Block Copolymer Self-Assembly

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Amphiphilic block copolymers spontaneously organize in water to form structures on length scales from nanometers to centimeters. Vesicles are one of these structures, and consist of a fluid bilayer membrane that has folded upon itself to form a sphere. Vesicles are structurally analogous to a cell membrane, and serve as the scaffold for the development of new colloids that respond to their environment to determine where and when they perform their function. By incorporating mechanisms from cellular design, we aim to create colloids that serve as a basis for a new generation of drug delivery vehicles, diagnostic imaging agents, and biological mimics. In order to achieve these goals, vesicles will be formulated that include not just one type of polymer, but many. The purpose of this project is to study the role of chemical structure, molecular weight and solution properties in the incorporation and mixing of different polymeric amphiphiles within the membrane of a single fluid vesicle. The incorporation of different types of polymer into a single vesicle will be measured by fluorescently labeling the polymer and tracking subsequent incorporation with solution fluorescence, fluorescent microscopy, and confocal microscopy. Since the limits on incorporating different polymers in a single vesicle will be thermodynamic in origin, we will be investigating the phase behavior of polymer mixtures in two dimensional fluids.

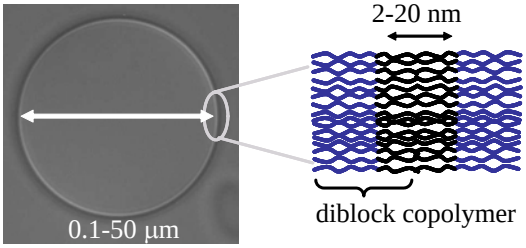

Figure 1. The vesicle surface consists of diblock copolymers that align next to one another in solution to form a fluid membrane similar in structure to cellular lipid membranes. We wish to investigate the role of chemical structure, molecular weight and solution properties on the assembly and resulting properties of the vesicles.