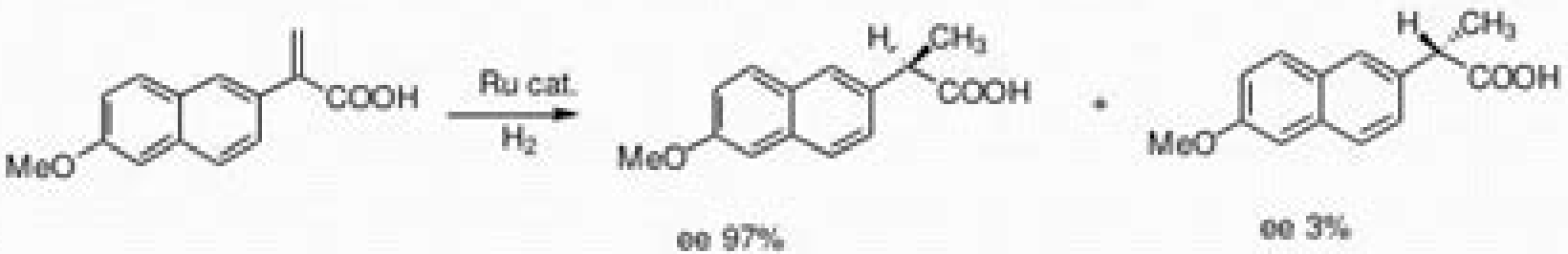
What is asymmetric synthesis?

Asymmetric synthesis or Stereoselective synthesis

A chemical reaction (or reaction sequence) in which one or more new elements of chirality are formed in a substrate molecule and which produces the stereoisomeric (enantiomeric or diastereoisomeric) products in unequal amounts. Traditionally called *asymmetric synthesis*.



What do we mean by asymmetric synthesis – a reaction that creates one configuration of new stereogenic elements by the action of a chiral reagent chiral auxillary or solvent acting on heterotopic (enantiotopic or diastereotopic) faces, atoms or groups of a substrate.

Asymmetric Synthesis

M Walker

Asymmetric Synthesis:

Principles of Asymmetric Synthesis R.E. Gawley,J. Aubé,1996-11-21 The world is chiral Most of the molecules in it are chiral and asymmetric synthesis is an important means by which enantiopure chiral molecules may be obtained for study and sale Using examples from the literature of asymmetric synthesis more than 1300 references the aim of this book is to present a detailed analysis of the factors that govern stereoselectivity in organic reactions It is important to note that the references were each individually checked by the authors to verify relevance to the topics under discussion The study of stereoselectivity has evolved from issues of diastereoselectivity through auxiliary based methods for the synthesis of enantiomerically pure compounds diastereoselectivity followed by separation and auxiliary cleavage to asymmetric catalysis In the latter instance enantiomers not diastereomers are the products and highly selective reactions and modern purification techniques allow preparation in a single step of chiral substances in 99% ee for many reaction types After an explanation of the basic physical organic principles of stereoselectivity the authors provide a detailed annotated glossary of stereochemical terms A chapter on Analytical Methods provides a critical overview of the most common methods for analysis of stereoisomers The authors then follow the tried and true format of grouping the material by reaction type Thus there are four chapters on carbon carbon bond forming reactions enolate alkylations organometal additions to carbonyls aldol and Michael reactions and cycloadditions and rearrangements one chapter on reductions and hydroborations carbon hydrogen bond forming reactions and one on oxidations carbon oxygen and carbon nitrogen bond forming reactions Leading references are provided to natural product synthesis that have been accomplished using a given reaction as a key step In addition to tables of examples that show high selectivity a transition state analysis is presented to explain to the current level of understanding the stereoselectivity of each reaction In one case Cram s rule the evolution of the current theory is detailed from its first tentative 1952 postulate to the current Felkin Anh Heathcock formalism For other reactions only the currently accepted rationale is presented Examination of these rationales also exposes the weaknesses of current theories in that they cannot always explain the experimental observations These shortcomings provide a challenge for future mechanistic investigations

Catalysis in Asymmetric Synthesis Vittorio Caprio,Jonathan M. J. Williams,2009-03-09 Catalysis in Asymmetric Synthesis 2nd Edition Asymmetric synthesis has become a major aspect of modern organic chemistry The stereochemical properties of an organic compound are often essential to its bioactivity and the need for stereochemically pure pharmaceutical products is a key example of the importance of stereochemical control in organic synthesis However achieving high levels of stereoselectivity in the synthesis of complex natural products represents a considerable intellectual and practical challenge for chemists Written from a synthetic organic chemistry perspective this text provides a practical overview of the field illustrating a wide range of transformations that can be achieved The book captures the latest advances in asymmetric catalysis with emphasis placed on non enzymatic methods Topics covered include Reduction of alkenes

ketones and imines Nucleophilic addition to carbonyl compounds Catalytic carbon carbon bond forming reactions Catalytic reactions involving metal carbenoids Conjugate addition reactions Catalysis in Asymmetric Synthesis bridges the gap between undergraduate and advanced level textbooks and provides a convenient point of entry to the primary literature for the experienced synthetic organic chemist Principles and Applications of Asymmetric Synthesis Guo-Qiang Lin,Yue-Ming Li,Albert S. C. Chan,2001-02-21 Asymmetric synthesis remains a challenge to practicing scientists as the need for enantiomerically pure or enriched compounds continues to increase Over the last decade a large amount of literature has been published in this field Principles and Applications of Asymmetric Synthesis consolidates and evaluates the most useful methodologies into a one volume resource for the convenience of practicing scientists and students Authored by internationally renowned scientists in the field this reliable reference covers more than 450 reactions and includes important stoichiometric as well as catalytic asymmetric reactions The first chapter reviews the basic principles common nomenclature and analytical methods and the remainder of the book is organized according to reaction type The text examines such topics as Carbon carbon bond formations involving carbonyls enamines imines and enolates Asymmetric C O bond formations including epoxidation dihydroxylation and aminohydroxylation Asymmetric synthesis using the Diels Alder reaction and other cyclizations Applications to the total synthesis of natural products Use of enzymes in asymmetric synthesis Practicing chemists in the pharmaceutical fine chemical and agricultural professions as well as graduate students will find that Principles and Applications of Asymmetric Synthesis affords comprehensive and current coverage *Principles of Asymmetric Synthesis* Robert E. Gawley,Jeffrey Aube,2012-05-29 The world is chiral Most of the molecules in it are chiral and asymmetric synthesis is an important means by which enantiopure chiral molecules may be obtained for study and sale Using examples from the literature of asymmetric synthesis this book presents a detailed analysis of the factors that govern stereoselectivity in organic reactions After an explanation of the basic physical organic principles governing stereoselective reactions the authors provide a detailed annotated glossary of stereochemical terms A chapter on Practical Aspects of Asymmetric Synthesis provides a critical overview of the most common methods for the preparation of enantiomerically pure compounds techniques for analysis of stereoisomers using chromatographic spectroscopic and chiroptical methods The authors then present an overview of the most important methods in contemporary asymmetric synthesis organized by reaction type Thus there are four chapters on carbon carbon bond forming reactions one chapter on reductions and one on oxidations carbon oxygen and carbon nitrogen bond forming reactions This organization allows the reader to compare the leading methods for asymmetric synthesis in an appropriate context A highlight of the book is the presentation and discussion of transition states at the current level of understanding for important reaction types In addition extensive tables of examples are used to give the reader an appreciation for the scope of each reaction Finally leading references are provided to natural product synthesis that has been accomplished using a given reaction as a key step Authoritative glossary

to aid understanding of stereochemical terminology Explanations of the key factors influencing stereoselectivity with numerous examples organized by reaction type A handy reference guide to the literature of asymmetric synthesis for practitioners in the field *Catalytic Asymmetric Synthesis* Takahiko Akiyama,Iwao Ojima,2022-05-27 Catalytic Asymmetric Synthesis Seminal text presenting detailed accounts of the most important catalytic asymmetric reactions known today This book covers the preparation of enantiomerically pure or enriched chemical compounds by use of chiral catalyst molecules While reviewing the most important catalytic methods for asymmetric organic synthesis this book highlights the most important and recent developments in catalytic asymmetric synthesis Edited by two well qualified experts sample topics covered in the work include Metal catalysis organocatalysis photoredox catalysis enzyme catalysis C H bond functionalization reactions Carbon carbon bond formation reactions carbon halogen bond formation reactions hydrogenations polymerizations flow reactions Axially chiral compounds Retaining the best of its predecessors but now thoroughly up to date with the important and recent developments in catalytic asymmetric synthesis the 4th edition of Catalytic Asymmetric Synthesis serves as an excellent desktop reference and text for researchers and students from upper level undergraduates all the way to experienced professionals in industry or academia Stereochemistry of Organic Compounds D. Nasipuri,1994 During Recent Years Stereochemistry Has Undergone A Phenomenal Growth Both In Theory And Practice With A Concomitant Increase Of Interest Among The Organic Chemists Biological Chemists Medicinal Chemists And Pharmacologists The Present Text Provides An Up To Date Coherent And Comprehensive Account Of The Subject Starting From The Fundamentals And Leading Up To The Latest Development As Far As Practicable Emphasis Has Been Placed On Symmetry Based Approach To Molecular Chirality Stereochemical Terminologies Modern Stereochemistry Is Replete With Them Topicity And Prostereoisomerism Conformational Analysis Dynamic Stereochemistry Chiroptical Properties And Assignment Of Absolute Configuration To Chiral Molecules Dynamic Stereochemistry Has Been Discussed With Reference To Conformation Reactivity Correlation Stereoselective Syntheses And Pericyclic Reactions A Large Cross Section Of Organic Reactions With Stereochemical Implication Has Been Incorporated Attempts Have Been Made To Familiarise The Readers With Modem Instrumental Techniques Nuclear Magnetic Resonance In Particular Used For Stereochemical Investigation Each Chapter Is Provided With A Summary Which Highlights The Main Points Of The Text Selective References Mostly Of Textbooks Monographs Review Articles And Significant Original Papers Have Been Given Extending Sometimes To Early 1991 The Book Is Expected To Fulfil The Long Felt Need For A Comprehensive Text On Modern Organic Stereochemistry Which Is Conspicuously Absent Since The Publication Of Professor Eliels Book In 1962 The Text May Be Adopted At Any Stage Of The University Teaching And At The Same Time Be Useful To The Practising Organic Chemists *Catalytic Asymmetric Synthesis* Iwao Ojima,2004-08-13 From the reviews of the First Edition An excellent text will no doubt provide the benchmark for comparative works for many years Journal of the American Chemical Society A resounding success the definitive current

summaries on their respective subjects Synthesis Since this important work was first published in 1993 the field of catalytic asymmetric synthesis has grown explosively spawning effective new methods for obtaining enantiomerically pure compounds on a large scale and stimulating new applications in diverse fields from medicine to materials science Catalytic Asymmetric Synthesis Second Edition addresses these rapid changes through new or substantially revised contributions from highly recognized world leaders in the field It presents detailed accounts of the most important catalytic asymmetric reactions known today discusses recent advances and retains from the previous edition essential and intriguing information on the initial development of certain processes An excellent working resource for academic researchers and industrial chemists alike the Second Edition features Contributions from Noyori Sharpless Kagan Trost Overman Shibasaki Doyle Okamoto Bolm Carreira and many other internationally renowned authorities New chapters on asymmetric carbometallations asymmetric amplification and autocatalysis and asymmetric polymerization Extended coverage of asymmetric carbene reactions including asymmetric intramolecular carbene insertion to C H bonds as well as asymmetric dihydroxylation and aminohydroxylation Extended coverage of asymmetric carbon carbon bond forming reactions and applications An appendix listing all chiral ligands in the book **Asymmetric Synthesis with Chemical and Biological Methods** Dieter Enders,Karl-Erich Jaeger,2007-04-09 Edited by two of the leading researchers in the field this book provides a deep interdisciplinary insight into stoichiometric and catalytic reactions in this continuously expanding area A plethora of top German scientists with an international reputation covers various aspects from classical organic chemistry to process development and from the theoretical background to biological methods using enzymes Throughout the focus is on the development of new synthetic methods in asymmetric synthesis the synthesis of natural and bioactive compounds and the latest developments in both chemical and biological methods of catalysis as well as the investigation of special technical and biotechnical aspects Asymmetric Synthesis Garry Procter,1996 All students studying organic chemistry need a good understanding of the methods of asymmetric synthesis In a single volume many of the most important methods of asymmetric sysnthesis are covered In self contained chapters it provides the principles of asymmetric additions to carbonyls enolate alkylation aldol reactions additions to C C double bonds reduction and oxidation rearrangements and hydrolysis esterification reactions Examples of the application in synthesis of natural products are given and selected examples are used to illustrate the various topics Chiral Reagents for Asymmetric Synthesis Leo A. Paquette,2003-08-01 Derived from the renowned Encyclopedia of Reagents for Organic Synthesis EROS the related editors have created a new handbook which focuses on chiral reagents used in asymmetric synthesis and is designed for the chemist at the bench This new handbook follows the same format as the Encyclopedia including an introduction and an alphabetical arrangement of the reagents As chiral reagents are the key for the successful asymmetric synthesis choosing the right reagents is essential in this handy reference the editors give details on how to prepare store and use the reagents as well as providing key reactions to demonstrate

where reagents have been successfully used Comprehensive information on 226 reagents Covers 64 reagents which were not included in EROS All information in one easy to use volume at an affordable price All reagents included will be added to e EROS please visit the site where you can gain access to over 50 000 reactions and 3 800 of the most frequently consulted reagents Visit www interscience wiley com eros Catalytic Methods in Asymmetric Synthesis Michelangelo Gruttadauria,Francesco Giacalone,2011-07-05 This book covers advances in the methods of catalytic asymmetric synthesis and their applications Coverage moves from new materials and technologies to homogeneous metal free catalysts and homogeneous metal catalysts The applications of several methodologies for the synthesis of biologically active molecules are discussed Part I addresses recent advances in new materials and technologies such as supported catalysts supports self supported catalysts chiral ionic liquids supercritical fluids flow reactors and microwaves related to asymmetric catalysis Part II covers advances and milestones in organocatalytic enzymatic and metal based mediated asymmetric synthesis including applications for the synthesis of biologically active molecules Written by leading international experts this book consists of 16 chapters with 2000 References and illustrations of 560 schemes and figures Asymmetric Synthesis of Natural Products Ari M. P. Koskinen,2012-06-15 Asymmetric Synthesis of Natural Products 2nd Edition introduces students to this rapidly growing field of organic chemistry The initial chapters present the foundations of asymmetric synthesis including the theory and applications of individual asymmetric reactions This is followed by chapters on each of the major individual classes of natural products their structures biosynthesis and interrelationships as well as examples of asymmetric syntheses and the practical value of these compounds Natural product classes covered include carbohydrates amino acids peptides proteins nucleosides nucleotides nucleic acids polyketides isoprenoids shikamic acid derivatives and alkaloids For this second edition the text has been thoroughly updated and expanded and includes new discussions and examples covering atom and redox economies practical aspects and environmental awareness Organocatalysis has emerged completely in the last ten years and has been fully integrated into this new edition **Asymmetric Synthesis II** Mathias Christmann,Stefan Bräse,2013-04-12 After the overwhelming success of Asymmetric Synthesis The Essentials displaying a broad range of organic asymmetric syntheses this is the second edition with latest subjects and authors While the aim of the first edition was mainly to honor the achievements of the pioneers in asymmetric syntheses the aim of this new edition was bringing the current developments especially from younger colleagues to the attention of students The format of the book remained unchanged i e short conceptual overviews by young leaders in their field including a short biography of the authors The growing multidisciplinary research within chemistry is reflected in the selection of topics including metal catalysis organocatalysis physical organic chemistry analytical chemistry and its applications in total synthesis materials research and industry The prospective reader of this book is a graduate or undergraduate student of advanced organic chemistry as well as the industrial chemist who wants to get a brief update on the current developments in the field **Dynamic Stereochemistry of Chiral Compounds**

Christian Wolf,2008 A comprehensive overview of fundamental concepts of asymmetric synthesis along with in depth discussion Recent developments that address important synthetic challenges are presented and highlighted with hundreds of examples **Asymmetric Catalysis In Organic Synthesis** Ryoji Noyori,1994-02-03 Deals with basic principles of asymmetric catalysis focusing on its synthetic significance Covers homogeneous asymmetric hydrogenation asymmetric catalysis via chiral metal complexes heterogeneous catalysis and non organometallic catalysis The collection of a range of stereoselective reactions illustrate various strategies and methodologies as well as their general utility **Advances in Asymmetric Synthesis** Alfred Hassner,1999-02-18 Enantioselective synthetic methods are not only in the forefront of chemical and pharmaceutical research but activity in this area is constantly increasing It is stimulated by the urgency to obtain drugs or compounds of medicinal interest as single anantiomers and the keeness to synthesize natural products in nonracemic form This volume presents seven chapters from pioneers and authorities in this rapidly expanding field

Asymmetric Organocatalysis Albrecht Berkessel,Harald Gröger,2006-03-06 Asymmetric catalysis represents still one of the major challenges in modern organic chemistry Besides the well established asymmetric metal complex catalysed syntheses and biocatalysis the use of pure organic catalysts turned out to be an additional efficient tool for the synthesis of chiral building blocks In this handbook the experienced authors from academia and industry provide the first overview of the important use of such metal free organic catalysts in organic chemistry With its comprehensive description of numerous reaction types e g nucleophilic substitution and addition reactions as well as cycloadditions and redox reactions this book targets organic chemists working in industry and academia and deserves a place in every laboratory TEXT BOOK OF PHARMACEUTICAL ORGANIC CHEMISTRY-III Mrs. Pradnya A. Bhosle (Kshirsagar),2025-04-21 This Textbook of Pharmaceutical Organic Chemistry III is a comprehensive resource designed for students and professionals in the field of pharmaceutical sciences It covers the fundamental principles of stereochemistry including optical geometrical and conformational isomerism which are crucial in drug design and medicinal chemistry The book provides an in depth study of chirality racemic modifications and resolution techniques ensuring a strong conceptual foundation in stereochemistry A major focus is given to heterocyclic chemistry detailing the synthesis reactivity and medicinal applications of important heterocyclic compounds such as pyrrole furan thiophene pyrazole imidazole oxazole thiazole pyridine quinoline acridine indole pyrimidine purine and azepines Their relevance in pharmaceutical applications is extensively discussed Additionally the book explores stereospecific and stereoselective reactions crucial in pharmaceutical synthesis and emphasizes their role in the development of bioactive molecules It also delves into important organic reactions of synthetic significance such as metal hydride reductions Clemmensen reduction Birch reduction Wolff Kishner reduction Oppenauer oxidation Dakin reaction and various rearrangements With a structured and student friendly approach this book serves as an essential guide for understanding reaction mechanisms synthesis strategies and the chemical behavior of pharmaceutical compounds It is a

valuable resource for pharmacy students researchers and professionals involved in organic synthesis and drug development

Fundamentals of Asymmetric Catalysis Patrick J. Walsh,Marisa C. Kozlowski,2009-01-02 This book describes the essential aspects of enantioselective catalysis in a clear logical fashion with chapters organized by concept rather than by reaction type The field of asymmetric catalysis plays an increasingly large role in chemical synthesis as the demand for single enantiomer starting materials intermediates and products rises This book describes the essential aspects of enantioselective catalysis in a clear logical fashion with chapters organized by concept rather than by reaction type Each concept is supported by carefully selected examples to give the reader broad exposure to a wide range of catalysts reactions and reaction mechanisms This book is designed to introduce advanced undergraduate or graduate chemistry students to asymmetric catalysis It can be used as the primary text in a course on this topic or as a reference by researchers who wish to increase their understanding It is also intended for synthetic chemists who wish to increase their likelihood for success when faced with the prospect of using asymmetric catalysts 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 ausw hlen die dann in 4 B nde entsprechend ihrer Klassifikation eingeteilt werden z B Oxidations und Reduktionsreagenzien Die endg ltigen Titel der B nde werden festgelegt sobald die Auswahl der 500 Reagenzien vorgenommen wurde Jeder Band wird sich in Umfang und Struktur an EROS orientieren d h er verf gt ber eine Einleitung die ausgew hlten Reagenzien erscheinen in alphabetischer Reihenfolge und es gibt jeweils einen Index zu Reagenzien Autoren und Themenkomplexen F r jedes Reagenz werden die physikalischen und chemischen Daten detailliert angegeben so da der Leser den Gebrauch der jeweiligen Reagenz versteht und sicher mit ihr arbeiten kann

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