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Book Review

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Modern aldol reactions, 2 volume set

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The aldol reaction is one of the most widely used carbon–carbon bond-forming reactions in organic synthesis, and remarkable advances in methodology for the stereoselective synthesis of chiral aldol products have been achieved in recent years. The task of compiling a comprehensive review of this rapidly expanding area is a daunting one, as illustrated by a *Chemical Abstracts* search that reveals over 13 000 reports on some form of the aldol reaction, with over 650 reports having appeared in 2004 alone! Consequently, the authors involved in producing this outstanding two-volume monograph are to be congratulated for producing a great review of aldol chemistry in a highly readable format.

This monograph has been produced as a two-volume set following the tradition of the Wiley–VCH series of organic chemistry textbooks, by inviting a series of expert authors to contribute individual chapters on selected topics in aldol chemistry. Volume 1 is entitled *Enolates, Organocatalysis, Biocatalysis and Natural Product Synthesis*, and achieves its aim in providing a pretty good coverage of these areas. It commences with a chapter on the basics of enolate chemistry, firmly establishing the principles that govern their addition to carbonyl compounds, which serves as an important revision element to researchers less familiar with the fundamentals of the aldol reaction. The following two chapters on titanium, boron, and silicon enolates delve more deeply into the principles of aldol stereocontrol, demonstrating how a detailed knowledge of aldol transition states can enable synthetic protocols to be designed that afford *syn*- or *anti*-aldol products in very high levels of stereocontrol. An in-depth analysis of the strategies employed to prepare chiral aldol products using 'non-catalytic' approaches is also covered, concentrating primarily on examples where chiral auxiliaries or chiral reagents have been employed for asymmetric synthesis. The subject matter changes in Chapter 4 to describe amine-catalysed aldol reactions, which provides an excellent introduction to the fast-changing world of organocatalytic aldol reactions, concentrating primarily on examples involving reaction of enamine equivalents of ketone enolates with aldehyde acceptors. The more specialized theme of biocatalytic aldol reactions is then discussed in the subsequent two chapters, with the ability of aldolases and catalytic antibodies to act as biocatalysts for stereoselective aldol or retro-aldol reactions being explored. Finally, Volume 1 concludes with a brief historical tour of the different types of aldol methodology that have been employed for synthesis of the epothilone class of natural products, which serves as an excellent complement to the other natural product syntheses that are outlined throughout this volume.

The second volume of *Modern Aldol Reactions* is simply subtitled *Metal Catalysis*, which achieves its aim of providing a comprehensive review of advances in this rapidly evolving area. The first five chapters detail recent developments in Lewis acid chemistry, concentrating heavily on the use of chiral metal complexes as asymmetric catalysts for different types of Mukaiyama aldol reaction. Therefore, the application of silver-, gold-, palladium-, boron-, silicon-, copper-, tin- and zirconium-containing Lewis acids as asymmetric catalysts for the development of a wide range of stereoselective aldol protocols is fully described. In Chapter 6, Shibasaki introduces the concept of the direct catalytic asymmetric aldol reaction, concentrating primarily on the use of bifunctional multinuclear metal catalysts for stereocontrol. Chapter 7 provides a brief, but welcome, critique of much of the preceding methodology, before describing the principle of employing Lewis base catalysts in aldol chemistry. Consequently, a detailed treatise of the ability of chiral phosphoramide ligands to catalyse the stereoselective addition of trichlorosilylenol-ethers to aldehyde acceptors is described. Finally, a brief review of the potential of the aldol–Tishchenko reaction for the 'one-pot' synthesis of monoprotected 1,3-diol fragments concludes this volume.

Overall, I found this collection to provide an excellent overview of the wide range of methodology that is currently employed for the asymmetric synthesis of chiral aldol products. In this respect, I found it invaluable for quickly determining which class of methodology was best suited for the preparation of a particular class of aldol product. As such, it is a perfect revision aid for research workers in the field who wish to familiarize themselves with recent advances in other areas of aldol chemistry. Furthermore, the inclusion of representative experimental protocols for key transformations in each chapter is particularly useful to the experimentalist who wishes to gauge the practicality of a given aldol reaction. I found that this collection of review articles provided a good historical narrative on the development of aldol chemistry, illustrated by numerous examples where different classes of aldol reaction have been applied to the synthesis of natural product targets. Since each chapter has been written by a different author, there is some overlap in concepts and coverage, whilst some research areas and contributions are dealt with in more detail than others. Nevertheless, the body of work presented in each chapter is generally well written and fair, with many authors covering the literature up to 2003, thus providing a good reflection of the current state of aldol chemistry.

In conclusion, since its arrival, this two-volume monograph has been one of the most frequently sourced reference books in my collection, having also been widely read by my research group, and other members of the department. Consequently, I recommend it highly to all students and research workers interested in synthetic organic chemistry, and conclude that it is a 'must-have' publication for all libraries serving a synthetic research community.

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