

Preface

Chitin and chitosan have been attracting attention as a final biomass all over the world. Interest in chitin and chitosan in fundamental science and applied research grows year by year. Chitin, chitosan and their derivatives have multifunctional properties with applications in the resource and energy sectors, as well as environmental problem-solving and practical life sciences. Thus, chitin and chitosan researchers continue to pursue further scientific and technological applications, particularly in the life sciences.

This volume is a comprehensive introduction to the science and practical applications of chitin and chitosan and their related enzymes. It covers the methods of synthesis, structures, properties and applications of chitin, chitosan and related enzymes.

One of our objectives is to review the basic physicochemical properties of chitin and chitosan and to present the fundamental preparative methods. We hope this will prove useful to those who are interested in the science and application of chitin and chitosan, as well as to those who wish to expand their knowledge in this area. Another objective of this monograph is to examine recent research and provide basic information on current topics. We have tried to present the new trends and to anticipate potential applications in the various fields of chitin, chitosan, and related enzymes. We have covered as wide a range of relevant topics as possible and discussed those areas where future work should be concentrated. However, the emphasis throughout this book is on those principles and topics which are based on the related subject matter.

The present volume consists of several main sections containing recent topics reported by a number of prominent researchers in this field. Chapter 1 is an introduction to the fundamental properties of chitin and chitosan. A basic understanding of the outline, dissolution, viscoelastic properties and regeneration of chitin and chitosan is very important in the development of science and technology related to chitin and chitosan. In Chapter 2, the conformation of the chitin and chitosan molecule in the solid state, the inorganic salt, the metal chelate of chitosan and the conformation of the chitosan molecule in an acidic solution are discussed. The chemical modifications of chitin and chitosan discussed in Chapter 3 are important for the development of new materials. Direct modifications, modifications by reactive precursors and modifications based on protection-deprotection techniques of chitin and chitosan are described. In Chapter 4, the

enzymes responsible for the biosynthesis and decomposition of chitin and chitosan are reviewed, their mechanisms are discussed and their applications in a variety of fields reported. In Chapter 5, adsorbents, coagulants and membranes for the separation of materials from chitin, chitosan and their derivatives are reviewed. The mechanisms of this separation are described and their applications discussed. In Chapter 6, the immunological properties and drug delivery systems for the pharmaceutical applications of derivatives of chitin and chitosan are discussed from the viewpoint of the chemical and physical structure of their derivatives. In Chapter 7, the biocompatibility, biodegradability, biological activity and applications of biomaterials derived from chitin, chitosan and their derivatives are reviewed using various examples. In Chapter 8, the use of a polyelectrolyte complex composed of chitin and chitosan for tissue regeneration is introduced. The role of chitin, chitosan and their derivatives in the regeneration of tissues *in vitro* and *in vivo* is reported. In Chapter 9, the various applications to fibers, films, hydrogels, and the hybridization of chitin, chitosan and their derivatives are reviewed. The applications of chitinous materials such as cosmetics, food additives, agricultural materials and water cleaning are also introduced. Finally, in Chapter 10, the future prospects of chitin and chitosan are discussed from the viewpoint of their science and technology. Chitin and chitosan will become very important key materials in the life sciences in the 21st century.

This volume on chitin and chitosan was planned while envisioning the science and technology of the 21st century. It is our hope that it will make a positive contribution to the future development of the scientific and technological applications for chitin, chitosan and related enzymes. In the preparation of this book, the most active scientists in this and related fields have been carefully selected as authors. We are grateful to all the contributors. Finally, we are indebted to Mr. Ippei Ohta of Kodansha Scientific Ltd. for his helpful suggestions and discussions concerning the organization of this book.

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Tadashi Uragami

Seiichi Tokura