Soft Living Active and Adaptive Matter

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Contrasting phases: insights into the physical properties of biomolecular condensates

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Abstract:

Many compartments within living cells exist as condensed fluid phases demixed from the surrounding solution. These biomolecular condensates are enriched in many distinct proteins and nucleic acids, and are thought to provide unique microenvironments for cellular biochemistry. Although the molecular composition of these multi-component condensates is crucial to their identity and physical properties, challenges in composition measurement have largely precluded establishment of a quantitative physical picture for these phases. In this talk, I'll describe our development of a label-free method based on quantitative (optical) phase microscopy to efficiently and precisely measure the composition and shape of micron-sized reconstituted biomolecular condensates. In addition to dynamic and temperature-dependent measurements in binary systems, I will present a general procedure to measure composition in multi-component condensates, which we validate by measuring the tie-lines and binodals for a ternary mixture containing RNA and the full-length RNA-binding protein FUS. Finally, I will discuss implications of our composition measurements for other physical properties of condensates (e.g. mechanical, dielectric, surface), and speculate on potential biological consequences of property modulation.

Date:
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Time:
9:00 AM-10:15 AM (PT)

About the speaker:

Dr. Patrick McCall is a postdoctoral researcher working jointly with Jan Brugués in the Excellence Cluster: Physics of Life at TU Dresden and Tony Hyman at the Max Planck Institute of Molecular Cell Biology and Genetics. By combining biochemical reconstitution with light microscopy and tools from soft matter physics, his research seeks to illuminate the molecular basis and physical properties of self-organized sub-cellular structures, such as biomolecular condensates.

Dr. McCall earned his PhD in Physics from the University of Chicago in 2017 advised by Margaret Gardel, where he studied the influence of non-equilibrium activity on the mechanics and dynamics of actin-based structures.

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