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Preface

It is our pleasure to present this special volume on tissue engineering in the series *Advances in Biochemical Engineering and Biotechnology*. This volume reflects the emergence of tissue engineering as a core discipline of modern biomedical engineering, and recognizes the growing synergies between the technological developments in biotechnology and biomedicine. Along this vein, the focus of this volume is to provide a biotechnology driven perspective on cell engineering fundamentals while highlighting their significance in producing functional tissues. Our aim is to present an overview of the state of the art of a selection of these technologies, punctuated with current applications in the research and development of cell-based therapies for human disease.

To prepare this volume, we have solicited contributions from leaders and experts in their respective fields, ranging from biomaterials and bioreactors to gene delivery and metabolic engineering. Particular emphasis was placed on including reviews that discuss various aspects of the biochemical processes underlying cell function, such as signaling, growth, differentiation, and communication. The reviews of research topics cover two main areas: cellular and non-cellular components and assembly; evaluation and optimization of tissue function; and integrated reactor or implant system development for research and clinical applications. Many of the reviews illustrate how biochemical engineering methods are used to produce and characterize novel materials (e.g. genetically engineered natural polymers, synthetic scaffolds with cell-type specific attachment sites or inductive factors), whose unique properties enable increased levels of control over tissue development and architecture. Other reviews discuss the role of dynamic and steady-state models and other informatics tools in designing, evaluating, and optimizing the biochemical functions of engineered tissues. Reviews that illustrate the integration of these methods and models in constructing model, implant (e.g. skin, cartilage), or ex-vivo systems (e.g. bio-artificial liver) are also included.

It is our expectation that the mutual relevance of tissue engineering and biotechnology will only increase in the coming years, as our needs for advanced healthcare products continue to grow. Already, tissue derived cells constitute important production systems for therapeutically and otherwise useful biomolecules that require specialized post-translational processing for their safety and efficacy. Biochemical engineering products, ranging from growth factors to

polymer scaffolds, are used as building blocks or signal molecules at virtually every stage of engineered tissue formation. Importantly, the realization of engineered tissues as clinically useful and commercially viable products will at least in part depend on overcoming the same efficiency challenges that the biotechnology industry has been facing. In this light, we see the interface between tissue engineering and various other fields of biochemical engineering as a very exciting area for research and development with enormous potential for cross-disciplinary education. In this regard, we anticipate that this and other similar volumes will also be useful as supplementary text for students.

We extend our special thanks to all of the contributing authors as well as Springer for embarking on this project. We are especially grateful to Dr. Thomas Scheper and Ulrike Kreusel for their incredible patience and hard work as our production editors.

Medford, August 2006

Kyongbum Lee
David Kaplan

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