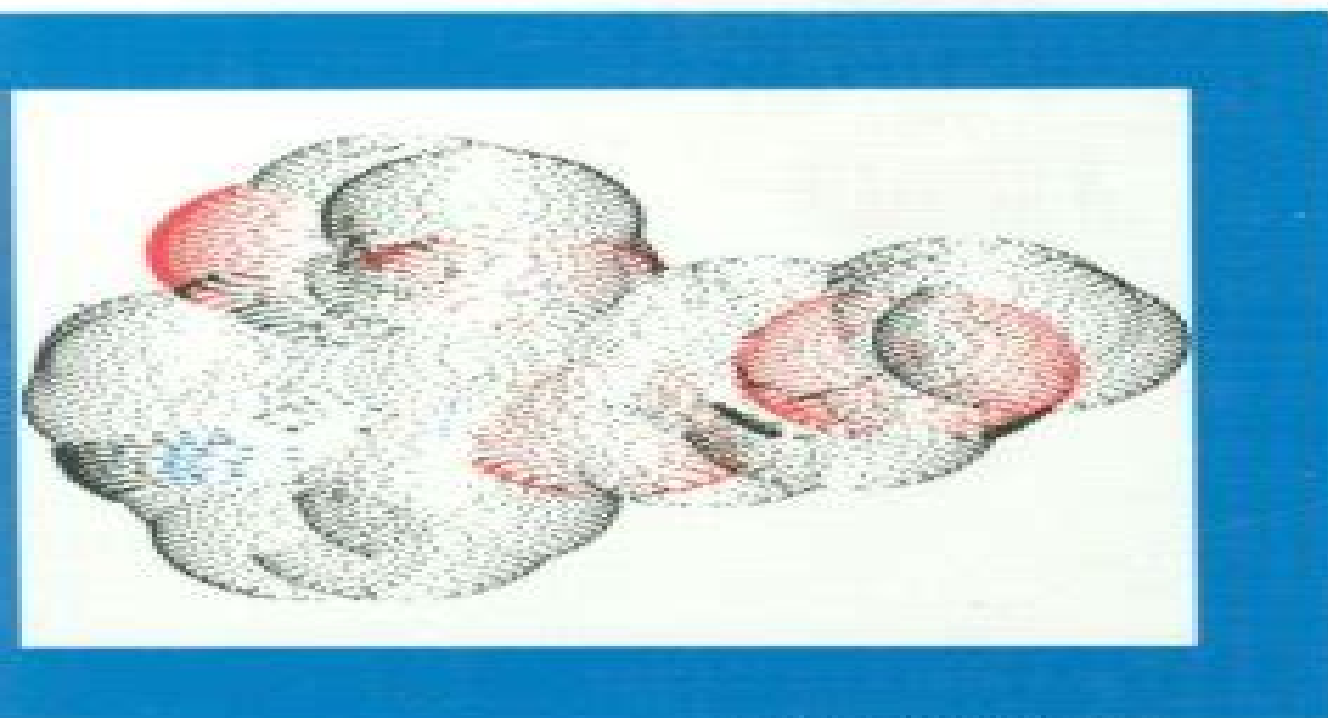


László Poppe, Lajos Novák

# Selective Biocatalysis

A Synthetic Approach



# Selective Biocatalysis A Synthetic Approach

**Mihály Nógrádi**



## **Selective Biocatalysis A Synthetic Approach:**

**Selective Biocatalysis** László Poppe, Lajos Novák, 1992-07-06 László Poppe, Lajos Novák *Selective Biocatalysis A Synthetic Approach* This stimulating monograph is a much needed response to the increasing use of biocatalysts in organic synthesis. In over 300 well referenced pages it reviews in detail applications and other aspects of the most widely used enzymes e.g. hydrolases, oxidoreductases and baker's yeast, illustrates with examples the potential in biocatalysis of other less frequently used enzymes and microorganisms, discusses general problems of biocatalysis e.g. stereochemistry of transformations, methods of influencing selectivity, indicates future trends in biocatalysis. Researchers and students in preparative organic chemistry, biotechnology and biochemistry will find this up to date monograph highly valuable in their daily work.

**Selective Biocatalysis** László Poppe, Lajos Novák, 1992 Chemists from Hungary review and evaluate the widening application of selective environment friendly biocatalysts. They emphasize the most widely used enzymes such as hydrolases, oxidoreductases and baker's yeast but provide examples of less frequently used enzymes and microorganisms such as lyases and aldolases. Chapters also outline the basics of biotransformation and biocatalysis and their stereochemical aspects. Fermentation processes and the production of compounds by biotechnological methods are not covered. Annotation copyright by Book News Inc, Portland, OR.

**Stereoselective Biocatalysis** Ramesh N. Patel, 2000-01-03 This book offers an explanation of the specific ways that biocatalysis outperforms chemical catalysis by utilizing ambient temperature and atmospheric pressure to minimize problems of isomerization, racemization and epimerization, employing microbial cells and enzymes that can be immobilized and reused over many cycles and overexpressing enzymes for greater economy and efficiency.

Introduction to Biocatalysis Using Enzymes and Microorganisms S. M. Roberts, 1995-01-27 This book gives an introduction to biotransformations, the practice of harnessing biological catalysts for the preparation of useful chemicals.

**Stereoselective Synthesis** Mihály Nógrádi, 2008-07-11 The state of the art in stereoselective synthesis. Thoroughly revised and updated, this enlarged second edition offers a plethora of valuable information on methods and reagents in stereoselective synthesis. Methods have been selected for high efficiency and selectivity; mechanistic aspects are treated succinctly with a strong emphasis on practical applications. For this new edition, material has been added on homogeneous diastereoselective hydrogenations, enantioselective oxidations, novel efficient chiral auxiliaries. Much of the information given is presented in figures and tables, which makes the book a valuable reference work for the practically minded organic chemist. From reviews of the first edition: The extensive material in the volume should prove particularly useful to anyone involved in synthetic chemistry or teaching a course in organic chemistry. *Journal of Medicinal Chemistry*. With nearly 1400 references cited, the book contains a wealth of information and should be a useful addition to the chemist's library. *The American Scientist*.

**Biocatalysis** Gonzalo de Gonzalo, Pablo Domínguez de María, 2017-11-02 Implementing biocatalytic strategies in an industrial setting at a commercial scale is a challenging task, necessitating a balance between industrial need against

economic viability With invited contributions from small and large scale chemical and pharmaceutical companies this book bridges the gap between academia and industry Contributors discuss current processes types of biocatalysts and improvements industrial motivation and key aspects to economically succeed With its focus on industry related issues this book will be a useful tool for future research by both practitioners and academics *Glycoscience* Joachim Thiem, Hugues Driguez, 1997 Annotation This book presents the state of the art in the synthesis very complex saccharide structures written by leading scientists at the forefront of this rapidly growing field Reflecting the particular significance in recent years of efficient and selective procedures employing enzymes for preparative purposes in the carbohydrate field a major proportion of the articles focus on these biocatalytic methods In addition recent strategies for the construction of unusual carbohydrates structures employing novel and creative methodologies are highlighted Further particular emphasis is placed on very complex saccharide structures as well as on special solutions to problems that are particularly challenging *Asymmetric and Selective Biocatalysis* Jose M. Palomo, Cesar Mateo, 2019-04-12 This Issue contains one communication six articles and two reviews The communication from Paola Vitale et al represents a work where whole cells were used as biocatalysts for the reduction of optically active chloroalkyl arylketones followed by a chemical cyclization to give the desired heterocycles Among the various whole cells screened baker's yeast *Kluyveromyces marxianus* CBS 6556 *Saccharomyces cerevisiae* CBS 7336 *Lactobacillus reuteri* DSM 20016 baker's yeast provided the best yields and the highest enantiomeric ratios 95:5 in the bioreduction of the above ketones In this respect valuable chiral non racemic functionalized oxygen containing heterocycles e.g. styrene oxide 2-phenyloxetane 2-phenyltetrahydrofuran amenable to be further elaborated on can be smoothly and successfully generated from their prochiral precursors Studies about pure biocatalysts with mechanistical studies application in different reactions and new immobilization methods for improving their stability were reported in five different articles The article by Su Yan Wang et al describes the cloning expression purification and characterization of an N-acetylglucosamine 2-epimerase from *Pedobacter heparinus* PhGn2E For this several N-acylated glucosamine derivatives were chemically synthesized and used to test the substrate specificity of the enzyme The mechanism of the enzyme was studied by hydrogen deuterium NMR The study at the anomeric hydroxyl group and C-2 position of the substrate in the reaction mixture confirmed the epimerization reaction via ring opening enolate formation Site directed mutagenesis was also used to confirm the proposed mechanism of this interesting enzyme The article by Forest H Andrews et al studies two enzymes benzoylformate decarboxylase BFDC and pyruvate decarboxylase PDC which catalyze the non oxidative decarboxylation of 2-keto acids with different specificity BFDC from *Pseudomonas putida* exhibited very limited activity with pyruvate whereas the PDCs from *S. cerevisiae* or from *Zymomonas mobilis* showed virtually no activity with benzoylformate phenylglyoxylate After studies using saturation mutagenesis the BFDC T377L A460Y variant was obtained with 10 000 fold increase in pyruvate benzoylformate The change was attributed to an improvement in the  $K_m$  value for pyruvate and a decrease in the  $k_{cat}$  value

for benzoylformate The characterization of the new catalyst was performed providing context for the observed changes in the specificity The article by Xin Wang et al compares two types of biocatalysts to produce D lysine L lysine in a cascade process catalyzed by two enzymes racemase from microorganisms that racemize L lysine to give D L lysine and decarboxylase that can be in cells permeabilized cells and the isolated enzyme The comparison between the different forms demonstrated that the isolated enzyme showed the higher decarboxylase activity Under optimal conditions 750 7 mmol L D lysine was finally obtained from 1710 mmol L L lysine after 1 h of racemization reaction and 0 5 h of decarboxylation reaction D lysine yield could reach 48 8% with enantiomeric excess ee of 99% In the article by Rivero and Palomo lipase from *Candida rugosa* CRL was highly stabilized at alkaline pH in the presence of PEG which permitted its immobilization for the first time by multipoint covalent attachment on different aldehyde activated matrices Different covalent immobilized preparation of the enzyme was successfully obtained The thermal and solvent stability was highly increased by this treatment and the novel catalysts showed high regioselectivity in the deprotection of per O acetylated nucleosides The article by Robson Carlos Alnoch et al describes the protocol and use of a new generation of tailor made bifunctional supports activated with alkyl groups that allow the immobilization of proteins through the most hydrophobic region of the protein surface and aldehyde groups that allows the covalent immobilization of the previously adsorbed proteins These supports were especially used in the case of lipase immobilization The immobilization of a new metagenomic lipase LipC12 yielded a biocatalyst 3 5 fold more active and 5000 fold more stable than the soluble enzyme The PEGylated immobilized lipase showed high regioselectivity producing high yields of the C 3 monodeacetylated product at pH 5 0 and 4 C Hybrid catalysts composed of an enzyme and metallic complex are also treated in this Special Issue The article by Christian Herrero et al describes the development of the Mn TpCPP Xln10A artificial metalloenzyme obtained by non covalent insertion of Mn III meso tetrakis p carboxyphenyl porphyrin Mn TpCPP 1 Mn into xylanase 10A from *Streptomyces lividans* Xln10A The complex was found able to catalyze the selective photo induced oxidation of organic substrates in the presence of RuII bpy 3 2 as a photosensitizer and CoIII NH<sub>3</sub> 5Cl 2 as a sacrificial electron acceptor using water as oxygen atom source The two published reviews describe different subjects with interest in the fields of biocatalysis and mix metallic biocatalysis respectively The review by Anika Scholtissek et al describes the state of the art regarding ene reductases from the old yellow enzyme family OYEs to catalyze the asymmetric hydrogenation of activated alkenes to produce chiral products with industrial interest The dependence of OYEs on pyridine nucleotide coenzyme can be avoided by using nicotinamide coenzyme mimetics In the review three main classes of OYEs are described and characterized The review by Yajie Wang and Huimin Zhao highlights some of the recent examples in the past three years that combine transition metal catalysis with enzymatic catalysis With recent advances in protein engineering catalyst synthesis artificial metalloenzymes and supramolecular assembly there is great potential to develop more sophisticated tandem chemoenzymatic processes for the synthesis of structurally complex chemicals In conclusion these nine

publications give an overview of the possibilities of different catalysts both traditional biocatalysts and hybrids with metals or organometallic complexes to be used in different processes particularly in synthetic reactions under very mild reaction conditions More Synthetic Approaches to Nonaromatic Nitrogen Heterocycles, 2 Volume Set Ana Maria Faisca

Phillips, 2022-04-11 More Synthetic Approaches to Nonaromatic Nitrogen Heterocycles An authoritative collection of resources discussing the latest trends in the synthesis of nonaromatic nitrogen heterocycles Widely distributed in nature nitrogen heterocycles are extremely common in synthetic substances found in pharmaceuticals agrochemicals and materials The literature is evolving rapidly and explores newly emerging structures and medicines More Synthetic Approaches to Nonaromatic Nitrogen Heterocycles offers R D professionals the opportunity to easily access a collection of the latest relevant research in the area In the second two volume set of this practical reference distinguished researcher Dr Ana Maria M M Faisca Phillips delivers a collection of resources focusing on the newest and most widely applicable trends emerging in synthetic strategies for nonaromatic nitrogen heterocycles With coverage of topics including organocatalysis cascade reactions flow chemistry in synthesis cycloaddition reactions metathesis cross coupling reactions and electrochemistry the book provides quick access to critical new avenues of synthesis More Synthetic Approaches to Nonaromatic Nitrogen Heterocycles Volume 1 and 2 also offers readers A thorough introduction to recent advances in the design and synthesis of cyclic peptidomimetics Comprehensive explorations of fused heterocycles and transition metal promoted synthesis of isoindoline derivatives Practical discussions of 1,4-diazepane ring based systems and recent advances in the synthesis of azepane based compounds In depth examinations of strained aziridinium ions asymmetric organocatalysis in alternative media and the electrochemical synthesis of non aromatic N heterocycles Perfect for academic and industrial researchers in organic chemistry and synthesis organometallic chemistry pharmaceutical chemistry catalysis and sustainable chemistry More Synthetic Approaches to Nonaromatic Nitrogen Heterocycles Volume 1 and 2 is an indispensable reference for anyone seeking an authoritative source of information on new and emerging trends in synthesis **Tools and Applications of**

**Biochemical Engineering Science** K. Schügerl, A.-P. Zeng, 2003-07-01 This special volume Tools and Applications of Biochemical Engineering Science is dedicated to Professor Wolf Dieter Deckwer on the occasion of his 60th birthday It was a great pleasure for me to act together with Professor Karl Schtiggerl as volume editor and to present here a collection of 11 outstanding review articles written mainly by former students associates colleagues and friends of Wolf Dieter Deckwer The title of this special volume well reflects the research interests and scientific pursuit of Wolf Dieter Deckwer during his more than 20 years work in the area of biochemical engineering particularly during the last 15 years when he was the head of the Biochemical Engineering Division of GBF German National Research Center for Biotechnology He has decisively pushed the development not only of software tools ranging from analytical means and mathematical models for monitoring and understanding cellular processes to gene expression systems for designing microorganisms but also of hardware tools such

as computer control systems bioreaction and separation devices for effectively producing a variety of bioproducts on semi production scale New developments in some of these important tools in biochemical engineering are reviewed in articles included in this volume Wolf Dieter Deckwer was among the leading biochemical engineers who timely pointed out the necessity of applying these tools in an integrated manner for bioprocess development By establishing Integrated Bioprocess Development as one of the GBF main search topics as early as 1990 he also actively promoted this idea

*Biotransformations* K. Faber, 2003-06-30 Whereas the hydrolases such as proteases esterases and lipases are sufficiently well researched to be applied in every standard laboratory other types of enzymes are still waiting to be discovered with respect to their applicability in organic chemistry transformations on a preparative scale This latter point is stressed here with the focus on the newcomer enzymes which show great synthetic potential Modern Aldol Reactions, 2 Volume Set Rainer Mahrwald, 2004-08-06 At long last the complete spectrum of the aldol reaction is presented here in this two volume handbook Top authors guarantee contributions of the highest quality beginning with fundamentals and then moving on to enolates and catalytic aldol reactions including the Mukaiyama Reaction Further sections are devoted to enzymatic aldol reactions in synthesis as well as such related reactions as the Henry Ene and Aldol Tishchenko reactions The wealth of information contained here allows a comprehensive overview of this important topic in organic chemistry removing the need for the hitherto time consuming research among the widely dispersed literature With a foreword by Professor D A Evans

*Analysis of Chiral Organic Molecules* Peter Schreier, Alexander Bernreuther, Manfred Huffer, 2011-06-01 No detailed description available for Analysis of Chiral Organic Molecules **Greene's Protective Groups in Organic Synthesis** Peter G. M. Wuts, 2014-08-08 An indispensable reference for any practicing synthetic organic or medicinal chemist this book continues the tradition of Greene's as comprehensive in the overall scope of coverage providing the most relevant and useful examples to illustrate each methodology Presents valuable material on the application of protective groups in organic chemistry that is not easily found by casual searching Helps chemists to plan investigate and carry out organic syntheses in an efficient manner Adds over 2800 new references to update since the publication of the last edition Reviews of the prior edition An essential bible for the library or personal bookshelf of chemists performing complex synthesis CHOICE May 2007 the most up to date compilation available should be an integral part of all institutional libraries it is also highly recommended that individuals maintain their own copy Journal of Medicinal Chemistry March 8 2007 continues to be a comprehensive guide to the techniques for the formation and cleavage of protective groups Journal of the American Chemical Society January 31 2007 **Bioorganic Chemistry** F.P. Schmidtchen, 2000-02-14 Springer Desktop Editions in Chemistry is a paperback series that offers selected thematic volumes from Springer chemistry review series to graduates and scientists in industry and academia at affordable prices Each volume presents an area of topical interest *Reagents, Auxiliaries, and Catalysts for C-C Bond Formation* Robert M. Coates, Scott E. Denmark, 1999-07-09 Aus dem bestehenden Material der

Encyclopedia of Reagents for Organic Synthesis EROS werden Paquette und die Herausgeber 500 bevorzugte Reagenzien ausgewählt die dann in 4 Bände entsprechend ihrer Klassifikation eingeteilt werden z.B. Oxidations- und Reduktionsreagenzien. Die endgültigen Titel der Bände werden festgelegt sobald die Auswahl der 500 Reagenzien vorgenommen wurde. Jeder Band wird sich in Umfang und Struktur an EROS orientieren und hier erfolgt eine Einleitung die ausgewählten Reagenzien erscheinen in alphabetischer Reihenfolge und es gibt jeweils einen Index zu Reagenzien, Autoren und Themenkomplexen. Für jedes Reagenz werden die physikalischen und chemischen Daten detailliert angegeben so daß der Leser den Gebrauch der jeweiligen Reagenz versteht und sicher mit ihr arbeiten kann.

**Dietary Carbohydrate Digestibility and Metabolic Effects in Human Health** F. Javier Moreno, Oswaldo Hernandez-Hernandez, Robert Rastall, 2019-12-09 *Industrial Biotechnology* Wim Soetaert, Erick J. Vandamme, 2010-03-30 Describing all topics of white biotechnology admitted to the 7th EU Frame Programme and new industrial production processes aiming towards the Kyoto objectives this comprehensive overview covers the technology applications economic potential and implications for society. Directed at readers with a general interest in a specific technology this is equally suitable as an introductory handbook to a wide range of industries including chemicals biotechnology and pharmaceuticals food and feed paper and pulp personal care energy and agriculture.

*Pharmaceutical Biocatalysis* Peter Grunwald, 2019-11-07 This volume provides an insight into the future strategies for commercial biocatalysis with a focus on sustainable technologies together with chemoenzymatic and biotechnological approaches to synthesize various types of approved and new active pharmaceutical ingredients (APIs) via proven and latest synthetic routes using single step biocatalytic or enzyme cascade reactions. Many of these drugs act as enzyme inhibitors as discussed in a chapter with a variety of examples. The targeted enzymes are involved in diseases such as different cancers metastatic and infectious diseases osteoporosis and cardiovascular disorders. The biocatalysts employed for API synthesis include hydrolytic enzymes alcohol dehydrogenases laccases imine reductases reductive aminases peroxygenases cytochrome P450 enzymes polyketide synthases transaminases and halogenases. Many of them have been improved with respect to their properties by engineering methods. The book discusses the syntheses of drugs including alkaloids and antibiotics non ribosomal peptides antimalarial and antidiabetic drugs prenylated xanthenes antioxidants and many important chiral intermediates required for the synthesis of pharmaceuticals.

**Science of Synthesis: Biocatalysis in Organic Synthesis Vol. 3** Kurt Faber, Wolf-Dieter Fessner, Nicholas J. Turner, 2015-03-11 The three Science of Synthesis volumes on Biocatalysis in Organic Synthesis present a broad contemporary overview on the state of the art in enzymatic methods for asymmetric synthesis suitable for academics and industrial researchers working in the field of organic synthesis. The goal is to start a new wave of enthusiasm for biocatalysis in the broader community and to give an overview of the field. Biocatalysis in Organic Synthesis offers critical reviews of organic transformations by experts including experimental procedures. The organization is based on the type of reaction performed under biocatalysis. Volume 3 begins with oxidation. A



chapter on enzyme catalyzed dihydroxylation is followed by reviews of alkane oxidation Oxidations of alcohols carbonyl compounds and heteroatoms are covered as are halogenations The use of biocatalysts in total synthesis cascade reactions and large scale industrial applications is considered Finally emerging trends are discussed

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