Master 2 research internship in Integrated Structural & Cell Biology in Grenoble

Supervisor(s):
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Host laboratory:
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Host group/team:
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Title of the M2 research internship:
Structural study of coat polymers at the surface of the Bacillus subtilis endospore

Project summary:
The bacterial spore owes its incredible resistance capacities to molecular structures that protect the cell content from external aggressions. Such resilience is an asset when spores are used for the benefit of humans, as in the case of probiotics (e.g. spores of *Bacillus subtilis*), or a major problem for public health, food safety or biowarfare when it comes to spores of pathogenic bacteria (e.g. spores of *Bacillus cereus* or *Clostridium difficile*). Among the determinants of resistance is an extracellular shell made of proteinaceous layers (the coat). The spore coat is a composite structure made of four main layers: the basement, the inner coat, the outer coat and the crust. Its assembly is based on a complex network of interactions involving first a tens morphogenetic proteins, and eventually more than 80 different proteins. Despite their importance for the acquisition of resistance properties, the architecture of the different coat layers remains unknown, because their deposition and maturation is a long (> 7 hours) and complex molecular process. Using cryo-electron tomography (cryo-ET) on spore lamellae generated by cryo-FIBM/SEM (cryo-focused ion beam milling coupled to scanning electron microscopy), we have recently provided the first description of the early stages of coat assembly in *B. subtilis* (Bauda et al., Nat Commun 2024). The M2 project will aim at characterizing the contribution of 4 main morphogenetic proteins to the assembly of the nascent coat layers using biochemical, biophysical and electron microscopy approaches. We are looking for a highly motivated student with background in cellular and structural microbiology.
This M2 internship is a springboard to a thesis project aiming at unraveling the architecture of the nursery coat layers and deciphering main stages of coat deposition. The study will be primarily conducted in the model organism *Bacillus subtilis*.

Keywords:
bacterial sporulation, macromolecular assemblies, integrated structural and cellular microbiology

Relevant publications of the team:
Bauda E, Gallet B, Moravcova J, Effantin G, Chan H, Novacek J, Jouneau PH, Rodrigues CDA, Schoehn G, Moriscot C, Morlot C (2024). Ultrastructure of macromolecular assemblies contributing to bacterial spore resistance revealed by in situ cryo-electron tomography. Nat. Commun. 15(1):1376.

Morlot C, Rodrigues CDA (2018). The new kid on the block: a specialized secretion system during bacterial sporulation. Trends Microbiol. pii: S0966-842X(18)30001-5.

Rodrigues CDA, Henry X, Neumann E, Kurauskas V, Bellard L, Fichou Y, Schanda P, Schoehn G, Rudner DZ, Morlot C (2016). A ring-shaped conduit connects the mother cell and forespore during sporulation in B. subtilis. Proc. Natl. Acad. Sci.USA 113(41):11585-11590