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

Supervisor(s):
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Host laboratory:
IBS, I2SR group
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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, all related to how DNA is involved in various cellular stress responses: 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. To this aim, we plan to use qPALM and sptPALM to follow how the complex distributes within mammalian cells.
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.
Depending on the chosen biological project, additional co-supervision will be insured by Joanna Timmins, Fabienne Hans or Philippe Frachet, all in the IBS I2SR group.

Keywords:
super resolution microscopy, Single molecule data analysis, Deinococcus radiodurans, cancer

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.

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

E. De Zitter, J. Ridard, D. Thédié, V. Adam, B. Lévy, M. Byrdin, G. Gotthard, L. Van Meervelt, P. Dedecker, I. Demachy, and D. Bourgeois*. “Mechanistic Investigations of Green mEos4b Reveal a Dynamic Long-Lived Dark State” J. Am. Chem. Soc., (2020), 142, 10978−10988. Doi: 10.1021/jacs.0c01880