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BOOK REVIEWS

Domino Reactions in Organic Synthesis. By Lutz Tietze, Gordon Brasche, and Kersten Matthias Gericke (Georg-August-Universität, Göttingen, Germany). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim. 2006. xiv + 618 pp. $200. ISBN 3-527-29060-5.

Syntheses of complex target molecules are evaluated according to many criteria, such as overall yield, efficiency, selectivity, novelty, and elegance. As the art of organic synthesis evolves, the application of domino reactions in total syntheses has emerged as one of the most effective strategies to achieve these goals. This highly readable book represents an important and timely addition to the chemical literature and builds substantially upon previous reviews by Tietze (*Angew. Chem., Int. Ed.* **1993**, *32*, 131−163 with Beifuss and *Chem. Rev.* **1996**, *96*, 115−136), one of the leaders of this field.

A domino reaction is defined by the authors as a "transformation of two or more bond-forming reactions under identical reaction conditions, in which the latter transformations take place at the functionalities obtained in the former bond forming reactions." This definition encompasses a wide range of synthetic transformations, including classic reactions such as the Mannich reaction and Robinson annulation. In the opening chapter, the origin of the term "domino" reaction is introduced, by analogy with a cascading series of dominos, and a brief overview of the advantages and classification of such reactions are outlined. The authors recommend the use of the term "domino" reaction as preferable to the competing terms "tandem" and "cascade" reactions. The older term "tandem" they suggest is limiting because it should only be applied to reactions in which *two* bonds are sequentially formed. On the other hand, they argue that although the term "cascade" suitably describes domino reactions, it also has many other scientific connotations, which make database searching more difficult.

The classification of domino reactions is not a simple task, given the wide variety of different reaction types, their order of occurrence, and the different reaction conditions that are possible. The authors classify reactions as being cationic, anionic, pericyclic, transition-metal-catalyzed, etc., with the first step of the domino reaction determining the parent category. A Mannich reaction is thus classified as an anionic domino reaction, since the first step is a nucleophilic addition of an amine onto an aldehyde. The author's own contribution of the domino Knoevenagel/hetero Diels−Alder method is classified as an anionic/pericyclic process.

The majority of the book comprises five chapters, outlining the use of cationic, anionic, radical, pericyclic, and transition-metal-catalyzed domino reactions. One of the main strengths of the book is the diversity of examples that are provided in each of these categories, particularly those utilized in total syntheses. Examples include West's elegant interrupted Nazarov cationic domino reactions, Curran's radical annulation approach to camptothecin analogues, Denmark's domino Diels−Alder/nitrone 1,3-dipolar cycloaddition approach, etc. The chapter on transition-metal-catalyzed domino reactions reinforces how much progress has been made in this area over the past few years, particularly using Pd-, Rh-, and Ru-based reactions. The remaining shorter chapters focus on more specific processes, including photochemically and enzymatically induced domino reactions, domino reactions initiated by oxidation or reduction, multicomponent reactions, and the use of special techniques, such as high-pressure, microwave-assisted, and solid-phase supported domino reactions.

For the most part the classification system works well and provides order to the many different types of domino reactions that are known in the literature. At times, unusual classifications occur, however, particularly in the differentiation between "cationic" and "anionic" processes. For example, the key transformation in Heathcock's beautiful total syntheses of the *Daphinphyllum* alkaloids, triggered by initial iminium ion formation and involving breathtaking sequences of reactions on cationic intermediates, is described as a "fivefold anionic/pericyclic" domino reaction.

Despite this minor reservation, the authors have managed to distill the enormous field of domino reactions in a systematic, concise, and clearly written manner. The coverage is by necessity selective, and for the most part more recent examples are highlighted, including over 1000 citations up to 2006. The examples cited include many methodological studies, but there is a greater emphasis on reports of applications of domino reactions in the total synthesis of natural products. This book will be of considerable interest to all practitioners of organic synthesis, and it is highly recommended for purchase by academic and industrial libraries. It should be particularly valuable to graduate students and postdoctoral fellows, and it could easily be used as the basis of an advanced graduate course. It will also surely serve as an inspiration for the development of new domino reactions and approaches.

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JA069820N

10.1021/ja069820n

10.1021/ja069820n CCC: $37.00