Functional polymer-lipid 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 [1]. Interestingly such systems offer also the possibility of controlled drug encapsulation and release [2,3]. 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 [1].

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 [4].

Interestingly systematic experiments indicate that mixtures of phospholipids and block copolymers or block copolymers with other block copolymers can form membranes in aqueous media consisting of phase separated copolymer domains. Depending on their composition, the thickness of the polymer and/or phospholipid domains and their viscosity, we observed a systematic influence on insertion of proteins into a preferred domain and their local mobility [5].

References

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