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Non-ionic micelles and encapsulation.

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The development of self-assembly as a useful approach to the synthesis and manufacturing of complex systems and materials is a central theme in our research. Amphiphilic block copolymers of the poly(ethylene oxide)-poly(propylene oxide) (PEO-PPO) family (commercially available as Ploxamers) are well-known for self-assembling into (core-shell spherical) micelles and (cubic, hexagonal, and lamellar) lyotropic liquid crystals in water. We are interested on how the aqueous phase behavior and structure of these non-ionic polymeric amphiphiles can be modulated by the addition of organic solvents or solutes. Our studies (i) probe the amphiphile organization in both micellar solutions and lyotropic liquid crystals, (ii) combine macroscopic observations (e.g., concentration-temperature micellization phase boundaries, ternary isothermal amphiphile-water-cosolvent phase diagrams) with microscopic measurements (from small-angle neutron and X-ray scattering), and (iii) aim to relate the type of structure formed and its properties to the relative swelling of the polymer blocks and to the location of the solvent/solute in the amphiphile assembly. These studies address the following practical questions: What are the “right” components and conditions for self-assembly? What if the conditions are no longer “right”? How can we “help” self-assembly? Modulation of structure-property relationships in amphiphile-containing media is central to formulation of pharmaceuticals and personal care products.