Introductory Remarks to Symposium 26

Phase separation in neuronal (patho)physiology

Dragomir Milovanovic, Christian Tetzlaff and Michael Fauth, Berlin and Goettingen

In the context of cell biology, liquid-liquid phase separation (LLPS) is a process where two or more molecules demix from the surrounding medium, forming so-called biomolecular condensates. During the last several years, a surge of papers suggests that LLPS underlies the organization and dynamics of synaptic vesicle clusters, presynaptic active zones, postsynaptic densities (of both excitatory and inhibitory synapses), endocytic sites, RNA granules, to name a few. Failure to regulate these condensates results in the formation of insoluble aggregates, a hallmark of many neurodegenerative diseases. As an emerging field, LLPS in neurons poses several critical challenges and opportunities. For instance, new methods are required to characterize and quantify the functional impact of these condensates in living cells. Furthermore, theoretical models and frameworks are needed to provide insights into how these condensates corroborate with neuronal depolarization and synaptic activity.

In this symposium, we plan to host five speakers addressing: (i) mechanisms how LLPS drives the synaptic architecture; (ii) the potential of LLPS to provide new insights into diseases mechanisms and therapeutic interventions in neurodegeneration; (iii) theoretical frameworks for modeling LLPS and coupling LLPS to synaptic plasticity; (iv) methods development required to characterize the LLPS in living neurons. Our invited speakers are leaders in a range of fields spanning from molecular biology, to genetics, to single-molecule imaging, and modeling.

Symposium 26

Friday, March 24, 2023
08:30 - 10:30, Lecture Hall 101

Chairs: Dragomir Milovanovic, Christian Tetzlaff and Michael Fauth, Berlin and Goettingen

08:30 **Opening Remarks**

08:35 Akihiro Kusumi, Okinawa, Japan
SINGLE-MOLECULE IMAGING STUDIES OF POSTSYNAPTIC RECEPTOR TURNOVER ON THE PSD PROTEIN CONDENSATES (S26-1)

08:55 Antoine Triller, Paris, France
A NANOSCALE DYNAMIC VIEW OF POST-SYNAPTIC RECEPTORS (S26-2)

09:15 Pietro Vittorio De Camilli, New Haven, USA
THE ENIGMATIC SPINE APPARATUS OF NEURONAL DENDRITIC SPINES (S26-3)

09:35 Jakob Rentsch, Berlin
SINGLE MOLECULE IMAGING FOR INVESTIGATING PHASE SEPARATION OF SYNAPTIC VESICLES IN NEURONS (S26-4)

09:50 Jovica Ninkovic, Munich
TDP-43 CONDENSATES AND LIPID DROPLETS REGULATE THE REACTIVITY OF MICROGLIA AND REGENERATION AFTER TRAUMATIC BRAIN INJURY (S26-5)

10:10 **Joint Discussion**

10:25 **Concluding Remarks**