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Cation Specific Stabilization of FUS Biomolecular Condensates

Biomolecular condensates have been linked to the neurodegenerative diseases, where the transition from a liquid-like to solid-like phase results in formation of irreversible protein aggregates. Yet, the molecular organization within condensates remains largely unknown. Here, the link between environmental conditions and phase separation of intrinsically disordered proteins are explored. The influence of salt concentration on the organization of condensates made from FUS protein is investigated, with a focus on biologically relevant chloride salts with Na+, K+, Mg2+, and Ca2+ counter ions. Attenuated total reflection THz (ATR-THz) spectroscopy is utilized to probe the intermolecular vibrational modes of the water hydrogen-bonding network, which reveals the structure and dynamics of protein hydration within condensates. In this study, results indicate that the hydration of FUS proteins is significantly perturbed by salt concentration, but is not cation specific. The strength of the hydrogen bonding network, however, is cation specific, and a weaker water network is observed for monovalent cations relative to divalent cations. Here, we reveal that the stability of biomolecular condensates is impacted by the presence of specific ions, ultimately shedding light on the molecular properties that dictate the organization of condensates.

References

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