The development of self-assembly as a useful approach to the synthesis and manufacturing of complex systems and materials has been identified as a "grand challenge" in the 2003 U.S. National Academies report "Beyond the Molecular Frontier".

http://www.nap.edu/books/0309084776/html

More recently (7/1/05), Science magazine included "How far can we push chemical self-assembly" in the top-25 list of "big questions" facing science.

http://www.sciencemag.org/cgi/content/full/309/5731/95

In our laboratory we utilize the self-assembly afforded by amphiphiles (e.g., surfactants, block copolymers, proteins) and the directed assembly promoted by external fields (e.g., shear, electric) for (i) fundamental elucidation of interactions and structure in supramolecular systems, (ii) formulation of nanostructured polymer-particle dispersions with desired properties, (iii) templating the synthesis of nanomaterials, and (iv) surface modification and organization of colloidal particles.

This presentation will address the interplay between the fundamentals of amphiphilic block copolymer (ABC) self-assembly in the presence of selective solvents, and the applications of ABCs in the formulation of complex fluids with tuneable properties, and in the synthesis of nanoparticles in a size- and shape-controlled manner. Ongoing research on shear-induced conformational changes of blood proteins and the dielectrophoretic collection of viral particles will also be highlighted.