Grenoble Alliance for Integrated Structural & Cell Biology

GRAL MASTER 2 RESEARCH SCHOLARSHIP - Program 2017 - 2018

INTERNSHIP PROPOSAL

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Research project title: Visualisation of bacterial nanocompartments inside the cell

5 Keywords to describe the project: bacterial microcompartment, encapsulin, fluorescence, electron microscopy, image analysis

Description of the project (aims, experimental techniques, recommended background):
Our research team "Molecular machines in bacteria and viruses" in part of the Methods and Electron Microscopy group in IBS. One of the main interests of the team is a huge macromolecular cage that is thought to counteract acid stress under starvation in enterobacteria but that we believe to be also a novel chaperone for specific ron-containing proteins. We analyze this assembly using an an integrated interdisciplinary multi-level approach ranging from genetics and cell biology through bioinformatics, biochemistry and biophysics, to structural studies by a combination of X-ray crystallography and cryo-electron microscopy, as well as single-molecule fluorescence. However, as a stress response machinery, this architecture is highly dynamic. Thus, we wish to use as a model system a similarly-sized but extremely stable and highly symmetrical bacterial microcompartment from an extremophile. This so-called encapsulin stores iron and protects bacteria from oxydative stress. In collaboration with laboratories from NIH (USA) and BIP (Marseille), experts in encapsulin structure and biology, we wish to visualize it inside the intact cell by single-molecule fluorescence and electron microscopy. We expect that fluorescence labeling will already be done before the student arrival. We are looking for a student interested in structural biology and wishing to work in an interdisciplinary and international environment.

Relevant publications of the team:

1. Assembly principles of a unique cage formed by hexameric and decameric E. coli proteins. Malet H, Liu K, El Bakkouri M, Chan SW, Effantin G, Bacia M, Houry WA, Gutsche I. Elife. 2014

2. Linkage between the bacterial acid stress and stringent responses: the structure of the inducible lysine decarboxylase. Kanjee U, Gutsche I, Alexopoulos E, Zhao B, El Bakkouri M, Thibault G, Liu K, Ramachandran S, Snider J, Pai EF, Houry WA. EMBO J. 2011

3. Structure of RavA MoxR AAA+ protein reveals the design principles of a molecular cage modulating the inducible lysine decarboxylase activity. El Bakkouri M, Gutsche I, Kanjee U, Zhao B, Yu M, Goret G, Schoehn G, Burmeister WP, Houry WA. Proc Natl Acad Sci U S A. 2010