Grenoble Alliance for Integrated Structural & Cell Biology

GRAL MSc RESEARCH SCHOLARSHIP 2020-2021

RESEARCH INTERNSHIP PROPOSAL

Institute / Group

IRIG / IBS - DYNAMOP

Supervisor	E-mail	Phone
Dominique Bourgeois	dominique.bourgeois@ibs.fr	+33 4 57 42 86 44

Research Project Title

Design of advanced fluorescent proteins for super-resolution fluorescence microscopy

Description of the project

Super-resolution fluorescence microscopy has become an essential tool to image biological samples at nanometric resolution. A very popular approach is PALM (PhotoActivated Localization Microscopy). PALM relies on the use of fascinating fluorescent markers called “phototransformable fluorescent proteins” (PTFPs). PTFPs exhibit amazing photophysical properties, for example a UV-induced green-to-red color change, which are fundamental to the PALM concept. However, PTFPs are not ideal and need to be optimized almost for every single biological application. At the IBS, we have developed a PALM microscope and we collaborate with teams of biologists, notably in the field of microbiology. In this truly interdisciplinary context, we aim at better understanding PTFPs and at engineering improved variants optimized for various applications. Here, the aim will be to optimize a PTFP to perform single-particle-tracking PALM (sptPALM) on Deinococcus radiodurans, a bacterium which exhibits outstanding radioresistance. D. radiodurans has a highly compact and dynamic nucleoid, possibly involved in radioresistance. Using the optimized PTFPs, and in collaboration with J. Timmins team at IBS, we will study the dynamical behavior of so-called “Nucleoid Associated Proteins” (NAPs), ie proteins that bind to and bend DNA to induce its compaction. Most of the work will rely on the use of state-of-the-art super-resolution microscopy from sample preparation to image acquisition and analysis. The recruited student should have a background and a strong interest in fluorescence microscopy and structural biology.

Keywords

Fluorescent proteins, PALM microscopy, single molecules, *Deinococcus radiodurans*, Nucleoid Associated Proteins

Relevant publications of the team

D. Thédié, R. Berardozzi, V. Adam, D. Bourgeois, “Photoswitching of Green mEos2 by Intense 561-nm Light Perturbs Efficient Green-to-Red Photoconversion in Localization Microscopy”, J. Phys. Chem. Lett., (2017), 8, 4424-4430.

E. de Zitter, D. Thédié, V. Mönkemöller, S. Hugelier, J. Beaudouin, V. Adam, M. Byrdin, L. Van Meervelt, P. Dedecker & D. Bourgeois, “Mechanistic investigation of mEos4b suggests a strategy to reduce track interruptions in sptPALM”, Nature Meth., (2019) 16, 707-710.

K. Floc’h, F. Lacroix, P. Servant, P. Servant, Y.S. Wong, J.P. Kleman, D. Bourgeois & J. Timmins “Cell morphology and nucleoid dynamics in dividing Deinococcus radiodurans”, Nature Commun., (2019), 10, 3815