Molecular mechanism of Type IVa pili activation by SgmX in *Myxococcus xanthus*

Keywords
Type IV pili, Bacterial cell motility, Molecular and cellular microbiology, NMR spectroscopy

Summary
In all living organisms, surface cell movements are essential for environmental exploration and multicellular development, and are also at the origin of cancer cell dissemination. In Bacteria, surface cell movements are mediated by a class of widespread nanomachines called Type-IV Pili (Tfp). Importantly, Tfp-based motility (or twitching), is at the root of highly cooperative cell movements, which on pathogens allow host colonization and biofilm formation, an important trait for bacterial resistance to various treatments. Despite an extensive knowledge on Tfp molecular structure, the determinants and regulations that convert Tfp into highly efficient motility machines remain largely unknown. In bacteria, twitching motility apparently relies on the simple processes of extension of µm-long pilin filaments, their binding of substrates and their retractions to pull cells forward. Nevertheless, this is not sufficient and Twitching motility is mediated by the coordinated action of multiple Tfpa machines asymmetrically activated at one side of the cell. However, the general underlying molecular mechanism remains unknown. In this PhD project, we proposed to characterize the underlying molecular mechanism that activates Tfpa machines in the motile bacteria *Myxococcus xanthus*.

The realization of the project will need the development of multidisciplinary approaches (molecular genetics, cell biology, biochemistry, NMR spectroscopy) in a collaborative environment. From this project we expect to shed the light for the first time on molecular principles underlying the asymmetric activation of Tfp machines at the base of twitching motility, a road to multicellular structure development.

Relevant publications

Berry JL, Pelicic V. Exceptionally widespread nanomachines composed of type IV pilins: the prokaryotic Swiss Army knives. FEMS Microbiol Rev. Jan; 39(1):134-54 (2015).

Herrou J, Mignot T. Dynamic polarity control by a tunable protein oscillator in bacteria. Curr Opin Cell Biol. Feb; 62:54-60 (2020).

Mercier, R. et al. The polar Ras-like GTPase MglA activates type IV pilus via SgmX to enable twitching motility in Myxococcus xanthus. Proc Natl Acad Sci U S A. 117, 28366-28373 (2020).

The co-supervisors

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Location
LISM and LCB, 31 chemin Joseph Aiguier Marseille, France

Doctoral school
Life and Health Sciences (ED 62), Aix-Marseille université (https://ecole-doctorale-62.univ-amu.fr/)

Expected profile of the candidate
The successful candidate must have a solid background in molecular biology with basic knowledge on protein purification technics. A master 2 internship in a laboratory using bacteria as a model system will be a plus but not discriminant. Enthusiasm for research, ability to work independently and good communication skills are important.