UFR de Chimie et de Biologie
UNIVERSITÉ Grenoble Alpes

Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2024-2025

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 assembly in streptococcal, staphylococcal and enterococcal pathogens using click chemistry and super-resolution fluorescence microscopy.

Objectives (up to 3 lines):

The objective of the project is to determine how the peptidoglycan, the most important component of the bacterial cell wall, is assembled in time and space in *Streptococcus pneumoniae*, *Staphylococcus aureus* and *Enterococcus faecium*, three human pathogens that have acquired antibiotic resistance properties.

Abstract (up to 10 lines):

Bacterial division and survival are intimately linked to the metabolism of the peptidoglycan, a three-dimensional mesh surrounding the cell and made up of glycan chains cross-linked by short peptides. Peptidoglycan synthesis is the target of our most common antibiotics (e.g. penicillins), whose action is diminished by the acquisition of antibiotic resistance traits. Despite its importance for bacterial physiology and antibiotherapies, we still poorly understand how the peptidoglycan is assembled in space and time. Our team has implemented click chemistry labeling of peptidoglycan, as well as super-resolution fluorescence microscopy (resolution of ~ 30 nm), to investigate the mechanisms of peptidoglycan synthesis (Trouve et al., 2021a, 2021b). During the internship, the student will use these breakthrough techniques to 1) isolate peptidoglycan fragments of various maturities to analyze their composition by mass spectrometry (in collaboration with an INSERM team in Paris) and 2) observe the architecture of peptidoglycan synthesis regions by dSTORM.

Methods (up to 3 lines):

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

Up to 3 relevant publications of the team:

Trouve, Zapun, Bellard, Juillot, Pelletier, Freton, Baudoin, Carballido-Lopez, Campo, Wong, Grangeasse, Morlot. DivIVA controls the dynamics of septum cleavage and peripheral peptidoglycan synthesis in *Streptococcus pneumoniae*. ***Under revision in mBio.*** *BioRxiv* doi: https://doi.org/10.1101/2024.05.09.593393.

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.

Requested domains of expertise (up to 5 keywords):

Cellular and/or structural biology, microbiology.