. The actual research is flexible and can be adapted to the expertise of the successful candidate. I am looking for somebody extremely motivated who is willing to pursue this work as a PhD student and who will be fully involved in the project and in the group (2 PhDs + 1 postdoc starting in 2019, other positions will also be opened later on).



3D image of biofilm (gold) in a packing of beads (black) obtained using X-ray tomography

How to apply? Send a cover letter, a CV (highlighting your level in English) and copies of transcripts (including lectures followed and grades/rankings when available) to yohan.davit@imft.fr (please indicate ERC_BEBOP_Bioreactor in the e-mail title). Retained candidates will be interviewed.