Experimental report

14/09/2023

Proposal: 8-02-996 **Council:** 10/2022

Title: Coexisting planar and curved modelmembranes: binary diffracting scaffolds.

Research area: Soft condensed matter

This proposal is a continuation of 8-02-889

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Samples: Lipids
Si blocks coated with SiO2 NP

Instrument	Requested days	Allocated days	From	To
D17	2	0		
FIGARO	2	2	28/06/2023	30/06/2023

Abstract:

Biological membranes constitute a key self-assembled structure in biology with a wide variety of roles including defining the limits of the cells and organelles but also hosting a range of biochemical reactions and biological processes. The structure of the biological membrane that we know well today is that of planar membranes, mainly due to methodological limitations. We have developed a new platform to study the structure of membranes under high curvature, importantly also in coexistence with membranes of low curvature. This implies that we can now study the behaviour of lipid mixtures with low and high intrinsic curvature and simultaneously characterise the structure and composition of the planar and curved membranes using selective lipid deuteration and neutron reflection. In this experiment we will study the model biological membrane structure on which there is not only coexistence of flat and curved regions but also to include two types of high curvature (NP with differing diameters). For this we will use specular and off-specular neutron reflection.

Our previous data showed that the quality of the SiO2 NP layer decreased with particle size. Here, we improved the coverage of the SiO2 NP layer for 50 nm and used an alternative method to deposit lipids on it. This because vesicle fusion failed in the past for POPC.

We then used the solvent exchange deposition method usign a mixture of tail deuterated POPC and hydrogenated cardiolipin on the 50 nm SiO2NP. The method was sucessful to form a layer in this case which is seem by a change in the periodiciy of the kissing fringes for 50 nm sample.

For 200 nm, we used the vesicle fusion instead to complete data collected at a different beamtime.

However there are 2 parameters we varied: the method of lipid bilayer deposition and the presence of $CaCl_2$ (needed for vesicle fusion). Divalent ions change the packing parameter of cardiolipin making the lipid less cylindrical.

Therefore we need to repeat the experiments using the same method for lipid deposition on the 2 different samples, so we can tell if the different composions observed on the flat vs curved bilayers are due to the presence of calcium or to the method of bilayer deposition. We hope for the first reason.

Measruements were slow, 3 hours at least… which meant we couldn't complete the data collection in 2 days at Figaro for 2 samples.

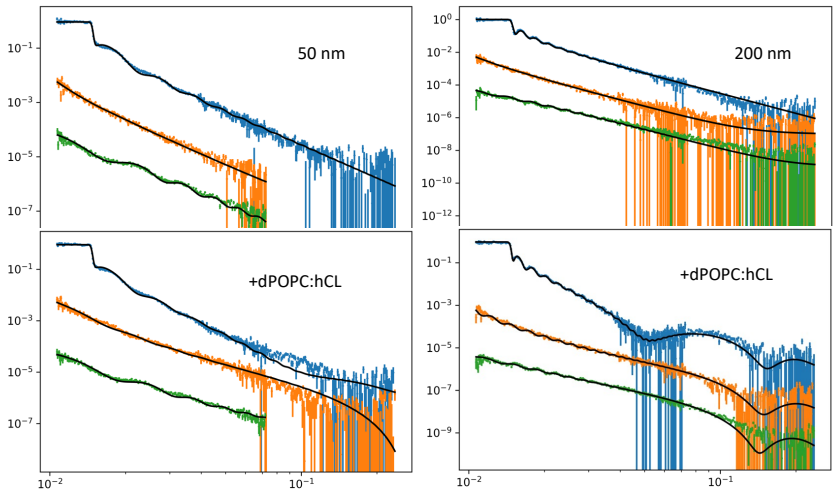

Fig 1. Specular NR for 50 nm (left) and 200 nm (right) NP surface scaffolds before and after coating with dPOPC-hCL mixtures.

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Ämne:
Författare: Marite Cardenas
Nyckelord:
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