In Situ Hierarchical Formation of Giant Amphiphile Bionanoreactors

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Amphiphilic protein-polymer chimeras –the so-called Giant Amphiphiles- are designed to mimic the hierarchical self-assembly displayed both in biological and synthetic material systems over a range of lengths. During the last years we synthesized and characterized several such protein-polymer amphiphilic bioconjugates through a series of different synthetic approaches varying from the direct coupling of end-functionalized polymers to proteins, to the grafting of polymers from protein macroinitiators.1,2,3 Interestingly, Giant Amphiphiles have shown to assemble into well-defined, functional superstructures suitable for a variety of materials applications.

Scheme 1. In situ, hierarchical formation of Giant Amphiphile bionanoreactors.

Two different synthetic approaches, the Atom Transfer Radical Polymerization (ATRP)2 and the Ring Opening Polymerization (ROP)3 grafting of a series of monomers from protein biomacroinitiators will be comparatively presented in this lecture (Scheme 1). It will be shown that these methods drastically improve synthetic yields and allow studying of the self-assembling behaviour and functionality of Giant Amphiphiles in unprecedented detail. More importantly, the in situ formation of multifunctional nanoreactors with interesting catalytic properties and significant application potential will be presented. Special focus will be placed on the synthesis of a novel series of biocompatible and degradable giant soaps. The functionality, self-assembling and self-destructing properties of the new bioconjugates will be discussed.

References

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Research interests: Synthesis of protein-polymer bioconjugates, Directed biomaterial assembly, Cascade (bio)catalysis, Single enzyme catalysis, (bio)material applications.