Thesis Project

Host Laboratory:
Interdisciplinary Institute for Neuroscience (IINS), UMR5297, Bordeaux – France
In the team "Quantitative Imaging of the Cell" directed by Jean-Baptiste Sibarita.

Start: PhD start will be beginning of 2017 academic year. Possibility to perform a Master 2 internship or a last year of engineer school internship during 2016-2017 academic year.
The PhD financing will be done through the ANR project "soLIVE" granted in 2016.

Keywords:
Light-sheet microscopy; Super-resolution; Single Particle Tracking; Structured Illumination Microscopy; Drosophila embryos.

Project description:
A PhD position is currently available at the Interdisciplinary Institute for Neuroscience (IINS) at Bordeaux to develop new super-resolution approaches for probing the fast and long-term dynamics of proteins in depth within complex tissues at high spatial resolution. This work will be based on a light-sheet microscope recently developed in the team and named soSPIM, which combines a single-objective with micro-fabricated chips featuring 45° mirrors[1]. We already demonstrated the capabilities of this systems to perform multi-scale 3D imaging from the whole drosophila embryos scale down to the single cell scale. In addition, we have shown that the combination of the optical sectioning provided by the light sheet excitation with a high numerical objective enables to perform single molecule based super-resolution up to 30 µm deep above the coverslip.
The aim of the project will be to improve the imaging capabilities of the soSPIM system to probe the various dynamics of adhesion proteins during the development of drosophila embryos at high spatial resolution. It will consist of implementing on the soSPIM system single particle tracking approaches and structured illumination microscopy methods[2] to probe the fast and long-term dynamics of proteins respectively. To achieve this goal, we will implement both excitation beam shaping[3] and adaptive optics[4] in order to optimize the excitation and detection paths, respectively, and implement specific micro-fabrication processes to create devices dedicated to the imaging of drosophila embryos. In collaboration with G. Giannone team (IINS, Bordeaux) and N. Brown team (Gurdon Institute, Cambridge), we will then study the formation and maturation of adhesion sites during drosophila embryos development and their role in muscle tissue formation.

Required skills:
The candidate should be highly motivated and should show a strong interest in the development of imaging tools for biology. Prior knowledge in optical microscopy and interest in micro-fabrication processes and biology would be preferred.
The candidate is strongly encouraged to perform his Master 2 internship or last year of engineer school internship on this subject before the thesis.

Contact:
To apply, candidates should email a CV and a motivation letter to:

- Rémi Galland (remi.galland@u-bordeaux.fr)

References

1. Galland, R. *et al.* 3D high- and super-resolution imaging using single-objective SPIM. *Nat. Methods* **12,** 641–644 (2015).
2. Gustafsson, M. G. L. Surpassing the lateral resolution limit by a factor of two using structured illumination microscopy. *J. Microsc.* **198,** 82–87 (2000).
3. Chen, B.-C. *et al.* Lattice light-sheet microscopy: Imaging molecules to embryos at high spatiotemporal resolution. *Science (80-.).* **346,** 1257998–1257998 (2014).
4. Izeddin, I. *et al.* PSF shaping using adaptive optics for three-dimensional single-molecule super-resolution imaging and tracking. *Opt. Express* **20,** 4957–67 (2012).

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