ITI HiFunMat Master Internship Proposal

☐ M 1 ☒ M 2

Effect of unsaturation position within phospholipids on oxidation of simple model of cell membranes

Internship supervisor

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Laboratory	Institut Charles Sadron
Collaboration with a HiFunMat member (*please indicate their name*)	☒ No ☐ Yes :

Student profile looked for

Master program (*more than one box can be ticked)*	☒ Material science and engineering ☒ Chemistry ☐ Physics
Other indications if necessary	

Internship description

Oxidation plays a central role in the lifecycle of eukaryotic cells, as it can influence the levels of biological self-assembly embodied by intracellular and plasma membranes. Oxidation is a natural metabolic outcome. It is a direct consequence of many processes such as mitochondrial respiration, inflammation, virus phagocytosis, ultraviolet and ionic irradiation, to name only a few. Lipid constituents of membranes are highly prone to oxidation, mainly on unsaturations of their alkyl chains. Previous studies of the physical effects of lipid oxidation have shown that it may lead to modifications in the membrane properties such as permeability, headgroup hydration, fluidity, thickness, and packing order. However, the most prominent physicochemical effect of lipid oxidation is the membrane area increase [1]. In this internship, the student will use a previously developed experimental protocol and analysis method, developed in the team **[2],** to measure the membrane area increase as a function of the position of the lipid unsaturation within the aliphatic tail. Giant Unilamellar vesicles (GUVs), which are closed membrane capsules, will be grown using a gel assisted template technique **[3]**, with different unsaturated phospholipids. Glass surfaces will be modified to allow controlled adhesion of the GUV to the surface. Combined epifluorescence and RICM (Reflection Interference Contrast Microscopy) experiments will be performed to measure precisely the increase of total membrane area. Oxidation will be induced by photosensitizers irradiated with intensive light, leading to a well-controlled hydroperoxidation reaction. The reorganization of the hydroperoxidized molecule within the membrane is expected to depend heavily on the distance between the unsaturation and the lipid head group, which is the key aspect of interest for this internship.

[1] Weber G., Charitat T., Baptista M. S., Uschoa A. F., *et al*. Soft Matter (2014), Vol 10 p 4241

[2] Aoki P. H. B., Schroder A. P., Constantino C. J. L., and Marques C. M. Soft Matter (2015) Vol 11 p 5995

[3] Weinberger A., Tsai F. C., Koenderink G. H., Schmidt T., e*t al* Biophys. J. (2013) Vol 105 p 154