

TITRE du Stage: Collective diffusion of Active Proteins

DIRECTEUR de Stage : Patricia BASSEREAU

patricia.bassereau@curie.fr

<https://science.institut-curie.org/team-bassereau>

Ce stage peut être poursuivi en thèse : OUI

Si oui, la thèse est-elle financée : Peut-être.

SUJET de la thèse: Effect of non-equilibrium activity on single membrane proteins' diffusion and clustering

Trans-membrane proteins are tightly embedded in fluid lipid bilayers where they diffuse laterally. Many membrane proteins are involved in the transport of ions or molecules through the membranes using different sources of energy (ATP hydrolysis, voltage, light, stretching etc...) that allow for conformational changes, thus shape changes. Our group showed that protein shape (conical versus cylindrical, for instance) has an effect on its lateral diffusion. Membrane deformations produced by the inclusion of non-cylindrical proteins can also lead to membrane-mediated attractive interactions and to protein clustering that have not been studied experimentally yet. Our general objective is to **investigate the effect of the functional conformational dynamics of membrane proteins on their diffusion and on their clustering.**

We will study BmrA from the ABC transporters family (Fig. 1A) that transport drugs across membranes upon ATP hydrolysis upon changes of conformation. During the internship, we will use FRAP (Fluorescence Recovery After Photobleaching) to measure the collective diffusion of BmrA reconstituted in Giant Unilamellar Vesicles, either in its open or its closed conformation. In the longer-term, the objective will be to study the diffusion of active BmrA molecules (with ATP) by FRAP and by single molecule tracking in giant liposomes of controlled tension (Fig. 1B) and in nanotubes of controlled curvature in order to decipher the effect of membrane mechanics on its diffusion. From the diffusion analysis and with super-resolution microscopy, we will study the effect of the protein activity on membrane-mediated clustering.

This project will be developed in close collaboration with D. Lévy (membrane protein expert) and with theoreticians in the Physico-Chimie Curie lab.

