Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2024-2025

Laboratory/Institute: Institut of Structural Biology (IBS) **Director:** W. Weissenhorn
Team: MICA **Head of the team:** Irina Gutsche
Name and status of the scientists in charge of the project:
Irina Gutsche (MICA group leader) et Jean-Philippe Kleman (leader of the M4D platform, GenOM team, I2SR group)
HDR: yes x no ☐
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Program of the Master's degree in Biology:
x Microbiology, Infectious Diseases and Immunology **x** Structural Biology of Pathogens
☐ Physiology, Epigenetics, Differentiation, Cancer ☐ Neurosciences and Neurobiology

Title of the project: Explore the links between a protein system involved in enterobacterial antibiotic sensitivity and the major respiratory complexes *in vivo*

Objectives (up to 3 lines):
Interrogate the cellular location of the AAA+ ATPase chaperone RavA and its partner ViaA by advanced 3D optical imaging and address its action on the lipid microdomains and the respiratory complexes inserted therein

Abstract (up to 10 lines):
Bacteria have to sense and respond to adverse and changing environmental conditions. 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. Cell membrane hosts respiratory complexes, which create a proton motive force that fuels energy production in form of ATP generation and enables multiple exchanges across the membrane; as a side effect, aminoglycoside antibiotics take advantage of it to penetrate inside the ell. We recently found that in E. coli lipid composition, membrane homeostasis and antibiotic sensitivity are controlled by the LdcI-RavA-ViaA chaperone system, which we are now investigating by combining *in vitro* and *in vivo* imaging by optical and electron microscopy with advanced data analysis and biochemical characterisations.

Methods (up to 3 lines): bacterial culture, in vivo optical imaging (bright field, 3D confocal and single-molecule localisation microscopy, in particular dSTORM), participation in *in vitro* characterisation if interested.

Up to 3 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. Nat 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. Proc Natl Acad Sci U S A. 2021 doi: 10.1073/pnas.2014383118.

Requested domains of expertise (up to 5 keywords): microbiology, biochemistry, fluorescence microscopy, interest in image analysis and in cryo-electron microscopy would be a plus