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Multidisciplinary resource for graduate studies and the biotechnology industry Knowledge of the genetic basis of biological functioning continues to grow at an astronomical rate, as do the challenges and opportunities of applying this information to the production of therapeutic compounds, specialty biochemicals, functional food ingredients, environmentally friendly biocatalysts, and new bioproducts from renewable resources. While genetic engineering of living organisms transforms the science of genomics into treatments for cancer, diabetes, and heart disease, or products for industry and agriculture, the science and technology of bioseparations are the keys to delivering these products in a purified form suitable for use by people. The methods, theory, and materials that reduce the science of bioseparations to practice, whether in the laboratory or the plant, are the subjects of Bioseparations Engineering. Examples address purification of biomolecules ranging from recombinant proteins to gene therapy products, with footnotes detailing economics of the products. Mechanistic analysis and engineering design methods are given for: * Isocratic and gradient chromatography * Sedimentation, centrifugation, and filtration * Membrane systems * Precipitation and crystallization Topics addressed within this framework are: stationary phase selection; separations development; modeling of ion exchange, size exclusion, reversed phase, hydrophobic interaction, and affinity chromatography; the impact of regulatory issues on chromatography process design; organization of separation strategies into logical sequences of purification steps; and bridges between molecular biology, combinatorial methods, and separations science. A result of teaching and developing the subject matter over ten years, Bioseparations Engineering is an ideal text for graduate students, as well as a timely desk book for process engineers, process scientists, researchers, and research associates in the pharmaceutical, food, and life sciences industries.

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Learn Chemical Reaction Engineering through Reasoning, Not Memorization Essentials of Chemical Reaction Engineering is the complete, modern introduction to chemical reaction engineering for today's undergraduate students. Starting from the strengths of his classic Elements of Chemical Reaction Engineering, Fourth Edition, in this volume H. Scott Fogler added new material and distilled the essentials for undergraduate students. Fogler's unique way of presenting the material helps students gain a deep, intuitive understanding of the field's essentials through reasoning, using a CRE algorithm, not memorization. He especially focuses on important new energy and safety issues, ranging from solar and biomass applications to the avoidance of runaway reactions. Thoroughly classroom tested, this text reflects feedback from hundreds of students at the University of Michigan and other leading universities. It also provides new resources to help students discover how reactors behave in diverse situations-including many realistic, interactive simulations on DVD-ROM. New Coverage Includes Greater emphasis on safety: following the recommendations of the Chemical Safety Board (CSB), discussion of crucial safety topics, including ammonium nitrate CSTR explosions, case studies of the nitroaniline explosion, and the T2 Laboratories batch reactor runaway Solar energy conversions: chemical, thermal, and catalytic water spilling Algae production for biomass Steady-state nonisothermal reactor design: flow reactors with heat exchange Unsteady-state nonisothermal reactor design with case studies of reactor explosions About the DVD-ROM The DVD contains six additional, graduate-level chapters covering catalyst decay, external diffusion effects on heterogeneous reactions, diffusion and reaction, distribution of residence times for reactors, models for non-ideal reactors, and radial and axial temperature variations in tubular reactions. Extensive additional DVD resources include Summary notes, Web modules, additional examples, derivations, audio commentary, and self-tests Interactive computer games that review and apply important chapter concepts Innovative "Living Example Problems" with Polymath code that can be loaded directly from the DVD so students can play with the solution to get an innate feeling of how reactors operate A 15-day trial of Polymath(tm) is included, along with a link to the Fogler Polymath site A complete, new AspenTech tutorial, and four complete example problems Visual Encyclopedia of Equipment, Reactor Lab, and other intuitive tools More than 500 PowerPoint slides of lecture notes Additional updates, applications, and information are available at www.umich.edu/~essen and www.essentialsofcre.com.

Separation science plays a critical role in maintaining our standard of living and quality of life. Many industrial processes and general necessities such as chemicals, medicines, clean water, safe food, and energy sources rely on chemical separations. However, the process of chemical separations is often overlooked during product development and this has led to inefficiency, unnecessary waste, and lack of consensus among chemists and engineers. A reevaluation of system design, establishment of standards, and an increased focus on the advancement of separation science are imperative in supporting increased efficiency, continued U.S. manufacturing competitiveness, and public welfare. A Research Agenda for Transforming Separation Science explores developments in the industry since the 1987 National Academies report, Separation and Purification: Critical Needs and Opportunities. Many needs stated in the original report remain today, in addition to a variety of new challenges due to improved detection limits, advances in medicine, and a recent emphasis on sustainability and environmental stewardship. This report examines emerging chemical separation technologies, relevant developments in intersecting disciplines, and gaps in existing research, and provides recommendations for the application of improved separation science technologies and processes. This research serves as a foundation for transforming separation science, which could reduce global energy use, improve human and environmental health, and advance more efficient practices in various industries.

This book is a short introduction to the engineering principles of harnessing the vast potential of microorganisms, and animal and plant cells in making biochemical products. It was written for scientists who have no background in engineering, and for engineers with minimal background in biology. The overall subject dealt with is process. But the coverage goes beyond the process of biomanufacturing in the bioreactor, and extends to the factory of cell's biosynthetic machinery. Starting with an overview of biotechnology and organism, engineers are eased into biochemical reactions and life scientists are exposed to the technology of production using cells. Subsequent chapters allow engineers to be acquainted with biochemical pathways, while life scientist learn about stoichiometric and kinetic principles of reactions and cell growth. This leads to the coverage of reactors, oxygen transfer and scale up. Following three chapters on biomanufacturing of current and future importance, i.e. cell culture, stem cells and synthetic biology, the topic switches to product purification, first with a conceptual coverage of operations used in bioseparation, and then a more detailed analysis to provide a conceptual understanding of chromatography, the modern workhorse of bioseparation. Drawing on principles from engineering and life sciences, this book is for practitioners in biotechnology and bioengineering. The author has used the book for a course for advanced students in both engineering and life sciences. To this end, problems are provided at the end of each chapter.

Biopharmaceuticals, medicines made by or from living organisms (including cells from living organisms), are extremely effective in treating a broad range of diseases. Their importance to human health has grown significantly over the years as more biopharmaceutical products have entered the market, and now the biggest selling drugs in the world are biopharmaceuticals. Biopharmaceutical Manufacturing: Principles, Processes and Practices provides concise, comprehensive, and up-to-date coverage of biopharmaceutical manufacturing. Written in a clear and informal style, the content has been influenced by the authors' substantial industry experience and teaching expertise. That expertise enables the authors to address the many questions posed over the years both by university students and professionals with experience in the field. Consequently, the book will appeal both to undergraduate or graduate students using it as a textbook and specialized industry

practitioners seeking to understand the big picture of biopharmaceutical manufacturing. This book:

Unlike extensive major reference works or handbooks, *Chemical Engineering: Trends and Developments* provides readers with a ready-reference to latest techniques in selected areas of chemical engineering where research is and will be focused in the future. These areas are: bioseparations; particle science and design; nanotechnology; and reaction engineering. The aim of the book is to provide academic and R&D researchers with an overview of the main areas of technical development and how these techniques can be applied. Each chapter focuses on a technique, plus a selection of applications or examples of where the technique could be applied.

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