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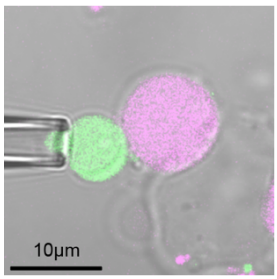
Mechanics and transfer dynamics at inter-organelle junctions

Cellular homeostasis strongly relies on the capacity of organelles to communicate with each other. Dysfunctions in inter-organelle communication are at the basis of several diseases such as Alzheimer's and neurodegeneration disorders, diabetes mellitus, etc.

Depending on the metabolic state, organelles can develop contacts to exchange molecules, e.g., lipids, proteins, or ions. There is a considerable need to understand how and which molecules are transported, the rate of exchange, how strong the forces acting at the junction between the organelles, etc. A limitation for understanding these features is technological. Making model compartments with controlled properties can overcome such a limitation. We recently developed tools that enable us to reconstitute the adhesion between different vesicles mimicking different organelles. We now aim to move to the next step by studying whether molecules can be exchanged between them.



Role of the student: after the student is trained into making the vesicles (roughly within two weeks), she/he will keep preparing them for the course of the internship. The goal will be to take micropipettes and take two different vesicles and make them adhered. Then pulling them apart will enable to assess of the adhesion strength. In the meantime, exchange between the vesicles will be followed by fluorescence means. Finally, she/he will measure the force distribution around the vesicle to determine whether there are anisotropic forces. Preliminary data suggest anisotropy.

The student will benefit from being in a multidisciplinary lab environment where biophysicists, chemists, biologists collaborate on different topics.

Field of research:
Soft Matter
Biophysics
Biology