

Preface

Biosynthetic polymer conjugates (also known as biological-synthetic polymers, biohybrid polymers, or polymer chimeras) are polymers containing biological segments – mostly polypeptides, proteins, polysaccharides, polynucleotides, and terpenes – and synthetic segments. The idea or aim is to synergistically combine the advantageous properties of both components, which include biological function, molecular recognition, chirality, biocompatibility of the biological component and solution properties, and processability of the synthetic component, thereby creating new biomaterials with sophisticated properties and structural features. Conjugate polymers are often designed for life science or biomedical applications (for instance, as smart carrier systems in targeted drug or gene delivery) and also have great potential for materials science (like for the production of bioinspired hierarchical structures or biominerals) and sustainable chemistry (especially polysaccharides and polyterpenes).

The laboratory syntheses of polypeptides and of peptide–polymer conjugates were achieved early in the last century and developed into the sophisticated materials they are today. Peptide sequences, oligonucleotides, and also oligosaccharides can nowadays be readily prepared by automated solid-phase syntheses; however, subsequent conjugation to synthetic polymers is often difficult. Here, the very recent advances in chemoselective coupling strategies, PEGylation, and “click” chemistry have contributed greatly to overcome these problems. Also the synthesis of protein–polymer conjugates has been facilitated by mild and efficient coupling strategies as well as by the development of controlled radical polymerization techniques (conjugation by grafting from). The controlled synthesis of well-defined polyterpenes is least developed, which is attributable to the multifunctionality and also to the limited solubility of terpene monomers.

This volume of *Advances in Polymer Science* is comprised of five chapters summarizing the state of the art in the synthesis of bioorganic–synthetic polymer conjugates based on oligo- and polypeptides (Chap. 1, authored by Henning Menzel), proteins (Chap. 2, Björn Jung and Patrick Theato), carbohydrates (Chap. 3, Ahmed M. Eissa and Neil R. Cameron), nucleotides (Chap. 4, Corinne Vebert-Nardin *et al.*), and terpenes (excluding polyisoprene and natural rubber) (Chap. 5,

Junpeng Zhao and Helmut Schlaad). The main focus is on synthesis, whereas special materials properties and potential applications are not discussed in great detail.

I would like to express my sincere thanks to all the contributors of this volume, authors, and reviewers, for their excellent and stimulating work. I hope that the articles will be an inspiration for new concepts and further developments in the field of biosynthetic polymer conjugates.

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