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

Supervisor(s):
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Host laboratory:
IBS, https://www.ibs.fr/

Host group/team:
I2SR: Integrated imaging of stress reponse / Pixel team

Title of the M2 research internship:
Optimization of data analysis for quantitative super-resolution fluorescence microscopy.

Project summary:
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). This technique relies on the use of fascinating fluorescent markers called “phototransformable fluorescent proteins” (PTFPs). PTFPs exhibit extraordinary properties, for example a UV-induced green-to-red color change, but their photophysical behavior is also highly complex. Nowadays, PALM imaging aims to be quantitative, e.g. approaches are developed to evaluate the stoichiometry of protein complexes (qPALM) or their diffusion dynamics (sptPALM). For every biological application, experimental conditions need to be optimized, and data processing requires taking into account the intricate behavior of the employed PTFPs. In this context we work on several biological projects, in the frame of various collaborations, that are all related to cellular stress response mechanisms. In the field of microbiology we are interested in Deinococcus radiodurans, a fascinating bacterium which withstands extreme doses of radiation. We use qPALM and sptPALM to investigate how DNA bound proteins maintain its compact and dynamic genome (called nucleoid) and participate in the response to radiation-induced stress. In the field of cancer, we are interested in how a specific complex between two proteins called YB1 and hNTH1 might be inhibited by drugs to improve treatments against resistant tumors. In the field of cell signaling, we are interested in studying how proteins of the Src family kinase (SFK proteins) reorganize upon various stimuli. In these latter 2 projects, we plan to use qPALM and sptPALM to follow how the proteins of interest distribute within the nucleus or the plasma membrane.
We are looking for highly motivated student in the field of single-molecule fluorescence imaging and data analysis. The student should have a background and a strong interest in biophysics and data processing. He/she will be involved in optimizing the complex analysis of quantitative PALM data on one of the biological project cited above.
The recruited student will eventually be co-supervised by a PhD student/postdoc of the group.

Keywords:
super resolution fluorescence microscopy, fluorescent proteins, data analysis

Relevant publications of the team:
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

J. Wulffele, D. Thédié, O. Glushonkov, and D. Bourgeois*. “mEos4b Photoconversion Efficiency Depends on Laser Illumination Conditions Used in PALM” J. Phys. Chem. Lett., (2022), 13, 5075–5080

D. Bourgeois. “Single Molecule Imaging Simulations with Advanced Fluorophore Photophysics” Commun Biol (2023) 6, 53