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Host lab : Laboratoire Adhesion & Inflammation (LAI)

Lab director : Olivier Theodoly

Internship duration: 4-6 months (from February 2023)

Internship project : (High-Speed) Atomic Force Microscopy observations of biomimetic membranes modified with microbial glycolipids

Glycolipids are abundant constituents of biological membranes, known to be involved in lipid lateral phase separation, local enrichment of membrane-anchored proteins, preferential membrane budding or selective ion attractivity. However, glycolipids are complex molecules, generally synthesized in small amounts through a tedious organic chemistry process. Alternatively, microbial glycolipids (MG) are obtained from microbial fermentation of glucose and vegetable oils. Some of them have interesting antimicrobial and antifungal properties. If cell lysis was suggested as a possible mechanism, their interactions with biological membranes remain unknown. Fundamental work is then required to better understand their interactions with phospholipids (PL) membranes. For instance, PL are known to form bilayers, while MG are known to form interdigitated single layers. We then want to address intriguing questions: how will PL and MG membranes match? Will there be mixing or phase separation? What will be the impact on the transition temperature, flexibility, thickness, stimuli responsiveness (ion, pH, temperature) of the membranes? Highlighting these aspects will create the opportunity to generate new MG-PL lipidic materials with unexpected surface and bulk behavior.

We will use atomic force microscopy (AFM) to characterize the morphology and nanomechanical properties of these systems in a controlled near-physiological environment (medium composition and temperature) and with fine spatial-temporal resolution. In addition, High-speed AFM (HS-AFM), a unique technique only mastered by few groups in the world, will allow us to observe the membranes modifications induced by addition of MG with nanometer spatial and sub-second temporal resolution.

This project may be continued as a PhD thesis.