Nanodiscs at interfaces- developing platforms for structure studies of membrane proteins.

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Nanodiscs are self assembled disc-like structures, which consist of a lipid bilayer held together by a circular protein belt named membrane schaffold protein (MSP). These discs provide an in situ native-like model of the cellmembrane their future main application is to act as containers for membrane proteins to study these in their natural environment. The nanodisc structure has been studied a lot in aqueous solution mostly by SANS and SAXS measurements, which have revealed evidence of a stable structure containing the expected components of lipids and protein. However the small angle scattering techniques on nanodiscs in bulk water have not yet proven the actual structure of the nanodiscs, though the composition is quite well defined. These methods performed in bulk suffer from the lack of orientation of the nanodiscs. An organized fixation is desirable to determine an accurate structure of the nanodiscs. We have shown with highly surface sensitive techniques such as Quartz Crystal Microbalance (D-QCM), Neutron reflectivity, AFM and Spectroscopic ellipsometry that nanodiscs adsorbs readily to SiO2 surfaces from an aqueous solution to the solid-liquid interface. However, a single ND layer does not present a large advantage over supported lipid bilayers in the sense that the membrane proteins will unavoidable be in contact with the underlying substrate, which may have consequences on the protein structure and function. Therefore, we have designed a method to overcome this problem. We form multilayers of oppositely charged nanodiscs. We are also studing the nanodiscs at the air-water interface. A film of a positively charged surfactant DODAB is formed in the langmuir trough. Negatively charged nanodiscs are subsequently injected to the bulk and neutron reflectivity shows that the nanodiscs form a dense layer below the film of surfactants.