Leibniz Institute on Aging –
Fritz Lipmann Institute

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Biomolecular condensates: molecular insights and implications for disease

Who: Simon Alberti
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When: 15.08.2025, 1pm
Where: FLI, Nucleus
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Abstract

Stress-inducible biomolecular condensates, such as ribonucleoprotein (RNP) granules and DNA damage sites, play pivotal roles in organizing cellular biochemistry and maintaining physiological function. In this talk, I will explore how the concept of biomolecular condensates has reshaped our understanding of cellular stress responses and uncovered fundamental links to aging-related diseases. I will present quantitative, bottom-up biochemical approaches that enable the reconstruction of complex, active condensates, such as RNP granules and DNA damage foci, in vitro. Combined with advanced imaging and biophysical techniques, these methods have yielded key insights into the molecular logic of condensate formation, including the driving forces that promote condensate assembly, the conformational dynamics that accompany assembly, and the regulatory mechanisms that modulate their behavior. This mechanistic understanding is now paving the way for the identification of druggable targets within condensate networks, opening new avenues for therapeutic intervention. Finally, I will highlight how the condensate framework illuminates the functional roles of stress-induced condensates, demonstrating how they act as dynamic, responsive hubs that integrate environmental signals and coordinate essential processes such as protein synthesis and DNA damage repair—thereby offering a novel perspective on the molecular underpinnings of age-associated diseases.

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