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Biopores/membrane proteins in synthetic polymer membranes

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Abstract

Background: Mimicking cell membranes by simple models based on the reconstitution of membrane proteins in lipid bilayers represents a straightforward approach to understand biological function of these proteins. This biomimetic strategy has been extended to synthetic membranes that have advantages in terms of chemical and mechanical stability, thus providing more robust hybrid membranes.

Scope of the review: We present here how membrane proteins and biopores have been inserted both in the membrane of nanosized and microsized compartments, and in planar membranes under various conditions. Such bio-hybrid membranes have new properties (as for example, permeability to ions/molecules), and functionality depending on the specificity of the inserted biomolecules. Interestingly, membrane proteins can be functionally inserted in synthetic membranes provided these have appropriate properties to overcome the high hydrophobic mismatch between the size of the biomolecule and the membrane thickness.

Major conclusion: Functional insertion of membrane proteins and biopores in synthetic membranes of compartments or in planar membranes is possible by an appropriate selection of the amphiphilic copolymers, and conditions of the self-assembly process. These hybrid membranes have new properties and functionality based on the specificity of the biomolecules, nature of the synthetic membranes.

General significance: Bio-hybrid membranes represent new solutions for the development of nanoreactors, artificial organelles or active surfaces/membranes that, by further gaining in complexity and functionality, will promote translational applications.

Keywords: membrane proteins, biopores, amphiphilic copolymers, synthetic membranes, polymersomes, giant unilamellar vesicles, planar membranes