UFR de Chimie et de Biologie
UNIVERSITÉ Grenoble Alpes

Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2021-2022

Laboratory/Institute: Institut de Biologie Structurale **Director:** Winfried WEISSENHORN
Team: Pneumococcus group **Head of the team:** Cecile MORLOT

Name and status of the scientist in charge of the project:
Cecile MORLOT, DR2 CNRS **HDR: yes**
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Program of the Master's degree in Biology:

√ Immunology, Microbiology, Infectious Diseases √ Structural Biology of Pathogens
☐ Physiology, Epigenetics, Differentiation, Cancer ☐ Neurosciences and Neurobiology

Title of the project:

Study of cell wall synthesis in a human pathogen using super-resolution fluorescence microscopy

Objectives (up to 3 lines):

The objective is to analyze the architecture of cell wall synthesis regions along the cell cycle of *Streptococcus pneumoniae*, to get insights into the mechanisms of cell division and morphogenesis. For this, the student will collect, process and analyze dSTORM data on cells in which the new cell wall has been labeled.

Abstract (up to 10 lines):

Bacterial division, morphogenesis and survival are intimately linked to cell wall metabolism. Despite its importance as fundamental knowledge and as a source of antibiotic targets, we still poorly understand how cell wall is synthesized in space and time to ensure proper cell division, shape and integrity. Fluorescence super-resolution microscopy methods such as dSTORM or PALM allow observation of cellular processes at resolutions 10 times higher than conventional fluorescence microscopy. Our team has implemented these powerful approaches in the human pathogen *Streptococcus pneumoniae* to observe the positioning and architecture of protein machineries (Jacq et al., 2015), as well as their cell wall synthesis activities (Trouve et al., 2021). During her/his internship, the student will use these breakthrough nanoscopy techniques to study the coordination between the synthesis of the two main components of the cell wall, the peptidoglycan and the teichoic acids.

Methods (up to 3 lines):

Microbiology (cell culture, characterization of phenotypes, biorthogonal click chemistry for metabolic labeling of cell wall components); acquisition and processing of dSTORM (direct STochastic Optical Reconstruction Microscopy) data; statistical analysis of dSTORM data (localization, dimensions, quantification, evolution).

Up to 3 relevant publications of the team:

Trouve, Zapun, Arthaud, Durmort, Di Guilmi, Söderström, Pelletier, Grangeasse, Bourgeois, Wong, **Morlot** (2021). Nanoscale dynamics of peptidoglycan assembly during the cell cycle of *Streptococcus pneumoniae*. ***Curr. Biol.*** 31:1-13.

Jacq, Adam, Bourgeois, Moriscot, Di Guilmi, Vernet, **Morlot** (2015). Remodeling of the Z-ring nanostructure during the *S. pneumoniae* cell cycle revealed by PhotoActivated Localization Microscopy. ***mBio*** 6(4). Pii: e01108-15.

Bonnet, Wong, Vernet, Di Guilmi, Zapun, Durmort (2018). One-pot two-step metabolic labeling of teichoic acids and direct labeling of peptidoglycan reveals tight coordination of both polymers inserted into pneumococcus cell wall. ***ACS Chem Biol***. 13(8):2010-15.

Requested domains of expertise (up to 5 keywords):

Cellular and/or structural biology, microbiology.