Book Reviews

Receptors: Models for Binding, Trafficking, and Signals. By Douglas A. Lauffenburger (University of Illinois) and Jennifer J. Linderman (University of Michigan). Oxford University Press: Oxford, U.K. x + 366 pp. $69.95. ISBN 0-19-506466-6.

As in many human activities, science has its fashions, or "hot" areas, which blossom, peak, and fade. "Molecular Biology" was a recent such phenomenon, with "Molecular Structure−Function" now beginning to rise. What will be the big research area after that? Many believe it will be cellular and intercellular "Integrative Biology." Professors Lauffenburger and Linderman have written a book which foretells what we can expect to see during the upcoming "Integrative Biology" era.

This book, really a textbook, concentrates on cell surface receptors. It presents illustrations of mathematical modeling and experimental cell and molecular biology combining to elucidate the cellular mechanisms in which surface receptors play roles and to develop the temporal and spatial relationships involved in these mechanisms and the associated cell functions.

There are only five chapters in the book in addition to an introduction chapter. Chapter 2 (Cell Surface Receptor/Ligand Binding Fundamentals) uses ligand−receptor events which occur at the outside of the cell surface to introduce the fundamental quantitative tools of chemical kinetics, thermodynamics, and molecular diffusion which are used throughout the book. Within the chapter, the models begin in simplest (ideal) form and are tested against experimental data. An attraction of this book is that the experimental methods used to obtain data are described and their weaknesses and limitations discussed; it is nice to see the strengths and weaknesses of both the theoretical approaches and the experimental methods presented side by side. Progressively, the models are enhanced to more realistically encompass actual effects: ligand depletion, true and cooperative cooperativity, multiple receptor states, interconverting receptor states, ternary complex formation, and receptor aggregation. In general, both in the book's structure and in that of each chapter, the most ideal (simplest) case is considered first to show basic features and then the complexities of the real world are illustrated and brought into the model. In this sense, Chapter 3 (Receptor/Ligand Trafficking), Chapter 4 (Physical Aspects of Receptor/Ligand Binding and Trafficking Processes), and Chapter 5 (Signal Transduction) generate a progressively more complex understanding of surface receptor roles in cells.

Chapter 6 (Receptor-Mediated Cell Behavior Responses) is in a sense the culmination of the developments in the earlier chapters used to describe intercellular functions: cell proliferation, cell adhesion, and cell migration. Even here, the presentation moves in an understandable sequence: an overview of the processes and experimental data (and methods) describing the phenomenon and the development in stages of mathematical models (and testing with experimental results) of increasing complexity.

It is interesting to note that the simplicity-to-complexity flow in the modeling is also matched by a progression from "continuum" modeling to "molecular" modeling required by the relatively low number of receptors per cell surface area.

This book is an excellent introduction to integrative cell biology. A useful feature is that the reader is not involved in the details of mathematical methods of solutions of differential equations: the basic equations are presented and the physical and chemical meanings of terms in the equations are discussed, and then the solutions are presented, often in graphical form. Cited references are abundant, and if so inclined, the reader can obtain the details from the literature. While there are no problems at the ends of the chapters, for use in a classroom setting, the 150−200 references at the chapter ends (most recent 1992) provide plenty of sources for problem material.

This reviewer recommends this book to those looking for the future directions in biomedical science; it will be found enlightening by biological and physical scientists and engineers.

Giles R. Cokelet, *University of Rochester*

Electrochemistry. Second Edition. By Philip H. Rieger (Brown University). Chapman and Hall: New York. 1994. xii + 484 pp. $59.95. ISBN 0-412-04391-2.

A number of books came out in the 1980s and 1990s that covered the basics of electrochemistry; these were intended as either a resource for practicing electrochemists, an introduction for students at the graduate level, or as a guide for scientists in other fields who needed to better understand electrochemical methods and theory. These books include the following: *Fundamentals of Electrochemical Analysis*, 2nd ed., Galus (1994); *Electrode Kinetics*, Gileadi (1993); *Principles of Electrochemistry*, 2nd ed., Koryta, Dvorak, and Kavan (1993); *Electrochemistry*, Rieger (1987); *Laboratory Techniques in Electroanalytical Chemistry*, Kissinger and Heineman (1984); *Electrochemical Methods*, Bard and Faulkner (1980). The topics covered in these texts included basic thermodynamics, discussions of the structure of the electrode interface and electrode kinetics, the basics of diffusional mass transfer in the absence of migration and its application to potential steps and scans, and more sophisticated applications of electrochemical methods.

The first edition of Rieger's book was published in 1987, and it did a good job of addressing the basics of the field as electrochemists have come to understand them over the last century. The new edition revisits most of the material in the original text with some fairly minor additions and corrections. It retains a classical approach to electrochemistry that is more thermodynamically rigorous than most other texts on this subject, but at the same time, there is a strong emphasis on electrochemical methods and theory relevant to the study of organic and organometallic chemistry. There are seven chapters covering electrode potentials, the electrode interface, electrolytic conductance, simple voltammetry, more complex voltammetry, electron-transfer kinetics, and large-scale electrolysis. There is also an appendix dealing with mathematical methods and digital simulations. A few new sections have been added to the book; there is now a solid introduction to ultramicroelectrodes and a discussion of spectroelectrochemistry that are relevant to mechanistic electrochemistry.

In the preface to both editions of the book, Rieger states, "I confess that my interest in electrochemistry is primarily in the mechanistic studies, particularly with organometallic systems. This orientation may be all too apparent for some readers." I think this is a fair statement, and for those for whom electrochemistry is a sideline (for example, those whose focus is in the biological sciences or in synthetic chemistry) and who want to teach themselves the theoretical underpinnings of mechanistic electrochemistry, this book is readable and will be a good companion. However, for those who are mainly interested in learning the nuts and bolts of experimental electrochemisty, Kissinger and Heineman's book may be a better choice, since many of the methods discussed in Rieger's book are somewhat dated and reflect its classical roots; for example, in the last chapter on electrolysis there are more references from the 1800s than there are from the 1980s and 1990s combined.

Rieger also says that his book "is a textbook with the aim of introducing electrochemistry to the previously uninitiated...". For practicing scientists I think it approaches this goal, but it is not the best choice for an introductory classroom text. At the present time, I do not think there is a general-purpose, up-to-date, electrochemistry text that is ideally-suited for classroom instruction, as a reference for practicing electrochemists, and for those in other fields who want to familiarize themselves with the theory and practice of electrochemistry. While Rieger's book may fill some of this gap, I think those whose science encompasses electrochemistry would best be served by waiting for the second edition of Bard and Faulkner's 14-year-old *Electrochemical Methods*. The significantly revised version of this modern classic should be available within a year or so.

Richard M. Crooks, *Texas A&M University*

Stereochemistry of Organometallic and Inorganic Compounds. Volume 5. Chains, Clusters, Inclusion Compounds, Paramagnetic Labels, and Organic Rings. Edited by Piero Zanello (Universita de Siena). Elsevier: Amsterdam. 1994. xvi + 662 pp. $305.75. ISBN 0444-81581-3.

The series begun by Ivan Bernal covering the *Stereochemistry of Organometallic and Inorganic Compounds* comes to an end with the fifth volume entitled *Chains, Clusters, Inclusion Compounds, Paramagnetic Labels, and Organic Rings*. This volume contains six

unrelated chapters that provide extensive and timely reviews of the crystal chemistry of cyclophosphates, the electrochemistry of homometallic carbonyl clusters, organometallic inclusion compounds, metal–nitroxyl interactions probed with ESR, stereocontrol via (η^6-arene)chromium complexes, and the stereochemistry of palladium-catalyzed cyclization reactions. Unlike other volumes of this type (and of this series), there is not an underlying theme that ties each of the chapters together. This editorial fault may discourage sales of this fifth volume to anyone other than libraries.

Chapter 1, compiled by the CNRS chemists Averbuch-Pouchot and Durif, is a 160-page review of cyclophosphate chemistry, which both authors have pioneered over the last 30 years. The chapter is more than merely a march through 169-plus structure types. Important lattice parameter values and bond distances are presented as well as phase diagrams and syntheses of many of the compounds discussed. The reader will also discover that Averbuch-Pouchot and Durif have redrawn each structural figure in polyhedral representations so that all figures within the chapter are easily viewed and readily compared. This feature is often overlooked in review articles (as it requires a great deal of additional work on the part of the authors) but is extremely helpful, especially when comparing a structure whose original figures were not the best "views" for comparison. Of the 407 references in this chapter, 148 were citations of the authors' own work, with most of those dated within the last 10 years. Averbuch-Pouchot and Durif have written an outstanding review of cyclophosphate chemistry, but it is unclear how this chapter fits with the theme of stereochemistry.

In the second chapter, the editor, Zanello, reviews the electrochemistry of homometallic carbonyl clusters containing three or more of the record-holding 38 metal atoms. This 244-page review contains 403 recent references, of which only 20 are the author's own work, and it presents over 131 structures (that is 1.6 "Dahls") and examines their redox versatilities. Perhaps an entire monograph should be dedicated to the topic of metallic carbonyl clusters, of which homometallic clusters are a majority, but lack of space here prevents that. Although these clusters have the potential for interesting catalytic chemistry, it is unclear, again, where this particular chapter fits into the theme of this series.

Harada of Osaka, Japan, reviews in chapter 3 the chemistry of inclusion compounds with cyclodextrins. An extensive background section briefs the unfamiliar reader on the unique chemistry of cyclodextrin molecules. This short chapter (44 pages) lacks recent references (since 1990) which leads the reader to believe that not much has happened in this area over the past four years. The author, whose own 27 references are listed out of 72, should be familiar enough with the area to know about any new papers in the recent literature. A one-page section in this chapter finally touches on some aspect of stereochemistry (p 449), and although the section presents some interesting aspects of cyclodextrin chemistry and their ability to resolve optical isomers, it is too short and makes the reader wonder, again, where this chapter fits into the superheading of stereochemistry.

Metal–nitroxyl interactions as probes of stereochemistry are explored in chapter 4 by Eaton and Eaton of the University of Denver. The Eatons, renowned electron paramagnetic spectroscopists, have written a nice review of the chemistry of macrocyclic ligands and their interactions with metal centers. These include, for example, nitroxyl radical-labeled porphyrins and EDTA. They cite 48 specific examples of labeled compounds and their spin behaviors in solution and the solid state. Overall, a short (46 pages) and concise (85 references) review.

The fifth chapter, written by Uemura of Osaka, Japan, discusses classical organic synthesis of organometallic compounds, in particular, recent developments on stereocontrol via (η^6-arene)chromium compounds. After a brief introduction, Uemura describes the synthesis of 175 compounds and the stereospecific nature of each. Although I am not an organometallic chemist, I found this chapter remarkably easy to follow. The compiled syntheses and references (over 100) will be very helpful to those who study stereoselective synthetic chemistry.

Heumann of Marseille, France, authors the sixth and final chapter of this volume. This chapter, like the last, fits the series nicely, with its subject being the stereochemistry of palladium-catalyzed cyclization reactions. Heumann divides the chapter into two parts: addition to carbon–carbon double bonds and addition to π-allyl intermediates and cascade reactions. The chemistry of nearly 230 compounds is discussed with detailed reactions and extensive (over 150) recent citations. This review centers on the reactions in which palladium compounds "may offer simple and elegant solutions for the stereoselective preparation of carbo- and heterocyclic compounds."

Overall, this fifth volume in the series of *Stereochemistry of Organometallic and Inorganic Compounds* leaves the reader wondering how some of the chapters fit under this heading; however, each chapter is well-written and informative. The book, at $305.75, makes a nice reference text for several disciplines but falls short of a unified volume.

Peter K. Dorhout, *Colorado State University*

Stochastic Dynamic Systems. Concepts, Numerical Methods, Data Analysis. By Josef Honerkamp (Albert-Ludwigs-Universitat, Freiburg). VCH: New York. 1993. xvi + 528 pp. $100.00. ISBN 1-56081-5639.

Do we really need another book on stochastic methods, given books already in print like *Stochastic Processes in Physics and Chemistry* by Nico van Kampen (North-Holland: Amsterdam, 1981) and *Handbook of Stochastic Methods for Physics, Chemistry and the Natural Sciences* by Crispin Gardiner (Springer-Verlag: Berlin, 1983)? Perusal of the English transition of this revision of Josef Honerkamp's original 1989 book makes clear that there is still room for a different perspective and a selection of different topics. Chapters 3–5 regarding data analysis are unique to this treatment and are a welcome addition to the stochastic methods toolbox. There are also rather good accounts of numerical methods, approximation techniques, and functional integral representations. Throughout the book, there are elementary, worked-out examples and comments. Overall, the writing style is concise, but precise, and exhibits the author's penetrating understanding of the various topics. Three slight criticisms come to mind: (1) The author seems to have indulged himself in Chapters 11 and 12 with his excursion into field theoretic functional methods. While I too find this material elegant, it does not really provide practical advances in applications over methods more easily accessible to readers without field theory background. (2) Chemists will not find the material directly aimed at chemistry. This is particularly evident in Chapter 7 on master equations, where the author could have drawn on extensive literature about master equation treatment of chemical processes. Simple examples from this literature would have increased the relevance of this book for chemists. There is no material in the book on reaction diffusion processes and their associated fluctuations. (3) The previous criticism stems from the void of references since 1989 (there are references to the author's own work from 1991). Several topics have seen significant advances since then: first passage times, numerical methods, colored noise problems, reaction diffusion processes, multidimensional problems, chaos, etc. It would have been helpful if the revision for translation had added an updated reference list.

Anyone who chooses to master stochastic processes will be well-served by this book. It gives excellent preparation for contact with the recent literature. It is really a matter of taste whether one chooses van Kampen, Gardiner, or Honerkamp. However, Honerkamp's book provides an excellent new option and that is no small achievement.

Ronald F. Fox, *Georgia Institute of Technology*

Modern Nonlinear Optics. Part 2. Volume LXXXV in Advances in Chemical Physics. Edited by Myron Evans (The University of North Carolina) and Stanislaw Kielich (Adam Mickiewicz University). John Wiley and Sons: New York. 1993. x + 836 pp. $195.00. ISBN 0-471-57.

This text is the second in a series of three volumes in *Advances in Chemical Physics* (Volumes 84–86) devoted to topics in nonlinear optics. By now, the field of nonlinear optics is over 30 years old and has important applications to optical switching and laser frequency conversion. The two guest editors (Evans and Kielich) have tried to provide a substantial selection of significant developments in the field. Part 1 is devoted to contributions from the "Poznan school" founded by S. Kielich, while Parts 2 and 3 present work from other laboratories around the world.

Several chapters in Part 2 are devoted to reviews of particular nonlinear optical effects, including holography and double phase conjugation (Jagannath and Caulfield), laser NMR spectroscopy (Evans), optical Kerr and Cotton–Mouton effects (Williams), harmonic generation (Andrews), and squeezed light (Parkins). Other chapters concern theoretical methods applied to nonlinear optics. These include a comprehensive review of computations of nonlinear molecular polarizabilities (Hasanein), the use of effective eigenvalue methods for treating relaxation phenomena (Coffey, Kalmykov and Massawe), the

theory of the longitudinal magnetic field of light (Evans), and a generalization of continuum electromagnetic properties of gases (Lakhtakia). Finally, there is a fine pedagogical chapter on selection rules for nonlinear optical processes (Stedman).

This volume is a useful addition to the chemical/physical literature of nonlinear optics. Some chapters are quite accessible to chemists (Jagannath, Hasanein, Williams, Andrews, and Stedman), while other more formal chapters are meant for physicists (Coffey, Lakhtakia, Evans, and Parkins). Most chapters assume some background knowledge of nonlinear optics. References are generally quite current, with all chapters including references as recent as 1992 (some to 1993).

However, there is one disturbing aspect of this volume. About one-third of the book is devoted to contributions by one of the editors (Evans) and concerns his controversial idea about the existence of a magnetic field along the direction of propagation of a circularly polarized light beam. This idea has not been confirmed experimentally and is not accepted by most experts in the field [Barron, L. D. *Physica B* **1993**, *190*, 307. Harris, R. A.; Tinoco, I. *Science* **1993**, *259*, 835. Buckingham, A. D.; Parlett, L. C. *Science* **1994**, *264*, 1748.] yet Evans' chapter on laser NMR assumes the existence of this field. Indeed, his 200-page chapter on longitudinal fields is not really a review but rather a string of mostly-unpublished manuscripts, many concerning the prediction of new phenomena based on the existence of the purported magnetic field. Given the controversial nature of these predictions, it would have been more appropriate if these manuscripts had been published in refereed journals.

Bruce A. Garetz, *Polytechnic University*

Glow Discharge Spectroscopies. Modern Analytical Chemistry. Edited By R. Kenneth Marcus (Clemson University). Plenum Publishing Corp.: New York. 1993. xx + 514 pp. $95.00. ISBN 0-306-44396-1.

The use of the glow discharge (GD) as an analytical source has grown only slowly over the last 30 years. However, recent developments have now given glow discharges a greater range of application as an analytical source. This book attempts to review the many advances in glow-discharge development and application as they pertain to analytical atomic spectroscopy. Although most of the information presented deals with research systems, the capabilities of the glow discharge as a spectroscopic source for the elemental analysis of solid samples can be easily understood by an analyst considering the acquisition of one of several commercial systems that are now available.

This volume is a collection of reviews written by selected experts in the various analytical fields in which the glow discharge has been employed, with each self-contained chapter referencing a wide variety of up-to-date literature (ca. 1992) on the particular topic. The book is divided into three main areas (with some chapters covering several topics): glow discharge fundamentals and diagnostics (two chapters), detection systems and source configurations (five chapters), and methods development (three chapters). Although most chapters are aimed at someone already familiar with the field, a novice can be brought up to speed by studying the initial chapter in the book, which explains the fundamental properties of the glow discharge.

The merits of several detection methods, including atomic absorption and fluorescence, atomic emission, and mass spectrometry are discussed in individual chapters by proponents of each technique. The strengths and weaknesses of alternative glow-discharge geometries (such as the hollow cathode source, which has its own chapter) and the use of glow discharges in tandem with other sources (laser ablation and graphite furnace atomization) are also covered.

The detection techniques and glow-discharge geometries discussed in this text have, for the most part, been previously reviewed in the literature, although many of the reviews are now somewhat dated. Possibly the most useful chapters, especially for those considering the purchase of a commercial system, deal with applications which are now driving the commercial development of the glow-discharge source. These applications include depth profiling and insulator analysis (each rating its own chapter) and residue analysis (especially in conjunction with furnace atomization).

The glow discharge has uses other than as an analytical source, the most important being as an etching reactor in semiconductor fabrication. To properly cover this broader field and the contributions of people in it would take several volumes; although the broader coverage does not fit into the scope of this collection, a brief discussion of laser diagnostics of widely-used reactive-gas plasmas is presented. At first this inclusion seems incongruous, especially because of the brevity of the discussion. However, diagnostic methods are essential in elucidating the complex, poorly-understood chemical composition and behavior of both reactive-gas plasmas and inert-gas plasmas more commonly used in analytical spectroscopy. In this light, it seems surprising that additional material about diagnostic methods is not included for comparison.

Overall, this volume would be very useful to researchers in the area of analytical glow-discharge development, if only to update their knowledge base, and also to those interested in analytical applications of this potentially powerful analytical source.

Mark J. Heintz and Gary M. Hieftje, *Indiana University*

Applications of Mass Spectrometry to Organic Stereochemistry. Edited by Janet S. Splitter (University of California, Berkeley) and František Tureček (University of Washington, Seattle). VCH: New York. 1993. xiv + 705 pp. $125.00. ISBN 0-89573-303-X.

This book is part of the series *Methods in Stereochemical Analysis*. Stereochemical effects in mass spectra have been noted from the beginning of organic mass spectrometry, and their application to assignments of configuration has been important when NMR or IR components were difficult. The advantages of mass spectrometry are the small amount of sample required and the possible application to large, labile, and relatively involatile molecules by condensed-phase ionization techniques. Several reviews on this topic have been published from 1976 to 1987, but this volume, written by active researchers in the field, constitutes the first comprehensive coverage of the applications of mass spectrometry to organic stereochemistry.

The book has 22 chapters and two appendixes from 21 contributors. Chapter 1 (Splitter) is an introduction and also discusses conformational equilibrium and intramolecular hydrogen bonding in neutral molecules. Chapters 2 (Falick) and 3 (Splitter) are general treatises. They describe the various mass-spectrometric techniques and the special structures involved in mass-spectral rearrangements such as distonic ions, ion-neutral-species complexes, and ionized carbenes.

The next 12 chapters are on electron, photon, and field ionization of small stereoisomeric molecules. Chapter 4 (Splitter) describes the stereochemical effects in the fragmentation processes of saturated and unsaturated acyclic molecular ions. The McLafferty rearrangement in flexible cyclohexyl compounds is shown in Chapter 5 (Eadon and Valente) to be faster than chair to chair interconversion. However, in Chapters 6 (Tureček), 7 (Splitter), and 8 (Grützmacher), evidence is presented for a twist form, which results in the equatorial substituents (OH, Cl, and Br) transforming to pseudoaxial positions. Chapters 9 (Vékey), 13 (Mandelbaum), and 14 (Groenewold and Gross) deal with stereospecific reactions involving anchimeric assistance and electrocyclic mechanisms. Stereoelectronic effects are given in Chapter 12 (Tureček). A few stereospecific reactions appear to be initiated by dissociative mechanisms (Chapters 7, 10, and 15; Splitter). Chapters 11 and 12 (Tureček) deal with stereochemical effects in the fragmentation of epimeric bi- and polycyclic and of heterocyclic ions.

In the third section, positive and negative CI spectra are discussed in Chapter 16 (Winkler and Splitter) and ion−molecule reactions are studied by ICR in Chapter 17 (Houriet and Tureček).

In the fourth section, Chapter 18 (Enzell, Dahlman, and Bielawski) discusses stereochemical effects in terpenes and terpenoids, Chapter 19 (Tabet) in steroids, Chapter 20 (Tamás) in quinolizidine and indole alkaloids, Chapter 21 (Kostova and Mollova) in rotenoids, and Chapter 22 (Nekrasov and Zagorevskii) in organometallic compounds. The uses of labeled compounds are found in Appendix A (Tureček) and the estimations of heats of formation in Appendix B (Splitter).

Each chapter is illustrated with a wealth of examples and is followed by an extensive list of references, apparently covering the field through 1992. A detailed subject index completes this volume.

This book is a timely and authoritative treatise on the use of mass spectral techniques in organic stereochemistry. It will aid the laboratory application of organic, biological, pharmaceutical, and analytical chemists in university and industrial laboratories.

Ulrich Hollstein, *University of New Mexico*