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FUNCTIONAL POLYMER MEMBRANES

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Similar to conventional surfactants or lipids also suitable amphiphilic block copolymers can self-assemble in aqueous media to micelles or membrane-like superstructures. The physical properties of these membranes can be controlled via the chemical constitution, the molecular weight and the hydrophilic-to-hydrophobic block length ratio of these polymers. For that purpose, we synthesized and characterized a whole series of related block copolymers. Interestingly such systems offer also the possibility of controlled drug encapsulation and release. Compared to conventional low molar mass blocks, membranes based on macromolecular self-assembly, can not only have the advantage of superior stability and toughness, but in addition offer numerous possibilities of tailoring physical, chemical and biological properties since many functions can be implemented simultaneously in one single macromolecule. Well-defined functions can also be introduced by combining these superstructures with suitable functional units from nature, e.g., by incorporation of integral membrane proteins. It has to be emphasized many integral membrane proteins can be functionally reconstituted in block copolymer membranes despite the considerable dimensional mismatch between the membranes and the proteins. This concept can be used to prepare so-called nanoreactors by encapsulting highly active catalysts and/or enzymes and influence their activity by coencapsulating crowding agents. Interestingly giant polymer vesicles and/or defined clusters of block copolymer vesicles can be used as a platform to visualize and investigate transmembrane processes, interactions with cells, diffusion processes and selective enzyme reactions in a locally defined, confined space or as mimicks of natural organelles.

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