M1-Molecular and Cellular Biology (MCB)
Internship Proposal Form
Chemistry-Biology Department

Laboratory/Company Address and Affiliation:

Institut de Biologie Structurale - CNRS/CEA/UGA (UMR5075)
71, avenue des Martyrs - CS10090 - 38044 Grenoble Cedex 9, France

Laboratory/Team Research/Company area (Keyword)

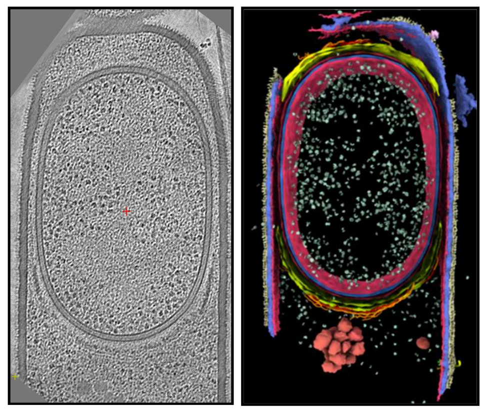
Institut de Biologie Structurale - Pneumococcus group (Headed by C. Morlot)

Bacterial division & sporulation. Cell wall, macromolecular protein complexes. Structural & cellular microbiology. Fluorescence microscopy, click chemistry, cryo-FIB/SEM, cryo-electron tomography.

Summary of the Proposed Internship Project (10 lines)

Title: **Biogenesis of the bacterial cell envelope**

Summary: Understanding how bacteria assemble their cell envelope is a major challenge in microbiology, with critical implications for **combating pathogens and antimicrobial resistance**. The cell envelope—a composite structure made of lipids, sugar polymers and proteins—plays a key role in maintaining cell shape and resisting environmental stresses. Two bacterial cell envelope structures stand out for their complexity: the **cell wall**, a mesh of glycans and peptides surrounding the cell, and the **spore coat**, a robust, multi-layered protein shell that self-assembles during sporulation. To study these structures at nanoscale resolution, we use **cryo-electron tomography (cryo-ET)**, a cutting-edge technique in structural biology. By preparing ultra-thin cell sections (lamellae) via **cryo-focused ion beam milling (cryo-FIB/SEM)** or ultramicrotomy, we visualize bacterial cells in 3D, uncovering dynamic stages of envelope assembly and stress adaptation. During this internship, you will investigate how bacteria modify their cell envelope to withstand environmental challenges. This internship is ideal for Master students passionate about structural biology and eager to gain hands-on experience in advanced electron microscopy techniques. You will contribute to groundbreaking research at the interface of microbiology and biophysics, while developing expertise in state-of-the-art imaging methods.



Left: sporulating *B. subtilis* cell observed by cryo-ET.
Right: segmentation of cell components.

Why Join Us: Be part of a dynamic team exploring the frontiers of bacterial cell biology, with direct applications in the fight against infectious diseases.

Methodologies and/or Techniques to be used

Cultivate bacterial models (*Streptococcus pneumoniae* and sporulating *Bacillus subtilis*); monitor cell growth and physiological states using fluorescence microscopy; prepare samples for cryo-FIB/SEM and ultramicrotomy; participate in cryo-ET data acquisition and processing, from lamellae milling to tomographic reconstruction.

Person to contact:

Name: Cecile MORLOT E-mail: cecile.morlot@ibs.fr Phone: 04 57 42 86 55
Please provide your grade records and ranking in your class.

Additional information

Nguyen, Bauda, Boyat, …, Grangeasse, Moriscot, Durmort, Zapun, **Morlot** (2025). Teichoic acids in the periplasm and cell envelope of *S. pneumoniae*. ***eLife*** 14:RP105132.

Bauda, Gallet, …, Schoehn, Moriscot, **Morlot** (2024). Ultrastructure of macromolecular assemblies contributing to bacterial spore resistance revealed by in situ cryo-electron tomography. ***Nat. Commun.*** 15(1):1376.

Proposal Form send as a PDF file to: sabrina.boulet@univ-grenoble-alpes.fr

File has to be named as: name-Internship-M1-MCB-2025-2026.pdf