Book Review

The Chemistry of Pheromones and Other Semiochemicals I. Topics in Current Chemistry, 239 Edited by Stefan Schulz (Technische Universität Braunschweig). Springer: Berlin, Heidelberg, New York. 2004. xii + 240 pp. $199.00. ISBN 3-540-20828-3.

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J. Am. Chem. Soc., **2005**, 127 (28), 10118-10119• DOI: 10.1021/ja041036k • Publication Date (Web): 23 June 2005

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BOOK REVIEWS

The Chemistry of Pheromones and Other Semiochemicals I. Topics in Current Chemistry, 239. Edited by Stefan Schulz (Technische Universität Braunschweig). Springer: Berlin, Heidelberg, New York. 2004. xii + 240 pp. $199.00. ISBN 3-540-20828-3.

This two-volume set focuses mainly on insect semiochemistry, but there are also chapters on marine, mammalian, and bacterial semiochemistry. The first volume consists of five chapters, covering chemical synthesis and biosynthesis of insect pheromones, pheromones of lepidopteran and hymenopteran insects (moths and butterflies, and ants, bees, sawflies, and wasps, respectively), and chemical defense in marine organisms. All of the chapters are written by well-known authors in their respective fields.

The first chapter, on chemical syntheses of pheromones, written by the renowned pheromone chemist Mori, consists of 63 examples selected from more than 900 syntheses published between 1990 and 2003 that range in complexity from relatively simple diene structures to more complicated structures with multiple chiral centers. Although the examples cover a wide range of chemistries and reagents, the accompanying text is sparing in terms of commentary. The author does not describe why particular examples were chosen, nor does he compare the advantages and limitations of the various syntheses presented. Factors critical to testing and further development of pheromones, such as efficiency and minimizing the number of steps, appear to be subordinated to the showcasing of a particular step or reagent. Thus, the chapter is an interesting read for experts in synthesis, but ultimately I found it slightly disappointing because the author did not share his thoughts and insights into what made each of the chosen syntheses of particular interest.

Chapter 2, by Ando and co-workers, begins with a useful overview of the sex pheromones of Lepidoptera. Pheromone blends and components have been identified from more than 500 lepidopteran species, with male moths of another 1200 species being attracted to known pheromones in field-screening trials. With this large number of species, the methodical cataloguing of the compounds provided here, broken down along taxonomic lines and chemical structural classes, is invaluable. In general, the structures fall into one of two structural types. Type I compounds consist of straight-chain $C_{10}-C_{18}$ alcohols, aldehydes, and acetates, with 0−3 double bonds, whereas Type II compounds consist of $C_{17}-C_{23}$ polyunsaturated hydrocarbons, or the corresponding mono- or diepoxides. The authors provide extensive details of the variations that have been found in these structures, such as the placement of double bonds in relation to biosynthetic pathways and the identification of unusual functional groups, and the narrative is backed up by useful tables and figures. The second part of Chapter 2 is a review of methodologies used in the identification of lepidopteran pheromones. The authors focus on determination of structural features from very small amounts of materials, such as the determination of the placement and geometry of double bonds, and the difficult task of determining the absolute configuration of trace quantities of the epoxide pheromones of Type II.

The third chapter, by Jurenka, provides an update on the biosynthesis of insect pheromones, focusing on moths, beetles, flies, and cockroaches, the insect orders in which most pheromone work has been carried out. The chapter builds on work started in the 1980s, which established some of the general parameters such as chain-shortening reactions, placement of double bonds by specific desaturases, and modifications of functional groups. There is also good coverage of more recent and ongoing work on the neuroendocrine control of biosynthesis and release of pheromones, including summaries of the identification, site of production, and mode of action of pheromone biosynthesis-activating neuropeptide (PBAN) in various lepidopteran species, and its relationship with other known insect hormones. In contrast, pheromone biosynthesis is mediated by a juvenile hormone in beetles and cockroaches and by 20-hydroxyecdysone in flies. The various experiments by which these results were obtained are nicely summarized. Overall, this chapter is well laid out and provides a valuable overview of the current state of knowledge and research in this field.

I found the fourth chapter, on semiochemicals of hymenoptera (bees, ants, wasps, and sawflies), by Keeling, Pletner, and Slessor of the well-known chemical ecology group at Simon Fraser University in Canada, to be the most satisfying in this volume. It is well organized and succinctly covers a tremendous breadth of material, including both intraspecific signals (pheromones) and interspecific cues (kairomones). The authors focused on studies in which both the compounds and their particular functions have been identified, as opposed to the plethora of ambiguous studies in which lists of gland constituents have been published, with minimal or no bioassays to determine their biological activity, if any. There are excellent descriptions of the functions of the various types of semiochemicals to enable nonspecialist readers to understand the roles of compounds in a particular insect's biology. The chapter is nicely broken down into separate discussions of solitary hymenoptera, social hymenoptera, and parasitic hymenoptera, with tables summarizing the semiochemicals of each group. The authors have also provided citations of recent reviews of particular aspects of hymenopteran semiochemistry for easy follow up. The last section of the chapter, on social insects, drives home the point that our knowledge and understanding of the chemistry and function of compounds used in the organization and regulation of insect colonies comprising thousands or even millions of individuals are rudimentary at best. In short, the chapter is both an interesting read and a valuable summary of the semiochemistry of this large and very diverse insect order.

The final chapter, by Pohnert, provides an interesting contrast to the insect-related theme of the rest of the volume by reviewing strategies for chemical defenses in marine organisms, particularly plankton and seaweeds. Because of the large volume of material, the author has wisely chosen to present strategies illustrated by case studies, with numerous citations of more

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10.1021/ja041036k CCC: $30.25

detailed and comprehensive books and reviews for the interested reader. The focus is on the dynamic defenses that are activated or up-regulated in response to attack. Pohnert also stresses the difficulties in conducting bioassays that realistically reproduce the natural context in which the various compounds are used by the organisms producing them. Strategies touched upon include straightforward toxic and antifeedant effects and more subtle and delayed effects, such as inhibition of reproduction and the activation of defenses in response to grazing. Pohnert also presents the interesting paradox in which blooms of marine algae that are highly toxic to vertebrates higher up the food chain have no apparent effect on some of the organisms that feed on them directly. The breadth of chemistry involved in marine defenses is also remarkable, varying from defenses based on the acidification of tissues to pH < 1 by sulfuric acid stored in vacuoles and the production of reactive oxygen species such as O_2^- and H_2O_2, to the extremely complex structures of compounds such as the brevetoxin and prymnesin polyethers. There are also interesting parallels drawn between the activation of chemical defenses in terrestrial plants and similar examples in the marine world. Overall, the chapter presents an excellent snapshot of the types of chemical defense strategies that have been found, while pointing out instances where bioassay results and their interpretation must be viewed conservatively due to the limitations of bioassay methods and conditions.

There were two things that I found disappointing. First, the copyediting was rather poor; in one chapter I found as many as five or six errors in a page. Second, the $199 list price for a modest volume of some 220 pages of text, with the companion volume priced at $249, will put it beyond the reach of graduate students, and probably many professionals as well.

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JA041036K

10.1021/ja041036k

Polysaccharides: Structural Diversity and Functional Versatility, 2nd ed. Edited by Severian Dumitriu (University of Sherbrooke, Quebec). Marcel Dekker: New York. 2005. xviii + 1204 pp. $269.95. ISBN 0-8247-5480-8.

This book is an extremely important reference for anyone seeking knowledge about the structure, analysis, diversity, and function of polysaccharides. It should be of value to both researchers and educators, as well as to those in the pharmaceutical industry. The scope of this book is as immense as polysaccharides are diverse. Nearly 50 chapters are used to review and discuss the current status of polysaccharide research. This second edition has been nicely updated to include new subject areas as well as new developments in the previously covered material. Appropriate referencing is provided throughout.

This handbook covers each area of import in polysaccharide research, including structural analysis, methods of polysaccharide modification, property and character analysis, biosynthesis, and in vivo function. Ample space is also provided for discussions of medically important aspects of polysaccharides, including their use in pharmaceutics, as drugs such as anticoagulants, as targets of antimicrobial therapies, and in cell trafficking.

This book is the most comprehensive and timely compilation of reviews of the structure, analysis, and function of polysaccharides that is currently available. It is, therefore, a "must have" for any person involved in polysaccharide research, pharmaceutics, or education.

R. Erik Edens, *University of Arkansas Medical Sciences and Arkansas Children's Hospital*

JA0410486

10.1021/ja0410486

Modern Aldol Reactions, Volumes 1 and 2. Edited by Rainer Mahrwald (Humboldt University, Berlin). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim, Germany. 2004. 699 pp. $405.00. ISBN 3-527-30714-1.

This two-volume set provides much needed comprehensive coverage of modern aldol reactions, an area of tremendous current activity, interest, and importance. Numerous references from 2003 indicate that coverage of the literature is quite current. Each chapter contains a few sample experimental procedures that give a good feel for the equipment and techniques needed to carry out these reactions. There is also an appropriate balance of schemes and text, with the quality of the graphics being excellent throughout.

In Volume 1, Braun provides an excellent overview of aldol reactions from their earliest days to modern aspects of stereocontrol. Ghosh and Shevlin discuss the use of titanium enolates in aldol reactions comprehensively and provide an extensive section on applications in natural products synthesis. Mukaiyama and Matsuo cover the use of boron and silicon enolates in crossed aldol reactions, starting with the development of this reaction in Mukaiyama's lab, and going on to provide a good survey of the field. List surveys modern amine-catalyzed aldol reactions, emphasizing stereochemical control using proline as a catalyst. Fessner covers the preparative use of enzymes to catalyze the aldol reaction, and Tanaka and Barbas discuss the development of antibody-catalyzed aldol reactions. Volume 1 concludes with an excellent case study by Schinzer on the varied use of the aldol reaction in the synthesis of the cytotoxic agent epothilone.

The first five chapters of Volume 2 address the use of various types of Lewis acid-catalyzed aldol reactions, most notably the Mukaiyama aldol reaction of an aldehyde and silyl enol ether. Yanagisawa covers silver, gold, and palladium Lewis acids; Ishihara and Yamamoto discuss boron and silicon Lewis acids; Johnson and Nicewicz describe copper Lewis acids; Shiina covers tin-promoted aldol reactions, including a section on their application in natural product synthesis; and Yamashita and Kobayashi present the use of zirconium alkoxides as Lewis acids. Shibasaki, Matsunaga, and Kumagai describe direct aldol reactions in which a chiral metal complex catalyzes the asymmetric aldol reaction of a ketone and aldehyde without the prior formation of an enolate or enol ether. Denmark and Fujimori exhaustively review the recently developed field of Lewis base-catalyzed enantioselective aldol reactions. Finally, Volume 2 concludes with a chapter by Mahrwald on the aldol-Tischenko reaction, in which the initially formed aldol adduct is reduced to the monoprotected diol by a second molecule of the aldehyde.

The coverage of the individual chapters is excellent. However, the organization of the material by the enolate or catalyst used does not always meet the needs of the synthetic chemist who is looking for the best way to make a specific target molecule. A chapter that addressed the advantages and disadvantages of the various ways to make different types of aldol products would have been a valuable addition. The index is only seven pages and will be of limited utility in accessing the individual chapters. Despite these minor concerns, these volumes provide outstanding coverage of this important reaction and should be in all chemistry libraries. Unfortunately, the price renders it out of the reach of most individuals.

Barry B. Snider, *Brandeis University*

JA0597101

10.1021/ja0597101

Interfacial Nanochemistry: Molecular Science and Engineering at Liquid-Liquid Interfaces. Edited by Hitoshi Watarai (Osaka University), Norio Teramae (Tohoku University), and Tsuguo Sawada (Tokyo University). From the series: Nanostructure Science and Technology. Edited by David J. Lockwood. Kluwer Academic/Plenum Publishers: New York. 2005. xiv + 322 pp. $129.00. ISBN 0-306-48527-3.

Interfacial Nanochemistry is a book on the chemistry of liquid−liquid interfaces that gives a snapshot of techniques used to study the adsorption of different surface-active molecular species to the interface, the dynamical mechanical response of the interfacial deformations, questions involving the structure of the interfacial transition zone between the adjacent phases, charge and mass transfer through the interface, diffusion of single molecular species, as well as electro-, photo-, and catalytic-surface chemistry. It is a collection of papers devoted to this research area that has been discussed within the symposium *Nano-Chemistry in Liquid-Liquid Interfaces* at Pacifichem 2001.

This book brings together contributions that would otherwise stand separately. As a consequence, basic information about the same techniques is sometimes repeated, and the quality of the research varies. It is mainly addressed to the scientific specialist who is already familiar with interfacial chemistry. For the scientist entering the field, the book might appear quite terse. The nanoscopic emphasis in the title is only partially reflected in the book through theoretical studies on the nanoscopic transition in the density profile across the interface and by single molecule studies of interfacial diffusion that are evaluated, unfortunately, using bulk instead of interfacial hydrodynamics. Concerning interfacial spectroscopic techniques, such as sum-frequency or second harmonic generation spectroscopy, the chapters refer to overview articles on those techniques. Electrochemical techniques, such as cyclic voltammograms of ion transfer, are discussed in detail and are also addressed to the nonspecialist.

In summary, this book gives a valuable overview of state-of-the-art research on chemistry at liquid−liquid interfaces and the theoretical methods and experimental techniques for their study. It should be on the bookshelf of researchers active in the field.

Thomas Fischer, *The Florida State University*

JA059712L

10.1021/ja059712l

Organic Reactions, Volume 65. Edited by Larry E. Overman (University of California, Irvine). John Wiley & Sons: Hoboken, NJ. 2005. viii + 628 pp. $125.00. ISBN 0-471-68260-8.

This volume of *Organic Reactions* contains two chapters: (1) "The Passerini Reaction" by Banfi and Riva and (2) "Diels-Alder Reactions of Imino Dienophiles" by Heintzelman, Meigh, Mahajan, and Weinreb. These are followed by a list of cumulative chapter titles by volume, an author index for Volumes 1−65, and a chapter and topic index for Volumes 1−65.

JA059723E

10.1021/ja059723e

Theilheimer's Synthetic Methods of Organic Chemistry, Volume 66, 2004. Edited by Alan F. Finch (Cambridge). S. Karger AG and the Thomson Corporation: Basel. 2004. xxvi + 374 pp. $632.00. ISBN 3-8055-7854-7.

This book, the second volume of *Theilheimer* for 2004, contains abstracts of new synthetic methods and supplementary data published in the literature from October 2003 to March 2004. As with previous volumes, it also features the sections "Further Trends and Developments in Synthetic Organic Chemistry 2004" and "Reviews", which cover new developments in synthetic organic chemistry through October 2004. A detailed subject index and list of supplementary references in Volume 66 complete the book.

JA0597294

10.1021/ja0597294

High-Resolution Continuum Source AAS: The Better Way to Do Atomic Absorption Spectrometry. By Bernard Welz (Universdade Federal de Santa Caterina, Florianoplis, Brazil), Helmut Becker-Ross, Stefan Florek, and Uwe Heitmann (ISAS, Institute for Analytical Sciences, Berlin). Wiley-VCH Verlag GmbH & Co. KgaA: Weinheim, Germany. 2005. xii + 295 pp. $130.00. ISBN 3-527-30736-2.

The contents of this volume focus upon high-resolution continuum source atomic absorption spectrometry (HR-CS AAS). Although continuum source AAS has been developed over decades, work performed since 1990 in the laboratories of the authors is emphasized in this volume. HR-CS AAS employs a "hot-spot" xenon lamp, an echelle monochromator, and a charge-coupled device detector.

The work in this volume was an integral part of the dissertation of one of the authors, who are clearly experts in this field. The book is designed to be a supplement to the classic volume on atomic absorption by Welz and Sterling, and hence the fundamentals of atomic spectrometry are not considered. However, it does cover all aspects of HR-CS AAS comprehensively, including history, theory, instrumentation, interferences, and applications. The newly developed commercial instrument is described, and a section on each element provides a list of analytical wavelengths and other relevant data, including appropriate atomization parameters. The chapter on diatomic molecules has relevance to other atomic spectrometric techniques, and thus may have the most general significance. A comprehensive list of applications provides a good starting point for practical analysis.

The volume is easy to read, well laid out, and is a definitive reference on this technique. However, I am not as confident about the outlook for this technique as are the authors, who predict widespread commercialization and use for routine analysis. I have been in the atomic spectrometry community for approximately 20 years, and enhanced use of continuum source AAS has been predicted by various individuals throughout that period. In my opinion, instrument manufacturers have made enormous investments in the techniques currently available, such as hollow-cathode lamp AAS and inductively coupled plasma-mass spectrometry. For a new technique to be developed by major manufacturers and certified by regulatory agencies, clear advantages in performance or cost must be demonstrated, neither of which currently exists for this technique.

However, my views on the commercial impact of the technique should not negatively reflect on the excellent science or the clear presentation offered in this volume. I highly recommend it for readers who are involved in fundamental research using atomic spectroscopy and interested in the exciting development of high-quality instrumentation.

David J. Butcher, *Western Carolina University*

JA0597395

10.1021/ja0597395

New Techniques in Solid-State NMR. Topics in Current Chemistry, 246. Edited by Jacek Klinowski (University of Cambridge, UK). Springer: Berlin, Heidelberg, New York. 2005. x + 358 pp. $299.00. ISBN 3-540-22168-9.

This contribution to Springer's *Topics in Current Chemistry* series focuses on the set of techniques known as solid-state NMR spectroscopy. Like other serial volumes of contributed papers, this book contains an olio of articles that reflects the editor's interests in this subject. Professor Klinowski, a former film critic, has a wide-ranging curiosity about the world, as his choice of topics for inclusion in this book indicates. They range from a review of the history of magic-angle-spinning NMR technology (with proper attributions to the work of pioneers such as Doskocilová, Schneider, Andrew, and Lowe, often missed by some recent writers) to applications of NMR in complex systems such as glasses, inclusion complexes, and bone. I particularly enjoyed reading the article by Vinogradov, Madhu, and Vega on obtaining high-resolution NMR spectroscopy of protons in solids, one of the most difficult and demanding problems in NMR spectroscopy. The exposition on multiple-quantum NMR by Rocha, Morais, and Fernandez provides a useful introduction to a current major area of exploration.

Any book of contributed articles is necessarily selective, and this one is no exception. One could have chosen other interesting areas of application, such as applications of NMR spectroscopy in archaeology or geology, to include in such a book. Likewise, one could have given a whole volume to efforts to understand the chemical shielding tensors determined by solid-state NMR. There will always be topics that should have been included in a volume such as this. The papers that are included are interesting, particularly for the practicing NMR spectroscopist. The volume is probably not of sufficient general interest to the community of chemists that it should be recommended to everyone. However, those chemists who follow developments in the technology of magic-angle spinning or who seek an interesting set of examples of applications of solid-state NMR will find interesting reading in its pages.

Cecil Dybowski, *University of Delaware*

JA059751X

10.1021/ja059751x

Metal-Catalyzed Cross-Coupling Reactions, Second, Completely Revised and Enlarged Edition: Volumes 1 and 2. Edited by Armin de Meijere (George-August-Universität, Göttingen) and Francois Diederich (ETH, Zürich). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim, Germany. 2004. xxii + xxii + 916 pp. $450.00. ISBN 3-527-30518-1.

Metal-catalyzed cross-coupling has arguably been one of the most significant synthetic developments in the last 20 years, and new, updated volumes by experts in the field can help illuminate all of the exciting recent advances for interested scientists. The second edition of *Metal-Catalyzed Cross-Coupling Reactions* is the highly anticipated new account of these important transformations. As the preface to Volume 1 indicates, "cross-coupling" searches reveal more than 6500 new articles from 1998 to 2003, with increasing numbers each year. Collecting all of the recent coupling chemistry here is daunting, but should be of great value to graduate students, postdoctoral researchers, professors, and industrial chemists, who now have rapid access to this work.

The first chapter on the mechanistic aspects of metal-catalyzed C−C and C−X bond-forming reactions contains significant new advances that contribute to the understanding of these important reactions. The selection of this chapter to begin the volume nicely orients the reader to how such processes are believed to proceed. It also illustrates how mechanistic studies have lagged behind synthetic developments, putting into perspective the research that is still needed to help in the overall understanding of cross-coupling reactions. Additional subjects covered in Volume 1 are metal-catalyzed coupling reactions of organoboron compounds with organic halides, coupling reactions with organotin reagents and organosilicon compounds, the Heck reaction, coupling reactions to sp-hybridized carbon atoms, and carbometalation reactions.

Volume II includes two new topics not covered in the first edition, namely, palladium-catalyzed C−N bond-forming reactions and directed orthometalations used to construct C(aryl)−C(aryl) and C(aryl)−heteroaryl bonds. In addition, this volume has chapters on palladium-catalyzed conjugate additions to dienes, cross-coupling using π-allylmetal intermediates, palladium-catalyzed coupling to propargyl compounds, and two chapters on C−C bond-forming reactions mediated by organozinc reagents and by organomagnesium reagents. A historical introduction to palladium catalysis begins the last chapter on Negishi coupling chemistry and puts this topic into perspective.

One of the strengths of this two-volume set is that it provides the researcher with the most important, up-to-date references for each of the topics. However, some of the chapters on palladium catalysis are similar to other recently published books on this subject. Such overlap would be very difficult to avoid in reality, and the authors do their best to add new important references and text. Another strength is that most synthetic chapters have a section on experimental procedures that should be especially useful for the experimental synthetic chemist. These sections list references, general conditions for types of reactions, and even specific reaction conditions.

Overall, this 900+ page edition will be widely appreciated and should be the book to which researchers refer to expand their knowledge of metal-catalyzed cross-coupling chemistry and its usefulness. It should also be a useful handbook for benchtop researchers in the laboratory. I would therefore recommend this book for the chemistry library and the collections of industrial or academic synthetic chemists.

Jon C. Antilla, *University of Mississippi*

JA059731V

10.1021/ja059731v