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Polysaccharides in Medicinal Applications. Edited by Severian Dumitriu, Marcel Dekker, Inc. New York, ISBN 0-8247-9540-7. 1996, 794 pp. \$195.00.

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BOOK REVIEW

Polysaccharides in Medicinal Applications. Edited by Severian Dumitriu, Marcel Dekker, Inc. New York, ISBN 0-8247-9540-7. 1996, 794 pp. \$ 195.00.

As an extremely extensive compilation of new developments and fundamental aspects in the growing field of the synthetic chemistry of complex carbohydrates, the authors of all the chapters and Editor are to be congratulated for drawing together this monograph in an extremely comprehensive and easily readable layout. Consisting of twenty six chapters, this volume is divided into two sections. The first part is entitled "Polysaccharides: Structure and General Properties" and consists of seven chapters. The second part entitled "Polysaccharides in Medicine" is a larger section consisting of nineteen chapters.

The first chapter by Hatanaka, entitled "Chemical Synthesis of Polysaccharides," illustrates new approaches through ring-opening polymerization of anhydrosugars. The chapter serves as a fundamental introduction to the chemistry of this fascinating group of carbohydrates.

Chapter 2, by Harada and Harada, entitled "Curdlan and Succinoglycan," describes new aspects of these two polymers, their biosynthesis, production, applications and physico-chemical properties.

The use of "Pullulan", a remarkable polysaccharide, is the subject of Chapter 3, by Gibbs and Seviour. The chapter specifically focuses on the chemical structure and production of this polysaccharide.

Chapter 4, entitled, "Cellulose and Its Derivatives: Structures, Reactions and Medical Uses" offers a rather short overview of the fundamental chemistry of cellulose. The main emphasis, however, is on medical applications.

Perhaps one of the most important, Chapter 5. by Popa deals with "Hemicelluloses." The important aspects of biosynthesis, isolation and production methods presented here include new industrial methodologies for the production of furfural, xylitol and other important carbohydrates, as well as their chemistry and applications.

The next two chapters (Chapters 6 & 7) illustrate the fundamental physical chemistry of hydrogels. Chapter 6 by Dumitriu, Vidal and Chornet, entitled "Hydrogels Based on Polysaccharides," is an extensive review (116 pages, 628 references) of the chemistry and the mechanistic and physical aspects of all known hydrogels. Chapter 7, by Kaetsu, deals with "Stimule-Sensitive Hydrogels" and reviews the important aspects of various models of mechanism of electroresponsiveness of polysaccharide composites.

In the second section, entitled "Polysaccharides in Medicine", three chapters (Chapters 8, 9 & 10) by Montreuil, respectively entitled "Glycobiology: General Aspects", "Structure and Biosynthesis of Glycoprotein" and "Normal and Pathological Catabolism of Glycoproteins," provide fundamental information on many aspects of medical applications of this new field of glycobiology, including biosynthesis of various

glycoproteins under normal and pathological conditions as characterized by various lysosome storage diseases.

All the classes of oligosaccharide antibiotics and their developments reported between 1983 and 1994 (with a total of 479 references) are outlined in Chapter 11. Entitled "Oligosaccharide Antibiotics," by Jutten and Greven, the chapter focuses on new analogs and their chemistry and biology. It is further documented by a subchapter on glucosidase inhibitors — their mechanism of action and biological activity. Synthetic trends of the future for this class of inhibitors and inhibitors of glycosyl transfer and N-glycoprotein processing are also briefly discussed in this chapter.

The mechanisms of protective immunity and antibody response are discussed in Chapter 12 written by Lee. Entitled "Bacterial Capsular Polysaccharides: Immunogenicity and Vaccines," the chapter also deals with the status of current, existing conjugate and glycoconjugate vaccines and their future utilization.

Jennings and Pon in Chapter 13, entitled "Polysaccharides and Glycoconjugates as Human Vaccines," review similar topics and classify existing polysaccharide vaccines based on their bacterial origin. A short section offers the current status of development of conjugate vaccines in humans.

The next two chapters (Chapters 14 & 15) contributed by Montreuil, deal with "Recombinant Glycoproteins: Pitfalls and Strategy" and "Glycoconjugates and Diseases". Both chapters are extremely informative and important for the new fields of recombinant glycoprotein as potential new therapeutics to combat lysosome storage diseases.

Chapter 16, written by de Belder and entitled "Medical Applications of Dextran and Its Derivatives" only details specific medical aspects of dextran and its new practical development in the field for organ perfusion and preservation, antithrombotic, anticoagulant and diagnostic agent for hysteroscopy.

"Polysaccharides in Oxygen-Carrier Blood Substitutes" are presented in Chapter 17 by Dellacherie. Plasma expanders such as, dextran and hydroxyethyl starch and other oligo- and polysaccharides coupled with hemoglobin are discussed.

Nagumo and Nishino present new developments in "Fucan Sulfates and Their Anticoagulant Activities" in Chapter 18. The "Pharmaceutical and Medical Applications of Cyclodextrins" written by Duchene and Wonessidjewe are described in Chapter 19. Enhancing the stability, solubility and bioavailability of drugs by cyclodextrins is the subject of this chapter.

An exceptionally interesting chapter entitled "Bioartificial Pancreas" by Iwata illustrates new strategies, developments and applications of agarose and agarose/polystyrenesulfonic acid microcapsules, functioning as an artificial kidney

The next two chapters (Chapters 21 & 22) deal with Chitosan and Chitin. The first, written by Hon and entitled "Chitin and Chitosan: Medical Applications," outlines the chemical modification of chitin and chitosan and their application in pharmacy for drug formulation.

Chapter 22, contributed by Beena, Paul, Chandy and Sharma and entitled "Chitosan: A Novel Matrix for Hemoperfusion" portrays pioneering studies of applications of encapsulated chitin and chitosan as absorbents for small molecules and bilirubin.

"Membranes as Biomaterials" authored by Ikada, as Chapter 23, describes various polysaccharide biomaterials as membranes for homodialysis, plasmapheresis, homostasis and immunoseparation. Chapter 24, written by Silver and Benedetto, offers developments

in applications of "Polysaccharides Used in Ophthalmology" and describes almost all known commercial products used in ophthalmology, such as vitreous implants and tissue adhesives.

The next chapter (Chapter 25), entitled "Hydrogels as Support for Drug Delivery System" and contributed by the editor, should have been placed as first in the second part of the book as it matches two previous chapters on similar topics. The chapter reviews functionalized dextran, cyclodextrins, starch, cellulose, chitin, and chitosan and the methods for immobilization of drugs on these polysaccharides by coupling, inclusion and complexation.

The final chapter (Chapter 26) contributed by Uglea and Ottenbrite characterize "Polysaccharides as Supports for Antiviral And Antitumoral Drugs". In particular, polymer drugs, drug-carrying polymers, and time-release drug polymers are described.

The book concludes with an extensive, fourteen page subject index, making the most specific polysaccharide easy to find. Since this volume was so meticulously edited, reading the error-free text is a pleasure.

Because this volume provides excellent coverage of the growing field of polysaccharides, it is highly recommended as a core reference text. It will be an essential addition to institutional libraries as a reference for organic and medicinal chemists, biochemists, pharmaceutical scientists, immunologists and biotechnologists actively engaged in research on the chemistry and biochemistry of carbohydrates specializing in polysaccharide chemistry.

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BOOK REVIEW

Polymeric Biomaterials, Edited by Severian Dumitriu, Marcel Dekker, New York, ISBN 0-8247-8969-5, x + 845 pp, 1994, \$195.00

This is a comprehensive reference on the physicochemical and biological properties of biomaterials. It covers many classes of medical polymers, including vinyl polymers, polyurethanes, and polysaccharides. The volume contains 17 chapters from over 40 academic and industrial contributors, mostly from Europe. It is organized in three parts: Polymers as Biomaterials; Medical and Surgical Applications; and Polymeric Drug and Drug Delivery Systems. The lengthy introductory chapter by Severian Dumitriu and Cristina Dumitriu-Medvichi on Hydrogel and General Properties of Biomaterials offers a thorough, theoretical background on various structural, mechanical and characterization aspects of polymers. The authors also cover the sterilization and disinfection of polymeric materials, which is often overlooked in other texts.

Chapter 2 by Severian Dumitriu and Daniela Dumitriu examines polymer biocompatibility, including biomaterial interactions with tissue and blood compatibility. Chapter 3 by Casu discusses in detail heparin, chemically modified glycosaminoglycans and heparinoid polysaccharides, their structure and biological activity. Two other chapters provide accounts of chitin-derived medical products and polymer surface modifications for enhanced blood compatibility, respectively. The latter includes chemical and other modifications and the immobilization of biologically active molecules.

In the second part, there are chapters on medical uses of polyurethane elastomers, therapeutic vascular devices, and dental and maxillofacial surgery applications of polymers. Chapter 9 by Rastrelli briefly treats skin graft polymers. Guttman and Guttman describe in detail the uses and biological properties of sutures. In a particularly interesting section the authors also cover composite and drug-delivering sutures.

Part three opens up with Jozefonvicz and Jozefonvicz' chapter on polymers in contact with blood, such as in extracorporeal devices, catheters, tubings, hollow fibers and membranes. The authors describe the relationship of blood compatibility to polymer structure and polymeric surfaces, as well as the impact of polymers on the immune system. Fitzgerald and Wilson highlight the various uses of polymeric systems in ophthalmic drug delivery. They describe polymer gel systems derived from carboxyvinyl polymers, poloxamer-polyethylene glycols and natural polymers. Of note is also chapter 13 on biodegradable drug delivery polymers by Domb, Amselem and Maniar. The authors cover the synthesis and degradation of polylactides, polycaprolactones, polyamides, polyphosphazenes, polyanhydrides and other synthetic polymers. For each system they also provide information on the polymer's biocompatibility and toxicity.

Chapter 14 by the editor and Maria Dumitriu is a very comprehensive review of polymeric drug carriers, which should have more appropriately preceded the first two chapters of this section. At close to 300 pages, with 77 tables, more than 170 figures and over 800 references, this chapter, like chapter 1, could have easily constituted a monograph by itself. The authors summarize first the prodrug approach to improved drug delivery, the various types of drug delivery systems and their uses. Extensive tables list vinyl polymers and other reactive polymers, as well as examples of numerous polymeric drug conjugates. Other topics include the design criteria for the preparation of polymer-drug conjugates, and the hydrolytic lability of drug-carrier linkages. The remaining two-thirds of the chapter is devoted to the syntheses of drug delivery polymers by polymerization, polycondensation and other types of polymer reactions. Many examples of polyamino acids and synthetic carbohydrate polymers carriers are also provided.

Chapter 15 treats the syntheses and medical applications of synthetic oligomers, such as acrylates and vinylics. It also covers polyethylene glycols and their copolymers. Chapter 16 is dedicated to a discussion of the preparation, characterization, and clinical uses of micro- and nano-particle drug carriers. Uglea's final chapter, entitled "Oligomers as "Physical Catalysts" in Biological Processes", examines biological and artificial membranes.

The contributed chapters are of variable length and their contents vary substantially in their depth of subject coverage. Overall, however, this is a valuable book that covers many aspects of biomaterials and their dental and medical uses. The various discussions of relevant biological, chemical and physical polymer properties are also very useful. Extensively indexed, the volume provides some 2,800 literature references and is uniformly typeset.

Although the book does not treat any regulatory aspects and certain material applications, such as burn and wound dressings, it will nevertheless be an essential source of information for all those interested in polymeric materials.

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