

Book review

Biomedical Functions and Biotechnology of Natural and Artificial Polymers (Frontiers in Biomedicine and Biotechnology, Vol. 3), Edited by Manssur Yalpani, ATL Press, Shrewsbury, MA, USA, 1996. ISBN 1-882360-02-8, 296 pp (including index), \$225.00 (clothbound); ISBN 1-882360-32-X, \$124.00 (paperbound).

A quick survey of online catalogues of several university and government libraries would demonstrate to a reader a great preponderance of available titles whose contents are similar to those of this book. Therefore, one might question the necessity of another volume on biopolymers and synthetic polymers and their medical applications. In his introductory chapter, the editor makes a clear case for this collection of recent advances within a very broad, rapidly growing field. Using a few choice statistics projecting the sales of pharmaceuticals and devices based on the materials covered here, Yalpani foresees an economic future for polymer-based technologies that is indeed — in his words — “staggering”. This volume sets in print 23 of the 49 oral and poster presentations given at a symposium at the 1995 International Chemical Congress of Pacific Basin Societies (Pacifichem '95) in Honolulu, Hawaii. Between Yalpani's brief but informative introduction and a serviceable subject index, the book's chapters are organized in three sections: Synthesis and Characterization, Novel Bioactive Assemblies, and Biotechnology and Biomedical Applications. The topics covered in these sections are summarized in the book's subtitle: self-assemblies, hybrid complexes, and biological conjugates of glycans, liposomes, polyethylene glycols, polyisopropylacrylamides, and polypeptides. Chapters on polysaccharides and other complex carbohydrates predominate each of the sections; therefore, readers of this journal should find much of the material interesting.

The first section, Synthesis and Characterization, includes two chapters describing methods for synthesizing new aminoglycans. T. Yoshida et al. present their syntheses of 3-amino-3-deoxyfuranans via stereoselective ring-opening polymerization of ribosan and xylosan derivatives, the products of which they intend to test as HIV inhibitors. J. Kadokawa et al., describe their attempts to circumvent the notorious difficulty of working with chitin by thermally polymerizing chitobiose, resulting in a chitosan analogue with alternating O- and N-glycosidic bonds. In the final chapter in this section, C. Yomota and S. Okada give the results of their study of the colligative properties of hyaluronate as a polyelectrolyte.

This section also includes the book's two best chapters. R. Linhardt et al. contribute a review of his group's recent work on structurally defined oligosaccharides from heparin and other glycosaminoglycans. Following a generously referenced background section, Linhardt et al. give a finely written account of his synthetic strategy towards target molecules for use in subsequent biological studies to probe the structure-function relationships of these sulfated glycans. S. Zalipsky offers an overview of his pioneering work with functionalized poly(ethylene glycols) and poly(2-oxazolines) for covalent modification of biologically relevant ligands and for the preparation of long-circulating liposomes. Zalipsky's chapter provides a well-referenced point of entry for readers interested in his technology.

The book's second section, Novel Bioactive Assemblies, comprises reports on recent developments in drug-delivery systems (DDSs) using a variety of approaches: supramolecular complexes, such as liposomes and hydrogels, and covalent conjugates. R. Koganty et al. describe their self-assembling liposome-based cancer immunotherapeutic, incorporating synthetic analogues of a tumor-associated antigen, a phagocytosis-stimulating peptide, and the glycolipid adjuvant, monophosphoryl lipid A. Koganty et al. demonstrate the ability of this method of antigen delivery for selective stimulation of cell-mediated immunity; thus, such a system should be more effective in eliminating solid tumors than carrier-protein-based conjugate vaccines, which predominantly stimulate the antibody response. Another possible route to stimulating CMI is presented by Y. Ohya et al., who have synthesized a multivalent adjuvant by conjugating an analogue of muramyl dipeptide to carboxymethylcurdlan; their conjugate could be regarded as a simple model of the cell wall of *bacille de Calmette-Guérin*.

Other notable chapters in this section are contributed by K. Akiyoshi et al., and T. Sato et al., both of which tackle the problem of stabilizing soluble macromolecules for delivery to the cytoplasm without degradation. Akiyoshi et al. describe host-guest assemblies of various proteins within monodisperse hydrogel nanoparticles of pullulan made amphiphilic with cholesteryl ethers. Sato et al. present a synthetic gene-transfer system, consisting of DNA complexed with lipophilic glutamate derivatives, which shows high resistance to hydrolysis by DNase I and high transfection efficiency. Several of the chapters in this section together illustrate a basic idea in DDS design: Understand the behaviour of a target cell's membrane and its components in order to formulate a delivery system whose interactions with the cell's surface will result in an immune response or introduction of an active compound into the cell by endocytosis.

Chitin is the focus of half of the chapters of the book's final section, Biotechnology and Biomedical Applications. With Kadokawa's offering from the first section, these chapters highlight the prominence of this abundant natural material and its derivatives in biocompatible medical devices and drug-delivery matrices. An interesting but perhaps out-of-place chapter by D. Koga describes a study in which a potential agricultural application is found for chitin and chitosan as effective elicitors of plant self-defense against pathogenic fungi; this process seems to be analogous to the immune response in animals. In the book's final chapter, M. Sakata et al. discuss their development of cross-linked polyacrylamides as adsorbents for the removal of endotoxins from solutions of high-molecular-weight compounds. This chapter should attract the attention of readers engaged in research and development of vaccines and other parenteral drugs.

Evidence of the rapid progress in the area of polymers in medical applications can be readily found by scanning the scientific programs of recent American Chemical Society meetings. Thus, preparation of a volume of collected meeting presentations in this field would require a quick turnaround to remain current. However, this book, released some seven months after Pacifichem, disappointingly treads a thin line between timeliness and hastiness. The chapters are essentially camera-ready manuscripts of inconsistent quality; particularly noticeable is the variability in writing quality, which ranged from crystal-clear to clumsy. This unfortunate and occasionally distracting drawback seems to indicate rushed preparation or a lack of due diligence somewhere in the book's production process. The overall result regretfully does not compare well with similar books from other publishers. Nevertheless, the editor's judicious choice of topics brings together a broad and engaging sampling of the ongoing research in the area, with emphasis on the work coming from the many Japanese laboratories represented here.

A.J. D'Ambra
Carbohydrate Chemistry Dept.
North American Vaccine, Inc.
Beltsville, MD 20705-4223, USA

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