Using SANS and SAXS to determine the detailed structure of nanodiscs.

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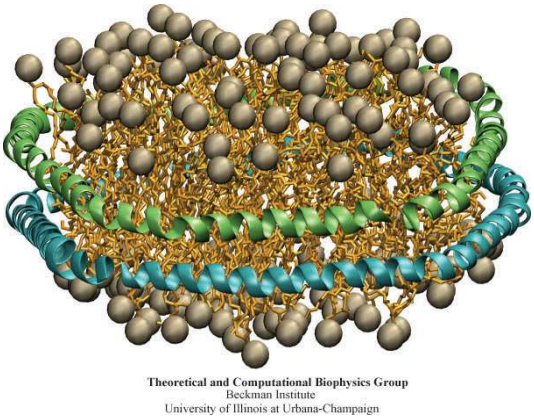

"Nanodiscs®" are nanometer sized phospholipids bilayer discs stabilized in aqueous solutions by an amphipatic protein belt. The maximal disc size is fully controlled by the length of the protein belt. The nanodisc system may be regarded as a protein-engineered version of the native human Apolipoprotein (apo-A1) which is a high density lipoprotein (HDL). And it bears great resemblance with this system. The nanodisc system is already being used to a wide extent as means for making membrane proteins water soluble thus allowing for a wide range of functional studies.

We are in the process of determining the detailed structure of the nanodiscs from a careful analysis of the SAXS and SANS data on the system. In order to do this we have derived a fully molecular constrained analytical model for the scattering of empty nanodiscs and fitted this to both SANS and SAXS data. The analysis is consistent with a structure of the nanodiscs as flat and disc shaped and with the belt surrounding the hydrophobic rim of the discs, i.e. in qualitative agreement with the above shown structure. However we find that the cross-section of the discs is elliptical rather than circular.

The information obtained from the SAXS and SANS analysis is very interesting on its own right since it allows for investigating the interplay between the confinement of the phospholipids and the protein belt. In a wider perspective a good description of the structure of the nanodiscs is also highly relevant because it will allow for using the nanodisc system as a structurally simple platform for investigating membrane proteins in solution with SAXS and SANS.