J|A|C|S
BOOK REVIEWS

Intermolecular Interactions: Physical Picture, Computational Methods and Model Potentials. Edited by Ilya G. Kaplan (Universidad Nacional Autónomo de México, Mexico). John Wiley & Sons, Ltd.: Chichester. 2006. xii + 368 pp. $160. ISBN 0-470-86332-3.

The fundamental importance of intermolecular interactions to many fields of science cannot be overestimated. In the absence of such interactions, nature would consist solely of ideal gases. An understanding of real gases and their properties and of all condensed-phase matter must be rooted in the knowledge of intermolecular interactions. Consequently, this book will be of interest to a broad range of readers.

The first chapter establishes the background for the remaining chapters. The importance of intermolecular interactions is first emphasized, followed by a history that focuses on how scientific understanding of intermolecular forces has developed. The chapter is rounded out by an introduction to the basic concepts of interatomic potentials and the adiabatic approximation, followed by a general classification of intermolecular interactions. The author of this introductory chapter succeeds at making the presentation comprehensible to a diverse group of readers without oversimplification.

Description of the various forms of intermolecular interactions is the focus of the second chapter. The discussion is qualitative in the sense that the emphasis is more on fundamental theory than on specific strategies for calculation; nonetheless, the chapter contains significant mathematical detail, some of which may not be followed by all readers. Categories of interactions include electrostatic (direct), resonance, polarization, exchange, retardation effects in long-range interactions, relativistic (magnetic), and interactions between macroscopic bodies. The nature of each interaction and the contexts in which it is important are emphasized, making the second chapter one that will be frequently revisited by the reader.

The final three chapters are both detailed and quantitative. As such, they contain valuable, specific information that will be accessed by most readers as needed. The third chapter sets forth the methodology of quantitative calculations and is intended to serve as a resource for individuals who perform calculations on many-electron systems. Users of electronic structure packages, e.g., *Gaussian*, will find this section valuable for selecting a method/basis set combination best suited to their system.

The fourth chapter focuses on many-body (nonadditive) effects, and the fifth chapter concludes with model potentials. After a comprehensive discussion of the functional forms and characteristics of model potentials, the last chapter continues with a discussion of the determination of parameters and potential reconstruction from experimental data. It ends with methods for global minimization, including simulated annealing, the diffusion equation method, and the basin-hopping and genetic algorithms.

Extensive appendices (~100 pages) are provided for the purpose of making the text self-sufficient. Entries include standard physical constants and unit conversions, mathematical tools (vector and tensor calculus, group theory), and the methodology of quantum mechanical calculations.

With so much well-packaged information on the topic of intermolecular interactions, this text will be useful to a broad range of readers. In its own right, it may prove suitable as a textbook for a special topics graduate-level course. More generally, individuals will find it an invaluable reference to the extent that their work depends on a fundamental understanding of intermolecular interactions and a practical knowledge of how relevant calculations are conducted.

David C. Easter, *Texas State University−San Marcos*

JA069785K

10.1021/ja069785k

Surface-Initiated Polymerization I and II. Advances in Polymer Science, 197 and 198. Edited by Rainer Jordan (TU München, Germany). Springer: Berlin, Heidelberg, New York. 2006. xii + 202. $199. ISBN 3-540-30247-6 (Volume I) and xii + 214 pp. $209. ISBN 3-540-30251-4 (Volume II).

This two-volume set is an excellent starting point for readers planning to enter the rapidly progressing and growing field of surface-initiated polymerization (SIP) as well as for experts who wish to keep up with recent developments and trends. Volume I (197) is divided into five parts that deal primarily with synthesis strategies to produce surface-confined polymer brushes. The opening chapter by Fukuda and colleagues sets the stage by teaching us about the development of high-density polymer brushes using surface-initiated radical polymerization. Subsequent chapters focus on surface-initiated photopolymerization, photoiniferter-based SIP, anionic and cationic SIP, and metathesis polymerization to and from surfaces. Volume II is divided into four parts that deal largely with the application of SIP to prepare grafted polymers with well-defined variation and control of structure. These include opening chapters on hyperbranched surface graft polymerizations and surface-grafted polymer gradients. The contributions by Brittain et al. and Netz and colleagues complete the set by illustrating the dynamic behaviors of grafted polymer brushes using experimental examples of stimuli-responsive brushes and theoretical descriptions of neutral and charged polymer brushes, respectively.

The collection encompasses the full breadth of the field, including mechanistic details of the various polymerization methods most commonly used; analytical characterization of the physicochemical properties of surface-confined polymers; theoretical treatment of the behavior of these systems; and applications of structurally well-defined polymer brush coatings. While it is useful having each chapter provide content on synthesis, characterization, and applications of surface-confined polymers, I would like to have seen an independent chapter,

Unsigned book reviews are by the Book Review Editor.

perhaps following the excellent introductory chapter by Fukuda and colleagues, on advanced analytical tools and techniques for characterizing these systems. Many of these tools and techniques are referred to (and some briefly described) repeatedly within the separate chapters, whereas others, e.g., neutron reflectivity, receive little-to-no attention. A chapter having a more comprehensive, focused treatment on analytical characterization would have been useful as a training tool, especially for student readers.

Each contribution provides a reasonably current and thorough treatment of one or more aspects of the field, written by an expert in that area. There is some variation in the format among the contributions. Most provide a comprehensive review of published literature up to 2006, while a few have a narrower scope that focuses largely on yet-to-be published results from the author's work. Several of the contributions do an exemplary job of teaching the reader about the topic, as might an introductory textbook. The chapter on surface-grafted polymer gradients is a good example. That same chapter also provided an outlook on where the field is headed. In this context, it would have been nice if more of the contributions identified areas where further work is needed and offered a look ahead.

Overall, this set presents to date developments and progress in surface-initiated polymerization. The contributions provide sufficiently complete bibliographies that will assist readers to identify resources for continued, in-depth study. I recommend this set highly as a resource for current practitioners and those readers just beginning careers in this field, my own students included.

Scott M. Husson, *Clemson University*

JA069751C

10.1021/ja069751c

Nanoscale Devices – Fundamental and Applications. Edited by Rudolf Gross (Bayerische Akademie der Wissenschaften, Garching, Germany), Anatolie Sidorenko (Institute of Electronic Engineering and Industrial Technologies ASM, Kishinev, Moldova), and Lenar Tagirov (Kazan State University, Kazan, Russia). Springer: Dordrecht. 2006. xxii + 400 pp. $89.95. ISBN 1-4020-5105-0.

This book is a collection of papers presented at the NATO Advanced Research Workshop on "Nanoscale Devices – Fundamentals and Applications" held in Kishinev, Moldova in September 2004. There are 27 chapters organized under the following headings: Science against Nontrivial Threat; Weak Magnetic Fields Detection Techniques and Devices; Novel Ideas and Principles of Devices; Pi-Shift Effect and Ferromagnetic/Superconductor Nanoscale Devices; Coherence Effects in F/S and N/F Nanostructures; Advanced Sensors of Electromagnetic Radiation; Novel Materials for Electronics; and Nanomaterials and Domains. There is no index.

JA0697929

10.1021/ja0697929

The Organic Chemistry of Sugars. Edited by Daniel E. Levy (Scios, Inc., Fremont, CA) and Péter Fügedi (Hungarian Academy of Sciences, Budapest). CRC Press and Taylor and Francis Group: Boca Raton, FL. 2005. xxiv + 880 pp. $199.95. ISBN 0-827-5355-0.

Carbohydrate chemistry over the past three decades or so has emerged from a fairly self-contained and specialized field to one that has been thrust into a position of center stage in chemical research. This shift in focus for the area, sometimes referred to as "glycoscience," has arisen through the impact of carbohydrates on many disciplines—biochemistry, immunology, medicinal chemistry, plant science, food science, and nanomaterials, to name a few. In all these areas, demands are made on the organic chemist to design and synthesize a variety of carbohydrate compounds, both simple and complex. Due to the number and variety of functional groups present on carbohydrate structures, most carbohydrate compounds are a challenge to the synthetic chemist, and synthesis in the field still largely belongs to those who specialize in the construction and manipulation of these compounds. While numerous monographs and compendia on carbohydrate chemistry have appeared in recent years, many are volumes that focus on the cutting edge of particular areas of glycoscience and are written for the specialist in carbohydrates. Some serve as textbooks that teach the basic principles, but few, if any, cover the synthesis of carbohydrates comprehensively, progressing from the simplest of compounds to the more complex. That is exactly where this volume fits: it teaches strategy, design, and execution of carbohydrate syntheses. The title, *The Organic Chemistry of Sugars*, is very appropriate and is unique among reference works in that regard. That coming closest in coverage to this volume perhaps is *Preparative Carbohydrate Chemistry* edited by Hanessian; however, that volume is more limited in scope and offers, in addition, actual preparative synthetic procedures.

The book consists of four main parts, having a total of 16 chapters, each written, or at least spearheaded, by a recognized expert or experts in the field. The chapters are more or less organized in the same fashion, with an introduction that covers the basic principles, followed by a more in-depth treatment of the subject that leads to the more complex molecules and applications. Little overlap is noted among the chapters, and the major topics essential to conducting organic synthesis in this field seem to be covered.

Part 1 begins with a beautiful chapter by Ferrier on the history of carbohydrate chemistry, focusing on the early developments of Fischer right up to the exciting present. Chapter 2 by Kuszmann is devoted to the basic principles—stereochemistry, conformational analysis, steric effects, the anomeric effect, and other subjects, including a brief encounter with nomenclature—that are essential to an understanding of the chemistry of these compounds. The chapter, which is essentially a "teaching" chapter, concludes with "Recommended Reading" rather than explicit literature citations, and among the choices, some leading articles (both monographs and reviews) are not cited. In Chapter 3, Oscarson, introduces the inevitable—protecting groups—and does a thorough job of developing strategies for a variety of functional groups among the various configurations of the major sugars. Again, one is left without references to the literature on several examples of strategies for monosaccharide protection, where some 30-odd compounds are covered in five schemes without a single reference that this reviewer could find. Fügedi covers glycosidation, a most important topic, in Chapter 4, which leads directly into his chapter on the syntheses of oligosaccharides in Chapter 5. Together, these chapters provide a balanced treatment of this important subject from the points of view of both strategy and methods.

The important concept of using sugars to synthesize non-carbohydrate compounds is taken up in Part II. Levy discusses the basic reactions—displacements, leaving groups, functional group interconversions, deoxygenation—in Chapter 6 and then proceeds to develop the chemistry of *C*-glycosylic compounds (*C*-glycosides) in Chapter 7. While the basic chemistry of these compounds is covered, more recent developments are not, with most references limited to the pre-1995 literature. Chapter 8 by Sollogoub and Sinaÿ is devoted to the chemistry of the conversion of sugars to carba-sugars, where O in the ring is replaced by C. The chemistry is developed in a modern, up-to-date manner and complements the traditional cyclitol literature. In a similar vein, in Chapter 9, a group of authors from the Technical University in Graz develop the subject of sugars with elements other than oxygen as the heteroatom in the ring. Thio sugars, imino sugars, and other heteroatom-substituted sugars, including a limited discussion on sugars with phosphorus in the ring, are presented in this rather short chapter on a sizable topic.

Part III is aptly entitled, "Sugars as Tools, Chiral Pool Starting Materials and Formidable Synthetic Targets". Kunz and a group from the University of Mainz cover sugars and their use as chiral auxiliaries in Chapter 10. The chapter is well written and dated to about 2000, focusing on the leading reactions that enable chemists to capitalize on the wealth of stereochemistry that is provided by saccharides in processes that include cycloadditions, conjugate additions reactions, and aldol condensations, among others. The next chapter by Chapleur and Crétien complements the preceding one and is devoted to the use of sugars as chiral starting materials in enantiospecific syntheses of largely non-carbohydrates. This chapter captures the more important examples in the literature that illustrate these concepts, which perhaps still remain underdeveloped by chemists. Toshima in Chapter 12 covers the classical synthesis of carbohydrate-containing complex natural products. His coverage is impressive in that most of the important antibiotics and related compounds, including saponins, are included. Then Vogel presents in Chapter 13 the "reverse to all this": the total asymmetric synthesis of monosaccharides and analogues from non-carbohydrate precursors. Using strategies developed in his laboratory and elsewhere, he takes on the task of relaying to the reader just how ordinary chemical compounds can be converted into sugars using the toolkit of the organic chemist. The chapter is admirably well developed, given the complexity of the area.

Part IV is concerned with applications of complex carbohydrates to glycobiology. Chapter 14 by Arya and Sarma is devoted to combinatorial chemistry as it applies to medicinal chemistry. With references that date through about 2002, the developments are well represented in this emerging field, which undoubtedly will expand, once solid- and solution-phase parallel synthetic methods are fully developed. Glycopeptides and their impact on the important area of post-translational glycobiology are covered in Chapter 15 by Mogemark and Kihlberg. Aspects of synthetic design are presented in light of the more important developments in the field of both *N*- and *O*-linked glycopeptides. Chapter 16 by Ernst, Kolb, and Schwardt covers the area of glycomimetics as they apply to drug discovery. In this chapter, biological rationale and design of mimetics are discussed, along with synthetic approaches to these as they apply to myelein-associated glycoprotein, glycosidase inhibitors, and selectin antagonists.

Overall, the compendium is well written, although some strict editorial intervention would have smoothed out the English and chemical terminology (e.g., "*O*-acetate" instead of "*O*-acetyl") here and there. References are current to about 2002 in most chapters, which dates the book a bit for a 2006 publication. One of the more serious criticisms of this book is directed at the publisher: just handling this 880-page tome for this review has resulted in four breaks in the spine, with pages ready to drop out. The binding appears to be glued, not sewn, which is disappointing for a book that has lasting value (a roll of mending tape is on order). The book, however, will prove indispensable to the practicing carbohydrate chemist and any organic chemist who chooses to delve into the synthesis of carbohydrate compounds.

David C. Baker, *University of Tennessee, Knoxville*

JA059892Z

10.1021/ja059892z

Boronic Acids: Preparation, Applications in Organic Synthesis and Medicine. Edited by Dennis G. Hall (University of Alberta). Wiley-VCH Verlag GmbH & Co. KGaA: Weinheim. 2005. xxvi + 550 pp. $170.00. ISBN 3-527-30991-8.

This book is an impressive compilation covering the broad field of boronic acids, a remarkable class of compounds that has found a home in so many different facets of chemistry as indicated by its organic, inorganic, and biochemical applications. The chemistry of boronic acids has gone through a series of rebirths over the years since their first preparation by Frankland in 1860. These range from the ground-breaking work of Lorand and Edwards relating to diol complexation in the 1950s to the more recent accounts of Lewis acid catalysis and to sensing/recognition applications as well as the development of numerous synthetic methods that use boronic acids as reagents for such reactions as Suzuki coupling, addition to unsaturated systems, and heteroatom arylation, to name a few. Given the breadth and diversity of this field, it is somewhat surprising to see so much of this work brought together into one volume. What is even more surprising is how well this volume is assembled and how thoroughly the material is covered in this work.

The editor, a frequent contributor to this field, has created a balanced and comprehensive collection that will be of considerable value to anyone interested in learning more about or working with boronic acids. The volume begins with an exceptional history and introduction to the chemical properties and reactivity of boronic acids. Chapter 1 alone has been a treasure trove of information and references for this reviewer. The next several chapters present synthetic routes to generate boronic acids and cover the diverse and extensive reactivity of these compounds as reagents and catalysts in organic synthesis. The volume ends with two chapters on the use of boronic acids in sensing and biomedical applications. Coverage of these many topics is uniformly good, with many relevant and timely references, although the chapters are inconsistent in depth, as might be expected for an edited volume covering such a broad subject. Without a doubt, this volume will be an invaluable tool for any researcher in the field of boronic acids, while still serving as a useful primer for the novice.

John J. Lavigne, *The University of South Carolina*

JA059840+

10.1021/ja059840+

Polyelectrolytes and Polyzwitterions: Synthesis, Properties, and Applications. Edited by Andrew B. Lowe and Charles L. McCormick (University of Southern Mississippi). American Chemical Society: Washington, DC (Distributed by Oxford University Press). 2006. xii + 186 pp. $149.00. ISBN 0-8412-3958-4.

The book was developed from the ACS symposium of the same title presented at the ACS 228th National Meeting in Philadelphia in August 2004. There are nine chapters on the latest developments in the chemistry of polyelectrolytes and polyzwitterions, a sampling of which includes “Polyelectrolyte Solutions: Phenomena and Interpretation”; “Synthetic Polyzwitterions: Water-Soluble Copolymers and Terpolymers”; and “Synthesis of Polyelectrolytes via Ring Opening Metathesis Polymerization”. The book concludes with an author and a subject index.

JA069794T

10.1021/ja069794t