Preface

This third edition of *Bioprocess Engineering: Basic Concepts* updates the prior two editions. Although the principles of bioprocess engineering stated in the first two editions remains sound, the field has made considerable advances in improving the productivity, consistency, and safety of bioprocesses.

Some of the major changes in the book come from biology itself with the development of tools that have greatly increased our ability to both understand and manipulate cell biology more effectively and cheaply. On the bioprocess side, tremendous advances have been made in production of biologicals with greater emphasis on processes incorporating animal cells. In particular, productivity in making many heterologous proteins has increased by several orders of magnitude over the last 16 years. The commercial use of animal cell culture has increased significantly over this period of time, and plant cell culture is starting to see commercial applications. Processes with microbes based on recombinant DNA and related technology have matured greatly. For any cell type, consistent authentic posttranslational processing of proteins remains challenging. The development of the concepts in systems and synthetic biology is now having an impact on the thinking of bioprocess engineers.

In this edition, we either introduce or expand discussion of the following issues:

- The role of small RNAs as regulators
- Cell-free processes

- Biofuels and energy
- Synthetic biology
- Role of genomics
- Development of single-use technology in bioprocesses
- Stem cell technology and utilization
- Use of techniques of microfabrication and nanobiotechnology as well as 3D printing
- Animal and plant cell biotechnology
- Development in environmental biotechnology

Teaching a subject as broad as bioprocess engineering in one semester is a difficult challenge, considering the range of backgrounds students may have. Although many engineering students have some formal exposure to specific areas of biology, they often have not had an opportunity to complete courses from several areas of biology. The biological concepts necessary for an engineer are described in Part 1, "The Basics of Biology: An Engineer's Perspective." Although this condensed treatment cannot replace an in-depth knowledge of biochemistry, genetics, microbiology, and cell biology, it serves as a useful starting point for a bioprocess professional. On the process side, an instructor might wish to emphasize Part 2, "Engineering Principles for Bioprocesses," dealing with biopharmaceuticals, bioenergy, or waste treatment, as they decide which topics would be effective for their students.

We hope this book imparts the excitement of bioprocess engineering as well as the basic concepts and knowledge to become a leader in this field.

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