

Biocatalysis Fundamentals and Applications

The book covers the fundamentals of the field of biocatalysis that are not treated in such detail (or even not at all) in existing biocatalysis books or biochemistry textbooks. It of course does not substitute existing biochemistry textbooks but will serve a suitable supplement as it discusses biochemical fundamentals in connection with the respective topics. With focus on the interdisciplinary nature of biocatalysis, the book contains many aspects of fundamental organic chemistry and some of inorganic chemistry as well, which should make it interesting not only for biochemistry but also for chemistry students. An important theme being emphasized in the book is that applied biocatalysis is one of the main prerequisites for a sustainable development. The topics covered range from basic enzyme chemistry (biosynthesis, structure, properties, interaction forces, kinetics) to a detailed description of catalytic mechanisms. It covers the fundamentals of the different enzyme classes together with their applications in native and in immobilized state or in the form of whole cells in aqueous as well as non-conventional media. Topics such as catalytic antibodies, nucleic acid catalysts, non-ribosomal peptide synthesis, evolutionary methods, and the design of cells are also included.

After the great success now in its 2nd Edition: This textbook covers all aspects of catalysis, including computational methods, industrial applications and green chemistry

This book addresses the use of ionic liquids in biotransformation and organocatalysis. Its major parts include an overview of the fundamentals of ionic liquids and their interactions with proteins and enzymes; the use of ILs in biotransformations; non-solvent applications such as additives, membranes, substrate anchoring, and the use of ILs in organocatalysis (from solvents to co-catalysts and new reactivities, as well as non-solvent applications such as anchoring and immobilization).

This book provides an actual overview of the structure, function, and application of carbohydrate-modifying biocatalysts. Carbohydrates have been disregarded for a long time by the scientific community, mainly due to their complex structure. Meanwhile, the situation changed with increasing knowledge about the key role carbohydrates play in biological processes such as recognition, signal transduction, immune responses, and others. An outcome of research activities in glycoscience is the development of several new pharmaceuticals against serious diseases such as malaria, cancer, and various storage diseases. Furthermore, the employment of carbohydrate-modifying biocatalysts—enzymes as well as microorganisms—will contribute significantly to the development of environmentally friendly processes boosting a shift of the chemical industry from petroleum- to bio-based production of chemicals from renewable resources. The updated content of the second edition of this book has been extended by discussing the current state of the art of using recombinantly expressed carbohydrate-modifying biocatalysts and the synthesis of minicellulosomes in connection with consolidated bioprocessing of lignocellulosic material. Furthermore, a synthetic biology approach for using DAHP-dependent aldolases to catalyze asymmetric aldol reactions is presented.

Fundamentals, Methods and Applications

Methods, Reactions, and Applications

Puschino-on-Oka, Russia

Biopolymeric Nanomaterials

Biocatalysis in the Pharmaceutical and Biotechnology Industries

Molecular biotechnology continues to triumph, as this textbook testifies - edited by one of the academic pioneers in the field and written by experienced professionals. This completely revised second edition covers the entire spectrum, from the fundamentals of molecular and cell biology, via an overview of standard methods and technologies, the application of the various "-omics", and the development of novel drug targets, right up to the significance of system biology in biotechnology. The whole is rounded off by an introduction to industrial biotechnology as well as chapters on company foundation, patent law and marketing. The new edition features: - Large format and full color throughout - Proven structure according to basics, methods, main topics and economic perspectives - New sections on system biology, RNA interference, microscopic techniques, high throughput sequencing, laser applications, biocatalysis, current biomedical applications and drug approval - Optimized teaching with learning targets, a glossary containing around 800 entries, over 500 important abbreviations and further reading. The only resource for those who are seriously interested in the topic. Bonus material available online free of charge: www.wiley-vch.de/home/molecbiotech

Nanobiocatalysis has rapidly developed into a subarea of enzyme biotechnology. It combines the advances in nanotechnology that have generated nanoscale materials of different sizes, shapes, and physicochemical properties, and the excellent characteristics of biocatalysts into an innovative technology. This book provides an overview of the various relations between nanotechnology and biocatalysis. It discusses the fabrication and application of nanomaterials for the immobilization of enzymes used in the sustainable production of goods and chemicals. Nanosupports have several advantages compared with bulk solid materials because of their high surface area, which results in a significantly reduced mass transfer limitation and comparatively high enzyme loading. These characteristics are also of great use for applications in the fields of enzymatic biosensors, biofuel cells, bioelectronics, and photoelectrochemical analyte detection, where conductive nanomaterials improve the rate of electron transfer. The book also presents an overview of nanotoxicology and covers nanostructured enzyme catalysis in organic solvents and its potential application for biodiesel production, probing of enzymatic activity, and identification of enzyme functions of inorganic nanoparticles as enzyme mimics.

Volume 7 of the Jenny Stanford Series on Biocatalysis deals with several different aspects of pharmaceuticals, which include not only various applications of drugs and their metabolism but also natural resources for active pharmaceutical ingredients as well as the removal of pharmaceutical pollution. In detail, novel approaches for developing microbial fermentation processes to produce vitamin B6 using microorganisms are described together with novel routes for vitamin B6 biosynthesis. The other topics discussed are new approaches for producing the successful anticancer drug Taxol from naturally occurring precursors, molecular farming through plant engineering as a cost-effective means to produce therapeutic and prophylactic proteins, and successful screening of potent microorganisms producing L-asparaginase for various chemotherapeutic applications. Furthermore, microbial biotransformations in the production and degradation of fluorinated pharmaceuticals are described. The other chapters inform the reader about the biotransformation of xenobiotics/drugs in living systems, the degradation of pharmaceuticals by white-rot fungi and their ligninolytic enzymes, and the removal of pharmaceutical pollution from municipal sewage using laccase.

Green Sustainable Process for Chemical and Environmental Engineering and Science: Solid State Synthetic Methods cover recent advances made in the field of solid-state materials synthesis and its various applications. The book provides a brief introduction to the topic and the fundamental principles governing the various methods. Sustainable techniques and green processes development in solid-state chemistry are also highlighted. This book also provides a comprehensive literature on the industrial application using solid-state materials and solid-state devices. Overall, this book is intended to explore green solid-state techniques, eco-friendly materials involved in organic synthesis and real-time applications. Provides a broad overview of solid-state chemistry Outlines an eco-friendly solid-state synthesis of modern nanomaterials, organometallic, coordination compound, and pure organic Gives a detailed account of solid-state chemistry, fundamentals, concepts, techniques and applications Deliberates cutting-edge recent advances in industrial technologies involved in energy, environmental, medicinal and organic chemistry fields

Biocatalysis and Agricultural Biotechnology

New Technologies and Applications

Biochemical Fundamentals and Applications

Biocatalysis

Drugs, Genetic Diseases, and Epigenetics

International Conference Biocatalysis-98--Fundamentals and Applications

The effective use of microemulsions has increased dramatically during the past few decades as major industrial applications have expanded in a variety of fields. Microemulsions: Properties and Applications provides a complete and systematic assessment of all topics affecting microemulsion performance and discusses the fundamental characteristics, theories, and applications of these dispersions. Thoroughly encompassing the significant developments of the past ten years, this book addresses the use of microemulsions in various fields, including: interactions at microemulsion interfaces, new types of surfactants, and the fundamentals of nanotechnology. It outlines experimental and traditional measurement techniques in a variety of microemulsified systems and provides reliable coverage of applicable techniques. Theory and Characterization Methods: The initial chapters cover theoretical aspects of microemulsion formation, with particular focus on methodologies for preparation. The book also includes characterization methods, including X-ray diffraction, transmission electron microscopy (TEM), light scattering, and small-angle neutron scattering. It includes discussions of viscosimetry, conductivity, ultrasonic velocity, and nuclear magnetic resonance (NMR). Practical Applications: The remainder of the coverage focuses on current and potential applications of microemulsions. The book examines commercial uses, including biocatalysis and enzymatic reactions, nutrition, the extraction of contaminated solids, pollution control, dispersion of drugs, and oil recovery. The contributors also discuss the use of microemulsions as a reaction medium for the formation of polymeric and inorganic nanoparticles, and applications in electrokinetic chromatography. Comprising the work of an international community of colloid scientists, this book explains why microemulsions are used for the intended application, how they are made, and how they react. Each chapter contains a description of the fundamental phenomena and principles involved in microemulsion processes, emphasizing the mechanism of microemulsion formation and deformation. A summary of recent research, the book eliminates the need to search through dozens of arcane online journal articles for critical information.

Bioprocessing for Value-Added Products from Renewable Resources provides a timely review of new and unconventional techniques for manufacturing high-value products based on simple biological material. The book discusses the principles underpinning modern industrial biotechnology and describes a unique collection of novel bioprocesses for a sustainable future. This book begins in a very structured way. It first looks at the modern technologies that form the basis for creating a bio-based industry before describing the various organisms that are suitable for bioprocessing - from bacteria to algae - as well as their unique characteristics. This is followed by a discussion of novel, experimental bioprocesses, such as the production of medicinal chemicals, the production of chiral compounds and the design of biofuel cells. The book concludes with examples where biological, renewable resources become an important feedstock for large-scale industrial production. This book is suitable for researchers, practitioners, students, and consultants in the bioprocess and biotechnology fields, and for others who are interested in biotechnology, engineering, industrial microbiology and chemical engineering. -Reviews the principles underpinning modern industrial biotechnology -Provides a unique collection of novel bioprocesses for a sustainable future -Gives examples of economical use of renewable resources as feedstocks -Suitable for both non-experts and experts in the bioprodud industry

Marine Bioprocessing is a highly topical subject - in both applied and basic research - but, as yet, the marine ecosystem is a relatively unexplored source of natural bioactive substances with potential therapeutic activity. This book addresses the use of marine enzymes in biocatalysis through a series of chapters from leading scientists within academic and industrial fields. Biocatalytic processes can take advantage of the habitat-related properties of marine enzymes, such as salt tolerance, hyperthermostability, barophilicity, cold adaptivity, and so on, whilst also taking into consideration substrate specificity and affinity. These evolved properties are linked to the metabolic functions of the enzymes and to the ecological aspects of the natural source. New properties can also be discovered at the molecular level of catalysis, particularly concerning the stereochemical characteristics of products. Marine enzymes for biocatalysis initially examines the nature and level of interest in marine biocatalytic diversity, and outlines the foundations of biocatalysis. It goes on to detail sources of marine enzymes, and to analyse examples from both chemical and stereochemical viewpoints of catalysis, including microbial enzymes and animal or plant sources. The book goes on to explore the future potential of marine bioprocessing in biocatalysis. Compiles studies from leading scientists in a direct and accessible format. Includes practical descriptions of results, adding further details not covered in formal articles Takes a molecular view which fully explains the enzymatic aspects of reactions, particularly regarding biocatalytic characteristics and descriptions of bioprocesses Selects examples of chemical and stereochemical aspects of enzymatic activity with respect to known terrestrial counterparts

Students contemplating careers in chemistry, whether in research, practice, or academia, obviously need a solid grounding in proper research methodology, reasoning, and analysis. However, there are few resources available that efficiently and effectively introduce these concepts and techniques and inspire students to undertake advanced research, particularly in the area of catalysis. Catalysis: Principles and Applications evolved out of a special, resonantly successful short course for graduate students interested in catalysis. It covers nearly the entire gamut of the subject, from its fundamentals to its modern, applied aspects. The chapters were contributed by catalysis specialists from leading academic institutions, national laboratories and industrial R&D labs. Because they are based on the authors' lecture notes, each chapter is highly accessible and for the most part self-contained. Topics include various spectroscopic methods, biocatalysis, x-ray and thermal analysis, photocatalysis, and recent developments, such as solid acid catalysis, fine chemical synthesis, and computer-aided catalyst design. The book also contains discussions on a variety of modern applications, including environmental pollution control, petroleum refining, fuel cells, and monomolecular films. Logically presented, well-illustrated, and thoroughly referenced, Catalysis: Principles and Applications offers an outstanding basis for courses in catalysis. It not only imparts the fundamentals, synthesis, characterization, and applications of catalysis, but does so in a way that will motivate students to pursue more advanced studies and ultimately career in the field.

Properties and Applications

Fundamentals Advances and Practices for a Greener Future

Concepts and Green Applications

Solid State Synthetic Methods

From Introductory Fundamentals to Advanced Applications

Esterification

Now in its 3rd Edition, Industrial Catalysis offers all relevant information on catalytic processes in industry, including many recent examples. Perfectly suited for self-study, it is the ideal companion for scientists who want to get into the field or refresh existing knowledge. The updated edition covers the full range of industrial aspects, from catalyst development and testing to process examples and catalyst recycling. The book is characterized by its practical relevance, expressed by a selection of over 40 examples of catalytic processes in industry. In addition, new chapters on catalytic processes in industry have been included. Existing chapters have been carefully revised and supplemented by new subchapters, for example, on metathesis reactions, refinery processes, petrochemistry and new reactor concepts. "I found the book accessible, readable and interesting - both as a refresher and as an introduction to new topics - and a convenient first reference on current industrial catalytic practise and processes." Excerpt from a book review for the second edition by P. C. H. Mitchell, Applied Organometallic Chemistry (2007)

Chemical processes provide a diverse array of valuable products and materials used in applications ranging from health care to transportation and food processing. Yet these same chemical processes that provide products and materials essential to modern economies, also generate substantial quantities of wastes and emissions. Green Chemistry is the utilization of a set of principles that reduces or eliminate the use or generation of hazardous substances in design. Due to extravagant costs needed to managing these wastes, tens of billions of dollars a year, there is a need to propose a way to create less waste. Emission and treatment standards continue to become more stringent, which causes these costs to continue to escalate. Green Chemistry and Engineering describes both the science (theory) and engineering (application) principles of Green Chemistry that lead to the generation of less waste. It explores the use of milder manufacturing conditions resulting from the use of smarter organic synthetic techniques and the maintenance of atom efficiency that can temper the effects of chemical processes. By implementing these techniques means less waste, which will save industry millions of dollars over time. Chemical processes that provide products and materials essential to modern economies generate substantial quantities of wastes and emissions, thus this new book describes both the science (theory) and engineering (application) principles of Green Chemistry that lead to the generation of less waste. This book contains expert advice from scientists around the world, encompassing developments in the field since 2000. Aids manufacturers, scientists, managers, and engineers on how to implement ongoing changes in a vast developing field that is important to the world's economy and environment.

Nanotechnology in Paper and Wood Engineering: Fundamentals, Challenges and Applications describes recent advances made in the use of nanotechnology in the paper and pulp industry. Various types of nano-additives commonly used in the paper industry for modification of raw material to enhance final products are included, with other sections covering the imaging applications of nano-papers and nano-woods in pharmaceuticals, biocatalysis, photocatalysis and energy storage. This book is an important reference source for materials scientists and engineers who are looking to understand how nanotechnology is being used to create more efficient manufacturing processes in for the paper and wood industries. Provides information on nano-paper production and its applications Explains the major synthesis techniques and design concepts of cellulose or wooden nanomaterials for industrial applications Assesses the major challenges of creating nanotechnology-based manufacturing systems for wood and paper engineering

The whole range of biocatalysis, from a firm grounding in theoretical concepts to in-depth coverage of practical applications and future perspectives. The book not only covers reactions, products and processes with and from biological catalysts, but also the process of designing and improving such biocatalysts. One unique feature is that the fields of chemistry, biology and bioengineering receive equal attention, thus addressing practitioners and students from all three areas.

Microemulsions

Industrial Catalysis

Applications of Porphyrinoids as Functional Materials

An Introduction to Molecular Biotechnology

Bioprocessing for Value-Added Products from Renewable Resources

Ionic Liquids in Biotransformations and Organocatalysis

BiocatalysisBiochemical Fundamentals and ApplicationsWorld Scientific Publishing Company

Thermal Analysis: From Introductory Fundamentals to Advanced Applications presents an easy-to-understand introduction to Thermal Analysis (TA) principles alongside in-depth coverage of the wide variety of techniques currently in use across several industries. It covers differential scanning calorimetry (DSC), temperature modulated DSC (TMDSC), differential thermal analysis (DTA), thermogravimetry (TG) or thermogravimetric analysis (TGA), thermomechanical analysis (TMA), differential photo-calorimetry (DPC), dynamic mechanical analysis (DMA), thermolithometry (TD), dielectric thermal analysis (DEA), thermally-stimulated current (TSC), emanation thermal analysis (ETA), thermoluminescence (TL), fast scanning calorimetry (FSC), and microcalorimetry. Chapters define the various TA techniques, report the Temperature-Modulated DSC (TMDSC) method and its applications, especially its use for studying the thermodynamic properties of polymers and pharmaceuticals, focus on the potential of TA in materials science with applications in chemistry and engineering, demonstrate, in detail, the various applications of TA in food, electronic industries, solid-state reactions, chemistry of polymers and large directing agents, kinetic studies, demonstrate the crystal structure and phase changes occurring upon heating by TA, and the potential of TA in recycling and waste management. Gives a solid introduction to the scientific principles of TA for those who are new to these techniques or need a deeper understanding Illustrates concepts with more than 100 schematic and analysis curves, several flow charts, process diagrams and photographs Contains chapters that cover the use of TA in materials science and crystal structures

This second edition of a bestselling textbook offers an instructive and comprehensive overview of our current knowledge of biocatalysis and enzyme technology. The book now contains about 40% more printed content. Three chapters are completely new, while the others have been thoroughly updated, and a section with problems and solutions as well as new case studies have been added. Following an introduction to the history of enzyme applications, the text goes on to cover in depth enzyme mechanisms and kinetics, production, recovery, characterization and design by protein engineering. The authors treat a broad range of applications of soluble and immobilized biocatalysts, including wholecell systems, the use of non-aqueous reaction systems, applications in organic synthesis, bioreactor design and reaction engineering. Methods to estimate the sustainability, important internet resources and their evaluation, and legislation concerning the use of biocatalysts are also covered.

This book covers the fundamental aspects of the electrochemistry and redox enzymes that underlie enzymatic bioelectrocatalysis, in which a redox enzyme reaction is coupled with an electrode reaction. Described here are the basic concept and theoretical aspects of bioelectrocatalysis and the various experimental techniques and materials used to study and characterize related problems. Also included are the various applications of bioelectrocatalysis to bioelectrochemical devices including biosensors, biofuel cells, and bioreactors. This book is a unique source of information in the area of enzymatic bioelectrocatalysis, approaching the subject from a cross-disciplinary point of view.

Pharmaceutical Biocatalysis

International Conference, June 13-18, 1998, Puschino-on-Oka, Russia

Solvents and Beyond

Catalysis

Marine Enzymes for Biocatalysis

Fundamentals and Applications

Closing a gap in the literature, this comprehensive book examines and discusses different non-aqueous systems from organic solvents to ionic liquids for synthetic applications, thus opening the door to new successful methods for biocatalytic reactions. It gathers into one handy source the information otherwise widely spread throughout the literature, combining useful background information with a number of synthetic examples, including industrial scale processes for pharmaceutical and fine chemicals. Extremely well structured, the text introduces the fundamentals of non-aqueous enzymology, before going on to new reaction media and synthetic applications using hydrolases and non-hydrolytic enzymes. The one-stop reference for everyone working in this hot field.

Describing the essential steps in the development of biocatalytic processes from concept to completion, this carefully integrated text combines the fundamentals of biocatalysis with technological experience and in-depth commercial case studies. The book starts with an introductory look at the history and present scope of biocatalysis and proceeds to detailed overviews of particular areas of interest. Written by industrial and academic experts, Applied Biocatalysis will be an important addition to the bookshelf for anyone teaching the subject or working in the chemical, food manufacturing or pharmaceutical industries, who is seeking to exploit the potential of biocatalysts.

This new volume, Biocatalysis and Agricultural Biotechnology: Fundamentals, Advances, and Practices for a Greener Future, looks at the application of a variety of technologies, both fundamental and advanced, that are being used for crop improvement, metabolic engineering, and the development of transgenic plants. The science of agriculture is among the oldest and most intensely studied by mankind. Human intervention has led to manipulation of plant gene structure for the use of plants for the production of bioenergy, food, textiles, among other industrial uses. A sound knowledge of enzymology as well as the various biotechnological processes is required to further utilize microbes as sources to provide the desired products for industrial utility. This volume provides an overview of all the aspects along with an updated review of the major plant biotechnology procedures and techniques, their impact on novel agricultural development, and crop plant improvement. Also discussed are the use of "white biotechnology" and "metabolic engineering" as prerequisites for a sustainable development. The importance of patenting of plant products, world food safety, and the role of several imminent organizations is also discussed. The volume provides an holistic view that makes it a valuable source of information for researchers of agriculture and biotechnology as well as agricultural engineers, environmental biologists, environmental engineers, and environmentalists. Short exercises at the end of the chapters help to make the book suitable for course work in agriculture biotechnology, genetics, biology, biotechnology, and plant science.

Biopolymeric Nanomaterials: Fundamentals and Applications outlines the fundamental design concepts and emerging applications of biopolymeric nanomaterials. The book also provides information on emerging applications of biopolymeric nanomaterials, including in biomedicine, manufacturing and water purification, as well as assessing their physical, chemical and biological properties. This is an important reference source for materials scientists, engineers and biomedical scientists who are seeking to increase their understanding of how polymeric nanomaterials are being used for a range of biomedical and industrial applications.

Biocatalysis and Nanotechnology: Fundamentals and Applications provides an overview of the major industrial uses of biocompatible nanomaterials, consisting of biopolymers, such as proteins (ilk, collagen, gelatin, β-casein, zein, and albumin), protein-mimicked polypeptides and polysaccharides (chitosan, alginate, pullulan, starch, and heparin). Biopolymeric nanomaterials may be used as 1) delivery systems for bioactive compounds in food application, (1i) for delivery of therapeutic molecules (drugs and genes), or for (1ii) tissue engineering. Provides information on the design concepts and synthesis of biopolymeric nanomaterials in biomedical and industrial applications Highlights the major properties and processing methods for biopolymeric nanomaterials Assesses the major challenges of producing biopolymeric nanomaterials on an industrial scale

Principles and Applications

International Conference Biocatalysis-98: Fundamentals and Applications

Nanotechnology in Paper and Wood Engineering

Handbook of Carbohydrate-Modifying Biocatalysts

Fundamentals, Enzyme Inhibitors, and Enzymes in Health and Diseases

Fundamentals and Applications : International Conference, Puschino-on-Oka, Russia, June 13-18, 1998

Catalysis has revolutionized the chemical industry as catalysts are used in the production of most chemicals, resulting in a multi-billion euro business. This advanced textbook is a must-have for all Master and PhD students in the field as it adopts a unique interdisciplinary approach to the topic of catalysis. It presents a collection of chapters that explain the fundamentals of catalysis as the area has developed over the past decades and introduces new catalytic systems that are of becoming of increasing current importance. It covers all the essential principles, ranging from catalytic processes at the molecular level to catalytic reactor design and includes several case studies illustrating the importance of catalysts in the chemical industry.

In this Completely Revised and Extended Edition with a significantly enhanced content, all Chapters have been updated considering relevant literature and recent developments until 2016 together with application oriented examples with a focus on Industrial Biocatalysis. Newly treated topics comprise among others systems metabolic engineering and metabolic engineering, pathway engineering, and de-novo computational design as actual research areas in biocatalysis. Information about different aspects of RNA technologies, and completely new Chapters on 'Fluorescent Proteins' and 'Biocatalysis and Nanotechnology' are also included. This book provides an overview of the world market of therapeutic enzymes and enzyme inhibitors, rare diseases, orphan drugs, the costs of drug development and therapies, and enzymes in downstream processing of pharmaceuticals. It discusses carbonic anhydrase inhibitors and their multiple drug interactions, carbonyltransferase inhibitors for pharmaceutical applications, employment of inhibitors for the treatment of neurodegenerative diseases, use of engineered proteins, bioactive peptides, and fibrinolytic enzymes for thrombolytic therapy, and enzymes important for the design and development of new drugs/drug metabolites such as aldehyde oxidases and cytochrome P450 enzymes and the role the latter play in vascular biology and pathophysiology. The treatment of cancer is explored in connection with enzymatic amino acid deprivation therapies and new drugs that act as chemical degraders of oncogenic proteins. The book also introduces the resistance mechanisms of cancer. Furthermore, it provides an insight into the relationship between pathological conditions of cardiovascular disease and oxidative stress. The text also focuses on the potential use of nanoparticles as carriers for enzymes with medical relevance, computer-aided drug design for the identification of multi-target directed ligands, and the development of improved therapeutics through a glycan-"designer" approach. It concludes with an introduction to the chemoenzymatic synthesis of drugs.

Providing an integrated approach to the various aspects of catalysis, this textbook is ideal for graduate students from catalysis, engineering, and organic synthesis.

Puschino-on-Oka, Russia [June 13 - 18, 1998]

Enzymatic Bioelectrocatalysis

From Principles to Applications

Biocatalysis and Nanotechnology

Science, Technology and Applications

Applied Biocatalysis

This publication contains full papers of both oral and poster presentations of the symposium "Immobilized Cells: Basics and Applications" that was held in Noordwijkerhout, The Netherlands, 26-29 November 1995. This volume covers recent developments in the field of immobilization e.g.: new support materials, characterization of support materials, kinetic characterizations, dynamic modelling, bioreactor types, scale up and applications are also given. Applications in the field of medicine, fermentation technology, food technology and environmental technology are described. Guidelines for research with immobilized cells. Based on the scientific sessions a strategy of research and methods for characterization of immobilized cells, especially in view of applications are given. The goal was to relate basic research to applications and to extract guidelines for characterization of immobilized cells in view of process design and application from the contributions. The manuscripts presented in these proceedings give an extensive and recent overview of the research and applications of immobilized-cell technology.

This book was written with the purpose of providing a sound basis for the design of enzymatic reactions based on kinetic principles, but also to give an updated vision of the potentials and limitations of biocatalysis, especially with respect to recent applic- cations in processes of organic synthesis. The 7rst 7ve chapters are structured in the form of a textbook, going from the basic principles of enzyme structure and fu- tion to reactor design for homogeneous systems with soluble enzymes and hete- geneous systems with immobilized enzymes. The last chapter of the book is divided into six sections that represent illustrative case studies of biocatalytic processes of industrial relevance or potential, written by experts in the respective 7elds. We sincerely hope that this book will represent an element in the toolbox of gr- uate students in applied biology and chemical and biochemical engineering and also of undergraduate students with formal training in organic chemistry, biochemistry, thermodynamics and chemical reaction kinetics. Beyond that, the book pretends also to illustrate the potential of biocatalytic processes with case studies in the 7eld of organic synthesis, which we hope will be of interest for the academia and pro- fessionals involved in R&D&I. If some of our young readers are encouraged to engage or persevere in their work in biocatalysis this will certainly be our more precious reward.

Biocatalysis has become an essential tool in the chemical industry and is the core of industrial biotechnology, also known as white biotechnology, making use of biocatalysts in terms of enzymes or whole cells in chemical processes as an alternative to chemical catalysts. This shift can be seen in the many areas of daily life where biocatalysts-with their environmentally friendly properties-are currently employed. Drivers are the big societal challenges resulting from concerns about the global climate change and the need for an assured energy supply. Modern biocatalysis relies to a large extent on the tremendous advances in the so-called omics techniques and the structural elucidation of biomolecules, which have led to synthetic biology and metabolic engineering as new research fields with high application potential for the rational design of enzymes and microbial production strains. In this book, renowned scientists discuss the actual developments in these research fields together with a variety of application-oriented topics.

This book gives an overview of the applications and potential applications of porphyrins and related macrocycles as smart or functional materials.

Contemporary Catalysis

Biocatalysis - 98

Industrial Biocatalysis

Fundamentals, Challenges and Applications

Immobilized Cells: Basics and Applications

A Practical Approach

Paves the way for new industrial applications using redox biocatalysis Increasingly, researchers rely on the use of enzymes to perform redox processes as they search for novel industrial synthetic routes. In order to support and advance their investigations, this book provides a comprehensive and current overview of the use of redox enzymes and enzyme-mediated oxidative processes, with an emphasis on the role of redox enzymes in chemical transformations. The authors examine the full range of topics in the field, from basic principles to new and emerging research and applications. Moreover, they explore everything from laboratory-scale procedures to industrial manufacturing. Redox Biocatalysis begins with a discussion of the biochemical features of redox enzymes as well as cofactors and cofactor regeneration methods. Next, the authors present a variety of topics and materials to the research and development of full-scale industrial applications, including: Biocatalytic applications of redox enzymes such as dehydrogenases, oxygenases, oxidases, and peroxidases Enzyme-mediated oxidative processes based on biocatalytic promiscuity All the steps from enzyme discovery to robust industrial processes, including directed evolution, high-throughput screening, and medium engineering Case studies tracing the development of industrial applications using biocatalytic redox reactions Each chapter ends with concluding remarks, underscoring the key scientific principles and processes. Extensive references serve as a gateway to the growing body of research in the field. Researchers in both academia and industry will find this book an indispensable reference for redox biotransformations, guiding them from underlying core principles to new discoveries and emerging industrial applications.

Because enzyme-catalyzed reactions exhibit higher enantioselectivity, regioselectivity, substrate specificity, and stability, they require mild conditions to react while prompting higher reaction efficiency and product yields. Biocatalysis in the Pharmaceutical and Biotechnology Industries examines the use of catalysts to produce fine chemicals and chiral intermediates in a variety of pharmaceutical, agrochemical, and other biotechnological applications. Written by internationally recognized scientists in biocatalysis, the authors analyze the synthesis of chiral intermediates for over 60 brand-name pharmaceuticals for a wide range of drug therapies and treatments. From starting material to product, the chapters offer detailed mechanisms that show chiral intermediates and other by-products of each reaction—including hydrolytic, acylation, halogenation, esterification, dehalogenative oxidation-reduction, oxygenative hydroxylation, deamination, transamination, and C-C, C-N, C-O bonds formation. Cutting-edge topics include advanced methodologies for gene shuffling and directed evolution of biocatalysts; the custom engineering of enzymes; the use of microbial cells and isolated biocatalysts; the use of renewable starting materials; and generating novel molecules by combinatorial biocatalysis and high-throughput screening. Focusing on industrial applications, the book also considers factors such as bulk processes, instrumentation, solvent selection, and techniques for catalyst immobilization, reusability, and yield optimization throughout. Biocatalysis in the Pharmaceutical and Biotechnology Industries showcases the practical advantages and methodologies for using biocatalysts to develop and produce chiral pharmaceuticals and fine chemicals.

Here, Professor J. Otera brings together for the first time the combined knowledge about this elementary yet multifaceted reaction. Starting from the methodical basics right up to practical applications, this book represents a comprehensive overview of this type of reaction, saving readers time-consuming research among the literature - and not just in practical matters.

All set to become a standard reference for every organic chemist. From the contents: METHODOLOGY Reaction of Alcohols with Carboxylic Acids and Their Derivatives Reactions with Carboxylic Acids Reaction with Esters: Transesterification Reaction with Acid Anhydrides Reaction with Acid Halides and Related Compounds Conversion of Alcohols to Esters through

Carbonylation SYNTHETIC APPLICATIONS Kinetic Resolution Enzymatic Resolution Nonenzymatic Resolution Asymmetric Desymmetrization Deacetylation through Transesterification Selective Esterification Applications to Natural Product Synthesis New Reaction Media Industrial Uses

Organic Synthesis with Enzymes in Non-Aqueous Media

Redox Biocatalysis

Thermal Analysis

Green Chemistry and Engineering

Biocatalysts and Enzyme Technology

Sources, Biocatalytic Characteristics and Bioprocesses of Marine Enzymes