

High-speed fluorescence microscopy for biomedical applications

ICube Laboratory, Strasbourg, France

Context: As part of developing an optical pole for biomedical research at the Institute of Biological Physics (IPB) in Strasbourg, an M2 research internship is proposed in the IPP team of the ICube laboratory.

An important aspect of current microscopy research is the search for higher resolution, be it temporal or spatial. Light sheet microscopy has enabled fast imaging of live samples, but the need for two objectives near the sample limits its practicality for imaging bigger samples or multiple samples in parallel.

Oblique plane microscopy (OPM) [1] is a recent light sheet technique allowing the acquisition of volumetric images from a single objective. The perspectives of this method for multiple biomedical applications: spheroid imaging, zebrafish imaging [2], neural imaging, are exciting, in particular in collaboration with the researchers from the Institute of biological Physics where the research will take place.

The aim of the project is the development of a system allowing the imaging of fast processes in biological samples such as cultured cells, multicellular spheroids and zebrafish embryos. In particular, you will participate to the development of a new OPM set-up at the IPB.

You will work on a remote refocusing set-up, which is the crucial part of an OPM system. The internship will be the optical set-up and alignment of the system, as well as its optical characterisation. The aim for the final system is a sub-cellular resolution coupled with an acquisition speed of several volumes per seconds, on a system allowing an evolution towards high-throughput imaging methods [3].

Depending on the student's profile and personal interests, the internship could also have a component of optical simulation of the OPM system or computational development for the microscope control and analysis strategies for the data produced.

Skills: Optical development and alignment

Supervisor: Dr Vincent Maioli

Wages: as per national rules (~600€/month)

If you are interested do not hesitate to contact Vincent Maioli (maioli@unistra.fr)

References:

- [1] C. Dunsby, "Optically sectioned imaging by oblique plane microscopy," *Opt. Express* 16, 20306-20316 (2008)
- [2] Maioli et al., *Fast in vivo multiphoton light-sheet microscopy with optimal pulse frequency*, *Biomedical Optics Express* Vol. 11, Issue 10, pp. 6012-6026 (2020).
- [3] Botcherby et al., *Opt. Lett.* 32, 2007-2009 (2007)
- [3] Maioli et al., *Time-lapse 3-D measurements of a glucose biosensor in multicellular spheroids by light sheet fluorescence microscopy in commercial 96-well plates*. *Sci Rep* 6, 37777 (2016)

