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Membrane stiffness and interaction of lipids with myelin basic protein in native and multiple sclerosis diseased myelin mimetic

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A major component of the saltatory nerve signal conduction is the multilamellar myelin membrane around axons. In demyelinating diseases like multiple sclerosis, this membrane is damaged which leads to severe problems in nerve conduction. In literature different values for the lipid composition of healthy myelin sheath and myelin in the condition of experimental autoimmune encephalomyelitis - the standard animal model for multiple sclerosis - have been found. In this work we try to elucidate the interaction mechanism of myelin basic protein - the structural protein responsible for the cohesion of the cytoplasmic leaflets of the myelin sheath - with membranes mimicking both compositions. As samples we use unilamellar vesicles and supported bilayer systems. With neutron and x-ray small angle scattering methods combined with cryo-TEM we can follow the rapid aggregation which leads to a slow process in which different structures are formed depending on the lipid composition. This structural information can be associated with the bending rigidity of the respective membrane measured with Neutron Spin Echo. Neutron reflectometry gives insights on how the interaction mechanism between membrane and protein functions and reveals how modified membranes are destabilized by the protein.

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