Book Review

Polymeric Biomaterials. Edited by Severian Dumitriu. Marcel Dekker, Inc., New York, 1994, 845 pp., ISBN 0-8247-8969-5.

This book consists of three parts with seventeen chapters authored by scientists from both academics and industry from several different countries. Part I deals with the structure and physicochemical properties of polymers with the methods to improve biocompatibility, and examples are drawn from various domains within the medical field. Part II details the multiple applications of polymers for medical and surgical purposes, and Part III describes the polymers that may be used in the pharmaceutical area either as drugs or alternately as drug carriers for controlled delivery. Each chapter is self contained with a comprehensive list of references in general, and serves as a good starting point to learn the state of the art in the particular field. Although this book may not be used as a text for graduate classes in the University, it can well serve as a quick reference guide to biomedical engineers and macromolecular chemists for specific applications of a variety of polymeric biomaterials.

Chapters 1 & 2 set the tone for Part I wherein the physics, chemistry and biology of various polymers are described including the microstructure of polymeric biomaterials and the importance of their mechanical properties together with the sterilization procedures and toxicity effects. An excellent review of the biocompatibility issue of polymers with several examples, and the various *in vitro* and *in vivo* strategies employed to study the interaction between biomaterials and physiological substrates is included. Chapters 3 and 5 discuss various approaches to prepare nonthrombogenic surfaces to improve blood compatibility such as surface immobilizaton of heparin, chemical procedures and treatment with energy sources. Chapter 4 appears to be somewhat abrupt in the flow but describes in detail the stimulation of defenses and tissue reconstruction when chitin and chitin derived substances are applied to mammals under circumstances such as wounds, injections and tumors.

Part II comprises five chapters each of which focuses on one specific application of polymeric biomaterials in the medical and surgical field. Chapter 6 presents the physicochemical characteristics of polyurethane elastomers and their applications in vascular grafts, mammalary prostheses and artificial hearts. In Chapter 7 the authors have outlined an historical perspective and the advent of autologous and homologous vascular grafts and the chemical processing of biological tissue to improve antithrombogenic characteristics to achieve long term potency. This chapter includes several SEM photomicrographs of synthetic vascular grafts using PTFE, polyester and polyurethanes and recent developments in the area of vascular surgery including sympathectomy, balloon angioplasty, laser recanalization and spinal chord stimulation. Chapter 8 starts with a succinct discussion on oral biology and biochemistry and all the cells and macromolecular structures of the extracellular matrix comprising the connective tissue which forms the periodontium. A summary of the general host-implant reactions is followed by the testing and evaluation methds of polymeric materials used in dentisry. Topics included in this chapter are operative dentistry, endodontic and periodontology treatments, and the application of biomaterials in artificial teeth, aesthetic facing, dental implants and local sustained release of antimicrobial agents. Skin grafts are often required in the treatment of skin loss due to traumatic or pathological events. The ideal properties of a skin substitute and examples of vapor-permeable membranes, hydrogels, xerogels, and hydrocolloid dressings are outlined in Chapter 9. The possibility of utilizing cultured epithelial sheets and several other future perspectives in this area are presented. Chapter 10 explains the physical, biological and handling characteristics of sutures, and also the preliminary criteria in the selection of an appropriate suture are listed. In addition to *in vitro* studies, the evaluation of the *in vivo* performance of sutures by means of clinical investigations are provided. An updated review of the application of biomaterials including coated sutures, composite sutures and drug delivery sutures make this chapter valuable.

Part III of this book deals with the use of polymers as drug and drug carriers. Various devices made from polymeric materials and used in biomedical application include: extracorporeal blood circulation devices, catheters, blood bags, plasma expanders, cardiac valves, membranes and fibers used in dialysis. Chapter 11 is a very well written chapter and special emphasis has been given for the compatibility, inflammatory and immunogenic response of these materials with biological systems. Polymeric systems used for ophthalmic delivery of active agents is the theme of Chapter 12. This chapter focuses on the anatomy of the eye and various forms of drug delivery systems available, and finally the formulation factors affecting bioavailability of drugs administered by the ocular route have been well presented with extensive examples. The chemistry, and properties of biodegradable polymers and various formulation techniques used in the development of these drug delivery systems are concisely described in the next chapter. This is a well organized chapter and the references are extensive and up to date. Chapter 14 is the longest chapter in this book and describes the pros and cons of polymeric drug delivery systems as drug carriers. Various approaches and techniques used in the development of controlled drug delivery systems with their advantages and limitations have been outlined. We feel some of the contents of this chapter are mere repetition of information already presented in previous chapters. Presentation of data and information in tabular forms is one of the greatest plus of this chapter. Medical application of oligomers, their synthesis and usefulness as drug carriers has been presented in Chapter 15. Hydrocarbon resins, oligoacrylates, oligoethers and oligovinylics, their synthesis and structure property relationships are well presented in this section. Chapter 16 focuses on micro and nanoparticles as drug carriers. The three different particulate systems discussed in this chapter include: macroparticles comprising of microcap-

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sules and microspheres, nanospheres and nanoparticles. The usefulness of these particulate systems as carriers for the delivery of anticancer drugs, antibiotics, antiinflammatory agents and immunomodulators have been critically analyzed. The last chapter of this book describes the use of oligomers as physical catalysts in biological processes. Biological and medical application of synthetic and artificial membranes, identification and separation of natural carriers and preparation of synthetic carriers have been discussed in this section. In our opinion, this chapter could have been a continuation of Chapter 15, for better flow and clarity of its contents.

The book follows a simple writing style with a systemic presentation of the concepts, and tables and figures are included whenever necessary to overcome verbose texts. However, due to the large number of topics covered, there appears to be a loss of depth of coverage in some chapters, and also multiple authorship has resulted in partial overlaps and repetitions in introduction materials without adequate cross-referencing. Since each chapter presents a good overview, we would recommend the book to any library interested in the areas of biomedical engineering, polymer chemistry and medical and pharmaceutical applications of polymers.

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