

Biochemical Engineering Book

The bioseparation engineering of today includes downstream process engineering such as waste water, material and gas treatment. Taking this tendency into account, bioseparation engineers gathered in Japan as a special research group under the main theme of "Recovery and Recycle of Resources to Protect the Global Environment". The scope of this book is based on the conference, and deals not only with recent advances in bioseparation engineering in a narrow sense, but also the environmental engineering which includes waste water treatment and bioremediation. The contributors of this book cover many disciplines such as chemical engineering, analytical chemistry, biochemistry, and microbiology. Bioseparation Engineering will stimulate young engineers and scientists who will develop bioseparation engineering further in the 21st century, and contribute to a world-wide attention to the global environment

This book discusses and illustrates practical problem solving in the major areas of chemical and biochemical engineering and related disciplines using the novel software capabilities of POLYMATH, Excel, and MATLAB. Students and engineering/scientific professionals will be able to develop and enhance their abilities to effectively and efficiently solve realistic problems from the simple to the complex. This new edition greatly expands the coverage to include chapters on biochemical engineering, separation processes and process control. Recent advances in the POLYMATH software package and new book chapters on Excel and MATLAB usage allow for exceptional efficiency and flexibility in achieving problem solutions. All of the problems are clearly organized and many complete and partial solutions are provided for all three packages. A special web site provides additional resources for readers and special reduced pricing for the latest educational version of POLYMATH.

This book offers a comprehensive review on biomass resources, examples of biorefineries and corresponding products. The first part of this book covers topics such as different biorefinery resources from agriculture, wood processing residues and transport logistics of plant biomass. In the second part, expert contributors present biorefinery concepts of different biomass feedstocks, including vegetable-oils, sugarcane, starch, lignocellulose and microalgae. Readers will find here a summary of the syngas utilization and the bio-oil characterization and potential use as an alternative renewable fuel and source for chemical feedstocks. Particular attention is also given to the anaerobic digestion-based and Organosolv biorefineries. The last part of the book examines relevant products and components such as alcohols, hydrocarbons, bioplastics and lignin, and offers a sustainability evaluation of biorefineries.

This book focuses on sterilizing grade filters in the biopharmaceutical industry, emphasizing practical applications of universal and dependable operational protocols, integrity testing, and troubleshooting to streamline the production and preparation of pharmaceuticals. Addresses the complexities of globalizing redundancy in filtration!

Metabolic engineering is a rapidly evolving field that is being applied for the optimization of many different industrial processes. In this issue of Advances in Biochemical Engineering/Biotechnology, developments in different areas of metabolic engineering are reviewed. The contributions discuss the application of metabolic engineering in the improvement of yield and productivity - illustrated by amino acid production and the production of novel compounds - in the production of polyketides and extension of the substrate range - and in the engineering of *S. cerevisiae* for xylose metabolism, and the improvement of a complex biotransformation process.

This work provides comprehensive coverage of modern biochemical engineering, detailing the basic concepts underlying the behaviour of bioprocesses as well as advances in bioprocess and biochemical engineering science. It includes discussions of topics such as enzyme kinetics and biocatalysis, microbial growth and product formation, bioreactor design, transport in bioreactors, bioproduct recovery and bioprocess economics and design. A solutions manual is available to instructors only.

This text is intended to provide students with a solid grounding in basic principles of biochemical engineering. Beginning with a historical review and essential concepts of biochemical engineering in part I, the next three parts are devoted to a comprehensive discussion of various topics in the areas of life sciences, kinetics of biological reactions and engineering principles. Having described the different building blocks of life, microbes, metabolism and bioenergetics, the book proceeds to explain enzymatic kinetics and kinetics of cell growth and product formation. The engineering principles cover transport phenomena in bioprocess systems and various bioreactors, downstream processing and environmental technology. Finally, the book concludes with an introduction to recombinant DNA technology. This textbook is designed for B.Tech. courses in biotechnology, B.Tech. courses in chemical engineering and other allied disciplines, and M.Sc. courses in biotechnology.

This book serves to highlight the seamless integration of the sciences leading to sustainable technologies. Chemical engineering is one of the major disciplines catering to the societal needs in the fields of energy, environment and materials. The chapters of this book have been selected to encompass the latest in industrial biotechnology and biochemical engineering principles and applications. The chapters are included here after careful review for content and depth. The book focuses on the relatively new areas of molecular biotechnology and nanotechnology which have a strong impact at the fundamental and process levels in chemical engineering. The book also covers analytical procedures, experimental techniques and process analysis in bioprocessing, bioremediation, green separation methods, and emerging nanoparticle applications. It should be useful to students, academicians, and practitioners alike.

This book facilitates the study of problematic chemicals in such applications as chemical fate modeling, chemical process design, and experimental design. This volume provides comprehensive coverage of modern biochemical engineering, detailing the basic concepts underlying the behavior of bioprocesses as well as advances in bioprocess and biochemical engineering science. It combines contemporary engineering science with relevant biological concepts in a comprehensive introduction to biochemical engineering. This book provides both a rigorous view and a more practical, understandable view of chemical compounds and biochemical engineering and their applications. Every section of the book has been expanded where relevant to take account of significant new discoveries and realizations of the importance of key concepts. Furthermore, emphases are placed on the underlying fundamentals and on acquisition of a broad and comprehensive grasp of the field as a whole.

With contributions by numerous experts

This is a well-rounded handbook of fermentation and biochemical engineering presenting techniques for the commercial production of chemicals and pharmaceuticals via fermentation. Emphasis is given to unit operations fermentation, separation, purification, and recovery. Principles, process design, and equipment are detailed. Environment aspects are covered. The practical aspects of development, design, and operation are stressed. Theory is included to provide the necessary insight for a particular operation. Problems addressed are the collection of pilot data, choice of scale-up parameters, selection of the right piece of equipment, pinpointing of likely trouble spots, and methods of troubleshooting. The text, written from a practical and operating viewpoint, will assist development, design, engineering and production personnel in the fermentation industry. Contributors were selected based on their industrial background and orientation. The book is illustrated with numerous figures, photographs and schematic diagrams.

Discover the subject of optimization in a new light with this modern and unique treatment. Includes a thorough exposition of applications and algorithms in sufficient detail for practical use, while providing you with all the necessary background in a self-contained manner. Features a deeper consideration of optimal control, global optimization, optimization under uncertainty, multiobjective optimization, mixed-integer

programming and model predictive control. Presents a complete coverage of formulations and instances in modelling where optimization can be applied for quantitative decision-making. As a thorough grounding to the subject, covering everything from basic to advanced concepts and addressing real-life problems faced by modern industry, this is a perfect tool for advanced undergraduate and graduate courses in chemical and biochemical engineering.

The biology, biotechnology, chemistry, pharmacy and chemical engineering students at various universities and engineering institutions are required to take the Biochemical Engineering course either as an elective or compulsory subject. This book is written keeping in mind the need for a text book on afore subject for students from both engineering and biology backgrounds. The main feature of this book is that it contains the solved problems, which help the students to understand the subject better. The book is divided into three sections: Enzyme mediated bioprocess, whole cell mediated bioprocess and the engineering principle in bioprocess. Dr. Rajiv Dutta is Professor in Biotechnology and Director, Amity Institute of Biotechnology, Lucknow. He earned his M. Tech. in Biotechnology and Engineering from the Department of Chemical Engineering, IIT, Kharagpur and Ph.D. in Bioelectronics from BITS, Pilani. He has taught Biochemical Engineering and Biophysics to B.E., M.E. and M.Sc. level student carried out advanced research in the area of Ion channels at the Department of Botany at Oklahoma State University, Stillwater and Department of Biological Sciences at Purdue University, West Lafayette, IN. He also holds the position of Nanion Technologies Adjunct Research Professor at Research Triangle Institute, RTP, NC. He had received various awards including JCI Outstanding Young Person of India and ISBEM Dr. Ramesh Gulrajani Memorial Award 2006 for outstanding research in electro physiology.

A revised edition of the well-received thermodynamics text, this work retains the thorough coverage and excellent organization that made the first edition so popular. Now incorporates industrially relevant microcomputer programs, with which readers can perform sophisticated thermodynamic calculations, including calculations of the type they will encounter in the lab and in industry. Also provides a unified treatment of phase equilibria. Emphasis is on analysis and prediction of liquid-liquid and vapor-liquid equilibria, solubility of gases and solids in liquids, solubility of liquids and solids in gases and supercritical fluids, freezing point depressions and osmotic equilibria, as well as traditional vapor-liquid and chemical reaction equilibria. Contains many new illustrations and exercises.

"Designed for an introductory course on Biochemical Engineering, this book interweaves bioprocessing with chemical reaction engineering concepts"--Back cover.

The emergence and refinement of techniques in molecular biology has changed our perceptions of medicine, agriculture and environmental management. Scientific breakthroughs in gene expression, protein engineering and cell fusion are being translated by a strengthening biotechnology industry into revolutionary new products and services. Many a student has been enticed by the promise of biotechnology and the excitement of being near the cutting edge of scientific advancement. However, graduates trained in molecular biology and cell manipulation soon realise that these techniques are only part of the picture. Reaping the full benefits of biotechnology requires manufacturing capability involving the large-scale processing of biological material. Increasingly, biotechnologists are being employed by companies to work in co-operation with chemical engineers to achieve pragmatic commercial goals. For many years aspects of biochemistry and molecular genetics have been included in chemical engineering curricula, yet there has been little attempt until recently to teach aspects of engineering applicable to process design to biotechnologists. This textbook is the first to present the principles of bioprocess engineering in a way that is accessible to biological scientists. Other texts on bioprocess engineering currently available assume that the reader already has engineering training. On the other hand, chemical engineering textbooks do not consider examples from bioprocessing, and are written almost exclusively with the petroleum and chemical industries in mind. This publication explains process analysis from an engineering point of view, but refers exclusively to the treatment of biological systems. Over 170 problems and worked examples encompass a wide range of applications, including recombinant cells, plant and animal cell cultures, immobilised catalysts as well as traditional fermentation systems. * * First book to present the principles of bioprocess engineering in a way that is accessible to biological scientists * Explains process analysis from an engineering point of view, but uses worked examples relating to biological systems * Comprehensive, single-authored * 170 problems and worked examples encompass a wide range of applications, involving recombinant plant and animal cell cultures, immobilized catalysts, and traditional fermentation systems * 13 chapters, organized according to engineering sub-disciplines, are grouped in four sections - Introduction, Material and Energy Balances, Physical Processes, and Reactions and Reactors * Each chapter includes a set of problems and exercises for the student, key references, and a list of suggestions for further reading * Includes useful appendices, detailing conversion factors, physical and chemical property data, steam tables, mathematical rules, and a list of symbols used * Suitable for course adoption - follows closely curricula used on most bioprocessing and process biotechnology courses at senior undergraduate and graduate levels.

A thorough introduction to the basics of bioengineering, with a focus on applications in the emerging "white" biotechnology industry. As such, this latest volume in the "Advanced Biotechnology" series covers the principles for the design and analysis of industrial bioprocesses as well as the design of bioremediation systems, and several biomedical applications. No fewer than seven chapters introduce stoichiometry, kinetics, thermodynamics and the design of ideal and real bioreactors, illustrated by more than 50 practical examples. Further chapters deal with the tools that enable an understanding of the behavior of cell cultures and enzymatically catalyzed reactions, while others discuss the analysis of cultures at the level of the cell, as well as structural frameworks for the successful scale-up of bioreactions. In addition, a short survey of downstream processing options and the control of bioreactions is given. With contributions from leading experts in industry and academia, this is a comprehensive source of information peer-reviewed by experts in the field.

Biochemical Engineering and Biotechnology, 2nd Edition, outlines the principles of biochemical processes and explains their use in the manufacturing of every day products. The author uses a direct approach that should be very useful for students in following the concepts and practical applications. This book is unique in having many solved problems, case studies, examples and demonstrations of detailed experiments, with simple design equations and required calculations. Covers major concepts of biochemical engineering and biotechnology, including applications in bioprocesses, fermentation technologies, enzymatic processes, and membrane separations, amongst others Accessible to chemical

engineering students who need to both learn, and apply, biological knowledge in engineering principals Includes solved problems, examples, and demonstrations of detailed experiments with simple design equations and all required calculations Offers many graphs that present actual experimental data, figures, and tables, along with explanations We are all aware of opportunities created by advances in molecular biology. Living cells and their components can be used to produce a large number of useful compounds such as therapeutics and other products. But to obtain significant benefits as a commercial operation, molecular biology needs the support of biochemical engineering. The vital area of biotechnology that is concerned with practical application of biological agents (whole cell systems and biocatalysts) and the methodologies and processes associated with it on an industrial scale is biochemical engineering. Biochemical engineering is applicable in different areas of biotechnology such as biochemical reactions, enzyme technology, environmental biotechnology, microbial manipulations, bioseparation technology, plant and animal cell cultures, and food technology. It consists of the development of new process technology, designing bioreactors, developing efficient, and economically feasible extraction and purification procedures (downstream processing). Chapter 1 and 2 discuss about the basic concept of biotechnology and biochemical engineering. Chapter 3 tells about the concept of enzyme kinetics, their evolution and use in biochemical engineering. Chapter 4 and 5 describe immobilized enzyme and industrial applications of enzymes. Chapter 6 depicts about industrial microbiology. This chapter discuss different concepts about fermentation process, cell products and other modified compounds. Chapter 7 tells about different types of cell cultivations in microbial, animal, and plant. Chapter 8 discuss about the fermentation proce4ss and its control. Chapter 9 and 10 describe cell kinetics and fermenter design and also how the cell grows. Chapter 11 discuss about the bioreactor design. Chapter 12 depicts the downstream processing, centrifugation, sedimentation and other technology. Chapter 13 tells about the sterilization. Under the direction of John Enderle, Susan Blanchard and Joe Bronzino, leaders in the field have contributed chapters on the most relevant subjects for biomedical engineering students. These chapters coincide with courses offered in all biomedical engineering programs so that it can be used at different levels for a variety of courses of this evolving field. Introduction to Biomedical Engineering, Second Edition provides a historical perspective of the major developments in the biomedical field. Also contained within are the fundamental principles underlying biomedical engineering design, analysis, and modeling procedures. The numerous examples, drill problems and exercises are used to reinforce concepts and develop problem-solving skills making this book an invaluable tool for all biomedical students and engineers. New to this edition: Computational Biology, Medical Imaging, Genomics and Bioinformatics. * 60% update from first edition to reflect the developing field of biomedical engineering * New chapters on Computational Biology, Medical Imaging, Genomics, and Bioinformatics * Companion site: <http://intro-bme-book.bme.uconn.edu/> * MATLAB and SIMULINK software used throughout to model and simulate dynamic systems * Numerous self-study homework problems and thorough cross-referencing for easy use

This book review series presents current trends in modern biotechnology. The aim is to cover all aspects of this interdisciplinary technology where knowledge, methods and expertise are required from chemistry, biochemistry, microbiology, genetics, chemical engineering and computer science. Volumes are organized topically and provide a comprehensive discussion of developments in the respective field over the past 3-5 years. The series also discusses new discoveries and applications. Special volumes are dedicated to selected topics which focus on new biotechnological products and new processes for their synthesis and purification. In general, special volumes are edited by well-known guest editors. The series editor and publisher will however always be pleased to receive suggestions and supplementary information. Manuscripts are accepted in English. Completely revised, updated, and enlarged, this second edition now contains a subchapter on biorecognition assays, plus a chapter on bioprocess control added by the new co-author Jun-ichi Horiuchi, who is one of the leading experts in the field. The central theme of the textbook remains the application of chemical engineering principles to biological processes in general, demonstrating how a chemical engineer would address and solve problems. To create a logical and clear structure, the book is divided into three parts. The first deals with the basic concepts and principles of chemical engineering and can be read by those students with no prior knowledge of chemical engineering. The second part focuses on process aspects, such as heat and mass transfer, bioreactors, and separation methods. Finally, the third section describes practical aspects, including medical device production, downstream operations, and fermenter engineering. More than 40 exemplary solved exercises facilitate understanding of the complex engineering background, while self-study is supported by the inclusion of over 80 exercises at the end of each chapter, which are supplemented by the corresponding solutions. An excellent, comprehensive introduction to the principles of biochemical engineering.

Part I: Process design -- Introduction to design -- Process flowsheet development -- Utilities and energy efficient design -- Process simulation -- Instrumentation and process control -- Materials of construction -- Capital cost estimating -- Estimating revenues and production costs -- Economic evaluation of projects -- Safety and loss prevention -- General site considerations -- Optimization in design -- Part II: Plant design -- Equipment selection, specification and design -- Design of pressure vessels -- Design of reactors and mixers -- Separation of fluids -- Separation columns (distillation, absorption and extraction) -- Specification and design of solids-handling equipment -- Heat transfer equipment -- Transport and storage of fluids.

A complete reference for fermentation engineers engaged in commercial chemical and pharmaceutical production, Fermentation and Biochemical Engineering Handbook emphasizes the operation, development and design of manufacturing processes that use fermentation, separation and purification techniques. Contributing authors from companies such as Merck, Eli Lilly, Amgen and Bristol-Myers Squibb highlight the practical aspects of the processes—data collection, scale-up parameters, equipment selection, troubleshooting, and more. They also provide relevant perspectives for the different industry sectors utilizing fermentation techniques, including chemical, pharmaceutical, food,

and biofuels. New material in the third edition covers topics relevant to modern recombinant cell fermentation, mammalian cell culture, and biorefinery, ensuring that the book will remain applicable around the globe. It uniquely demonstrates the relationships between the synthetic processes for small molecules such as active ingredients, drugs and chemicals, and the biotechnology of protein, vaccine, hormone, and antibiotic production. This major revision also includes new material on membrane pervaporation technologies for biofuels and nanofiltration, and recent developments in instrumentation such as optical-based dissolved oxygen probes, capacitance-based culture viability probes, and in situ real-time fermentation monitoring with wireless technology. It addresses topical environmental considerations, including the use of new (bio)technologies to treat and utilize waste streams and produce renewable energy from wastewaters. Options for bioremediation are also explained. Fully updated to cover the latest advances in recombinant cell fermentation, mammalian cell culture and biorefinery, along with developments in instrumentation Industrial contributors from leading global companies, including Merck, Eli Lilly, Amgen, and Bristol-Myers Squibb Covers synthetic processes for both small and large molecules

Biochemical engineering mostly deals with the most complicated life systems as compared with chemical engineering. A fermenter is the heart of biochemical processes. It is essential to operate a system properly. A description of enzymatic reaction kinetics is followed by cell growth kinetics to determine several kinetic parameters. Operations and analyses of several biochemical processes are included to determine their special. The book also covers the determination of several operational parameters, such as volumetric mass transfer coefficient, mixing time, death rate constant, chemical oxygen demand, and heat of combustion. This book provides a novel description of the experimental protocol to find out several operational parameters of biochemical processes. A comprehensive collection of numerous experiments based on fundamentals, it focuses on the determination of not only the characteristics of raw materials but also other essential parameters required for the operation of biochemical processes. It also emphasizes the applicability of the analysis to various processes. Equipped with illustrative diagrams, neat flowcharts, and exhaustive tables, the book is ideal for young researchers, teachers, and scientists working towards developing a solid understanding of the experimental aspects of biochemical engineering.

Systems Metabolic Engineering: The Creation of Microbial Cell Factories by Rational Metabolic Design and Evolution, by Chikara Furusawa, Takaaki Horinouchi, Takashi Hirasawa, Hiroshi Shimizu Impacts of Quorum Sensing on Microbial Metabolism and Human Health, by Yang-Chun Yong, Jian-Jiang Zhong CHO Glycosylation Mutants as Potential Host Cells to Produce Therapeutic Proteins with Enhanced Efficacy, by Peiqing Zhang, Kah Fai Chan, Ryan Haryadi, Muriel Bardor, Zhiwei Song Cell-Free Biosystems for Biomanufacturing, by Chun You, Y.-H. Percival Zhang Lipid Bilayer Membrane Arrays: Fabrication and Applications, by Xiaojun Han, Guodong Qi, Xingtao Xu, Lei Wang RNA Aptamers: A Review of Recent Trends and Applications, by Kyung-Nam Kang, Yoon-Sik Lee

The rapid growth of industries has resulted in the generation of high volume of solid and liquid waste. Today, there is a need of Clean and Green technology for the sustainable waste management. Biochemical and Environmental Bioprocessing: Challenges and Developments explore the State-of-art green technologies to manage the waste and to recover value added products. Microbes play an important role in the bioremediation. Bioprocess engineering an interdisciplinary connects the Science and Technology. The bioconversion and bioremediation is essentially required for the management of various hazardous substances in the environment. This book will give an intensive knowledge on the application of Biochemical and Bioprocess technologies for the eco-friendly management of pollution. This book serves as a fundamental to the students, researchers, academicians and Engineers working in the area of Environmental Bioremediation and in the exploration of various bioproducts from waste. Features Reviews various biological methods for the treatment of effluents from Industries by using biomass and biopolymers. Highlights the applications of various bioreactors like Anaerobic Sequential Batch Reactor, Continuously stirred anaerobic digester, Up-flow anaerobic sludge blanket reactor, Fluidized and expanded bed reactors. Presents the cultivation of algae in Open Pond, Closed loop System, and Photo-bioreactors for bioenergy production. Discusses the intensified and integrated biorefinery approach by Microwave Irradiation, Pyrolysis, Acoustic cavitation, Hydrodynamic cavitation, Electron beam irradiation, High pressure Autoclave reactor, Steam explosion and photochemical oxidation. Outlines the usage of microbial fuel cell (MFC) for the production bioelectricity generation in different modules Tubular MFC, Stacked MFC, Separate electrode modules Cutting edge research of synthesis of biogenic nanoparticles and Pigments by green route for the health care and environment management.

Anaerobic digestion is a major field for the treatment of waste and wastewater. Lately the focus has been on the quality of the effluent setting new demands for pathogen removal and for successful removal of unwanted chemicals during the anaerobic process. The two volumes on Biomethanation are devoted to presenting the state of art within the science and application of anaerobic digestion. They describe the basic microbiological knowledge of importance for understanding the processes of anaerobic bioreactors along with the newest molecular techniques for examining these systems. In addition, the applications for treatment of waste and wastewaters are presented along with the latest knowledge on process control and regulation of anaerobic bioprocesses. Together these two volumes give an overview of a growing area, which previously has never been presented in such a comprehensive way.

Genetic and cellular technologies in life science have recently achieved remarkable progress, and thus the roles of biochemical engineers have also been changed to incorporate the use of new technology. Therefore, this book deals with current topics in biochemical engineering. The chapters of this book discuss research that has introduced artificial enzymes, kinetic models in bioprocessing, a small-scale production process, and production of energy with microbial fuel. These chapters offer novel ideas for the production of effective compounds and energy. Moreover, other research has introduced the production technology of stem cells and biomedical processes using nanoshells and extracellular

vesicles. These chapters will provide novel ideas to produce effective compounds and develop therapies for various diseases.

Biochemical Engineering Fundamentals, 2/e, combines contemporary engineering science with relevant biological concepts in a comprehensive introduction to biochemical engineering. The biological background provided enables students to comprehend the major problems in biochemical engineering and formulate effective solutions.

Introduction to Biomedical Engineering is a comprehensive survey text for biomedical engineering courses. It is the most widely adopted text across the BME course spectrum, valued by instructors and students alike for its authority, clarity and encyclopedic coverage in a single volume. Biomedical engineers need to understand the wide range of topics that are covered in this text, including basic mathematical modeling; anatomy and physiology; electrical engineering, signal processing and instrumentation; biomechanics; biomaterials science and tissue engineering; and medical and engineering ethics. Enderle and Bronzino tackle these core topics at a level appropriate for senior undergraduate students and graduate students who are majoring in BME, or studying it as a combined course with a related engineering, biology or life science, or medical/pre-medical course. *

NEW: Each chapter in the 3rd Edition is revised and updated, with new chapters and materials on compartmental analysis, biochemical engineering, transport phenomena, physiological modeling and tissue engineering. Chapters on peripheral topics have been removed and made available online, including optics and computational cell biology. *

NEW: many new worked examples within chapters * NEW: more end of chapter exercises, homework problems * NEW: Image files from the text available in PowerPoint format for adopting instructors * Readers benefit from the experience and expertise of two of the most internationally renowned BME educators * Instructors benefit from a

comprehensive teaching package including a fully worked solutions manual * A complete introduction and survey of BME * NEW: new chapters on compartmental analysis, biochemical engineering, and biomedical transport phenomena * NEW: revised and updated chapters throughout the book feature current research and developments in, for example biomaterials, tissue engineering, biosensors, physiological modeling, and biosignal processing. * NEW: more worked examples and end of chapter exercises * NEW:

Image files from the text available in PowerPoint format for adopting instructors * As with prior editions, this third edition provides a historical look at the major developments across biomedical domains and covers the fundamental principles underlying biomedical engineering analysis, modeling, and design *bonus chapters on the web include:

Rehabilitation Engineering and Assistive Technology, Genomics and Bioinformatics, and Computational Cell Biology and Complexity.

This special volume "Tools and Applications of Biochemical Engineering Science" is dedicated to Professor Wolf-Dieter Deckwer on the occasion of his 60th birthday. It was a great pleasure for me to act together with Professor Karl Schtiggerl as volume editor and to present here a collection of 11 outstanding review articles written mainly by former students, associates, colleagues and friends of Wolf-Dieter Deckwer. The title of this special volume well reflects the research interests and scientific pursuit of Wolf-Dieter Deckwer during his more than 20 years' work in the area of biochemical engineering, particularly during the last 15 years when he was the head of the Biochemical Engineering Division of GBF (German National Research Center for Biotechnology). He has decisively pushed the development not only of "software tools" ranging from analytical means and mathematical models for monitoring and understanding cellular processes to gene expression systems for designing microorganisms, but also of "hardware tools" such as computer control systems, bioreaction and separation devices for effectively producing a variety of bioproducts on semi-production scale. New developments in some of these important tools in biochemical engineering are reviewed in articles included in this volume. Wolf-Dieter Deckwer was among the leading biochemical engineers who timely pointed out the necessity of applying these tools in an integrated manner for bioprocess development. By establishing "Integrated Bioprocess Development" as one of the GBF main - search topics as early as 1990 he also actively promoted this idea.

All engineering disciplines have been developed from the basic sciences. Science gives us the information on the reasoning behind new product development, whereas engineering is the application of science to manufacture the product at the commercial level. Biological processes involve various biomolecules, which come from living sources. It is now possible to manipulate DNA to get the desired changes in biochemical processes. This book provides students the knowledge that will enable them to contribute in various professional fields, including bioprocess development, modeling and simulation, and environmental engineering. It includes the analysis of different upstream and downstream processes. The chapters are organized in broad engineering subdisciplines, such as mass and energy balances, reaction theory using both chemical and enzymatic reactions, microbial cell growth kinetics, transport phenomena, different control systems used in the fermentation industry, and case studies of some industrial fermentation processes. Each chapter begins with a fundamental explanation for general readers and ends with in-depth scientific details suitable for expert readers. The book also includes the solutions to about 100 problems.

This volume deals with "Microbial Production of L-Amino Acids" and presents five comprehensive, expert and actual review articles on the modern production of Amino Acids by application of biotechnologically optimized microorganisms. This includes not only the modern techniques of enzyme, metabolic and transport engineering but also sophisticated analytical methods like metabolic flux analysis and subsequent pathway modeling. A general review about industrial processes of Amino Acid production provides a comprehensive overview about recent strain development as well as fermentation technologies. It was our special interest to focus the other articles on the most important and best selling amino acids on the world market i.e. L-Glutamate, L-Lysine and L-Threonine. The authors of this special volume have contributed significantly to the progress of Amino Acid biotechnology in the last decades and earn our special gratitude and admiration for their expert review articles.

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