MICROCOMPARTMENTALIZATION BY AQUEOUS PHASE SEPARATION AS A STEP TOWARDS PROTOCELLS. C. D. Keating (Department of Chemistry, Pennsylvania State University, University Park PA 16802, keating@chem.psu.edu)

Compartmentalization of functional or pre-functional molecular components within a special microenvironment is a critical step towards the generation of protocells. Non-membranous compartments rich in macromolecules can occur due to several types of liquid-liquid phase separation. When multiple phases coexist, solutes such as ions, small molecules, and biopolymers can become compartmentalized by partitioning due to the different solvent environment and/or affinity interactions (e.g. ion pairing, hydrogen bonding). The extent of localization depends on solute identity and varies with compartment composition. Local concentrations in excess of one molar are achievable, and reaction microenvironments inside the droplets can differ greatly from the bulk medium. These observations suggest the possibility of "cytoplasm first" systems in which functional microcompartments can be maintained in the absence of an amphiphile bilayer membrane. Such constructs provide high encapsulation efficiencies and allow solute entry/egress. Additionally, these non-membranous compartments can serve as templates for assembly of lipid self-assemblies (e.g., vesicles), forming a permeable membrane-like coating at the interface. This interfacial layer stabilizes the droplets against coalescence but does not prevent uptake of nucleic acid oligomers.