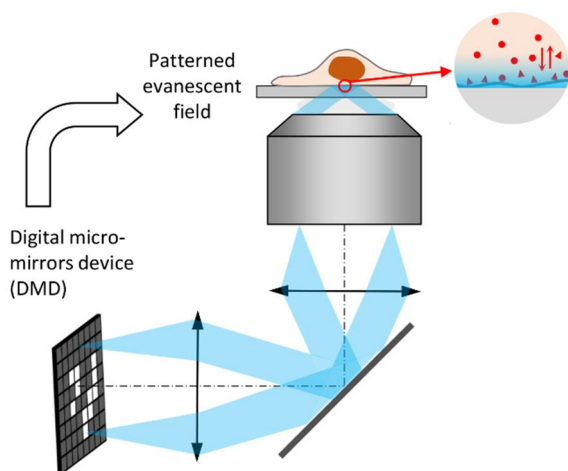


FUNDED PhD and M2 INTERNSHIP PROPOSAL

EVANESCENT FIELD PATTERNING FOR OPTOGENETIC ACTIVATION OF LIVE CELLS



Optogenetics probes are engineered proteins the isomerization state of which can be controlled with light illumination (generally in the 400 – 540 nm range). Upon optical activation these molecules interact with cellular partners, initiating some specific biological activity (such as the contractile machinery, adhesion, motility, etc.). Cell response can be modulated by the spatio-temporal properties of the optical signal. Hence, having a better spatio-temporal control of the photoactivation process is a key point to understand the dynamics of cellular biological processes.

With this goal in mind, we propose to develop a setup for programmable patterned evanescent field illumination, in order to directly activate the basal membrane of a cell adhering on a substrate, rather than the standard cytosolic (i.e. bulk) activation. This implies two conditions: i) the laser beam incident on the coverslip/aqueous medium must have an incidence angle above the critical angle to generate a longitudinally evanescent field; ii) its angular distribution should be tailored to obtain the desired transverse illumination pattern. Since these two conditions must fulfill the constraint of diffraction law, there is a compromise between penetration depth and spatial resolution. To control the incident light field, a wavefront shaping approach will be performed using a Digital Micromirror Device (DMD).

The project entails both simulations, to optimize the pattern to apply on the DMD for a desired illumination pattern, and developing an optical bench to test this approach and define the best optical configuration compatible with a microscope environment.

This internship requires a background in optics/physics. It will take place in Grenoble, at the Laboratory for Interdisciplinary Physics (LIPhy) and at the Institute for Advanced Biosciences (IAB).

We are especially interested by applicants who would be willing to continue this internship with a PhD, which has been recently funded by the ANR.

Contact: Irène Wang – tél. 04 76 51 47 29 – irene.wang@univ-grenoble-alpes.fr
 Antoine Delon – tél. 04 76 63 58 01 – antoine.delon@univ-grenoble-alpes.fr