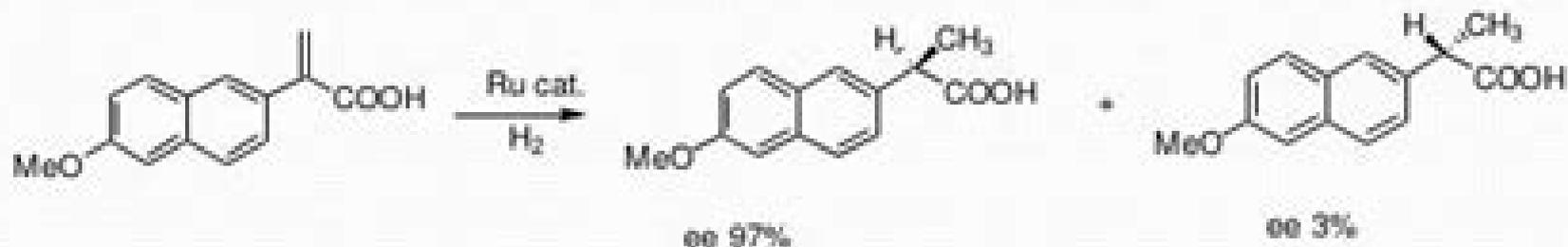


What is asymmetric synthesis?

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 auxiliary or solvent acting on heterotopic (enantiotopic or diastereotopic) faces, atoms or groups of a substrate.

Asymmetric Synthesis

**Guo-Qiang Lin, Yue-Ming Li, Albert S. C.
Chan**



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

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 **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

Catalytic Asymmetric Synthesis Iwao Ojima, 2013-03-14 Praise for the previous editions An excellent text will no doubt provide the benchmark for comparative works for many years Journal of the American Chemical Society An excellent state of the art compilation of catalytic asymmetric chemistry should be included in any chemistry reference collection Choice This is a tremendous resource and an excellent read I recommend immediate purchase Perkin Transactions 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 Third Edition addresses these rapid changes through contributions from highly recognized world leaders in the field This seminal text presents detailed accounts of the most important catalytic asymmetric reactions known today and discusses recent advances and essential information on the initial development of certain processes An excellent working resource for academic researchers and industrial chemists alike the Third Edition features Six entirely new chapters focusing on novel approaches to catalytic asymmetric synthesis including non conventional media conditions organocatalysis chiral Lewis and Bronsted acids CH activation carbon heteroatom bond forming reactions and enzyme catalyzed asymmetric synthesis A new section focusing on the important new reaction asymmetric metathesis in carbon carbon bond forming reactions Updated chapters on hydrogenation carbon carbon bond forming reactions hydrosilylations carbonylations oxidations amplifications and autocatalysis and polymerization reactions Retaining the best of its predecessors but now thoroughly up to date Catalytic Asymmetric Synthesis Third Edition serves as an excellent desktop reference and text for researchers and students from the upper level undergraduates through 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 Modern 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

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

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

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 synthesis 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

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

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 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

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 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

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 enantiomers and the keenness to synthesize natural products in nonracemic form This volume presents seven chapters from pioneers and authorities in this rapidly expanding field

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 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

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

Asymmetric Synthesis Alan Aitken,S. N. Kilenyi,1992-12-30 Asymmetric synthesis is one of the most important

areas of research and development in synthetic organic chemistry and has wide ranging industrial applications This introduction to the subject covers chirality nomenclature and analytical methods of resolution The main body of the text describes the principal methods available to the organic chemist wishing to synthesize chiral compounds Case studies are included and reference sections allow access to the relevant review and research literature This book is written for organic chemists at postgraduate and advanced undergraduate level Asymmetric Synthesis of Natural Products Ari M. P. Koskinen, 2022-09-09 Asymmetric Synthesis of Natural Products Fully updated learning resource covering the concept of using natural product chemistry for strategies in asymmetric synthesis The third edition of Asymmetric Synthesis of Natural Products introduces students to the rapidly growing field of natural products in organic chemistry discussing the practical mainly pharmacological importance of selected compounds and emphasizing the target oriented approach of organic synthesis which is key in industrial strategies To aid in reader comprehension the text includes key references and an Index of Compounds The textbook is based on two lecture courses Asymmetric Synthesis Asymmetric Synthesis of Natural Products which the author has delivered more than 50 times over the past 20 years in Finland the UK Italy and Greece This third edition is fully updated from the earlier versions published by Wiley in 1993 and 2012 The importance of natural products as truly renewable raw materials in sustainable chemistry and circular economy is illustrated through applications of e g organocatalysis organometallic catalysis and biocatalysis The contents consist of traditional text supplemented with illustrations such as chemical drawings and structural formulae Three dimensional aspects are also discussed with the use of 3D renderings of structures for both reaction mechanisms molecular modeling and crystallographic data Sample topics covered in the textbook include The foundations of asymmetric synthesis including the theory and applications of individual asymmetric reactions Sustainable development the circular economy and use of renewable raw materials that have become prominent in many fields of science and technology Various natural product classes including carbohydrates amino acids peptides proteins nucleosides nucleotides nucleic acids and polyketides The properties of these natural product classes including their structures biosynthesis and interrelationships as well as examples of asymmetric syntheses and the practical value of these compounds Asymmetric Synthesis of Natural Products is a comprehensive authoritative and up to date learning resource on the subject for advanced level undergraduate or early stage graduate students It is also useful for specialists already working in synthesis who wish to learn about asymmetric synthesis

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Table of Contents Asymmetric Synthesis

1. Understanding the eBook Asymmetric Synthesis
 - The Rise of Digital Reading Asymmetric Synthesis
 - Advantages of eBooks Over Traditional Books
2. Identifying Asymmetric Synthesis
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Asymmetric Synthesis
 - User-Friendly Interface
4. Exploring eBook Recommendations from Asymmetric Synthesis
 - Personalized Recommendations
 - Asymmetric Synthesis User Reviews and Ratings
 - Asymmetric Synthesis and Bestseller Lists
5. Accessing Asymmetric Synthesis Free and Paid eBooks
 - Asymmetric Synthesis Public Domain eBooks
 - Asymmetric Synthesis eBook Subscription Services
 - Asymmetric Synthesis Budget-Friendly Options

6. Navigating Asymmetric Synthesis eBook Formats
 - ePub, PDF, MOBI, and More
 - Asymmetric Synthesis Compatibility with Devices
 - Asymmetric Synthesis Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Asymmetric Synthesis
 - Highlighting and Note-Taking Asymmetric Synthesis
 - Interactive Elements Asymmetric Synthesis
8. Staying Engaged with Asymmetric Synthesis
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Asymmetric Synthesis
9. Balancing eBooks and Physical Books Asymmetric Synthesis
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Asymmetric Synthesis
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Asymmetric Synthesis
 - Setting Reading Goals Asymmetric Synthesis
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Asymmetric Synthesis
 - Fact-Checking eBook Content of Asymmetric Synthesis
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

-
- Interactive and Gamified eBooks

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