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Studying model membranes with neutrons

To study the dynamics and function of cellular membranes it is important to understand their structure. This involves experiments on model systems and can profit from a probe that is able to access different scales of size and time: thermal neutrons. Since the pioneering work in the seventies on cell membrane structure by neutron scattering, developments driven by constantly improving neutron instrumentation, coupled with development of measurement and analysis methods, have involved both the optimization of samples towards more biologically relevant model systems and include the use of more complex lipid mixtures up to natural extracts.
Recent developments in the study of the structure of membranes will be presented including neutron and x-ray reflectometry study of the out-of-equilibrium fluctuations of phospholipid membranes induced by the active transmembrane protein bacteriorhodopsin (BR) [1]. A detergent-mediated incorporation method was used to incorporate BR in model planar bilayers and structural modifications induced by light activation were measured.
Furthermore, the use of neutron scattering methods to study the interaction of the spike protein of SARS-CoV-2 virus will be presented [2], including results revealing the different roles of peptides present within the fusion domain and the role of intracellular calcium levels that could provide an indication to where and how the viral and host membranes fuse during SARS-CoV-2 infection [3].

References

[1] Insertion and activation of functional Bacteriorhodopsin in a floating bilayer by T. Mukhina et al., JCIS (2021)
[2] Lipid bilayer degradation induced by SARS-CoV-2 spike protein as revealed by neutron reflectometry, by A. Luchini et al. Scientific Reports (2021)
[3] Strikingly Different Roles of SARS-CoV-2 Fusion Peptides Uncovered by Neutron Scattering", by A. Santamaria et al., J. Am. Chem. Soc. (2022).

Session

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