Preface

Biopolymers and their derivatives are diverse, abundant, important for life, they exhibit fascinating properties and are of increasing importance for various applications. Living matter is able to synthesize an overwhelming variety of polymers, which can be divided into eight major classes according to their chemical structure: (1) nucleic acids such as ribonucleic acids and deoxyribonucleic acids, (2) polyamides such as proteins and poly(amino acids), (3) polysaccharides such as cellulose, starch and xanthan, (4) organic polyoxoesters such as poly(hydroxyalkanoic acids), poly(malic acid) and cutin, (5) polythioesters, which were reported only recently, (6) inorganic polyesters with polyphosphate as the only example, (7) polyisoprenoids such as natural rubber or Gutta Percha and (8) polyphenols such as lignin or humic acids.

Biopolymers occur in any organism, and in most organisms they contribute to the by far major fraction of the cellular dry matter. Biopolymers possess a wide range of different essential or beneficial functions for the organisms: conservation and expression of genetic information, catalysis of reactions, storage of carbon, nitrogen, phosphorus and other nutrients and of energy, defense and protection against the attack of other cells or hazardous environmental or intrinsic factors, sensors of biotic and abiotic factors, communication with the environment and other organisms, mediators of adhesion to surfaces of other organisms or of non-living matter and many more. In addition, many biopolymers are structural components of cells, tissues, and whole organisms.

To fulfil all these different functions, biopolymers must exhibit rather diverse properties. They must very specifically interact with a large variety of different substances, components and materials, and often they must have extraordinarily high affinities to them. Finally, many of them must have a high strength. Some of these properties are utilized directly or indirectly for various applications. This and the possibility to produce them from renewable resources, as living matter mostly does, make biopolymers interesting candidates to industry.

Basic and applied research have already revealed much knowledge on the enzyme systems catalyzing biosynthesis, degradation and modification of biopolymers as well as on the properties of biopolymers. This has also resulted in an increased interest in biopolymers for various applications in industry, medicine, pharmacy, agriculture, electronics and various other areas. However, considering the developments during the last two decades and reviewing the literature shows that our knowledge is still scarce. The genes for the biosynthesis pathways of many biopolymers are still not available or were identified only recently, many new biopolymers have just been described, and from only a minor fraction of

biopolymers the biological, chemical, physical and material properties have been investigated. Often promising biopolymers are not available in sufficient amounts. Nevertheless, polymer chemists, engineers and material scientists in academia and industry have discovered biopolymers as chemicals and materials for many new applications, or they consider biopolymers as models to design novel synthetic polymers.

The first edition of this multivolume handbook comprehensively reviews and compiles information on biopolymers in 10 volumes covering (a) occurrence, synthesis, isolation and production, (b) properties and applications, (c) biodegradation and modification not only of natural but also of synthetic polymers, and (e) the relevant analysis methods to reveal the structures and properties. Volumes 1-8 are structured according to the chemical classes of biopolymers, whereas Volume 9 focusses on aspects of the biodegradation of synthetic polymers and Volume 10 deals with general aspects related to biopolymers.

This book series will hopefully be helpful to many scientists, physicians, pharmaceutics, engineers and other experts in a wide variety of different disciplines, in academia and in industry. It may not only support research and development but may be also suitable for teaching.

Publishing of this book series was achieved by chosing volume editors and authors of the individual volumes and chapters for their recognized expertise and for their excellent contributions to the various fields of research. I am very grateful to these scientists for their willingness to contribute to this reference work and for their engagement. Without them and without their comitment and enthusiasm it would have not been possible to compile such a book series.

I am also very grateful to the publisher WILEY-VCH for recognizing the demand for such a book series, for taking the risk to start such a big new project and for realizing the publication of *Biopolymers* in excellent quality. Special thanks are due to Karin Dembowsky and many of her WILEY-VCH colleagues, especially from production and marketing, for their constant effort, their helpful suggestions, constructive criticism, and wonderful ideas.

Last but not least I would like to thank my family for their patience, and I have to excuse for the many hours the preparation of this book series kept me away from them.

Münster, February 2001 Alexander Steinbüchel