Methods and Applications of Cycloaddition Reactions in Organic Synthesis

Cycloaddition reactions are indispensable tools used by organic chemists, and include not only the well-known Diels–Alder reaction [4+2] cycloaddition but also many other thermal, photochemical, and transition-metal-catalyzed cycloadditions. Chemists who are committed to the principles of step-economy and atom-economy in the synthesis of complex natural products or of new molecular structures for innovative materials are also committed to an understanding of the scope and limitations of cycloaddition reactions. Accordingly, such ring-forming reactions are of great importance and value. They are undoubtedly among those chemistry topics that are continually hot, not only because of their wide applicability, but also with regard to the development of new synthetic methods and concepts.

The book edited by Nagatoshi Nishiwaki approaches the topic of cycloaddition reactions from different directions and perspectives, through a multi-author monograph. Here the term "cycloaddition reaction" is applied quite broadly. The outline of the book does not follow a classification by reaction type or mechanism, nor is it structured according to applications. Instead, cycloaddition reactions are defined by a building-blocks approach, in which they are systematized through a formal [*m*+*n*] combination of two components giving the corresponding ring system. However, the resulting appearance of the different syntheses of carbocyclic and heterocyclic ring systems and their applications does not always seem entirely logical. In over 650 pages consisting of 20 chapters that are essentially independent, the authors discuss cycloadditions of the [2+1], [2+2], [3+2], [3+3], [4+2], [5+1], [4+3], and [5+2] types. Syntheses of small to medium-sized carbocyclic and heterocyclic rings are covered, with the additional systematization of increasing ring size (from 3 to 7). However, the reactions are not classified according to the underlying mechanism (e.g., reactions controlled by orbital symmetry, ionic or free-radical reactions, or photochemical or transition-metal-mediated transformations), nor are they subdivided according to applications. Consequently, the individual chapters give the impression of being thematically isolated.

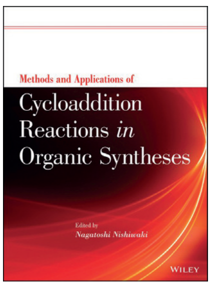
With regard to scope and complexity of the topic, the book comprises a large collection of selected—mainly author-specific—contributions to the chemistry of cycloaddition reactions. Following the idea of a multi-author volume, cycloadditions are discussed and presented from many different standpoints and views about priorities. On the one hand, this makes the book quite interesting, because autonomous chapters can be read independently. On the other hand, it fails to provide the "big deal" of a comprehensive and long-lasting review of the topic. The applications described are mainly in the synthesis of natural products. Exceptions are the two chapters that deal respectively with [4+2] cycloadditions to synthesize substituted oligoacenes through a Diels–Alder reaction (Chitoshi Kitamura) and with the synthesis of greatly extended π-conjugated systems through cycloreversion strategies (Hidemitsu Uno). Both chapters are initiatives in modern aspects of materials science. Besides dealing with the synthesis of linear acenes and more complex π-extended arenes and heteroarenes, the authors discuss parameters that might influence the packing of acenes in a single crystal, as well as certain photophysical properties in solution and in the solid state.

Although the list of [*m*+*n*] cycloadditions that are covered appears comprehensive, some other relevant topics in this field are omitted or only briefly mentioned. For example, chapters dealing with the Paterno–Büchi reaction, or with photochemically induced [2+2] cycloadditions of olefins, as well as arene–alkene cycloadditions, would certainly have been useful additions to the book. Likewise, a compilation of the various transition-metal-mediated cycloadditions, which underwent a tremendous development within the last few years, as well as a renaissance of the Wilke chemistry, would have been highly desirable. Although Chapter 20 (by H. Clavier and H. Pellissier) discusses transition-metal-catalyzed [5+2] cycloadditions briefly, this chapter focuses solely on seven-membered rings.

Therefore, this book should be regarded as a current snapshot of mainly author-specific topics on cycloaddition reactions in organic chemistry, rather than a didactically structured and coherent summary of the subject as a whole. Moreover, most chapters concentrate on the authors' own work in too much detail, so that some chapters could have been subtitled with "My cycloadditions for…".

The design, layout, and cover of this book create a good impression of high quality. Likewise, the uniform-style chemical drawings and tables, as well as the professional presentation, invite reading. Even the A4 format of the book's 672 pages does not make it too unwieldy, so that it can still be comfortably held separate from the desk area and—of course—be read.

Overall, the book is a very successful—albeit selective—collection on a fundamental topic in organic synthesis: cycloaddition reactions. It is certainly not a timeless comprehensive contribution to this field, and probably that was never intended. However, this book will be a useful



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source of selected current topics in the field. A reader who is looking for interesting snapshots within different aspects and perspectives of cycloaddition reactions will certainly find that in one or several chapters of this nice and useful book.

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