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Assembly, Properties and Function of Synthetic Phase-Separated RNA/Protein Organelles NICOLE TAYLOR, SHANA ELBAUM, HOWARD STONE, CLIFFORD BRANGWYNNE, Princeton Univ — Non-membrane bound RNA/protein (RNP) bodies play a key role in cellular RNA processing steps. Many RNA helicases, required for RNA processing, are key components of RNPs. Consistent with this, a purified RNA helicase, Laf-1, exhibits a salt and protein concentration dependent phase separation *in vitro*, resulting in liquid-like droplets. We use such synthetic RNPs to study the biophysics of RNP assembly, and to elucidate the link between their physical properties and function. To accomplish this, we are developing custom microfluidic devices to measure biophysical properties, nucleation and growth kinetics, and RNA processing function of droplets. We measure droplet viscosity by applying a shear stress to protein droplets that adhere to the channel wall; measurements are consistent with those taken using a particle microrheology approach. We also monitor and control protein droplet nucleation using oil/water emulsions. Our results provide a new platform for addressing how the cell regulates organelle assembly and properties through protein, RNA, and ATP concentration. We anticipate that these findings will offer insight into the contribution of RNPs in key RNA processing functions in the cell.

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