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Molecular binding and exchange between model membranes and biologically relevant lipid assemblies

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Model cellular membranes are often used to understand the interactions with biomolecules and nanoparticles[1], but the effects of such interactions go beyond molecular binding and include processes such as biomembrane restructuring and molecular exchange that may lead to changes in the structure and composition of the interacting nanoparticles.

Here I will present our most recent work aiming at increasing the understanding of the role of biomembrane structure and composition on the function of lipoproteins. Lipoproteins are nanoemulsion-like particles composed of fats and proteins (apolipoproteins).[2] The complexity of lipoproteins is great, with different amounts and types of fats and proteins. We use lipoproteins from human healthy adults and look systematically at their capacity to exchange lipids as a function of membrane composition. We find that membrane charge, level of unsaturation in the acyl tails and presence of cholesterol all regulate lipoprotein function[3]–[5]. We also show significant differences in the exchange capacity of synthetic lipoproteins reconstituted with a single apolipoprotein type[6].

Further, we show that the incubation with SARS CoV2 Spike proteins affects the exchange capacity of lipoproteins[7] that may be linked to the altered cholesterol metabolism in COVID19 patients.

Finally, apolipoproteins also exchange and we demonstrate that their binding to Lipid-based nanoparticles (LNPs) affect the structure and composition of these particles[8]. The extent to which this component redistribution takes place may be correlated with the LNP's capacity for protein expression and thus their therapeutic efficiency.

All these experiments are possible thanks to neutron scattering combined with deuteration, since this is an ideal approach to study the structure and dynamics of multicomponent systems where different parts of the system can be highlighted individually[8]–[11].

Level of Expertise

Expert

Presenter Gender

Woman

Pronouns

She/Her

Which facility did you use for your research

National Deuteration Facility

Students Only - Are you interested in AINSE student funding

Do you wish to take part in the Student Poster Slam

Condition of submission

Yes

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