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BOOK REVIEWS

Enantiomer Separation: Fundamentals and Practical Methods. Edited by Fumio Toda (Okayama University of Science, Japan). Kluwer Academic Publishers: Dordrecht, Boston, London. 2004. viii + 334 pp. $149.00. ISBN 1-4020-2336-7.

This book covers enantiomer separation, with an emphasis on separation by chiral inclusion complexes and crystallization, biological methods—especially enzymatic resolution—as well as preparative liquid and gas chromatographic methods. The first chapter by the editor, Toda, covers exclusively his own work on resolutions by inclusion complexation, with references from the 1980s to the present. Toda purposely covers practical procedures with reported percent enantiomer excesses and yields, with virtually no coverage of mechanisms of chiral recognition. The chapter should be particularly useful for those who spend a lot of time struggling with the sometimes arduous task of optical resolutions by repeated recrystallizations. The following chapter by Ogura and Akakzome covers the structure and mechanism of asymmetric resolution by a single crystalline dipeptide. Diagrams of packed layer structures of the dipeptide/inclusion compounds are presented with molecular interpretations, and the reader gets a good sense of the complexity of the phenomena of chiral recognition.

The third chapter is a review of the use of tartaric acid derivatives as chiral resolving agents. This chapter needed the attention of a copy editor, as it contains several misalignments in its tables and misspellings. Aside from this, the chapter is mostly a compilation of experimental results from select references from the 1980s to 2000. The most current references in 2003 are only listed as "accepted for publication" or "submitted for publication."

Sakamoto's intriguing chapter on the spontaneous chiral crystallization of achiral materials is highly recommended for anyone interested in the concept of chiral crystals and their space groups. This is a topic not covered in most introductory organic texts on stereochemistry, where an achiral molecule spontaneously crystallizes into a chiral space group, which then further reacts photochemically from the solid state to form a chiral product in enantiomeric excess. This is a particularly well-presented chapter with good figures and explanations. There are two complementary chapters on the concepts of preferential crystallization that focus on industrial applications. The first by Tamura and Ushio presents a logical progression of fundamental concepts of racemic conglomerates, compounds, and mixed crystals, whereas the chapter by Nohira and Sakai mostly deals with strategies for obtaining preferential enrichment.

The two chapters on enzymatic kinetic resolutions are both thorough and well referenced and make a convincing case to the reader of the power of enzymatic reactions for obtaining enantiomerically enriched molecules. Numerous examples on the use of lipases and hydrolytic enzymes are illustrated. The figures and graphs are excellent, and both chapters read well. Some of the concepts presented in these chapters would fit well into an introductory chapter.

The book ends with two chapters on the use of preparative-scale gas and liquid chromatography, respectively. Both of these chapters are recommended as good introductions to the practical aspects of the techniques, including good illustrations of the available chiral stationary phases. Capillary electrophoresis is not covered in the book, which is somewhat understandable, given that it is generally not regarded as a preparative technique. However, where analytical methods for determining enantiomer excess are discussed, it is not mentioned.

Overall, this book succeeds in covering the practical methods for separating enantiomers on a preparative scale. It is less successful in presenting the fundamentals. It lacks a solid introductory chapter, and many of the basic concepts are presented for the first time in the latter chapters. The book cannot be recommended as a text for a course, but it can be recommended as a resource for those working in the field of enantiomer separation, especially enzymatic resolutions, the practical aspects of crystallization, and preparative scale chromatography techniques.

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Dictionary of Microscopy. By Julian P. Heath (Cambridge, UK). John Wiley & Sons, Ltd: Chichester, UK. 2005. 358 pp. $49.95. ISBN 0-470-01199-8.

This dictionary was created to meet the challenge of a rapidly developing vocabulary for a rapidly expanding field. Over 2500 terms used "in the fields of light microscopy, electron microscopy, scanning probe microscopy, X-ray microscopy and related techniques" are defined here. To obtain the concise definitions, the author consulted the microscopy literature, brochures from the manufacturer, and the Web, as well as friends and colleagues, the key sources of which are either listed in the bibliography or acknowledged. There are many illustrations and technical diagrams to support the definitions in this dictionary, which also includes a list of acronyms, a bibliography, and sponsor information.

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Microwaves in Organic and Medicinal Chemistry, Volume 25. By C. Oliver Kappe and Alexander Stadler (Karl-Franzens-University Graz). From the Series, Methods and Principles in Medicinal Chemistry. Edited by R. Mannhold, H. Kubinyi, and G. Folkers. Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim. 2005. xii + 410 pp. $170.00. ISBN 3-527-31210-2.

Since the first published article in 1986 demonstrating the use of microwave heating in synthetic organic chemistry, this

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alternative method of heating chemical reactions has proven to be a useful addition to the techniques of synthetic methodology. So too should this book prove useful for scientists interested in the technique. This monograph, which contains eight chapters, is roughly divided into four topics: microwave theory, equipment, experimental theory, and a pertinent literature review.

In the first three chapters, the authors present an overview of microwave-assisted organic synthesis and a concise discussion of the theory behind microwave heating as it applies to synthesis. The theory section is well written, and there is a clear description of the differences between conventional and microwave heating. These discussions then lead to a narrative on kinetic and athermal effects in microwave heating, which includes a balanced discussion of the much debated "microwave effect." In the last chapter of this section, the authors give an overview of microwave equipment with an up-to-date description of state-of-the-art synthetic microwave instrumentation.

The next two chapters cover the fundamental considerations for carrying out a microwave synthetic reaction: solvent vs solvent-free reaction, comparison of open/closed vessels, scale-up, and methods applicable to combinatorial chemistry. The second of the two chapters provides a clear step-by-step explanation for adapting a conventional organic reaction into a comparable microwave synthetic method, as well as how to optimize and troubleshoot this reaction.

The final chapters of the book, actually about 300 of the 400 pages of the text, contain surveys of the recent literature on both general organic synthesis and combinatorial chemistry/high-throughput organic synthesis. The chapter on general organic synthesis covers a wide range of synthetic reactions of relevance to both the organic and medicinal chemists interested in utilizing microwave heating in their syntheses. The last chapter focuses on techniques that are applicable to combinatorial/high-throughput syntheses—solid-supported reagents/reactants, fluorous chemistry, and ionic liquids—and the application of focused microwave heating in these key transformations that are used especially in the development of pharmaceutical compounds.

Overall, the monograph is well written and provides both clear explanations for the inexperienced user of microwaves and detail for the experienced user. All the references are current and allow one to delve into more detail about the material presented. One weakness of the text is the focus on dedicated microwave reactors versus domestic microwave ovens. Although there are safety and reproducibility issues when using a domestic microwave for synthetic transformation, a significant portion of the currently published work on organic synthesis has been performed using this equipment. However, the very well-constructed literature review and the "how to" chapters make this a book with a great deal of useful practical information for chemists.

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Advances in Heterocyclic Chemistry, Volume 88. Edited by Alan R. Katritzky (University of Florida, Gainesville). Elsevier Academic Press: San Diego, CA. 2005. x + 324 pp. $180.00. ISBN 0-12-020788-5.

The 88th volume in this venerable series edited by Katritzky consists of four very different reviews, each of which either is a sequel to an earlier review or is to be followed by a companion chapter in a future volume in this series. The four reviews range in length from 54 to 110 pages, each including up to 15 pages of mostly post-1990 references including patents. When patents or less available sources are cited, *Chemical Abstract* reference numbers are generally given. As in previous volumes in this series, the convenient year/journal-based citation system allows direct access to the literature without requiring that the end-of-chapter bibliographies be consulted. A useful subject index is also included.

A lengthy chapter, "Microwave Irradiation for Accelerating Organic Reactions. Part I: Three-, Four- and Five-Membered Heterocycles" by El Ashry, Ramadan, Kassem, and Hagar, begins the volume. More than 2000 articles, reviews, and books have been published on microwave-assisted organic synthesis (MAOS) since the seminal 1986 papers by Gedye, Giguere, and colleagues, and a goodly number of these deal with heterocyclic synthesis. While the authors do a good job of distilling recent applications of MAOS to three−five-membered rings from this extensive literature, this chapter would have benefited from better copyediting, as there are quite a few poorly written sentences and stylistic inconsistencies, unfortunately even on the first page of the book! Given the extraordinary activity in this area it would also have been helpful to conclude the chapter with an addendum summarizing articles appearing after submission of the manuscript, e.g., as was done in a key review article missed by the authors (Kappe, C. O. *Angew. Chem., Int. Ed.* **2004**, *43*, 6250−6284).

The second chapter, "Organometallic Complexes of the η^2(N, C)-Coordinated Derivatives of Pyridine" by Sadimenko, is a dense, heavily referenced, encyclopedic listing of syntheses of 300 complexes of pyridine and fused-pyridine systems with transition and rare earth metals as well as nontransition metals. There is only the briefest general discussion of these complexes along with mention of their possible uses as catalysts, molecular wires, and luminescent materials. Interest in this chapter will be limited to specialists, who will have to consult the original references for more information on each of the many compounds.

The third and shortest chapter, "Annulated Heterocyclo-Purines II: Fused Six- and More-Membered Heterocyclo-Purinediones, -Purinones and -Purineimines" by Rybar, is a continuation of Part I published in Vol. 87 of this series. This is another "specialists-only" chapter covering synthesis of three ring systems based on purines annulated to six- and seven-membered heterocycles (e.g., pyrido-, pyrimido-, pyrazino-, triazino-, azepino-, diazepino-purines, and related oxa- and thia-heterocycles), together with brief coverage of the reactivity and biological activity of these ring systems.

"Fluorine-Containing Heterocycles. Part III: Synthesis of Perfluoroalkyl Heterocycles Using Perfluoroolefins Containing a Reactive Group at the Double Bond" by Furin completes the volume. This chapter is a continuation of Parts I and II published in Vol. 86 and 87 of this series. The author reviews syntheses of fluoroalkyl-group-containing thiazoles, dihydrothiazoles, and 1,3-thiazines as well as heterocyclic synthesis using carbonyl-group-containing fluoroolefins and perfluoroalkyl-group-containing alkynes.

Those readers whose interests take them beyond a single chapter will find that there is variation in the style of the author-prepared artwork from chapter to chapter, and sometimes even within a single chapter, e.g., use of different fonts, different conventions for designating R groups (R″ vs R^2; Bu-*t* vs Bu^t, tert.Bu, or t-Bu), different abbreviations for time and temperature (25° vs 25 °C vs 25°C), and instances of variable type size. A cursory reading of the text also reveals words inappropriately separated into syllables. These problems, as well as the copyediting shortcomings noted above, detract from an otherwise carefully prepared monograph. The chapters in this volume, when taken together with the companion chapters in Volumes 86 and 87, will certainly be useful to specialists. For this reason, this volume can be recommended for technical libraries with healthy budgets.

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Poly(arylene ethynylene)s: From Synthesis to Application. Advances in Polymer Science, Volume 177. Edited by Christoph Weder (Case Western Reserve University). Springer: Berlin, Heidelberg, New York. xii + 272 pp. $226.00. ISBN 3-540-23366-0.

Conjugated polymers are currently at the forefront of polymer science, where interest in them stems from their strong potential to be developed into a variety of advanced materials with applications in electronic, optoelectronic, and optical devices. When considering conjugated polymers, one typically first thinks of poly(phenylene vinylene) or polythiophene (PPV and PT, respectively). These materials have been the focus of much scientific research, because of their history in the area of polymer light-emitting devices (PPV) and in organic semiconductors (PT). Although having received less attention, the poly(phenylene ethynylene)s (PPEs) also possess interesting and potentially useful optical and electronic properties. This book provides a highly useful snapshot view of the field of PPEs as it stands today. It should serve as an excellent resource for active researchers as well as for beginning students interested in learning more about conjugated polymers and PPEs in particular.

The book consists of a series of chapters written by leading academic scientists whose research has focused on the synthesis, properties, and applications of PPE-type conjugated polymers and oligomers. Although the volume is not a "one-stop-shop" for beginners who need to learn everything about the area of conjugated polymers, it will serve as a resource for those interested in becoming familiar with aspects of this specialized set of conjugated materials. Overall the choice of authors and topics is good; most of the leading groups in the area are represented within the monograph. The chapters are relatively consistent with respect to writing style and depth. The quality of the printed book is excellent; the copy is clear, and the technical preparation of the book is well done. In addition to the printed volume, the publisher also provides institutions that have a standing subscription to *Advances in Polymer Science* access to an electronic version of the text. By navigating (with some difficulty) through the Springer site to the series, one can download pdf files that contain the original text of each chapter in page-layout view.

The book begins with a chapter by Bunz that provides an overview of poly(arylene ethynylene)s, with an emphasis on synthesis and structure from the perspective of a synthetic organic/polymer chemist. The chapter contains a number of very useful tables that allow the reader to scan quickly the many different PPEs that have been prepared by various groups over the past several years. The repeat unit structure is provided, along with reagents and conditions used for the synthesis and an entry listing the primary literature citation(s) for the work. This style of presentation follows that used in several previous reviews and chapters authored by Bunz that have been highly cited, and it seems likely that the current chapter will be equally useful to workers in the field.

In the next chapter, Klemm and co-workers provide a concise review of the poly(arylene ethynylene)s that contain transition metal units. The chapter is organized into sections involving the various categories of metal-containing polymers, with an emphasis given to structures and synthesis, although some information is provided concerning properties, such as UV−visible absorption. The focus is on systems that contain chelating ligands such as bipyridine and terpyridine, but examples of PPE-type polymers that contain ferrocene and cyclobutadiene−cobalt complexes are also included.

Ray and Moore are the authors of Chapter 3, which highlights work carried out over the past several years by the Moore group on *meta*-linked PPE-type oligomers and related systems. This chapter gives a good introduction into the area of helical self-assembly in *meta*-linked PPE systems. The concept is explored from several avenues, including the use of optical absorption, circular dichroism, and fluorescence spectroscopy to probe the folding process. More recent work from the group is also reviewed, including guest-binding, guest-induced folding, and imine-metathesis polymerization in helical self-assembling materials. This chapter is one of the best overall reviews of work from the Moore lab that this reviewer is aware of.

The fourth chapter by Zheng and Swager is a discussion of sensor applications of PPE-type polymers. This group pioneered this field, where the fluorescence of a conjugated polymer is used to signal the presence of a target analyte with very high sensitivity. The basic concepts related to the use of fluorescent conjugated polymers as platforms for sensors are reviewed, and a number of specific systems that have been developed to target particular categories of analytes are covered. A section of the chapter is devoted to the application of water-soluble fluorescent polymers as biosensors. Because this area has been particularly active in the past several years, this section should be of wide interest to those interested in biosensors.

Yamamoto, Yamaguchi, and Yasuda provide a nice overview of PPE-type polymers that contain heteroaromatic groups in the conjugated backbone. This chapter is devoted mainly to structure and synthesis with a format that includes a number of tables summarizing structures, synthetic conditions, and optical properties (absorption and fluorescence). It should be useful to those seeking to learn about the scope of different PPEs that are known and the reaction conditions needed for their synthesis.

Finally, the book ends with an excellent chapter by Voskerician and Weder that focuses on the electronic (semiconductor) properties of poly(arylene ethynylene)s. This chapter provides an outstanding overview of the interesting properties of the materials of this class of conjugated polymers, and how

they can be used in applications ranging from organic thin film transistors to light-emitting diodes. It is a very useful review of this field and should catch the interest of many scientists working in the area.

Overall I enjoyed reading this book. It should belong to the library of any research institution where there is an interest in the chemistry of organic materials. Many researchers active in the field may also benefit by having a copy on their bookshelf. My one criticism of the book is its lack of a beginning chapter that gives some of the basic principles governing this family of materials, e.g., structure, bonding, conformation, etc., and that contrasts the PPE-family with other classes of indirect gap conjugated polymers. Such an introduction would be particularly useful for introducing this area of polymer science to graduate students and others who are just entering the field.

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