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Probing phase transitions in dynamic biopolymer complexation AMANDA MARCIEL, MATTHEW TIRRELL, The University of Chicago — In nature, biopolymers partition into dynamic compartments to facilitate and regulate their interactions. These dynamic compartments are referred to as membraneless organelles and consist of biopolymer rich interiors that rapidly assemble and disassemble to form liquid droplets, hydrogels or fibril structures. However, the physical interactions that affect the formation, dissolution, and regulation of these assemblages are poorly understood. Interestingly, polyelectrolyte complexes produced using simple homopolymers are similar to membraneless organelles. Polyelectrolyte complexation is an entropically driven process, where electrostatic attraction between oppositely charged polymers results in a release of bound counterions and rearrangement of water molecules. Under defined conditions, oppositely charged polyelectrolytes can form complexes consisting of a dense polymer rich phase in a polymer depleted aqueous phase. Whether complexation results in a liquid or solid precipitate depends on the strength of electrostatic interactions, which are mediated by salt concentration, acidity/basicity of the monomers and their distribution along the polymer backbone. In this work, we investigate the forces that govern membraneless organelle formation by engineering model polypeptide analogs of intrinsically disordered sequences and study their phase transition behavior. Our work holds the potential to develop a basic understanding of polyampholyte/polyelectrolyte complexation.

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