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Adhesion Process of Biomimetic Myelin Membranes Triggered by Myelin Basic Protein

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The myelin sheath is an essential part of the nervous system, which enables rapid signal conduction. Damage of this complex membrane system results in demyelinating diseases such as multiple sclerosis (MS). The process in which myelin is generated in vivo is called myelination. In our study, we investigated the adhesion process of large unilamellar vesicles with a supported membrane bilayer that was coated with myelin basic protein (MBP) using time-resolved neutron reflectometry. Our aim was to mimic and to study the myelination process of membrane systems having either a lipid-composition resembling that of native myelin or that of the standard animal model for experimental autoimmune encephalomyelitis (EAE), which represents MS-like conditions. We were able to measure the kinetics of the partial formation of a double bilayer in those systems. The kinetics could be modelled using a random sequential adsorption simulation. By using a free energy minimization method, we were able to calculate the shape of the adhered vesicles and to determine the adhesion energy per MBP. For the native membrane the resulting adhesion energy per MBP is larger than that of the EAE modified membrane type. Our observations might help in understanding myelination and especially remyelination - a process in which damaged myelin is repaired - which is a promising candidate for treatment of the still mostly incurable demyelinating diseases such as MS.

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