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Biomimetic Coacervate Environments for Protein Analysis SARAH PERRY, Univ of Mass - Amherst, PATRICK MCCALL, SAMAVAYAN SRIVASTAVA, DAVID KOVAR, MARGARET GARDEL, MATTHEW TIRRELL, University of Chicago — Living cells have evolved sophisticated intracellular organization strategies that are challenging to reproduce synthetically. Biomolecular function depends on both the structure of the molecule itself and the properties of the surrounding medium. The ability to simulate the in vivo environment and isolate biological networks for study in an artificial milieu without sacrificing the crowding, structure, and compartmentalization of a cellular environment, represent engineering challenges with tremendous potential to impact both biological studies and biomedical applications. Emerging experience has shown that polypeptide-based complex coacervation (electrostatically-driven liquid-liquid phase separation) produces a biomimetic microenvironment capable of tuning protein biochemical activity. We have investigated the effect of polypeptide-based coacervates on the dynamic self-assembly of cytoskeletal actin filaments. Coacervate materials are able to directly affect the nucleation and assembly dynamics. We observe effects that can be attributed to the length and chemical specificity of the encapsulating polypeptides, as well as the overall crowded nature of a polymer-rich coacervate phase. Coacervate-based systems are particularly attractive for use in biochemical assays because the compartmentalization afforded by liquid-liquid phase separation does not necessarily inhibit the transport of molecules across the compartmental barrier.

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