

## Book &amp; Media Reviews

**Organic Synthesis: The Science behind the Art**

by W. A. Smit, A. F. Bochkov, and R. Caple

The Royal Society of Chemistry: Thomas Graham House,  
Cambridge, UK, 1998. xx + 475 pp. ISBN 0-85404-544-9.  
\$25.00

reviewed by Arthur R. Murdoch

In this book, the authors raise the question "Why do Organic Synthesis?" Now with the power of instrumentation at the chemist's disposal, total synthesis is no longer necessary for structure proof. So where does the future of organic synthesis lie?

To answer this question, the authors present the development of the problems as attacked by the synthetic chemist. This consists of first formulation of the "Goals of an Organic Synthesis" (Chapter 1) followed by a review of the "Tactics of Synthesis" (Chapter 2). Here they "present merely a step-by-step exposure of the basic guidelines that govern the elaboration and utilization of synthetic methods as tools for the solution of organic synthesis problems." Chapter 2 comprises almost half of the book (185 pages). It is divided into sections that address the principle classes of transformations required, the "tools", in the synthesis of a target molecular structure. The process is introduced by an excellent discussion of the difference between kinetic and thermodynamic control events. The role of entropy is also presented. The authors then present the available tools for (i) building carbon-to-carbon bonds, (ii) functional group interconversions, (iii) control of selectivity, (iv) construction of cyclic systems, (v) carbon skeleton rearrangements.

Along the way they develop the concept of "synthons" and elucidate the nature of "reactive equivalence" in differing but readily interconvertible "building blocks". In this chapter, the reader is expected to have a solid foundation in basic organic chemistry, but from there, the authors lead the reader to the most recent and complex transformations in the synthetic arsenal.

Chapter 3 presents a detailed analysis of the "Strategy of Synthesis", the importance of planning the synthetic process. Herein are developed the concepts of "strategic core" and "strategic bond" as keys to the planning process. Both linear and convergent schemes are described. Special attention is focused on the retrosynthetic approach to synthesis design. The chapter ends with a review of contributions and limitations of computer-aided retrosynthetic studies. It was argued that effective planning of a synthesis required that "anyone wishing to be involved in organic synthesis—read, analyze, and store data from the current scientific literature!" It was suggested that one of the principal contributions of

computer-assisted retrosynthetic analysis was the compilation and systemization of the immense amount of information in the area of organic synthesis.

Chapter 4 presents selected examples of the more recent achievements in organic synthesis. These include preparation of "exotic" structures resulting from structure-oriented design as well as directly useful substances (e.g., pharmaceuticals) resulting from function-oriented design.

The last short chapter reviews the contributions of organic synthesis to the whole of the body of scientific knowledge. In particular, it argues the significance of model systems in the investigation of biochemical processes.

Throughout the book, the authors repeat the theme, organic synthesis is an overtly practical enterprise. They support this assertion with numerous examples of useful products that were developed either as a direct result or as a byproduct of synthetic studies. They highlight the ability, even necessity, of synthetic processes to prepare analogues to known useful substances to optimize their desirable properties. This is especially important in pharmaceutical chemistry.

A second theme, expressed in the title, is the art of the enterprise. Certainly, the craft of organic synthesis is based upon a broad foundation of studies in reaction processes and mechanisms, but it also requires an artist's creativity to perceive the relationships and processes that result in the exquisitely elegant schemes found in recent literature. Although serendipity is undoubtedly a frequent component, many of the most impressive outcomes were carefully engineered to fulfill a desired end.

The book was written with the assumption that the reader is well founded in basic organic theory. The authors build upon that foundation, culminating in the presentation of the most recent advances in synthesis of both exotic and useful substances. The reactions involved are thoroughly described and presented in well-drawn structural presentations (schemes). The book is well indexed and each chapter is heavily referenced (19 pages of densely packed references, both original papers and seminal reviews). In this respect it would be a valuable reference for anyone in the field. I was impressed with the multitude of developments that have occurred in the last few decades. This compilation would serve as an excellent review and update for organic chemists who have not remained completely current in the field as well as an excellent source for practitioners newly entering the field. While I would not recommend the book as a course text, it would provide excellent collateral reading and be an outstanding source for course lecture material. Overall, it is very readable and is highly recommended reading to anyone interested in the contributions of organic synthesis to the scientific enterprise.

*Arthur R. Murdoch is in the Department of Chemistry, Mount Union College, Alliance, OH 44601.*