

Cell Culture In Bioproduction Fed Batch Mammalian

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Fed-Batch Cultures - Henry C. Lim 2013-04-22

Many, if not most, industrially important fermentation and bioreactor operations are carried out in fed-batch mode, producing a wide variety of products. In spite of this, there is no single book that deals with fed-batch operations. This is the first book that presents all the necessary background material regarding the 'what, why and how' of optimal and sub-optimal fed-batch operations. Numerous examples are provided to illustrate the application of optimal fed-batch cultures. This unique book, by world experts with decades of research and industrial experience, is a must for researchers and industrial practitioners of fed-batch processes (modeling, control and optimization) in biotechnology, fermentation, food, pharmaceuticals and waste treatment industries.

Industrial Biotechnology - Christoph Wittmann 2017-03-06

The latest volume in the Advanced Biotechnology series provides an overview of the main product classes and platform chemicals produced by biotechnological processes today, with applications in the food, healthcare and fine chemical industries. Alongside the production of drugs and flavors as well as amino acids, bio-based monomers and

polymers and biofuels, basic insights are also given as to the biotechnological processes yielding such products and how large-scale production may be enabled and improved. Of interest to biotechnologists, bio and chemical engineers, as well as those working in the biotechnological, chemical, and food industries.

New Insights into Cell Culture Technology - Sivakumar Joghi Thatha Gowder 2017-05-10

The book "New Insights into Cell Culture Technology" focuses on many advanced methods and techniques concerned with cell culture. The contributing authors have discussed various developments in cell culture methods, the application of insect cells for the efficient production of heterologous proteins, the expansion of human mesenchymal stromal cells for different clinical applications, the remote sensing of cell culture experiments and concepts for the development of cell culture bioprocess, continuous production of retroviral pseudotype vectors, and the production of oncolytic measles virus vectors for cancer therapy. This book is an original contribution of experts from different parts of the globe, and the in-depth information will be a significant resource for

students, scientists, and physicians who are directly dealing with cells. ["Culture" is essential for human life and also the life of a cell. - Sivakumar Gowder]

Applied Bioengineering - Toshiomi Yoshida 2017-01-12

A comprehensive overview of the topic, highlighting recent developments, ongoing research trends and future directions. Experts from Europe, Asia and the US cover five core areas of imminent importance to the food, feed, pharmaceutical and water treatment industries in terms of sustainable and innovative processing and production. In the field of enzyme engineering, they summarize historic developments and provide an overview of molecular enzyme engineering, while also discussing key principles of microbial process engineering, including chapters on process development and control. Further sections deal with animal and plant cell culture engineering. The final section of the book deals with environmental topics and highlights the application of bioengineering principles in waste treatment and the recovery of valuable resources. With its cutting-edge visions, extensive discussions and unique perspectives, this is a ready reference for biotechnologists, bioengineers, biotechnological institutes, and environmental chemists.

Stability of Growth Profiles and Protein Production of R-Cho Cells in Long Time Culture - Tushar Chatterji 2012-03

Bachelor Thesis from the year 2010 in the subject Medicine - Biomedical Engineering, grade: A, VIT University (School of Bio-Sciences and Technology), course: B.Tech Biotechnology, language: English, abstract: The important criteria for successful generation of a therapeutic protein from a recombinant cell are to obtain a cell line that maintains stability of the production process. If this is not achieved it can generate problems for process yields, effective use of time and money, and for regulatory approval of products. However, selection of a cell line, media and fed-batch process that sustain stability of production over the required time period may be difficult to achieve during development of a therapeutic protein. Studies were carried out to find the Stability of the Cell Lines in terms of cell counts and Monoclonal Antibody productivity

by growing CHO cells in Low Osmolality Media and comparing their growth profiles with cells maintained in normal production media. Fed-batch trials were also carried out to test the effect of glutamine on the stability of these cells when maintained in Low Osmolality and production media. A trial to test the glucose consumption in the presence and absence of salts of copper and zinc was also performed for three different clones of CHO cell lines. An increase in cell count and antibody productivity was observed for cells in Low Osmolality Media when different fed-batch processes were carried out. Further studies will be aimed at increasing the antibody titre such that the cells are carried forward for production processes, thus enhancing process development.

Bioreactors for Tissue Engineering - Julian Chaudhuri 2006-01-16

For the first time in a single volume, the design, characterisation and operation of the bioreactor system in which the tissue is grown is detailed. Bioreactors for Tissue Engineering presents an overall picture of the current state of knowledge in the engineering of bioreactors for several tissue types (bone, cartilage, vascular), addresses the issue of mechanical conditioning of the tissue, and describes the use of techniques such as MRI for monitoring tissue growth. This unique volume is dedicated to the fundamentals and application of bioreactor technology to tissue engineering products. Not only will it appeal to graduate students and experienced researchers in tissue engineering and regenerative medicine, but also to tissue engineers and culture technologists, academic and industrial chemical engineers, biochemical engineers and cell biologists who wish to understand the criteria used to design and develop novel systems for tissue growth in vitro.

Animal Cell Biotechnology - Hansjörg Hauser 2014-11-10

This book introduces fundamental principles and practical application of techniques used in the scalable production of biopharmaceuticals with animal cell cultures. A broad spectrum of subjects relevant to biologics production and manufacturing are reviewed, including the generation of robust cell lines, a survey of functional genomics for a better understanding of cell lines and processes, as well as advances in regulatory compliant upstream and downstream development. The book

is an essential reference for all those interested in translational animal cell-based pharmaceutical biotechnology.

Recombinant Glycoprotein Production - Virgínia Picanço-Castro
2017-09-19

This volume covers a wide spectrum of techniques and approaches that are used in the upstream and downstream processing for recombinant glycoprotein production. Chapters guide the reader through state-of-art of therapeutic recombinant glycoproteins, explores the patent literature, expression systems used for glycoproteins production, methods employed in the downstream processing of different glycoproteins, and information about analytical tools and formulation strategies. Written in the highly successful Methods in Molecular Biology series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible laboratory protocols, and tips on troubleshooting and avoiding known pitfalls. Authoritative and cutting-edge, *Recombinant Glycoprotein Production: Methods and Protocols* aims to ensure successful results in the further study of this vital field

Handbook of Industrial Chemistry and Biotechnology - James A. Kent
2013-01-13

Substantially revising and updating the classic reference in the field, this handbook offers a valuable overview and myriad details on current chemical processes, products, and practices. No other source offers as much data on the chemistry, engineering, economics, and infrastructure of the industry. The Handbook serves a spectrum of individuals, from those who are directly involved in the chemical industry to others in related industries and activities. It provides not only the underlying science and technology for important industry sectors, but also broad coverage of critical supporting topics. Industrial processes and products can be much enhanced through observing the tenets and applying the methodologies found in chapters on Green Engineering and Chemistry (specifically, biomass conversion), Practical Catalysis, and Environmental Measurements; as well as expanded treatment of Safety, chemistry plant security, and Emergency Preparedness. Understanding these factors

allows them to be part of the total process and helps achieve optimum results in, for example, process development, review, and modification. Important topics in the energy field, namely nuclear, coal, natural gas, and petroleum, are covered in individual chapters. Other new chapters include energy conversion, energy storage, emerging nanoscience and technology. Updated sections include more material on biomass conversion, as well as three chapters covering biotechnology topics, namely, Industrial Biotechnology, Industrial Enzymes, and Industrial Production of Therapeutic Proteins.

Manual of Industrial Microbiology and Biotechnology - Arnold L. Demain
1999

This second edition of the bestselling Manual of Industrial Microbiology and Biotechnology brings together in one place the biological and engineering methodologies required to develop a successful industrial process, from culture isolation and development to useful product. The editors have enlisted a broad range of experts, including microbial ecologists, physiologists, geneticists, biochemists, molecular biologists, and biochemical engineers. This comprehensive perspective provides a valuable "how to" resource, the structure of which resembles the sequence of operations involved in the development of a commercial biological process and product.

Industrial Scale Suspension Culture of Living Cells - Hans-Peter Meyer
2014-07-30

The submersed cultivation of organisms in sterile containments or fermenters has become the standard manufacturing procedure, and will remain the gold standard for some time to come. This book thus addresses submersed cell culture and fermentation and its importance for the manufacturing industry. It goes beyond expression systems and integrally investigates all those factors relevant for manufacturing using suspension cultures. In so doing, the contributions cover all industrial cultivation methods in a comprehensive and comparative manner, with most of the authors coming from the industry itself. Depending on the maturity of the technology, the chapters address in turn the expression system, basic process design, key factors affecting process economics,

plant and bioreactor design, and regulatory aspects.

Comprehensive Biotechnology - 2019-07-17

Comprehensive Biotechnology, Third Edition unifies, in a single source, a huge amount of information in this growing field. The book covers scientific fundamentals, along with engineering considerations and applications in industry, agriculture, medicine, the environment and socio-economics, including the related government regulatory overviews. This new edition builds on the solid basis provided by previous editions, incorporating all recent advances in the field since the second edition was published in 2011. Offers researchers a one-stop shop for information on the subject of biotechnology Provides in-depth treatment of relevant topics from recognized authorities, including the contributions of a Nobel laureate Presents the perspective of researchers in different fields, such as biochemistry, agriculture, engineering, biomedicine and environmental science

Animal Cell Technology: Basic & Applied Aspects - Kazumi Yagasaki 2013-11-27

Animal cell technology is a growing discipline of cell biology which aims not only to understand structures, functions and behaviors of differentiated animal cells, but also to ascertain their abilities to be used in industrial and medical purposes. The goal of animal cell technology includes accomplishments of clonal expansion of differentiated cells with useful ability, optimization of their culture conditions, modulation of their ability for production of medically and pharmaceutically important proteins and the application of animal cells to gene therapy, artificial organs and functional foods. This volume gives the readers a complete review of present state-of-the-art in Japan and other countries where this field is well advanced. The Proceedings will be useful for the cell biologists, biochemists, molecular biologists, immunologists, biochemical engineers and other disciplines related to animal cell culture, working in either academic environments or in industries of biotechnology and pharmacy.

Cell Culture Technology for Pharmaceutical and Cell-Based Therapies - Sadettin Ozturk 2005-08-30

Edited by two of the most distinguished pioneers in genetic manipulation and bioprocess technology, this bestselling reference presents a comprehensive overview of current cell culture technology used in the pharmaceutical industry. Contributions from several leading researchers showcase the importance of gene discovery and genomic technology devel

Cell Technology for Cell Products - Rodney Smith 2007-01-24

The 19th ESACT meeting was to highlight the novel capabilities of the industry to move the products towards the clinic. It was attended by a wide range of workers in the industry and for many it was their first ESACT meeting. The proceedings here include the short papers adding the knowledge of the previous meetings and provide a reference for the researcher entering, or continuing in the field of Animal Cell Technology. [Perfusion Cell Culture Processes for Biopharmaceuticals](#) - Moritz Wolf 2020-08-06

This book is a monography about perfusion cell cultures for the production of biopharmaceuticals, such as therapeutic proteins (i.e. biomolecules like monoclonal antibodies), and describes the fundamentals, design and operation of these processes. Context is given in the first chapters to understand the state-of-the-art of the technology. We then give an overview of the challenges and objectives in operating mammalian cell perfusion cultures and provide guidelines for the design and setup of lab-scale bioreactor systems, and the required control structure to achieve stable operation. Scale-down devices and PAT tools are described in the context of continuous manufacturing and guidelines for process optimization are given using a variety of case studies to illustrate different approaches. Scale-up is also adressed with a strong focus on bioreactor aeration and mixing, shear stress and cell retention device. Finally, a general introduction for the application of mechanistic and statistic models in bioreactor process development and optimization is given in the last chapter.

Monoclonal Antibody Production - National Research Council 1999-06-06

The American Anti-Vivisection Society (AAVS) petitioned the National

Institutes of Health (NIH) on April 23, 1997, to prohibit the use of animals in the production of mAb. On September 18, 1997, NIH declined to prohibit the use of mice in mAb production, stating that "the ascites method of mAb production is scientifically appropriate for some research projects and cannot be replaced." On March 26, 1998, AAVS submitted a second petition, stating that "NIH failed to provide valid scientific reasons for not supporting a proposed ban." The office of the NIH director asked the National Research Council to conduct a study of methods of producing mAb. In response to that request, the Research Council appointed the Committee on Methods of Producing Monoclonal Antibodies, to act on behalf of the Institute for Laboratory Animal Research of the Commission on Life Sciences, to conduct the study. The 11 expert members of the committee had extensive experience in biomedical research, laboratory animal medicine, animal welfare, pain research, and patient advocacy (Appendix B). The committee was asked to determine whether there was a scientific necessity for the mouse ascites method; if so, whether the method caused pain or distress; and, if so, what could be done to minimize the pain or distress. The committee was also asked to comment on available in vitro methods; to suggest what acceptable scientific rationale, if any, there was for using the mouse ascites method; and to identify regulatory requirements for the continued use of the mouse ascites method. The committee held an open data-gathering meeting during which its members summarized data bearing on those questions. A 1-day workshop (Appendix A) was attended by 34 participants, 14 of whom made formal presentations. A second meeting was held to finalize the report. The present report was written on the basis of information in the literature and information presented at the meeting and the workshop.

Bioprocessing Technology for Production of Biopharmaceuticals and Bioproducts - Claire Komives 2018-12-27

Written for industrial and academic researchers and development scientists in the life sciences industry, *Bioprocessing Technology for Production of Biopharmaceuticals and Bioproducts* is a guide to the tools, approaches, and useful developments in bioprocessing. This important

guide: • Summarizes state-of-the-art bioprocessing methods and reviews applications in life science industries • Includes illustrative case studies that review six milestone bio-products • Discusses a wide selection of host strain types and disruptive bioprocess technologies

Animal Cell Technology: From Target to Market - E. Lindner-Olsson 2012-12-06

Proceedings of the 17th ESACT Meeting June 10-14, 2001, Tylösand, Sweden

Mammalian Cell Cultures for Biologics Manufacturing - Weichang Zhou 2014-01-15

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.

New Bioprocessing Strategies: Development and Manufacturing of Recombinant Antibodies and Proteins - Bob Kiss 2018-12-06

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.

Therapeutic Antibody Engineering - William R Strohl 2012-10-16

The field of antibody engineering has become a vital and integral part of making new, improved next generation therapeutic monoclonal antibodies, of which there are currently more than 300 in clinical trials across several therapeutic areas. Therapeutic antibody engineering examines all aspects of engineering monoclonal antibodies and analyses the effect that various genetic engineering approaches will have on future candidates. Chapters in the first part of the book provide an introduction to monoclonal antibodies, their discovery and development and the fundamental technologies used in their production. Following chapters cover a number of specific issues relating to different aspects of antibody engineering, including variable chain engineering, targets and mechanisms of action, classes of antibody and the use of antibody fragments, among many other topics. The last part of the book examines development issues, the interaction of human IgGs with non-human systems, and cell line development, before a conclusion looking at future issues affecting the field of therapeutic antibody engineering. Goes beyond the standard engineering issues covered by most books and delves into structure-function relationships Integration of knowledge across all areas of antibody engineering, development, and marketing Discusses how current and future genetic engineering of cell lines will pave the way for much higher productivity

Cell Culture Engineering - Wei-Shu Hu 2006-08-16

Since the introduction of recombinant human growth hormone and insulin a quarter century ago, protein therapeutics has greatly broadened the horizon of health care. Many patients suffering with life-threatening diseases or chronic dysfunctions, which were medically untreatable not long ago, can attest to the wonder these drugs have achieved. Although the first generation of protein therapeutics was produced in recombinant *Escherichia coli*, most recent products use mammalian cells as production hosts. Not long after the first production of recombinant proteins in *E. coli*, it was realized that the complex tasks of most post-translational modifications on proteins could only be efficiently carried out in mammalian cells. In the 1990s, we witnessed a rapid

expansion of mammalian-cell-derived protein therapeutics, chiefly antibodies. In fact, it has been nearly a decade since the market value of mammalian-cell-derived protein therapeutics surpassed that of those produced from *E. coli*. A common characteristic of recent antibody products is the relatively large dose required for effective therapy, demanding larger quantities for the treatment of a given disease. This, coupled with the broadening repertoire of protein drugs, has rapidly expanded the quantity needed for clinical applications. The increasing demand for protein therapeutics has not been met exclusively by construction of new manufacturing plants and increasing total volume capacity. More importantly the productivity of cell culture processes has been driven upward by an order of magnitude in the past decade.

Cell Line Development - Mohamed Al-Rubeai 2009-08-11

Mammalian cell lines command an effective monopoly for the production of therapeutic proteins that require post-translational modifications. This unique advantage outweighs the costs associated with mammalian cell culture, which are far greater in terms of development time and manufacturing when compared to microbial culture. The development of cell lines has undergone several advances over the years, essentially to meet the requirement to cut the time and costs associated with using such a complex host as production platforms. This book provides a comprehensive guide to the methodology involved in the development of cell lines and the cell engineering approach that can be employed to enhance productivity, improve cell function, glycosylation and secretion and control apoptosis. It presents an overall picture of the current topics central to expression engineering including such topics as epigenetics and the use of technologies to overcome positional dependent inactivation, the use of promoter and enhancer sequences for expression of various transgenes, site directed engineering of defined chromosomal sites, and examination of the role of eukaryotic nucleus as the controller of expression of genes that are introduced for production of a desired product. It includes a review of selection methods for high producers and an application developed by a major biopharmaceutical industry to expedite the cell line development process. The potential of cell

engineering approach to enhance cell lines through the manipulation of single genes that play important roles in key metabolic and regulatory pathways is also explored throughout.

Continuous Processing in Pharmaceutical Manufacturing -

Ganapathy Subramanian 2015-02-09

With contributions from biotechnologists and bioengineers, this ready reference describes the state of the art in industrial biopharmaceutical production, with a strong focus on continuous processes. Recent advances in single-use technology as well as application guidelines for all types of biopharmaceutical products, from vaccines to antibodies, and from bacterial to insect to mammalian cells are covered. The efficiency, robustness, and quality control of continuous production processes for biopharmaceuticals are reviewed and compared to traditional batch processes for a range of different production systems.

Animal Cell Culture - Mohamed Al-Rubeai 2014-11-28

Animal cells are the preferred “cell factories” for the production of complex molecules and antibodies for use as prophylactics, therapeutics or diagnostics. Animal cells are required for the correct post-translational processing (including glycosylation) of biopharmaceutical protein products. They are used for the production of viral vectors for gene therapy. Major targets for this therapy include cancer, HIV, arthritis, cardiovascular and CNS diseases and cystic fibrosis. Animal cells are used as in vitro substrates in pharmacological and toxicological studies. This book is designed to serve as a comprehensive review of animal cell culture, covering the current status of both research and applications. For the student or R&D scientist or new researcher the protocols are central to the performance of cell culture work, yet a broad understanding is essential for translation of laboratory findings into the industrial production. Within the broad scope of the book, each topic is reviewed authoritatively by experts in the field to produce state-of-the-art collection of current research. A major reference volume on cell culture research and how it impacts on production of biopharmaceutical proteins worldwide, the book is essential reading for everyone working in cell culture and is a recommended volume for all biotechnology libraries.

Animal Cell Bioreactors - Chester S. Ho 2013-10-22

Animal Cell Bioreactors provides an introduction to the underlying principles and strategies in the in vitro cell culture biotechnology. It addresses engineering aspects such as mass transfer, instrumentation, and control ensuring successful design and operation of animal cell bioreactors. The goal is to provide a comprehensive analysis and review in the advancement of the bioreactor systems for large-scale animal cell cultures. The book is organized into four parts. Part I traces the historical development of animal cell biotechnology. It presents examples of work in progress that seeks to make animal cell biotechnology processes as productive on a cost per unit of product basis as that achieved by other microbial systems. Part II includes chapters dealing with the implications of cell biology in animal cell biotechnology; protein-bound oligosaccharides and their structures; the development of serum-free media and its use in the production of biologically active substances; and the metabolism of mammalian cells. Part III focuses on animal cell cultivation, covering topics such as the fixed bed immobilized culture; three-dimensional microcarriers; and hydrodynamic phenomena in microcarrier cultures. Part IV discusses the design, operation, and control of animal cell bioreactors.

Cell Culture Engineering - Gyun Min Lee 2020-01-13

Offers a comprehensive overview of cell culture engineering, providing insight into cell engineering, systems biology approaches and processing technology In Cell Culture Engineering: Recombinant Protein Production, editors Gyun Min Lee and Helene Faustrup Kildegaard assemble top class authors to present expert coverage of topics such as: cell line development for therapeutic protein production; development of a transient gene expression upstream platform; and CHO synthetic biology. They provide readers with everything they need to know about enhancing product and bioprocess attributes using genome-scale models of CHO metabolism; omics data and mammalian systems biotechnology; perfusion culture; and much more. This all-new, up-to-date reference covers all of the important aspects of cell culture engineering, including cell engineering, system biology approaches, and processing technology.

It describes the challenges in cell line development and cell engineering, e.g. via gene editing tools like CRISPR/Cas9 and with the aim to engineer glycosylation patterns. Furthermore, it gives an overview about synthetic biology approaches applied to cell culture engineering and elaborates the use of CHO cells as common cell line for protein production. In addition, the book discusses the most important aspects of production processes, including cell culture media, batch, fed-batch, and perfusion processes as well as process analytical technology, quality by design, and scale down models. -Covers key elements of cell culture engineering applied to the production of recombinant proteins for therapeutic use - Focuses on mammalian and animal cells to help highlight synthetic and systems biology approaches to cell culture engineering, exemplified by the widely used CHO cell line -Part of the renowned "Advanced Biotechnology" book series

Cell Culture and Upstream Processing - Michael Butler 2007-08-07

Upstream processing refers to the production of proteins by cells genetically engineered to contain the human gene which will express the protein of interest. The demand for large quantities of specific proteins is increasing the pressure to boost cell culture productivity, and optimizing bioreactor output has become a primary concern for most pharmaceutical companies. Each chapter in Cell Culture and Upstream Processing is taken from presentations at the highly acclaimed IBC conferences as well as meetings of the European Society for Animal Cell Technology (ESACT) and Protein Expression in Animal Cells (PEACe) and describes how to improve yield and optimize the cell culture production process for biopharmaceuticals, by focusing on safety, quality, economics and operability and productivity issues. Cell Culture and Upstream Processing will appeal to a wide scientific audience, both professional practitioners of animal cell technology as well as students of biochemical engineering or biotechnology in graduate or high level undergraduate courses at university.

Cell Culture Bioprocess Engineering, Second Edition - Wei-Shou Hu

2020-03-11

This book is the culmination of three decades of accumulated experience in teaching biotechnology professionals. It distills the fundamental principles and essential knowledge of cell culture processes from across many different disciplines and presents them in a series of easy-to-follow, comprehensive chapters. Practicality, including technological advances and best practices, is emphasized. This second edition consists of major updates to all relevant topics contained within this work. The previous edition has been successfully used in training courses on cell culture bioprocessing over the past seven years. The format of the book is well-suited to fast-paced learning, such as is found in the intensive short course, since the key take-home messages are prominently highlighted in panels. The book is also well-suited to act as a reference guide for experienced industrial practitioners of mammalian cell cultivation for the production of biologics.

Identification of novel modulators towards high cell density and high-producing Chinese hamster ovary suspension cell cultures as well as their application in biopharmaceutical protein production - Beat Thalmann 2015-08-28

Amongst the mammalian producer cell lines, the Chinese hamster ovary (CHO) cell lines are of predominant importance in biopharmaceutical production. Thus, novel factors increasing overall productivity are sought and bear the potential to reduce the unit costs of a production process. Furthermore, the current patent situation for several therapeutic proteins demands innovative tools to at least maintain or preferentially increase the cost-effectiveness of their production processes. In this thesis, hitherto unknown factors were revealed by next generation sequencing of chemically mutated and selected CHO-K1 suspension cell lines. Two factors were proven to improve CHO-based production processes: cgrSnord78 and cgrTtc36. The *Cricetulus griseus* Ttc36 increases the integral as well as the maximal viable cell density and abolishes the cell-cell aggregation whilst cgrSnord78 improves the specific as well as volumetric productivity without significant impact on cell growth. Based on the present results and discussion, foundations for

future research on these functionally unrevealed factors are laid. Hence, this work represents the first step towards the application of the genuine biomolecules cgrTtc36 and cgrSnord78 in biopharmaceutical protein production.

Production of Biologicals from Animal Cells in Culture - R. E. Spier
2013-09-24

Production of Biologicals from Animal Cells in Culture reviews the state of the art in animal cell biotechnology, with emphasis on the sequence of events that occur when generating a biological from animal cells in culture. Methods that enable adjustment of nutrient feed streams into perfusion bioreactors so as to increase productivity are described. A number of issues are also addressed, such as the usefulness of the fingerprint method for cell characterization. Comprised of 135 chapters, this book begins with an overview of the problems and benefits of animal cell culture, followed by a discussion on the isolation of immortal murine macrophage cell lines. The reader is systematically introduced to the use of DNA fingerprinting to characterize cell banks; immortalization of cells with oncogenes; lipid metabolism of animal cells in culture; and energetics of glutaminolysis. Subsequent chapters explore serum-free and protein-free media; the physiology of animal cells; gene expression in animal cell systems; and animal cell bioreactors. The monitoring and assay of animal cell parameters are also considered, along with downstream processing and regulatory issues. This monograph will be of interest to students, practitioners, and investigators in the fields of microbiology and biotechnology.

Continuous Biomanufacturing - Ganapathy Subramanian 2017-09-12

This is the most comprehensive treatise of this topic available, providing invaluable information on the technological and economic benefits to be gained from implementing continuous processes in the biopharmaceutical industry. Top experts from industry and academia cover the latest technical developments in the field, describing the use of single-use technologies alongside perfusion production platforms and downstream operations. Special emphasis is given to process control and monitoring, including such topics as 'quality by design' and automation.

The book is supplemented by case studies that highlight the enormous potential of continuous manufacturing for biopharmaceutical production facilities.

Bioprocess Engineering Principles - Pauline M. Doran 1995-04-03

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.

Expression Systems - Michael R. Dyson 2007

Protein expression is an increasingly important tool for research on gene function. What is needed is not just a lab manual providing established methods as well as the latest state-of-the-art protocols, but also clear advice on what expression system to choose when. *Expression Systems: Methods Express* uniquely fills this need. It covers expression across a broad range of systems, including the following. * Baculovirus expression vectors * CHO cells * E. coli * HEK293-EBNA1 cells * Lactococcus lactis and other gram positive bacteria * S. cerevisiae * transfected insect cells * Pichia pastoris * mammalian cells using BacMam viruses * lentiviral vectors * wheat germ cell-free system The book takes the reader through how to make an informed choice of appropriate system, taking into account the protein target, the time involved, the ultimate use of the expressed protein, and the laboratory equipment required. It also provides step-by-step methods for each system. In addition, the book describes the optimisation of expression strategies, expression engineering using ribosome display, and how to select protein variants with improved expression. Every chapter discusses the merits and limitations of the approaches available, describes the key techniques in full practical detail, and provides sensible advice for immediate use at

the bench. In summary, *Expression Systems: Methods Express* is a comprehensive laboratory manual and information resource for researchers at all levels, from postgraduate student to principal investigator.

Bioreactors - Carl-Fredrik Mandenius 2016-02-16

In this expert handbook both the topics and contributors are selected so as to provide an authoritative view of possible applications for this new technology. The result is an up-to-date survey of current challenges and opportunities in the design and operation of bioreactors for high-value products in the biomedical and chemical industries. Combining theory and practice, the authors explain such leading-edge technologies as single-use bioreactors, bioreactor simulators, and soft sensor monitoring, and discuss novel applications, such as stem cell production, process development, and multi-product reactors, using case studies from academia as well as from industry. A final section addresses the latest trends, including culture media design and systems biotechnology, which are expected to have an increasing impact on bioreactor design. With its focus on cutting-edge technologies and discussions of future developments, this handbook will remain an invaluable reference for many years to come.

Cell Culture Engineering and Technology - Ralf Pörtner 2021

This contributed volume is dedicated towards the progress achieved within the last years in all areas of Cell Culture Engineering and Technology. It comprises contributions of active researchers in the field of cell culture development for the production of recombinant proteins, cell line development, cell therapy and gene therapy, with consideration of media development, process scale-up, reactor design, monitoring and control and model-assisted strategies for process design. The knowledge and expertise of the authors cover disciplines like cell biology, engineering, biotechnology and biomedical sciences. This book is conceived for graduate students, postdoctoral fellows and researchers interested in the latest developments in Cell Engineering.

Advances in Bioprocess Engineering - Enrique Galindo 2013-04-17

Bioprocess engineering has played a key role in biotechnology,

contributing towards bringing the exciting new discoveries of molecular and cellular biology into the applied sphere, and in maintaining established processes, some centuries-old, efficient and essential for today's industry. Novel developments and new application areas of biotechnology, along with increasing constraints in costs, product quality, regulatory and environmental considerations, have placed the biochemical engineer at the forefront of new challenges. This second volume of *Advances in Bioprocess Engineering* reflects precisely the multidisciplinary nature of the field, where new and traditional areas of application are nurtured by a better understanding of fundamental phenomena and by the utilization of novel techniques and methodologies. The chapters in this book were written by the invited speakers to the 2nd International Symposium on Bioprocess Engineering, Mazatlan, Mexico, September 1997.

Disposable Bioreactors II - Dieter Eibl 2013-12-17

Dynamic Single-Use Bioreactors Used in Modern Liter- and m³- Scale Biotechnological Processes: Engineering Characteristics and Scaling Up, by Christian Löffelholz, Stephan C. Kaiser, Matthias Kraume, Regine Eibl, Dieter Eibl. Orbitally Shaken Single-Use Bioreactors, by Wolf Klöckner, Sylvia Diederichs, Jochen Büchs. Therapeutic Human Cells: Manufacture for Cell Therapy/Regenerative Medicine by Christian van den Bos, Robert Keefe, Carmen Schirmaier, Michael McCaman. Fast Single-Use VLP Vaccine Productions Based on Insect Cells and the Baculovirus Expression Vector System: Influenza as Case Study by Regine Eibl, Nina Steiger, Sabine Wellnitz, Tiago Vicente, Corinne John, Dieter Eibl. Microbial High Cell Density Fermentations in a Stirred Single-Use Bioreactor by Thomas Dreher, Bart Walcarius, Ute Husemann, Franziska Klingenberg, Christian Zahnow, Thorsten Adams, Davy de Wilde, Peter Casteels, Gerhard Greller. Quorus Bioreactor: A New Perfusion-Based Technology for Microbial Cultivation by Sheena J. Fraser, Christian Endres. Cultivation of Marine Microorganisms in Single-Use Systems by

Friederike Hillig, Maciej Pilarek, Stefan Junne, Peter Neubauer. Flexible Biomanufacturing Processes that Address the Needs of the Future by Bernhard Diel, Christian Manzke, Thorsten Peuker. An Approach to Quality and Security of Supply for Single-Use Bioreactors by Magali Barbaroux, Susanne Gerighausen, Heiko Hackel. A Risk Analysis for Production Processes with Disposable Bioreactors by Tobias Merseburger, Ina Pahl, Daniel Müller, Markus Tanner.

[Animal Cell Biotechnology](#) - Ralf Pörtner 2016-08-23

Animal Cell Biotechnology: Methods and Protocols, Third Edition constitutes a comprehensive manual of state-of-the-art and new techniques for setting up mammalian cell lines for production of biopharmaceuticals, and for optimizing critical parameters for cell culture from lab to final production. The volume is divided into five parts that reflect the processes required for different stages of production. In Part I, basic techniques for establishment of production cell lines are addressed, especially high-throughput synchronization, insect cell lines, transient gene and protein expression, DNA Profiling and Characterisation. Part II addresses tools for process and medium optimization as well as microcarrier technology while Part III covers monitoring of cell growth, viability and apoptosis, metabolic flux estimation, quenching methods as well as NMR-based techniques. Part IV details cultivation techniques, and Part V describes special applications, including vaccine production, baculovirus protein expression, chromatographic techniques for downstream as well as membrane techniques for virus separation. Written in the successful *Methods in Molecular Biology* series format, chapters include introductions to their respective topics, lists of the necessary materials and reagents, step-by-step, readily reproducible protocols, and notes on troubleshooting and avoiding known pitfalls. *Animal Cell Biotechnology: Methods and Protocols*, Third Edition provides a compendium of techniques for scientists in industrial and research laboratories that use mammalian cells for biotechnology purposes.