

# Biocatalysis Fundamentals And Applications

***Closing a gap in the  
literature, this comprehensive  
book examines and discusses***

*Page 1/196*

*biocatalysis-fundamentals-and-applications*

***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***

*Page 2/196*

***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***

*Page 3/196*

***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***

*Page 4/196*

*biocatalysis-fundamentals-and-applications*

***everyone working in this hot field.***

***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***

*Page 5/196*

***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***

*Page 6/196*

*biocatalysis-fundamentals-and-applications*

***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***

*Page 7/196*

***the molecular level to catalytic reactor design and includes several case studies illustrating the importance of catalysts in the chemical industry.***

***The whole range of biocatalysis, from a firm***

*Page 8/196*



***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***

*Page 9/196*

*biocatalysis-fundamentals-and-applications*

***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.***

*Page 10/196*

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***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.***

*Page 11/196*

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***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***

*Page 12/196*

*biocatalysis-fundamentals-and-applications*

***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***

*Page 13/196*

***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***

*Page 14/196*

***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***

*Page 15/196*

***the bioprocess and  
biotechnology fields, and for  
others who are interested in  
biotechnology, engineering,  
industrial microbiology and  
chemical engineering.  
•Reviews the principles  
underpinning modern***

*Page 16/196*

*biocatalysis-fundamentals-and-applications*



***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***

*Page 17/196*

*biocatalysis-fundamentals-and-applications*

***bioproduct industry***  
***Redox Biocatalysis***  
***Enzymatic Basics and***  
***Applications***  
***Ionic Liquids in***  
***Biotransformations and***  
***Organocatalysis***  
***Industrial Biocatalysis***

*Page 18/196*

***Biopolymeric Nanomaterials***  
***Enzymatic Bioelectrocatalysis***

**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**

*Page 19/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 20/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 21/196*

*biocatalysis-fundamentals-and-applications*

**Alcohols to Esters through  
Carbonylation SYNTHETIC  
APPLICATIONS Kinetic Resolution  
Enzymatic Resolution  
Nonenzymatic Resolution  
Asymmetric Desymmetrization  
Deacetylation through  
Transesterification Selective**

*Page 22/196*

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**Esterification Applications to  
Natural Product Synthesis New  
Reaction Media Industrial Uses**  
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

*Page 23/196*

*biocatalysis-fundamentals-and-applications*

**therapies, and enzymes in downstream processing of pharmaceuticals. It discusses carbonic anhydrase inhibitors and their multiple drug interactions, carboxylesterase inhibitors for pharmaceutical applications, employment of inhibitors for the**

*Page 24/196*

*biocatalysis-fundamentals-and-applications*



**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**

*Page 25/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 26/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 27/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 28/196*

*biocatalysis-fundamentals-and-applications*

**glycan-“designer” approach. It concludes with an introduction to the chemoenzymatic synthesis of drugs.**

**This unique book gives a timely overview about the fundamentals and applications of supported ionic liquids in modern organic**

*Page 29/196*

*biocatalysis-fundamentals-and-applications*

**synthesis. It introduces the concept and synthesis of SILP materials and presents important applications in the field of catalysis (e.g. hydroformylation, hydrogenation, coupling reactions, fine chemical synthesis) as well as energy technology and gas separation.**

*Page 30/196*

*biocatalysis-fundamentals-and-applications*

**Written by pioneers in the field, this book is an invaluable reference book for organic chemists in academia or industry.**

**Now in it's 3rd Edition, Industrial Catalysis offers all relevant information on catalytic processes in industry, including many recent**

*Page 31/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 32/196*

*biocatalysis-fundamentals-and-applications*



**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 with renewable materials and polymerization catalysis have been**

*Page 33/196*

*biocatalysis-fundamentals-and-applications*

**included. Existing chapters have been carefully revised and supported by new subchapters, for example, on metathesis reactions, refinery processes, petrochemistry and new reactor concepts. "I found the book accesible, readable and interesting - both as a refresher and**

*Page 34/196*

*biocatalysis-fundamentals-and-applications*

**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)  
Nanotechnology in Paper and Wood**

*Page 35/196*

*biocatalysis-fundamentals-and-applications*

**Engineering  
Science, Technology and  
Applications  
Puschino-on-Oka, Russia  
Fundamentals and Applications  
Biochemical Fundamentals and  
Applications  
Methods, Reactions, and**

*Page 36/196*

*biocatalysis-fundamentals-and-applications*

## **Applications**

**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**

*Page 37/196*

*biocatalysis-fundamentals-and-applications*

**oriented examples with a focus on Industrial Biocatalysis. Newly treated topics comprise among others systems metabolic engineering approaches, metagenome screening, new tools for pathway engineering, and de-novo computational design as**

*Page 38/196*

*biocatalysis-fundamentals-and-applications*

**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.**

*Page 39/196*

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**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**

*Page 40/196*

*biocatalysis-fundamentals-and-applications*



**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**

*Page 41/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 42/196*

**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**

*Page 43/196*

**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**

*Page 44/196*

*biocatalysis-fundamentals-and-applications*

**production, probing of enzymatic activity, and identification of enzyme functions of inorganic nanoparticles as enzyme mimics. Biopolymeric Nanomaterials: Fundamentals and Applications outlines the fundamental design concepts and emerging**

*Page 45/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 46/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 47/196*

*biocatalysis-fundamentals-and-applications*

**a range of biomedical and industrial applications.**

**Biopolymeric nanomaterials refer to biocompatible nanomaterials, consisting of biopolymers, such as protein (silk, collagen, gelatin,  $\beta$ -casein, zein, and albumin), protein-mimicked polypeptides**

*Page 48/196*



**and polysaccharides (chitosan, alginate, pullulan, starch, and heparin). Biopolymeric nanomaterials may be used as i) delivery systems for bioactive compounds in food application, (ii) for delivery of therapeutic molecules (drugs and genes), or**

*Page 49/196*

**for (iii) 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**

*Page 50/196*

**nanomaterials Assesses the major challenges of producing biopolymeric nanomaterials on an industrial scale Providing an integrated approach to the various aspects of catalysis, this textbook is ideal for graduate students from**

*Page 51/196*

*biocatalysis-fundamentals-and-applications*

**catalysis, engineering, and  
organic synthesis.**

**Fundamentals, Enzyme  
Inhibitors, and Enzymes in  
Health and Diseases  
Solvents and Beyond  
Biocatalysis -98  
Biocatalysts and Enzyme**

*Page 52/196*

*biocatalysis-fundamentals-and-applications*

**Technology**  
**Biocatalysis and Nanotechnology**  
**Fundamentals, Methods and**  
**Applications**

This book broadly reviews the modern techniques and significant applications of chemical sensors and biosensors. Chapters are written by experts in the

*Page 53/196*

*biocatalysis-fundamentals-and-applications*

field - including Professor Joseph Wang, the most cited scientist in the world and renowned expert on sensor science who is also co-editor. Each chapter provides technical details beyond the level found in typical journal articles, and explores the application of chemical sensors and

*Page 54/196*

*biocatalysis-fundamentals-and-applications*

biosensors to a significant problem in biomedical science, also providing a prospectus for the future. This book compiles the expert knowledge of many specialists in the construction and use of chemical sensors and biosensors including nitric oxide sensors, glucose sensors, DNA

*Page 55/196*

*biocatalysis-fundamentals-and-applications*

sensors, hydrogen sulfide sensors, oxygen sensors, superoxide sensors, immuno sensors, lab on chip, implatable microsensors, et al. Emphasis is laid on practical problems, ranging from chemical application to biomedical monitoring and from in vitro to in vivo, from single

*Page 56/196*

*biocatalysis-fundamentals-and-applications*



cell to animal to human measurement. This provides the unique opportunity of exchanging and combining the expertise of otherwise apparently unrelated disciplines of chemistry, biological engineering, and electronic engineering, medical, physiological. Provides user-oriented guidelines for

*Page 57/196*

*biocatalysis-fundamentals-and-applications*

the proper choice and application of  
new chemical sensors and biosensors  
Details new methodological  
advancements related to and  
correlated with the measurement of  
interested species in biomedical  
samples Contains many case studies  
to illustrate the range of application

*Page 58/196*

*biocatalysis-fundamentals-and-applications*

and importance of the chemical sensors and biosensors  
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

*Page 59/196*

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, resoundingly successful short course for graduate

*Page 60/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 61/196*

*biocatalysis-fundamentals-and-applications*

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 catalysts, fine chemical synthesis,

*Page 62/196*

*biocatalysis-fundamentals-and-applications*

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:

*Page 63/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 64/196*

*biocatalysis-fundamentals-and-applications*



careers in the field.

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,

*Page 65/196*

*biocatalysis-fundamentals-and-applications*

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,

*Page 66/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 67/196*

*biocatalysis-fundamentals-and-applications*

engineering. Methods to estimate the sustainability, important internet resources and their evaluation, and legislation concerning the use of biocatalysts are also covered. This book provides an actual overview of the structure, function, and application of carbohydrate-modifying

*Page 68/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 69/196*

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

*Page 70/196*

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

*Page 71/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 72/196*

*biocatalysis-fundamentals-and-applications*



bioprocessing of lignocellulosic material. Furthermore, a synthetic biology approach for using DAHP-dependent aldolases to catalyze asymmetric aldol reactions is presented.

New Technologies and Applications  
Applications of Porphyrinoids as

*Page 73/196*

*biocatalysis-fundamentals-and-applications*

Functional Materials

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

Esterification

Biocatalysis and Agricultural  
Biotechnology: Fundamentals,  
Advances, and Practices for a Greener  
Future

*Page 74/196*

*biocatalysis-fundamentals-and-applications*

## Industrial Catalysis

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

*Page 75/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 76/196*

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

*Page 77/196*

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

*Page 78/196*

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

*Page 79/196*

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

*Page 80/196*

*biocatalysis-fundamentals-and-applications*



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

*Page 81/196*

and materials essential to modern economies generate substantial quantities of wastes and emissions, this new book describes both the science (theory) and engineering (application) principles of Green

*Page 82/196*

*biocatalysis-fundamentals-and-applications*

Chemistry that lead to the generation of less waste This book contains expert advise from scientists around the world, encompassing developments in the field since 2000 Aids manufacturers, scientists,

*Page 83/196*

*biocatalysis-fundamentals-and-applications*

managers, and engineers on  
how to implement ongoing  
changes in a vast developing  
field that is important to the  
environment and our lives  
Molecular biotechnology  
continues to triumph, as this

*Page 84/196*

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

*Page 85/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 86/196*

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

*Page 87/196*

color throughout - Proven structure according to basics, methods, main topics and economic perspectives - New sections on system biology, RNA interference, microscopic techniques, high throughput

*Page 88/196*

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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

*Page 89/196*

*biocatalysis-fundamentals-and-applications*

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](http://www.wiley-vch.de/home/molecbiotech)  
This book introduces readers to

*Page 90/196*

*biocatalysis-fundamentals-and-applications*

industrially important enzymes and discusses in detail their structures and functions, as well as their manifold applications. Due to their selective biocatalytic capabilities, enzymes are used in a broad range of industries and

*Page 91/196*

*biocatalysis-fundamentals-and-applications*

processes. The book highlights selected enzymes and their applications in agriculture, food processing and discoloration, as well as their role in biomedicine. In turn, it discusses biochemical engineering strategies such as

*Page 92/196*

enzyme immobilization, metabolic engineering, and cross-linkage of enzyme aggregates, and critically weighs their pros and cons. Offering a wealth of information, and stimulating further research by presenting

*Page 93/196*

new concepts on enzymatic catalytic functions in basic and applied contexts, the book represents a valuable asset for researchers from academia and industry who are engaged in biochemical engineering,

*Page 94/196*

*biocatalysis-fundamentals-and-applications*

microbiology and biotechnology.  
Switchable Solvents  
Sources, Biocatalytic  
Characteristics and  
Bioprocesses of Marine  
Enzymes  
Biocatalysis

*Page 95/196*

*biocatalysis-fundamentals-and-applications*

Biocatalysis-98

Organic Synthesis with Enzymes  
in Non-Aqueous Media

Fundamentals, Challenges and  
Applications

**Biocatalysis has become an  
essential tool in the**

*Page 96/196*

*biocatalysis-fundamentals-and-applications*



**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**

*Page 97/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 98/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 99/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 100/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 101/196*

*biocatalysis-fundamentals-and-applications*

**discuss the actual developments in these research fields together with a variety of application-oriented topics.**

**Marine bioprospecting is a highly topical subject - in**

*Page 102/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 103/196*

*biocatalysis-fundamentals-and-applications*

**book addresses the use of marine enzymes in biocatalysis through a series of chapters from leading scientists within academic and industrial fields. Biocatalytic**

*Page 104/196*

*biocatalysis-fundamentals-and-applications*



**processes can take  
advantage of the habitat-  
related properties of  
marine enzymes, such as  
salt tolerance,  
hyperthermostability,  
barophilicity, cold**

*Page 105/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 106/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 107/196*

*biocatalysis-fundamentals-and-applications*

**characteristics of products.  
Marine enzymes for  
biocatalysis initially  
examines the nature and  
level of interest in marine  
biological diversity, and  
outlines the fundamentals**

*Page 108/196*

*biocatalysis-fundamentals-and-applications*

**of biocatalysis. It goes on to detail sources of marine enzymes, and to analyse examples from both chemical and stereochemical viewpoints of catalysis, including**

*Page 109/196*

*biocatalysis-fundamentals-and-applications*

**microbial enzymes and animal or plant sources. The book goes on to explore the future potential of marine bioprospecting in biocatalysis. Compiles studies from leading**

*Page 110/196*

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**scientists in a direct and accessible format. Includes practical descriptions of results, adding further details not often covered in formal articles Takes a molecular view which fully**

*Page 111/196*

*biocatalysis-fundamentals-and-applications*

**explains the enzymatic aspects of reactions, particularly regarding biocatalytic characteristics and descriptions of bioprocesses Selects examples of chemical and**

*Page 112/196*

*biocatalysis-fundamentals-and-applications*



**stereochemical aspects of  
enzymatic action with  
respect to known terrestrial  
counterparts**

**This book describes the  
essential steps in the  
development of biocatalytic**

*Page 113/196*

*biocatalysis-fundamentals-and-applications*

**processes from concept to completion. It is a carefully integrated text which combines the fundamentals of biocatalysis with technological experience and in-depth commercial**

*Page 114/196*

*biocatalysis-fundamentals-and-applications*

**case studies. The book starts with an introductory look at the characteristics and present applications of biocatalysts, followed by more detailed overviews of these areas.**

*Page 115/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 116/196*

*biocatalysis-fundamentals-and-applications*

**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**

*Page 117/196*

*biocatalysis-fundamentals-and-applications*

**organocatalysis (from solvents to co-catalysts and new reactivities, as well as non-solvent applications such as anchoring and immobilization).  
Electrochemical Sensors,**

*Page 118/196*

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**Biosensors and their  
Biomedical Applications  
Immobilized Cells: Basics  
and Applications  
Green Chemistry and  
Engineering  
Applied Biocatalysis**

*Page 119/196*

*biocatalysis-fundamentals-and-applications*

**International Conference  
Biocatalysis-98:  
Fundamentals and  
Applications  
Fundamentals and  
Applications : International  
Conference, Puschino-on-**

*Page 120/196*

*biocatalysis-fundamentals-and-applications*



## **Oka, Russia, June 13-18, 1998**

The book covers the fundamentals of the field of biocatalysis that are not treated in such detail (or even not

*Page 121/196*

*biocatalysis-fundamentals-and-applications*

at all) in existing  
biocatalysis books or  
biochemistry textbooks.  
It of course does not  
substitute existing  
biochemistry textbooks  
but will serve a

*Page 122/196*

*biocatalysis-fundamentals-and-applications*

suitable supplement as  
it discusses biochemical  
fundamentals in  
connection with the  
respective topics. With  
focus on the  
interdisciplinary nature

*Page 123/196*

*biocatalysis-fundamentals-and-applications*

of biocatalysis, the book contains many aspects of fundamental organic chemistry and some of inorganic chemistry as well, which should make it

*Page 124/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 125/196*

the main prerequisites  
for a sustainable  
development. The topics  
covered ranges from  
basic enzyme chemistry  
(biosynthesis,  
structure, properties,

*Page 126/196*

interaction forces,  
kinetics) to a detailed  
description of catalytic  
mechanisms. It covers  
the fundamentals of the  
different enzyme classes  
together with their

*Page 127/196*

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,

*Page 128/196*



nucleic acid catalysts,  
non-ribosomal peptide  
synthesis, evolutionary  
methods, and the design  
of cells are also  
included.

Green Sustainable

*Page 129/196*

*biocatalysis-fundamentals-and-applications*

Process for Chemical and  
Environmental  
Engineering and Science:  
Switchable Solvents  
explores the  
preparation, properties,  
chemical processes and

*Page 130/196*

*biocatalysis-fundamentals-and-applications*

applications of this class of green solvents. The book provides an in-depth overview on the area of switchable solvents in various industrial applications,

*Page 131/196*

focusing on the  
purification and  
extraction of chemical  
compounds utilizing  
green chemistry  
protocols that include  
liquid-liquid, solid-

*Page 132/196*

liquid, liquid-gas and lipids separation technologies. In addition, it includes recent advances in greener extraction and separation processes.

*Page 133/196*

This book will be an invaluable guide to students, professors, scientists and R&D industrial specialists working in the field of sustainable chemistry,

*Page 134/196*

*biocatalysis-fundamentals-and-applications*

organic, analytical,  
chemical engineering,  
environmental and  
pharmaceutical sciences.  
Provides a broad  
overview of switchable  
solvents in sustainable

*Page 135/196*

chemical processes  
Compares the use of  
switchable solvents as  
greener solvents over  
conventional solvents  
Outlines eco-friendly  
organic synthesis and

*Page 136/196*



chemical processes using  
switchable solvents

Lists various industrial  
separations/extraction

processes using  
switchable solvents

Nanotechnology in Paper

*Page 137/196*

*biocatalysis-fundamentals-and-applications*

and Wood Engineering:  
Fundamentals, Challenges  
and Applications  
describes recent  
advances made in the use  
of nanotechnology in the  
paper and pulp industry.

*Page 138/196*

*biocatalysis-fundamentals-and-applications*

Various types of nano-additives commonly used in the paper industry for modification of raw material to enhance final products are included, with other

*Page 139/196*

sections covering the  
imaging applications of  
nano-papers and nano-  
woods in  
pharmaceuticals,  
biocatalysis,  
photocatalysis and

*Page 140/196*

energy storage. This book is an important reference source for materials scientists and engineers who are looking to understand how nanotechnology is

*Page 141/196*

being used to create  
more efficient  
manufacturing processes  
in for the paper and  
wood industries.

Provides information on  
nano-paper production

*Page 142/196*

and its applications  
Explains the major  
synthesis techniques and  
design concepts of  
cellulosic or wooden  
nanomaterials for  
industrial applications

*Page 143/196*

Assesses the major challenges of creating nanotechnology-based manufacturing systems for wood and paper engineering

This publication

*Page 144/196*

*biocatalysis-fundamentals-and-applications*



contains full papers of both oral and poster presentations of the symposium "Immobilized Cells: Basics and Applications" that was held in Noordwijkerhout,

*Page 145/196*

The Netherlands, 26-29  
November 1995. This  
volume covers recent  
developments in the  
field of immobilization  
e.g.: new support  
materials,

*Page 146/196*

*biocatalysis-fundamentals-and-applications*

characterization of  
support materials,  
kinetic  
characterizations,  
dynamic modelling,  
bioreactor types, scale  
up and applications are

*Page 147/196*

also given. Applications in the field of medicine, fermentation technology, food technology and environmental technology are described.

*Page 148/196*

*biocatalysis-fundamentals-and-applications*

Guidelines for research  
with immobilized cells.  
Based on the scientific  
sessions a strategy of  
research and methods for  
characterization of  
immobilized cells,

*Page 149/196*

especially in view of applications are given. The goal was to relate basic research to applications and to extract guidelines for characterization of

*Page 150/196*

immobilized cells in view of process design and application from the contributions. The manuscripts presented in these proceedings give an extensive and recent

*Page 151/196*

*biocatalysis-fundamentals-and-applications*

overview of the research  
and applications of  
immobilized-cell  
technology.

Enzyme Biocatalysis

International

Conference, June 13-18,

*Page 152/196*

*biocatalysis-fundamentals-and-applications*



1998, Puschino-on-Oka,  
Russia  
Marine Enzymes for  
Biocatalysis  
An Introduction to  
Molecular Biotechnology  
Principles and

*Page 153/196*

*biocatalysis-fundamentals-and-applications*

Applications  
International Conference  
Biocatalysis-98--Fundamentals and Applications  
This new volume,  
Biocatalysis and  
Agricultural Biotechnology:

*Page 154/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 155/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 156/196*

*biocatalysis-fundamentals-and-applications*

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 biosynthetic pathways is required to

*Page 157/196*

further utilize microbes as sources to provide the desired products for industrial utility. This volume provides an overview of all these aspects along with an updated review of the major plant

*Page 158/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 159/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 160/196*

*biocatalysis-fundamentals-and-applications*



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

*Page 161/196*

*biocatalysis-fundamentals-and-applications*

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.

*Page 162/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 163/196*

*biocatalysis-fundamentals-and-applications*

electrode reaction.  
Described here are the basic  
concept and theoretical  
aspects of  
bioelectrocatalysis and the  
various experimental  
techniques and materials  
used to study and

*Page 164/196*

characterize related problems. Also included are the various applications of bioelectrocatalysis to bioelectrochemical devices including biosensors, biofuel cells, and bioreactors. This book is a

*Page 165/196*

*biocatalysis-fundamentals-and-applications*

unique source of information  
in the area of enzymatic  
bioelectrocatalysis,  
approaching the subject from  
a cross-disciplinary point  
of view.

This book gives an overview  
of the applications and

*Page 166/196*

*biocatalysis-fundamentals-and-applications*

potential applications of porphyrins and related macrocycles as smart or functional materials. This book was written with the purpose of providing a sound basis for the design of enzymatic reactions based

*Page 167/196*

*biocatalysis-fundamentals-and-applications*

on kinetic principles, but also to give an updated vision of the potentials and limitations of biocatalysis, especially with respect to recent applications in processes of organic synthesis. The first five

*Page 168/196*

*biocatalysis-fundamentals-and-applications*



chapters are structured in the form of a textbook, going from the basic principles of enzyme structure and function to reactor design for homogeneous systems with soluble enzymes and hete-

*Page 169/196*

*biocatalysis-fundamentals-and-applications*

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,

*Page 170/196*

written by experts in the  
respective fields. We  
sincerely hope that this  
book will represent an  
element in the toolbox of  
graduate students in applied  
biology and chemical and  
biochemical engineering and

*Page 171/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 172/196*

*biocatalysis-fundamentals-and-applications*

of biocatalytic processes with case studies in the field of organic synthesis, which we hope will be of interest for the academia and professionals involved in R&D&I. If some of our young readers are encouraged

*Page 173/196*

*biocatalysis-fundamentals-and-applications*

to engage or persevere in their work in biocatalysis this will certainly be our more precious reward.

Catalysis

Green Sustainable Process  
for Chemical and  
Environmental Engineering

*Page 174/196*

*biocatalysis-fundamentals-and-applications*

and Science  
From Principles to  
Applications  
Biocatalysis-98,  
Fundamentals and  
Applications  
Microemulsions  
Concepts and Green

*Page 175/196*

*biocatalysis-fundamentals-and-applications*

## Applications

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

*Page 177/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 178/196*

*biocatalysis-fundamentals-and-applications*

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.

*Page 179/196*

*biocatalysis-fundamentals-and-applications*

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,

*Page 180/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 181/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 182/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 183/196*

*biocatalysis-fundamentals-and-applications*

them from underlying core principles to new discoveries and emerging industrial 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

*Page 185/196*

*biocatalysis-fundamentals-and-applications*

characteristics, theories, and applications of these dispersions. Thoroughly encompassing the significant developments of the past ten years, this book describes a wide range of topics, including interactions at microemulsion

*Page 186/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 187/196*

*biocatalysis-fundamentals-and-applications*

applicable techniques. Theory and Characterization Methods The initial chapters cover theoretical aspects of microemulsion formulation, with particular focus on methodologies for preparation. The book also addresses

*Page 188/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 190/196*

*biocatalysis-fundamentals-and-applications*

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

*Page 192/196*

*biocatalysis-fundamentals-and-applications*



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

*Page 193/196*

*biocatalysis-fundamentals-and-applications*

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.

Supported Ionic Liquids

*Page 194/196*

*biocatalysis-fundamentals-and-applications*

Bioprocessing for Value-Added  
Products from Renewable  
Resources  
Handbook of Carbohydrate-  
Modifying Biocatalysts  
A Practical Approach  
Properties and Applications

*Page 195/196*

*biocatalysis-fundamentals-and-applications*

# Contemporary Catalysis

*Page 196/196*

*biocatalysis-fundamentals-and-applications*