Assembly of deuterated phospholipid nanodiscs for Small-Angle Neutron Scattering studies

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Structural or biophysical studies of membrane proteins require hydrophobic nanostructured environments that mimic the native membrane proprieties. Using the bio-engineered membrane scaffold protein (MSP) and assembled phospholipids a discoidal bilayer structure with a well-defined diameter named lipid nanodisc can reproduce the natural structure of native membranes. Lipids used for nanodisc assembly include phosphatidylcholine (PC-lipids), 2,3-Dimyristoyl-sn-glycero-1-phosphocholine, 2,3-Dipalmitoyl-sn-glycero-1-phosphocholine, 3-palmitoyl-2-oleoyl-sn-glycero-1-phosphocholine, as well as mixtures of PC with charged phospholipids, multicomponent mixtures of various lipids with cholesterol were also reported.

In this contribution we will present data on deuterated lipid nanodiscs designed for Small Angle-neutron Scattering contrast matching experiments. Partially deuterated MSP was assembled with different types of deuterated lipids to form lipid nanodiscs with diameters of 9, 11 and 30 nm. We characterized commercially available mixtures of protiated and deuterated DMPC that can be contrast matched in 85% D2O buffer. In addition, we produced natural lipid extracts from deuterated E. coli cultures to obtain a uniform distribution of deuterium label in the lipids that can be contrast matched at 90% D2O buffer. For many situations involving the incorporation of large membrane protein assemblies, larger discoidal bilayer structures are desired. For these types of large systems, we produce a large nanodisc (30 nm) and used deuterated E. coli total lipids to assemble the discoidal bilayer structure.

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