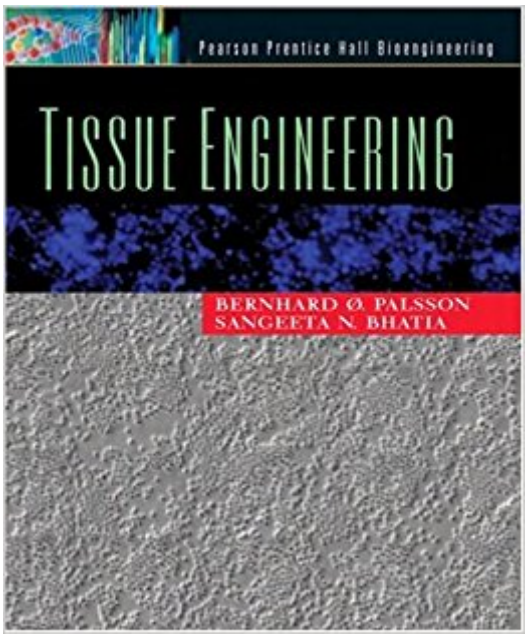
Tissue Engineering



Synopsis

This bookÃ¢â ¬â •the first in its fieldÃ¢â ¬â •lays the foundation for individuals studying tissue engineering. It provides a conceptual framework that includes exposure to all the necessary background material in all areas. A four-part presentation covers quantitative cell and tissue biology, cell and tissue characterization, engineering methods and design, and clinical implementation. For cell culture scientists and engineers.

Book Information

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Customer Reviews

Tissue engineering is a complex and emerging field of study that combines basis biological sciences (molecular, cell, and tissue biology and physiology), engineering fundamentals (fluid mechanics, transport phenomena, materials science, chemical kinetics), clinical aspects (surgery, transplantation, immunology, pathology, radiology) and biotechnology (cell culture, cell separations, gene transfer). All these disciplines converge to study of tissue dynamics that coordinate tissue repair, replacement, and reconstruction. These are procedures and therapies in which cells themselves act as the therapeutic agents. This book on tissue engineering is the first textbook in this field and it offers the convergence of important fundamental concepts in biology, engineering, medicine, and biotechnology. These diverse concepts are carefully organized and laid out in a clear framework to orient students entering the field. This framework includes four parts: Part I: Quantitative Cell and Tissue Biology—Including tissue organization, tissue dynamics, morphogenesis, stem cells, cellular fate processes, and their coordination. Part II: Cell and Tissue

Characterization-Including high-throughput technologies, cell and tissue properties, cell and tissue culture, and gene transfer Part III: Engineering Methods and Design-Including time constant analysis, scale-up procedures, cell separations, biomaterial scaffolds, and how to tailor biomaterials Part IV: Clinical Implementation-Including conventional approaches to tissue repair, host integration, and producing tissue-engineered therapies. This book thus offers the basics of this emerging field to the student and a framework in which instructors can build comprehensive courses, with the flexibility to emphasize and expand on any particular topic.

Tissue engineering holds the promise to repair or replace damaged organs. As a discipline, the field has evolved dramatically from its origins in the late 1980s. In particular, the rapid advances in stem cell biology have rekindled the enthusiasm use cell-based approaches for the treatment of disease. For success in this area, must learn to manipulate, produce, and deliver collections of cells as building blocks of tissues. Transplanted cells and tissue constructs are influenced by their microenvironment and can be manipulated to effectively interact with patients. The underpinnings of tissue engineering are thus broad, and span a wide spectrum of scientific and engineering fundamentals. This list includes basic biological sciences (cell biology, physiology, embryology, and wound healing); engineering fundamentals (fluid dynamics, transport phenomena, materials science, mechanics, and chemical kinetics); many clinical aspects (surgery and transplantation, immunology, pathology, radiology, and medicine), and various relevant biotechnologies (cell culture, cell separation, and gene transfer). This long list of specialized knowledge makes it challenging to organize all the necessary background material for the student of tissue engineering in a clear and succinct manner. In writing this book, we aimed to lay the foundation for students studying tissue engineering at both the undergraduate and the graduate level. We have attempted to provide a conceptual framework that includes exposure to all of the necessary background material. Thus, we cannot treat any particular subject in great detail but rather can provide the needed conceptual background in all areas. Instructors will find this text to be a useful framework since it is amenable to augmentation based on the instructors area of expertise and desired focus of a course in tissue engineering. The text is written primarily for senior bioengineering students or first-year graduate students and assumes a working knowledge of the engineering fundamentals. In this spirit, we have provided a series of engineering-style homework problems and solutions in order to allow students to work through the concepts presented. Nonetheless, we also hope that the text will be useful to traditional engineering students, material scientists, medical students, laypeople, and biologists. We have chosen to present the material in four parts: quantitative cell and tissue biology, cell and

tissue characterization, engineering methods and design, and clinical implementation. Throughout the text, we have emphasized relevant time and length scales of physicochemical processes in cell biology and medicine. Armed with these fundamentals, we seek to have students establish a conceptual framework within which to place further advances in the field. Many societal and technical challenges still remain for the field to move forward, and we have highlighted these to the extent possible.

Writing a textbook like this one is a significant undertaking. There are many individuals and organizations to thank for helping us with various aspects of the writing process. The Whitaker Foundation generously provided financial support for this project through their Teaching Materials program. Their recognition that textbooks are required to build consensus and firmly establish a field will be an important part of their legacy. Two individuals were key in preparing this text. Marc Abrams tirelessly assisted in compiling all aspects of this text and prepared it using LATEX, which made the production and publication an easier process. Salman Khetani made heroic efforts in reading all of the material in detail and offering perceptive criticism, suggestions, and input that significantly improved the quality of the text. He and Valerie Liu provided important feedback on their experience teaching from this text and help with preparing homework problems. Christophe Schilling, Ramprasad Ramakrishna, Jason Papin, Stephen Fong, and Timothy Allen also provided help with homework problems. Some individuals provided significant help with particular chapters; Nathan Price and Karl Francis with Chapter 6, Jason Papin with Chapter 7, and Markus Herrgard with Chapter 8. Michelle Williamson provided the original illustrations. A number of individuals assisted in proofreading the text; including Tim Allen, Derren Barken, Markus Covert, Iman Famili, Steve Fong, Anu Raghunathan, Jennifer Reed, Sharon Wiback, Kanika Chawala, and Thuy Vo. Many of our colleagues have provided feedback, pointed us to important resources, or shared preprints and course notes. Thanks go especially to Francois Berthiaume, John Bischof, Christopher Chen, Tejal Desai, Jennifer Elisseeff, Robert Sah, Fred Schoen, Mehmet Toner, and Peter Zandstra. Finally, we wish to thank our families for their support of this seemingly never-ending project. In particular, Sangeeta thanks her husband, Jagesh, for his insight and love and her Dad, Narain, for his encouragement and wisdom. Bernhard Palsson has a number of people and institutions to thank. The Fulbright and Ib Henriksen Foundations provided him with fellowship support to spend a leave at the Technical University of Denmark in 1996. Jens Nielsen and John Villadsen acted as his hosts and encouraged him to prepare a series of lectures on tissue engineering during his stay in Denmark. (Those lectures nucleated this book.) The Hougen Visiting Professorship at the University of Wisconsin in 2000 provided another leave during which portions of this text were written. He is grateful for the support and understanding of his wife Mahshid and

children Shireen and Sirus who helped with the preparation of the index of this book. BERNHARD O. PALSSON SANGEETA N. BHATIA

text book that I needed.

Tissue engineering is developing field that not a lot of textbooks as linear circuit or algebra on the market. The content of the book articulately describe the methodology and essential issues about TE. It well mix biology, Chemistry, physiology, and material mechanics together and state in an easy- understanding style. Not many complicate and scary mathematical equations and complex and tricky explanations. The easy- catching figure and plot are accessible for freshman enter into this field. There are some engineering problem in the back to recapitulate the principle ideas and thoughts on how to deal with research problem in the lab. It is a recommendable reference for beginner.

As advertised all is good!

This text book was nothing I expected. The topics are not explained in detail. There are lot of mathematical models, but they are not explained at all! The content is hard to follow and definitely not suitable to undergraduate students. They assume that the reader already knows lot of the topics and the mathematical equations, so I do not see why the authors expected people to even buy the book!!

This book is not a hard read, yet it is still useful and up-to-date as a college level introduction to tissue engineering

Engineering) Tissue Engineering, Second Edition Stem Cells, Tissue Engineering and Regenerative Medicine Tissue Engineering Culture of Cells for Tissue Engineering Tissue Engineering: From Cell Biology to Artificial Organs Principles of Tissue Engineering, Second Edition Principles of Tissue Engineering 3D Bioprinting and Nanotechnology in Tissue Engineering and Regenerative Medicine Orthodontically Driven Corticotomy: Tissue Engineering to Enhance Orthodontic and Multidisciplinary Treatment Biomechanics and Mechanobiology of Aneurysms (Studies in Mechanobiology, Tissue Engineering and Biomaterials) (Volume 7) Cells and Biomaterials for Intervertebral Disc Regeneration (Synthesis Lectures on Tissue Engineering) Biomedical Applications of Polyurethanes (Tissue Engineering Intelligence Unit) Gravity Sanitary Sewer Design and Construction (ASCE Manuals and Reports on Engineering Practice No. 60) (Asce Manuals and Reports on Engineering ... Manual and Reports on Engineering Practice)