

Biomedical Mass Transport and Chemical Reaction: Physicochemical Principles and Mathematical Modeling

By James S. Ultman, Harihara Baskaran, Gerald M. Saidel

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Teaches the fundamentals of mass transport with a unique approach emphasizing engineering principles in a biomedical environment

- Includes a basic review of physiology, chemical thermodynamics, chemical kinetics, mass transport, fluid mechanics and relevant mathematical methods
- Teaches engineering principles and mathematical modelling useful in the broad range of problems that students will encounter in their academic programs as well as later on in their careers
- Illustrates principles with examples taken from physiology and medicine or with design problems involving biomedical devices
- Stresses the simplification of problem formulations based on key geometric and functional features that permit practical analyses of biomedical applications
- Offers a web site of homework problems associated with each chapter and solutions available to instructors

Homework problems related to each chapter are available from a supplementary website (

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Editorial Review

From the Back Cover

Teaches the fundamentals of mass transport and chemical reaction with a unique approach emphasizing engineering principles in a biomedical environment

The impact of engineering on medicine and biology has grown significantly. Not only has this resulted in an impressive world-wide increase in educational biomedical engineering programs, but many traditional chemical and agricultural engineering departments have changed their names to include "bio-" recognizing the importance of biomedical engineering research and development to human welfare and the global economy.

Biomedical Mass Transport and Chemical Reaction is designed for students whose educational emphasis involves physicochemical aspects of biomedical systems. A major objective of this textbook is to integrate engineering principles with relevant biomedical applications at the cellular, tissue, organ, and whole-body levels. These applications incorporate basic as well as more sophisticated and complex concepts, which are appropriate for graduate as well as advanced undergraduate engineering students.

Divided into seven parts *Biomedical Mass Transport and Chemical Reaction* features:

- Basic biological and modelling concepts
- An overview of the thermodynamics that relate to interfacial, membrane and chemical reaction equilibria
- Rate equations to analyze mass diffusion and chemical reactions
- Basic transport models in fluids and membranes
- Multi-dimensional transport of molecules and cell population dynamics
- Compartment models and analyses
- Detailed models related to treatment of tissue and organ dysfunction, delivery and distribution of drugs, and interpretation of biomedical measurements

The approach is unique in that it is organized by engineering principles rather than by specific types of applications. Learning is reinforced with diverse example problems of increasing complexity. This empowers students with the self-confidence necessary to successfully tackle new problems throughout their careers.

About the Author

James S. Ultman, PhD, is a Professor Emeritus of Chemical Engineering and Biomedical Engineering at the Pennsylvania State University.

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Gerald M. Saidel, PhD, is a Professor of Biomedical Engineering at Case Western Reserve University.

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Bruce Healy:

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