Internship Proposal – Master 2

Mapping the photosynthetic apparatus using super-resolution microscopy.

Contact: Bruno Robert

Email : bruno.robert@cea.fr

Institute for Integrative Biology of the Cell (I2BC) - UMR 9198
Bioenergetics, Structural Biology and Mechanisms Unit (SB^2SM)
Laboratory of Bioenergetics, Metalloproteins and Stress (LBMS).
CEA-Saclay, 91911 Gif-sur-Yvette Cedex.

Project:

The LBMS team is interested in studying the mechanisms underlying the function of photosynthetic membrane proteins: from single pigment molecules to *in vivo* studies, via isolated proteins and membranes. We combine biochemical and molecular biology techniques with advanced spectroscopic/imaging methods and modelling, to understand the properties and function of the entire photosynthetic apparatus.

The LBMS team is developing an original method of super-resolution fluorescence microscopy yielding lateral and axial resolutions of about 150 nm and 300 nm, respectively. This method has been optimized for investigating the 3-D structure of the photosynthetic membrane at a mesoscopic scale, and its remodeling during adaptation. The project will involve i) isolation of chloroplasts, ii)their mapping upon adaptation to light conditions, and iii) development and applications of methods to improve images and analyse their statistical significance.

The student will in parallel participate to the development of a super-resolution resonance-Raman imaging system, designed to provide, in the long term, super-resolution pictures containing chemical information, in particular on photosynthetic membranes.

For this internship, the student will receive a broad training, from sample preparation, electronic spectroscopy, Raman spectroscopy, super-resolution techniques, image processing and analysis.

References:

1. Schermelleh, L.; Ferrand, A.; Huser, T.; Eggeling, C.; Sauer, M.; Biehlmaier, O.; Drummen, G. P. C., Super-resolution microscopy demystified. *Nat Cell Biol* 2019, 21 (1), 72-84.
2. Gall, A.; Pascal, A. A.; Robert, B., Vibrational techniques applied to photosynthesis: Resonance Raman and fluorescence line-narrowing. *Biochimica et Biophysica Acta-Bioenergetics* 2015, 1847 (1), 12-18.
3. Mendes-Pinto, M. M.; Sansiaume, E.; Hashimoto, H.; Pascal, A. A.; Gall, A.; Robert, B., Electronic Absorption and Ground State Structure of Carotenoid Molecules. *Journal of Physical Chemistry B* 2013, 117 (38), 11015-11021.
4. Pascal, A. A.; Liu, Z.; Broess, K.; van Oort, B.; van Amerongen, H.; Wang, C.; Horton, P.; Robert, B.; Chang, W.; Ruban, A., Molecular basis of photoprotection and control of photosynthetic light-harvesting. *Nature* 2005, 436 (7047), 134-137.