**Bio-inspired active nano-membranes**

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2-dimensional molecular self-assembly offers unprecedented possibilities for creating ultrathin (<10 nm) membranes with controllable structural, mechanical and chemical properties. While most self-assembled membranes are passive entities, it is in principle possible to embed active molecules such as externally switchable channels or energy harvesters hence creating active membranes able to carry out certain tasks on-demand. However, creating active artificial nano-membranes remain a significant challenge.

This project aims at creating bio-inspired active nano-membranes able to sense mechanical stress and fully characterize the systems sensing capabilities so as to inform, among other, industrial biotechnology practices. The emphasis will be placed on understanding the interplay between composition, molecular structure, sensitivity and sensing dynamics. This will be achieved through a combination of state-of-the-art experimental techniques including atomic force microscopy, microbiology, force spectroscopy, electrophysiology and patch clamp measurements as well as fluorescence microscopy.

As a starting point, membranes will be made of a mixture of synthetic *E. coli* lipids embedding mechanosensitive channel proteins (MSCs). MSCs embedded in a membrane, exposed to an osmotic shock can aggregate into liquid-like clusters which promote the closure of individual channels. The extent of clustering is highly dependent on the channel concentration and membrane stress to yield a tightly regulated gating system. Understanding the interplay between the local molecular arrangement of MSCs, the environment, the mechanical/chemical channel gating and the overall membrane activity will serve will help develop a model that links nanoscale effects with the macroscopic the behaviour of the membrane.

The project is to be run in collaboration with Fujifilm Diosynth Biotechnologies (FDB).