

In Part 3, “Engineering Principles for Bioprocesses,” greater attention is given to issues associated with animal cell bioreactors. The discussion of chromatographic processes is expanded. In Part 4, “Applications to Nonconventional Biological Systems,” the material has been rearranged and updated and a new chapter added. These changes are evident in the chapters on animal and plant cell culture. Particularly important is the expanded discussion on choice of host-vector systems for production of proteins from recombinant DNA technology. Coverage of two areas of increasing importance to bioprocess engineers, metabolic and protein engineering, has been expanded. A new chapter on biomedical applications illustrates how approaches to bioprocess engineering are relevant to problems typically considered to be biomedical engineering. The chapter on mixed cultures has been extended to cover advanced waste-water treatment processes. An appendix providing descriptive overviews of some traditional bioprocesses is now included.

The suggestions for further reading at the end of each chapter have been updated. We are unable in this book to provide in-depth treatment of many vital topics. These readings give students an easy way to begin to learn more about these topics.

Teaching a subject as broad as bioprocess engineering in the typical one-semester, three-credit class has never been easy. Although some material in the first edition has been removed or condensed, the second edition is longer than the first. For students with no formal background in biology, coverage of all of the material in this book would require a four-credit class. In a three-credit class we suggest that the instructor cover Chapters 1 to 11 (with 7 being optional) and then decide on subsequent chapters based on course goals. A course oriented toward biopharmaceuticals will want to include careful coverage of Chapters 12 and 14 and some coverage of 13 and 15. A course oriented toward utilization of bioresources would emphasize Chapter 16 and the Appendix and selected coverage of topics in Chapters 13 and 14.

Many students now enter a bioprocess engineering course with formal, college-level instruction in biology and biochemistry. For such students Chapters 2, 4, 5, 7, and 8 can be given as reading assignments to refresh their memories and to insure a uniform, minimal level of biological knowledge. Lecture time can be reserved for material in other chapters or for supplementary material. For these five chapters study questions are provided for self-testing. Under these circumstances the instructor should be able to cover the rest of the material in the book.

Once again we have been assisted by comments from many colleagues across the world. These comments have included suggestions for new material to be incorporated and for corrections. While the list is too long to include here, specific contributions deserve special recognition. Mohammad Ataai provided us a summary of IMAC (immobilized metal affinity chromatography) that has been incorporated into the revision. Kelvin Lee provided the paragraph describing 2-D gel electrophoresis. We thank Laura Palomares for an excellent job in updating and revising a first draft of the Appendix on traditional bioprocesses. The first edition of this book was translated into Korean, and Yoon-Mo Koo, Jin Ho Seo, Yong Keun Chang, and Tai Hyun Park provided us an extensive list of corrections, which has been very helpful in preparation of this revision.

We wish to also thank our families for their support during the process of this revision.