

Title: Exploring “invisible” borders for bio-applications using liquid-liquid phase separation

Abstract: Conventional homogeneous bulk environments require large sample and reagent quantities as well as significant effort to functionalize and characterize materials. Living cells efficiently process biomolecules and biochemical reactions through “invisible” borders, so called membrane-less organelles, utilizing liquid-liquid phase separation (LLPS) and compartmentalization. Engineering such cell-mimetic microenvironments can enhance in vitro biomaterial synthesis and analysis. I have exploited microfabrication, surface engineering, and LLPS technologies to create cell-inspired microenvironments. In this talk, LLPS-based platforms are explored and implemented in order to create novel micro-scale bioassay platforms at liquid-liquid interfaces for regulation of biochemical reactions, assessment of macromolecular crowding in LLPS, evaluation of breast cancer migration, fabrication of immunogenic microstructures, and construction of multiplex immunoassays. Overall, LLPS enables rapid and selective mass exchange and diffusion with small quantity of reagents, provide robust and reliable reaction platforms, and open new doors to explore functional material processes and biological assays that conventional approaches fail to achieve.