Adsorption of atherosclerotic lipoproteins to supported lipid bilayers

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Atherosclerosis is a major contributor to global morbidity and mortality with 31 % of all deaths in 2008 linked to cardiovascular disease [*1*]. It is has been shown that various lipoprotein particles in the blood play an important role in the development and subsequent rupture of atherosclerotic plaques [*2*, *3*]. Current best practise for diagnosis and further monitoring of the progress of atherosclerosis is by measurement of the ratio of high (HDL) to low (LDL) density lipoproteins in the blood, with high proportions of HDL showing a protective effect on the body [*4*]. In this work we aim to study the interaction of lipoprotein particles with cell membrane mimics using scattering methods that are especially sensitive to the adsorption, exchange and uptake of lipids from bilayers.

High and low density lipoproteins are aggregates of lipophilic cholesterol esters and triglycerides encapsulated by a lipid monolayer and apolipoproteins. The two classes differ in density, apolipoprotein and absolute component amounts. HDL is often known as the 'good cholesterol' due to its ability to clean up and remove cholesterol from fatty deposits, whereas LDL is considered 'bad cholesterol' as it has a tendency to deposit cholesterol to the arterial wall in the form of atherosclerotic plaques [*5-7*]. We have studied the interaction of lipoproteins with supported lipid bilayers using a number of surface sensitive techniques including, neutron reflection, QCM-D and ellipsometry. Through the combination of neutron reflection with deuterated and hydrogenated supported lipid bilayers it is possible to monitor adsorption of the lipoproteins as well as the exchange and uptake from the lipid bilayer. Results show that, although both HDL and LDL exchange material with the bilayers, only HDL removes lipids. Moreover, the extent of lipid exchange and lipid removal was also dependent on the charge of the supported lipid bilayer and the co-addition of LDL and HDL. These results highlight the role of lipoprotein particle type on their ability to exchange and deposit/remove lipids from model cellular membranes, as well as the existence of competitive processes between these particles and the model membrane.

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