Contribution ID: **84** Type: **Talk (17 + 3 min)**

The role liquid-liquid phase separation in biological process; a study with small angle neutron scattering and neutron reflectometry

Tuesday, 21 March 2023 12:10 (20 minutes)

The role of Liquid-liquid phase separation (LLPS) in biology is increasingly recognised. Here we study two different cases in which LLPS occurs. First, actin remodelling has been found to involve LLPS, which likely acts to upregulate critical proteins and adjust their activity. Preliminary data indicates that cell membrane stiffness is a key factor in coacervation at the cell membrane. The relationship between membrane stiffness, coacervation, and actin remodelling will be investigated by creating a neutron reflectometry (NR) and Atomic Force Microscopy (AFM) data set of the effect of protein XopR on supported lipid bilayers (SLB). AFM will allow for effect of XopR on the SLB to be monitored in real-time, while NR with selective deuteration will allow the detailed analysis of structural change in the SLB due to XopR, as well as providing information on the nature and origins of the coacervation (i.e. is coacervation 2D or 3D, and is it seeded at the membrane?).
Second, re-engineered beak squid peptides that undergo LLPS have been proposed as a gene and drug delivery carrier. We use small angle neutron and X-ray scattering (SANS/SAXS) to show that the structure of the cargo protein in the coacervate phase remains unchanged as compared to the dilute phase.
In summary, we hope to show the strength of SANS and NR to study LLPS in biology. This project results from a new collaboration between Nanyang Technological University, Malmo University and Institute Biofisika.

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Session Classification: From Polymers to Thermodynamics

Track Classification: Soft Condensed Matter