Internship and PhD proposal

Gamete fusion mechanism revealed by expansion microscopy

Where: Laboratoire de Physique de l'Ecole Normale Supérieure (LPENS), Paris 5th, Team « Molecular Membrane Mechanisms »

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Human sterility appears as an increasing problem in modern society with ~20% of couples consulting for fertility disorders. The causes are often not identified because the detailed process of mammalian fertilization remains poorly understood. In particular, little is known on the molecular and membrane mechanisms by which a sperm and an oocyte fuse to produce a new being. When the fertilizing sperm reaches the oocyte plasma membrane, the gametes enter in an interaction phase that leads to the fusion of their membranes. For fusion to occur, the proteo-lipidic membranes have to locally reach favorable configurations, the mechanism of which remains unknown. Our interdisciplinary team, working at the interface between physics and biology on fertilization is developing innovative biophysical approaches to get new insights on this fundamental biological mechanism [1].

The objective of the internship, will be to elucidate the membrane remodeling and protein redistribution in the contact zone between the sperm and the egg leading to gamete fusion. The strategy is to use the recently developped expansion microscopy technique to obtain high resolution images of the contact zone [2]. This is a difficult challenge due to the submicrometric sizes of the membrane structures involved. Expansion microscopy allows to increase the size of the sample by a factor 20 while maintaining its structure. The aim of the internship will be to apply this technique to oocytes with spermatozoa in interaction.

[1] B. Ravaux *et al*, Egg CD9 protein tides correlated with sperm oscillations tune the gamete fusion ability in mammal, J. Mol. Cell Biol. 10 (2018) 494–502.
[2] P.W. Tillberg *et al*, Protein-retention expansion microscopy of cells and tissues labeled using standard fluorescent proteins and antibodies, Nat. Biotechnol. 34 (2016) 987–992.