

M2 INTERNSHIP OFFER

Title: **Modelling the collective behaviours of the social bacteria *Myxococcus xanthus***

Type: **Experimental and Theoretical/Numerical**

Duration: 6 months, starting around February 2026

Possibility to continue into a PhD after the internship: **yes (desirable)**

Laboratories:

- Laboratoire de Chimie Bactérienne (LCB), 13009 Marseille
- Institut de Recherche sur les Phénomènes Hors Équilibre (IRPHÉ), 13013 Marseille

Supervisors: Târn MIGNOT (LCB) tmignot@imm.cnrs.fr, Aurore LOISY (IRPHÉ) aurore.loisy@univ-amu.fr

Summary of the project

Myxococcus xanthus is a predatory bacteria that exhibits complex social behaviour and has been used as a model organism to study microbial cooperation. In favourable conditions, *M. xanthus* form coordinated swarms that hunt on other bacteria (like *E. coli*) and invade their colonies. In harsh conditions such as starvation, they collectively transform into complex multicellular structures (fruiting bodies) to survive in the form of spores. Prey consumption is a collective process requiring prey cell recognition by single cells and attraction of large cell groups (Figure 1).

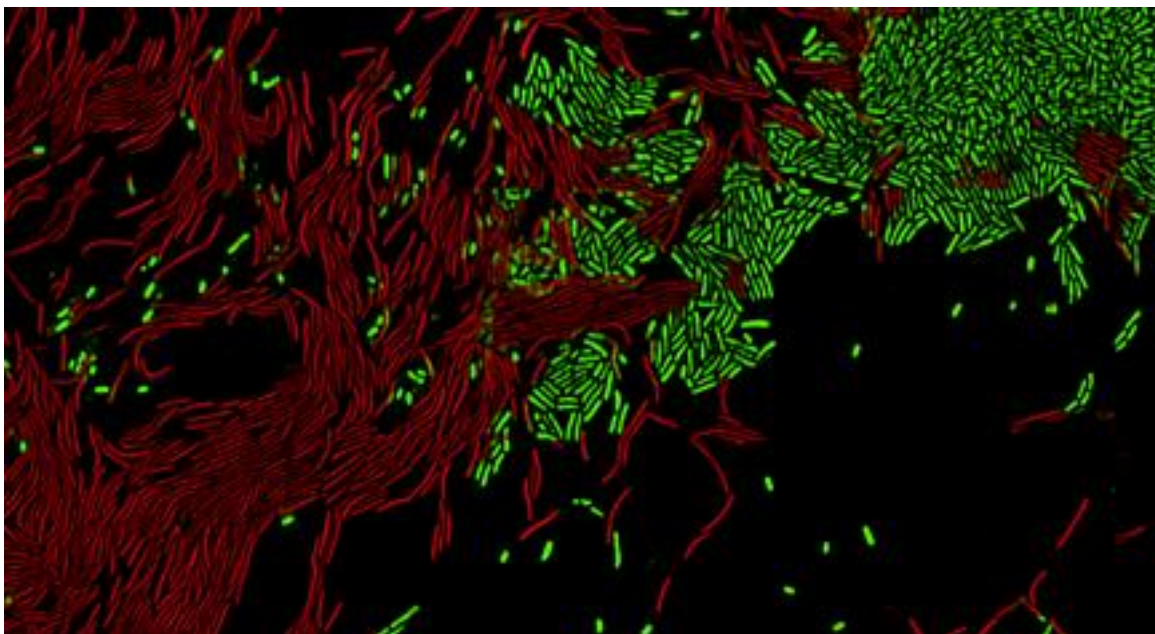


Figure 1: Prey invasion by *M. xanthus*. Myxococcus cells (red) detect *E. coli* Prey cells (green) and signal larger groups, provoking collective invasion and killing of the prey cells.

The goal of this internship is to develop an agent-based model of *M. xanthus* able to explain the collective mechanism of prey invasion. The intern will conduct predation experiments, analyse bacteria trajectories and develop the model under the guidance of the supervisors (possibly using data-driven, AI-based techniques). We will first model the response of individual myxobacteria to the presence of prey from experiments conducted at LCB. We will then develop a numerical model of this complex active system and compare predictions to experiments carried out at large bacteria densities.

Profile of the intern

We are looking for a strongly motivated biophysicist. Prior experience with microscopy/image analysis and complex systems modelling/programming is a plus.

Working environment

The experiments will be conducted at LCB (Tâm Mignot) and the modelling at IRPHE (Aurore Loisy, living and bio-inspired systems team).

Relevant recent references

Saulnier et al. (2024), <https://www.biorxiv.org/content/10.1101/2024.10.28.620572v1>