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### **Supramolecular concepts in self-assembly of complex polymer systems**

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We discuss the complexation, the self-assembly behaviour and nanostructures obtained in comb-like liquid crystalline polymers formed by ionic complexation of cationic dendronized polymers and anionic lipids. The resulting self-assembled materials exhibit thermotropic liquid crystalline behaviour and a rich state diagram. The topology of the LC phases resulting from the self-assembly process, their lattice parameter and the distribution of polymer and lipid domains are discussed via birefringency analysis, small angle x-ray scattering, differential scanning calorimetry and transmission electron microscope. Depending on the generation of the dendronized polymer and the length of the alkyl chains, amorphous, lamellar, columnar hexagonal and a rarely observed columnar tetragonal phase can be obtained, where the long-range ordering of the structures is a function of the generation of the dendronized polymer considered and the lattice space is of the order of 3-6 nm. The selective staining of polymer/lipid domains allows establishing unambiguously the composition of each domain in the observed nanostructures and a structural model is proposed which accounts for the systematic variations of structure in terms of alkyl chain length as well as polymer generation. Furthermore, we discuss our recent efforts towards enhancing long-range order via external applied fields. Owing to the reversible nature of the ionic complexation this process proves high relevance for nanoporous channels, biomimetic, transport and nanotemplating applications. References: Canilho, N.; Kasemi, E.; Mezzenga, R.; Schluter, A.D. *J. Am. Chem. Soc.* **128**, 13998 (2006).