4bg Assembly and Investigation of Biomimetic Colloids

Kevin D. Hermanson

Through modern wet chemistry and recombinant techniques, a large variety of molecules that mimic biological functions can be created. These biomimetic molecules are valuable for both understanding how biological materials function, and for creating large scale structures to be used as implant devices and encapsulation technologies. The concepts that are paramount in understanding how biomimetic molecules interact, and how they can be assembled into large scale structures lie at the interface of colloid and polymer science. In the research presented here, concepts from colloid and polymer science are utilized to understand the interactions between biomimetic molecules and to assemble biomimetic molecules into large structures.

Among the large variety of structures useful for implant devices and encapsulation technologies, one of the most ecumenical is that of the thin shelled vesicle. Such thin shelled vesicles can be formed from a large number of different colloids through the self-assembly of colloidal particles at the interface of emulsion droplets. Here this technique is combined with the natural propensity of biological molecules to associate and bind. In this process biomimetic colloids are adsorbed on the interface of an emulsion droplet. Once the colloids are adsorbed, the emulsion interface induces the natural binding behavior of the biological molecules causing the molecules to bind together. The resulting structures are micron-sized vesicles with a shell thickness between 5 and 40 nanometers. The microstructural and mechanical properties of the final shell resemble the natural properties of the biological molecules, and as a result the assembled shells can be used to gain further insight into the structure-property relationship of the natural molecules which are mimicked.