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

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Host laboratory:
IBS, https://www.ibs.fr/

Host group/team:
I2SR and MICA

Title of the M2 research internship:
Bacterial membrane and antibiotic sensitivity: unravelling the roles and mechanisms of a chaperone triad by 3D imaging

Project summary:
Pathogenic and commensal bacteria have evolved a diverse array of strategies to survive and even flourish in adverse environments. Enteric bacteria for example adapt to environmental stresses in the human gastrointestinal tract such as acid stress, oxygen limitation and exposure to antibiotics. A major role in stress response and adaptation is played by the bacterial envelope: membrane lipids not only determine the cell shape but also localise proteins to and within the envelope, control their folding and activity, and participate in the adaptive response as well as in biofilm formation, motility, virulence, and energy metabolism. The bacterial inner membrane hosts respiratory complexes, which generates a proton motive force essential for ATP production and membrane transport; as a side effect, aminoglycoside antibiotics exploit this gradient to penetrate into the cell. We recently discovered that in *E. coli*, lipid composition, membrane homeostasis and antibiotic sensitivity are controlled by the LdcI-RavA-ViaA chaperone triad. Building on our most recent unpublished findings, this M2 project will investigate the colocalisation of the triad components with respiratory complexes, lipids, and other potentially relevant systems at specific sites at the *E. coli* cell periphery using quantitative 3D single-molecule localisation microscopy. The internship will serve as a foundation for a PhD thesis aiming to decipher the sophisticated mechanisms that enable enterobacterial survival under challenging environmental conditions, employing a combination of optical and cryo-electron microscopy, advanced image analysis, and biochemical and biophysical characterisations.

Keywords:
Bacteria, *E. coli*, 3D super-resolution microscopy, chaperone, membrane

Relevant publications of the team:

The AAA+ ATPase RavA and its binding partner ViaA modulate *E. coli* aminoglycoside sensitivity through interaction with the inner membrane. Felix J, Bumba L, Liesche C, Fraudeau A, Rébeillé F, El Khoury JY, Huard K, Gallet B, Moriscot C, Kleman JP, Duhoo Y, Jessop M, Kandiah E, Barras F, Jouhet J, Gutsche I. Nature Commun. 2022; doi: 10.1038/s41467-022-32992-9.

Supramolecular assembly of the *Escherichia coli* LdcI upon acid stress. Jessop M, Liesche C, Felix J, Desfosses A, Baulard M, Adam V, Fraudeau A, Huard K, Effantin G, Kleman JP, Bacia-Verloop M, Bourgeois D, Gutsche I. PNAS 2021; doi: 10.1073/pnas.2014383118.