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Book review

Tissue Engineering and Biodegradable Equivalents
K. Lewandrowski, D.L. Wise, D.J. Trantolo, J.D. Gresser, M.J. Yaszemski, D.E. Altobelli (Eds.); Marcel Dekker, New York, 2002, 811 pages, ISBN: 0-8247-0755-9, US$ 235.00

The title promises a close view at a hot, multidisciplinary field of science: tissue engineering. In his introduction, Lewandrowski hopes for an enthusiastic presentation of the complexity of the topic. The addendum 'and Biodegradable Equivalents' implicates that finding a good line and strategy for his book was very difficult for the editor. It is a reference textbook without special efforts to help the searching reader.

Three threads are recognizable throughout the book: materials, cells and analytics. The editor arranged the manuscripts by human organs in seven parts with an additional section covering analytical aspects. Most authors are familiar to the interested reader and Lewandrowski avoids to present the papers of the dinosaurs in this field.

Part I introduces us into biomaterials for tissue engineering. At first, a good overview about synthetic polymers and natural scaffolds is provided. Materials mimicking the natural tissue enviroment like collagen, fibrin and hyaluronic acid are described. In addition, the application of polylactide for engineering of blood vessels, skin, cartilage, nerve, liver, bone and for experiments with artificial dura mater is explained followed by a detailed characterization of the biomedical applications of urethans. The significance of drug delivery in tissue engineering and electrospinning as a technique to achieve fibrous scaffolds are other aspects which are covered. A presentation of fundamental physiological factors in bone tissue engineering, like osteoblast and influence of growth factor, should point out the importance of the biomaterial for incorporation of cells and signaling molecules. Generally, the list of the materials used is very long. The editor should not abstain from a strategical and logical presentation of the important principles. Here, the book is lacking to transport the complexity of the topic.

Part II demonstrates tissue engineered cartilaginous material in a short manner. The first chapter written by Peretti, Xu and Randolph introduces in the fundamentals of cartilage and includes a presentation of materials. Unfortunately, all pictures of tissue are monochrome. The presented materials are: polyglycolide, collagen, hyaluronan, alginate and poly(ethylene oxide). An interesting idea is the application of autologous perichondrium. The following sections describe scaffolds for meniscus and the last chapter gives another summary of basics and material.

Part III contains references about bone repair biomaterial. We struggle through a collection of chapters and regret that we hold a reference book in our hands. Extensive knowledge of osteoclust, osteoblast biology and mechanisms of ossification is the prerequisite to understand the contributions. The part comprehends prosthetic replacement, injectable calcium phosphate cements and inorganic bone substitutes like Endobon, Ceros and Cavat. In addition, Lewandrowski describes the demineralization and perforation of cortical bone allografts by means of mathematical modeling for geometries.

Part IV surprises with an amuse-gueule, that we take faithfully: gene therapy application like adenovirus vector-mediated gene transduction for treatment of bone disease.

Part V summarizes three subjects: engineering of muscle, skin biomaterials and ophthalmological application. Not only clinical aspects are presented but also the market of commercial products for skin reconstruction including the composition of both acellular and cellular matrices. Skuk and Tremblay explore the use of muscle-derived cells for treatment of muscle pathologies. The last chapter of part V provides an excellent presentation of tissue engineering in ophthalmology. At first, the basic anatomy of the eye, laminar organization of retin, posterior segments and medical and surgical treatment are explained. The reconstruction of corneal tissue results can be achieved by a sequential method with collagen, corneal keratinocytes and fibroblasts. Materials used in tissue engineering of the posterior ocular segment are PGLA and PHB.

Part VI starts with another short chapter on materials in this case for urological use by Kim. The description of the clinical application of, for example, fibrin sealant and bandage in urology is followed by a part looking at sealants and adhesives in tissue engineering from a physician's point of view.

Going into Part VIII, we still hope to learn basic principles. Adequate analytical tools for biomaterials in tissue engineering are key factors in this field. At first, combinatorial cell culture is explained which provides to develop a technology to develop organs from multilineage stem cells. The next chapter about biochemical and biological evaluation assembles analytic methods. Liebmann–Vinson enthusiastically presents methods to study the biomaterial. Important physical attributes of three-dimensional scaffolds, which are frequently used in tissue

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engineering are porosity, pore size, mechanical strength and surface properties like surface energy and surface charge. Analytical techniques including mercury porosimetry, SEM, measurement of contact angle or streaming potential and stress–strain test are used. After a short introduction to molecular signaling, its relevance for biochemical assays is explained. Four major properties of cells characterize their behavior depending upon material and conditions of culture: cell adhesion, morphology, proliferation and differentiation. Corresponding analytical tools are histological evaluation, immunoblot assays, and measurement of enzymatic activity or double-stranded DNA content. Thus, the chapter helps to correlate cell growth with material properties. The following chapter containing clinical application for lumbar body, is highly specific, but its placement after the text from Liebmann–Vinson with a global overview is good for the understanding. After learning, the analytics from the view of a technologist the application is illustrated by a physician. In this way, the wide range of tissue engineering is opened. The last chapter with its topic about characterization of dentin arranges well in this part.

The reference character of a scientific book can be always an alibi to collect papers on different scientific aspects in an unstructured manner. Whereas this book is in some sections rather confusing than helpful, the last part with significant characterization is structured best and very useful for engineers of tissue. The book touches many diverse notions to reach the aim of reconstructed tissue. In comparison with other books like the excellent 'Biomedical Engineering Handbook' (Joseph D. Bronzino) and 'Biomimetic materials and design' (Dillow/Lowmann) which take a more scientific and provide principles in a well structured way, a slightly better arrangement would have been desirable.

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