

Experimental report

14/07/2025

Proposal: 9-13-1160

Council: 10/2024

Title: LNP shell structure and controlling ApoE lipid removal

Research area: Soft condensed matter

This proposal is a new proposal

Main proposer: Marite CARDENAS

Experimental team: Birgit FELDERER
Jovana DRDANOVSKI

Local contacts: Philipp GUTFREUND

Samples: Lipids
ApoE

Instrument	Requested days	Allocated days	From	To
D17	0	0		
FIGARO	3	3	23/05/2025	26/05/2025

Abstract:

Apolipoproteins are the amphipathic proteins that enable the transport of fat in the body. Apolipoprotein E (ApoE) is an important protein mainly present in HDL that enables HDL recognition in the liver and fat removal from the body. ApoE is the main component of the protein corona present in lipidic nanoparticles such as liposomes and lipid-based nanoparticles (LNPs). Using neutron reflectometry (NR), we demonstrated that ApoE selectively removed saturated lipids and had a lower affinity for unsaturated lipids or cholesterol molecules. ApoE binds to LNPs is the main reason why LNPs are cleared from the body via the liver, and therefore blocking ApoE binding to LNPs seems a logical way to improve LNP efficiency and enable organ targeting. It has been shown that substitution of cholesterol by a plant sterol increases LNP efficiency and modulated LNP morphology. Among plant sterols, campesterol is of special interest since its ingestion lowers plasma cholesterol levels. Neutron reflectivity is a key technique to get determine the structure and composition of lipid bilayer matching the shell of LNPs upon binding to ApoE.

Experimental report

We aimed to deposit lipid mixtures on the flat silica surface and on a 60 nm nanoparticle-coated silica block to unravel lipid preference to co-existing flat and curved block regions.

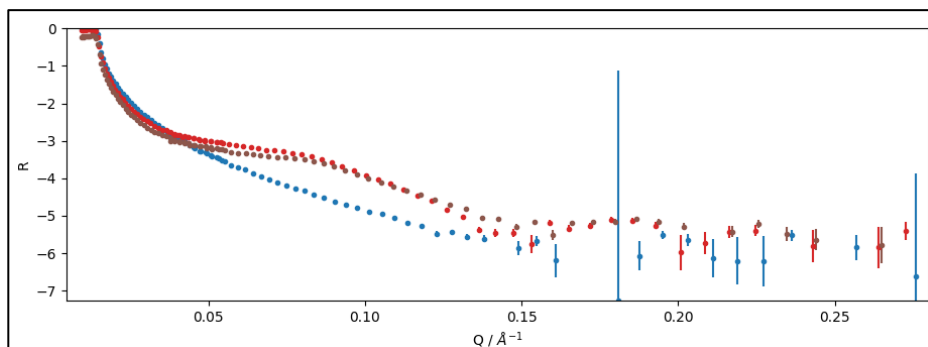


Fig.1. Formation of SLB based on 0.5 mg/ml of Cholesterol/MC3/DSPC in d-PBS at pH 7.4 on flat surface (brown and red lines).

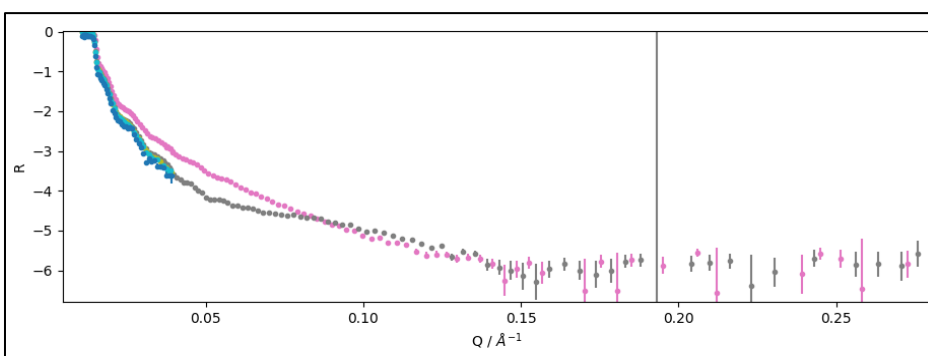


Fig.2. NP-coated block characterized in d-PBS (pink curve). Deposition of 0.5 mg/ml of dCholesterol/MC3/DSPC in d-PBS at pH 7.4 on the same block (grey line). SLB-ApoE kinetics is shown by gold, light and dark blue lines.

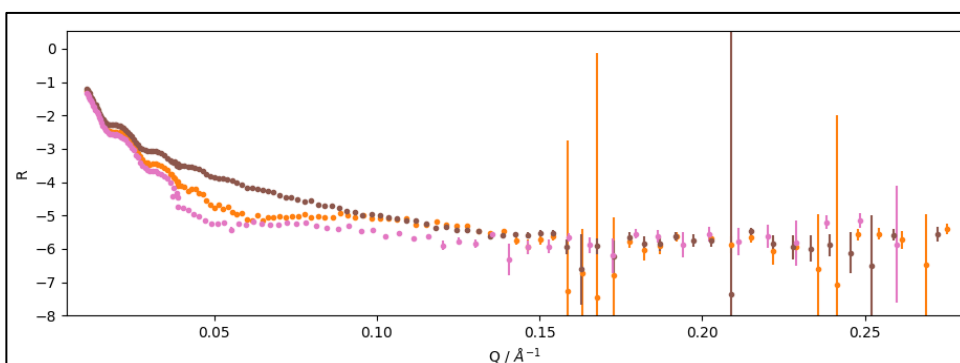


Fig.3. NP-coated block characterized in h-PBS (brown curve). Deposition of 0.5 mg/ml of dCholesterol/MC3/DSPC in h-PBS at pH 7.4 on the same block (orange line). Scan after addition of ApoE is represented by pink color.

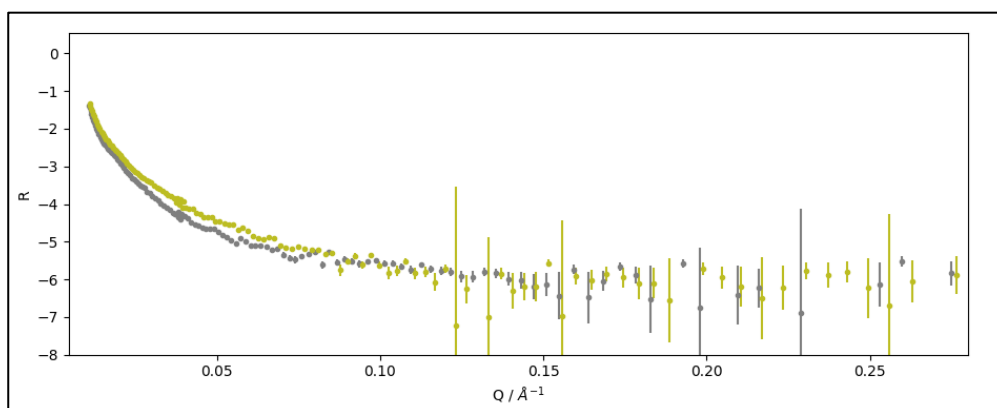


Fig.4. NP-coated block characterized in CmSi (olive color), followed by injection of 0.5 mg/ml of dCholesterol/MC3/DSPC (grey line).

Reflectivity data on SLB formation on both flat and NP-coated surfaces was collected successfully. Moreover, data on SLB-ApoE was collected and analysis is ongoing.