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BOOK REVIEWS

Modern Molecular Photochemistry of Organic Molecules. By Nicholas J. Turro (Columbia University, USA), V. Ramamurthy (University of Miami, USA), and J. C. Scaiano (University of Ottawa, Canada). University Science Books: Sausalito, CA. 2010. xxxvi + 1084 pp. $134.50. ISBN 978-1-891389-25-2.

Modern Molecular Photochemistry of Organic Molecules (MMPOM) is the long-awaited update of Turro's *Modern Molecular Photochemistry* (MMP), which was published in 1978. A great deal has happened in the field of organic photochemistry over the past three decades, and the important developments have been incorporated into MMPOM. Two noted authors, Ramamurthy and Scaiano, have also been added. A forerunner to this volume, *Principles of Molecular Photochemistry: An Introduction*, appeared in print a year ago and introduced photochemical and photophysical concepts in seven chapters. This primer is included in MMPOM, along with an additional seven chapters on organic photochemical reactions. The result is an impressive and comprehensive volume on organic photochemistry.

MMPOM preserves and extends the use of intuitive pictorial models based on classical physics to describe the quantum mechanical principles governing photophysical and photochemical processes, which set apart the original book, MMP, and made it so useful in the teaching of organic photophysics and photochemistry to graduate students and advanced undergraduates. In MMPOM, this approach is extensively used to evaluate quantum mechanical matrix elements qualitatively and for visualizing the role of vibrational wave functions and Franck–Condon factors in radiative and radiationless transitions between potential energy surfaces. A pictorial vector model is developed to illustrate concepts involving electron spin, the interaction of electron spin with a magnetic field, and spin–orbital coupling. The model is used to explain magnetic field effects on the reactivity of triplet radical pairs and triplet biradicals as well as to aid the understanding of spectroscopic techniques such as CIDEP and CIDNP, which are used for the study of radical pairs. Another hallmark of the 1978 book was the use of state-correlation diagrams to explain photochemical reactivity, the practice of which is continued in MMPOM, while incorporating up-to-date results from computational chemistry.

Two highlights of MMPOM are the chapters on energy and electron transfer and on supramolecular organic photochemistry. Exchange energy transfer and dipole–dipole energy transfer are well-illustrated by experimental examples, and the underlying theory of each is thoroughly treated. The exposition of Marcus theory for electron transfer is elegant in its clarity and economy, and the experimental examples are particularly apt. Likewise, supramolecular photochemistry is illustrated by diagrams that give very clear, concise portrayals of the experimental examples.

The latter half of MMPOM is devoted to organic photochemical reactions, organized according to the type of chromophore, in the order of carbonyl compounds, alkenes, enones and dienones, and aromatic molecules. The experimental examples include investigations of transient intermediates and fast reactions using laser flash-photolysis techniques on time scales ranging from milliseconds to femtoseconds. Toward the end of each chapter are examples of practical applications that use the photoreactivity described in that chapter. A simple paradigm is used throughout to organize the functional group photochemistry according to six basic categories of reaction: H-atom abstraction, addition to multiple bonds, electron transfer, α-cleavage, β-cleavage, and cis–trans isomerization. The last chapter shows how the simple paradigm can be adapted for predicting photoreactivity of other types of chromophores.

In conclusion, MMPOM will be a valuable tool for teaching organic photochemistry, although its length may make it challenging to use as a textbook. MMPOM provides a solid theoretical background that integrates well with the experimental examples and practical applications. Most schemes and equations are referenced in the text, making it a valuable reference work that has an extensive index. The knowledgeable organic photochemist will find much to learn from MMPOM, as will practitioners in the fields of chemical biology, polymer chemistry, materials science, and nanoscience who use organic photochemistry.

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Organotransition Metal Chemistry: From Bonding to Catalysis. By John Hartwig (University of Illinois, Urbana-Champaign). University Science Books: Sausalito, CA. 2010. xxxii + 1128 pp. $134.50. ISBN 978-1-891389-53-5.

Collman, Hegedus, Norton and Finke published their landmark volume, *Principles and Applications of Organotransition Metal Chemistry*, in 1987. The field of organometallic chemistry experienced dramatic progress in fundamental and applied directions during the subsequent decades, yet this book maintained its status as the most comprehensive pedagogical resource and widely used reference book in the field. An update has been sorely needed, but the expansive growth of the field rendered the prospect that such a revision would (or could) ever be prepared increasingly unlikely. That is, until Hartwig agreed to step in and fill the void. Hartwig recruited an impressive collection of co-workers and leaders in the field, and together they have prepared a thorough revision and update of the original volume. The outcome is a worthy successor to its forebear.

This book, like the 1987 original, represents an all-things-to-all-people survey of the field of transition-metal organometallic chemistry, simultaneously functioning as a textbook, a comprehensive review, and a reference book. For classroom instructors and students, it will serve as the benchmark text for an advanced undergraduate or graduate course in organometallic chemistry. The lack of end-of-chapter problems and relatively high cost may cause some undergraduate instructors to adopt a more traditional introductory textbook; however, such books will lack the breadth of scholarly content and coverage of

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material. For nonexpert researchers and those new to the field, this book provides a thorough introduction to the fundamental reaction classes in organometallic chemistry and a systematic survey of important catalytic methods. Organic chemists with little or no formal training in transition-metal chemistry often find themselves using transition-metal reagents or catalysts, and such individuals will find this to be a particularly useful resource. Meanwhile, experienced researchers and others with a strong background in the field will appreciate the extensive compilation of leading references to primary journal and review articles, which are cited liberally throughout the volume.

The logical and systematic presentation of content in the book is well suited to meet the needs of students and researchers alike. There are 22 chapters, divided into three general groupings: introductory material covering basic principles of bonding and ligand types in organometallic chemistry (Chapters 1−4); systematic coverage of fundamental classes of reactions, including ligand substitutions, oxidative additions/reductive eliminations, insertions/eliminations, nucleophilic/electrophilic reactions of coordinated ligands, and reactions of metal−ligand multiple bonds (Chapters 5−13); and surveys of the most prominent classes of catalytic reactions, including reactions of alkenes—e.g., hydrogenation, heterofunctionalization, metathesis—carbonylations, substitution reactions—e.g., cross-coupling, allylic substitution—and C−H functionalizations (Chapters 14−22). The material presented and references cited are completely revised and updated relative to the 1987 book, but coverage of important classic studies and major historical contributions is retained. The result is an extraordinarily thorough, albeit necessarily selective, survey of the historical and contemporary achievements in the field of organotransition metal chemistry.

This book is destined to be the go-to resource for the field of transition-metal organometallic chemistry for many years to come. It will undoubtedly find a place on the bookshelf of virtually every organic and inorganic chemist, alongside classics like *March's Advanced Organic Chemistry* and Cotton and Wilkinson's *Advanced Inorganic Chemistry*.

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Chiral Separations by Capillary Electrophoresis. Edited by Ann Van Eeckhaut and Yvette Michotte (both at Vrije Universiteit Brussel, Belgium). From the Chromatographic Science Series, Volume 100. Edited by Jack Cazes. CRC Press (an imprint of the Taylor & Francis Group): Boca Raton, FL. 2010. xviii + 526 pp. $152.96. ISBN 978-1-4200-6933-4.

This book is the 100th volume in the CRC Press *Chromatographic Sciences* series edited by Jack Cazes, who died recently. The series is intended to provide global reviews of specialized topics in separations. The broad range of topics covered by the other volumes reflects Cazes's wide-ranging interests and stewardship. Although other volumes in this series have been devoted entirely to chiral separations by chromatography, e.g., Vols. 40, 90, and 98, or included chapters devoted to chiral separations by capillary electrophoresis, e.g., Vols. 64 and 75, this one is the first that is entirely focused on chiral separations by capillary electrophoresis.

The first chapter introduces the biological basis and consequences of chirality, whereas the second includes details of the underlying theoretical basis for chiral separations by capillary electrophoresis and a thorough discussion of the some of the experimental subtleties that can lead to errors in the accurate determination of stability constants. Other chapters are devoted to specific classes of chiral selectors, including macrocyclic antibiotics, proteins, peptides, and ligand exchange. Two chapters address issues specific to the pharmaceutical or biomedical fields. Platforms for effecting separations—e.g., capillary electrochromatography, microchips—and mass spectrometry interfacing make up the rest of the material covered.

The titles of some chapters, e.g., Chapters 3 and 4 on cyclodextrins; Chapters 8 and 9 on micellar electrokinetic chromatography and microemulsion electrokinetic chromatography, respectively; and Chapters 14 and 15 on electrochromatography, suggest some potential redundancy in content. However, the two chapters devoted to cyclodextrins are entirely appropriate, reflecting their predominance in the field. The content of other pairs are similarly complementary. For instance, Chapter 11 covers quantitative analysis from a pharmaceutical regulatory perspective whereas Chapter 12 specifically deals with the challenges of biological assays.

Most of the contributors are experienced in both chromatographic and electrophoretic platforms for chiral separations and use examples from both to amplify concepts. For instance, Foley does a nice job in the chapter on chiral microemulsion electrokinetic chromatography in contrasting the intramolecular synergism in chiral selectivity observed with established chiral selectors—e.g., cyclodextrins, macrocyclic antibiotics—and the intermolecular synergism observed in the microemulsion systems. Lämmerhofer does a commendable job of highlighting the strengths and limitations of capillary electrochromatography.

Given the importance of the topic, I sincerely wish I could like this book more. There are many places where the authors and editors were underserved by the production team with awkward phrasing, misplaced tables, and inconsistencies in formatting. Furthermore, although some of the authors provide critical evaluations of the work that has been done, e.g., the complexity of molecular micellar systems offset by their advantages for CE-MS interfacing and an even-handed discussion of the challenges of capillary electrochromatography, a number of the chapters are so focused on proselytizing for single-isomer chiral selectors that seminal contributions, like Stobaugh's work with sulfobutyl cyclodextrins made in an era before the single-isomer materials were available, are ignored.

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Single Particle Tracking and Single Molecule Energy Transfer. Edited by Christoph Bräuchle, Don C. Lamb, and Jens Michaelis (all at Ludwig-Maximilians-Universität München, Germany). WILEY-VCH Verlag GmbH & Co. KGaA: Weinheim. 2010. xvi + 344 pp. $195. ISBN 978-3-527-32296-1.

This book is a compilation of review articles highlighting applications of the titular techniques to problems in biosciences and materials science/nanoscience. A wide range of scientific topics are covered which the editors have organized into three general areas: Single-Particle Imaging and Tracking, Energy

Transfer on the Nanoscale, and Single Molecules in Nanosystems. In the first two areas, a series of reviews of applications follow technique-oriented articles that introduce the fundamentals of single-particle tracking and fluorescence resonance energy transfer (FRET). These technique-oriented articles are a particular strength of the book and should be of great use to any researcher thinking about applying single-molecule-based methods in his or her own laboratory as well as to beginning graduate students in the field. They are sufficiently detailed in that the articles lay out the basic mathematical formalisms needed to understand and apply the methods described and offer a glimpse of the wide range of problems to which these methods can be applied. In addition, the editors correctly recognize the importance of including reviews on the state of the art in probe labels, such as quantum dots, as continued developments in these areas are critical to the ultimate success of all of the imaging methods discussed. In fact, it would have been good if the book contained a review of nonsemiconductor labels, such as metal-atom-based dots, as well.

Although the predominant applications discussed in this volume are biological, it was refreshing to see at least a few examples in the realm of materials science included as well, e.g. studies of energy transfer in conjugated polymers and particle diffusion in a variety of confined environments such as silica-based channels. Two other articles, one on plasmonics and another on single-molecule catalysis, connect less obviously to the stated themes of the book but are nonetheless enjoyable and informative to read.

Although the stated focus of this book is on single-particle tracking and FRET, areas that are nicely covered here, I wish it had been expanded to include super-resolution imaging methods and fluorescence-lifetime imaging. The addition of reviews in these areas would make this book a complete “go-to” guide for up-to-date information on the breadth of optical microscopy imaging methods in use today. Nonetheless, the current volume is still a valuable sourcebook for scientists entering this field and for those wishing to broaden their exposure to research in this area.

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