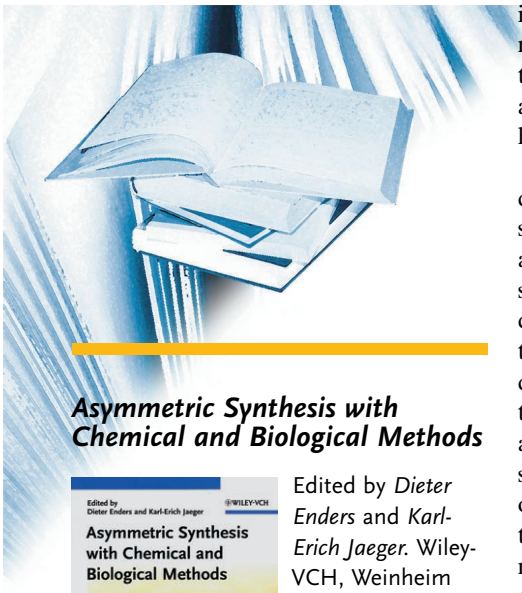
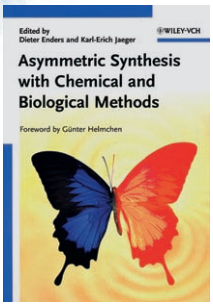


Asymmetric Synthesis with Chemical and Biological Methods



Edited by *Dieter Enders* and *Karl-Erich Jaeger*. Wiley-VCH, Weinheim 2007. 446 pp., hardcover € 149.00.—ISBN 978-3-527-31473-7

The SFB 380 is dead. Long live the SFB 380. During the 12 years of intensive research and collaboration (1994–2005), the legendary SFB 380 program of the German Research Association made its mark on asymmetric synthesis. The evidence of that has now been made available by Wiley-VCH in the form of a comprehensive handbook, which collects together the results from about 20 different research groups. These results are concerned with many different areas of organic and organometallic chemistry, and with microbiological and enzymatic processes in stereoselective C-H, C-C, and C-heteroatom bond-forming reactions.

The first third of the book describes equimolar asymmetric syntheses. First, D. Enders and W. Bettray report on new enantioselective methods for the formation of C-C bonds. A following chapter from the same group describes results on total syntheses of natural products using the well-known SAMP and RAMP methodologies. Next, H.-J. Gais has developed asymmetric C-C bond-forming reactions based on the use of α-sulfonyl and α-sulfonimidoyl carbanions. The effectiveness of this new method has been proven by numerous applications. A. Salzer and W. Braun describe how they have developed daniphos ligands and applied them to asymmetric organic syntheses. C. Ganter ends this part of the book with an article about the development of new types of heterometallocenes.

The second part of the book is devoted to catalytic asymmetric syntheses. C. Bolm describes the development and use of chiral sulfoximines, and in a separate chapter the same author describes asymmetric aryl transfer reactions. S. Bräse presents an overview of the development of paracyclophanes and their use as ligands in 1,2- and 1,4-addition reactions. H.-J. Gais, in a second contribution, describes progress on the development of an enantioselective palladium-catalyzed allylalkylation method. W. Leitner and colleagues give an overview of the development of quinaphos ligands and their applications to the asymmetric hydrogenation of functionalized olefins and aromatic ketones, asymmetric 1,4-addition reactions of carbanions, asymmetric hydrovinylations, and the cycloisomerization of 1,6-dienes. This second part ends with an article by Hölderich and co-workers reviewing progress on the immobilization of transition-metal complexes and their use in asymmetric hydrogenations, epoxidations, and epoxide-opening reactions.

The third part is concerned with biological methods for asymmetric synthesis. K.-E. Jaeger and colleagues discuss their research on the direct evolution of benzoyl formiate decarboxylase. In reactions using selected variants of this enzyme, it was possible to isolate the corresponding α-hydroxyketones with very high enantioselectivity. Sahm and co-workers describe the structures and activity mechanisms of thiamine-based enzymes: transketolases, decarboxylases, and aldolase I. M.-R. Kula's research group describes work on C-C bond-forming enzymes (α-ketocarboxylic acid decarboxylases and hydroxynitrile lyases). These enzymes are very interesting tools, especially as they can, in principle, offer a method for the synthesis of chiral α-hydroxylated carbonyl compounds. In the following chapter, M. Müller and W. Hummel describe methods for the regioselective asymmetric reduction of ketones by the use of alcohol dehydrogenases in the presence of isopropanol. This transformation is also a valuable method, because the problem of the related Meerwein–Ponndorf–Verley–Oppenhauer series does not at present have a general solution. This applies especially to the examples of the aliphatic ketones that are discussed in the article. The authors were able to show that, in combination with the benzoyl formiate decarboxylase mentioned above, their method provides an elegant route to chiral 1,2-diols with specific configurations. W.-D. Fessner presents an overview of the use of enzymes in asymmetric C-C bond-forming reactions, in which different aldolases are used to achieve the desired results. L. Elling describes progress on broadening the range of biochemical properties and applications of recombinant sucrose synthase. M.-K. Kula's group, in a second very nice contribution, demonstrates the possibilities for achieving asymmetric reductions in combination with C-C bond-forming reactions. The chiral 1,2-diols and propargyl alcohols obtained by these enzymatic transformations are valuable building blocks for total syntheses of natural products. At this point there is some overlapping with the contents of the review by M. Müller and W. Hummel. Lastly, Wandrey and colleagues end the book with an overview of technological applications of asymmetric syntheses, which covers applications of organometallic complexes as well as microbiological and enzymatic processes.

This book should be read by everybody who is working in the area of asymmetric syntheses. It is suitable not only for students and post-graduate doctoral candidates, but also for scientists in academia and industry. In a way that no other work has done, it shows not only that a combination of chemical and biochemical methods makes it possible to synthesize a wide variety of target molecules, but also that a cross-fertilization between these two disciplines can bring great benefits for both. The SFB 380 is dead—but the SFB 380 lives on.

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