Book Reviews *

Saponins: Chemistry and Pharmacology of Natural Products. By K. Hostettman and A. Marston (Lausanne University, Switzerland). Cambridge University Press: Cambridge, U.K. 1995. xii + 548 pp. $120.00. ISBN 0-521-32970-1.

This comprehensive monograph is an authoritative, well-written, and up-to-date volume which contains much chemistry and biological activity of saponins. The careful organization, systematic approach, and comprehensiveness of the volume make it a valuable resource for both scientists in industrial organizations, graduate students, and faculty members in the agricultural, biological, chemical, and medical sciences. Kurt Hostettman and Andrew Marston are on the faculty of the School of Pharmacy, Lausanne University, Switzerland. This volume contains many structural formulas, only a few of which are incorrect. Nomenclature and stereochemistry is generally good, but the saponin field is one of complexity and diversity which makes the use of the common names of saponin more prevalent than the technical names.

The reader will find a thorough discussion of the occurrence and distribution of the triterpene saponins, steroid saponins, and the steroid alkaloid glycosides from plants and some marine organisms in Chapter 2. The introductory chapter briefly discusses (a) biosynthesis (since only a small amount of research activity had been done on saponins, it is necessarily presented mostly on the classical biosynthetic pathways involving squalene-2,3-epoxide which is cyclized to give the aglycones); (b) classes of aglycones, which are expanded on in Appendix 2 Structures of Triterpene Saponins; and (c) nomenclature and stereochemistry of saponins. Chapter 3 provides a discussion of detection and quantitative determination of saponins and isolation through extraction and preliminary purification followed by chromatography of many types; however, the authors conclude that a combination of methods is best for the very complicated saponin mixtures, such as ginseng, quillaja, gypsophila, and alfalfa. Structure determination is outlined in Chapter 4 for both the hydrolyzed and the nonhydrolyzed (naturally occurring according to the procedure used) saponins; there are discussions of artifact formation, enzymatic hydrolysis, microbial hydrolysis, mild and selective cleavage methods, and NMR and MS spectrometry as well as other techniques for structure elucidation (permethylation of sugars, IR, molecular optical rotation). The authors make the point of saying that no X-ray crystallography has been done at the present time, which is not surprising to those that work with saponins. Chapter 5 provides an exhaustive list of pharmacological and biological properties of triterpene saponins. Of particular interest is the treatment of the disease called schistosmiasis, which is endemic in 76 countries and affects over 200 million people, mainly in tropical and subtropical regions of the world; other effects are cardiovascular, antiinflammatory, antiexudative, immunomodulation, antiulcer, fungicidal, hemolysis, bitterness, sweetness, cholesterol-reducing ability in humans and animals, and effects on capillary fragility. Toxicity is important in the use of saponins since they are present in the diet (beans, peas, lentils, etc.); however, saponins are poorly absorbed by animals, and they are either excreted unchanged or metabolized in the gut; consequently, it is difficult to ascertain the pharmacokinetics of these interesting molecules. Chapter 6 provides the pharmacology and biological testing of the steroid saponins and steroid alkaloid saponins, which includes piscicidal activity (fish poison), insecticidal and antifeedant activity, plant growth inhibition (allelopathy), and cytotoxic and antitumor activity. Chapter 7 discusses commercially important preparations and products of sarsaparilla root, licorice, aescine from horse chestnut, *Hederae folium* which provides an expectorant, *Quillajia* bark, *Gypsophila* species, and ginseng. Hostettman and Marston report that some claims for the effectiveness of ginseng are justified, particularly because the ginseng saponins act as adaptogens (stimulating the nonspecific resistance of an organism and building up general vitality).

The very useful appendixes cover the species and plants containing triterpene saponins, as well as structures of triterpene saponins and spirostanol saponins. Entries in Appendixes 2 and 3 are not in alphabetical order, which makes it very difficult to find a particular saponin structure. The book is well referenced, having 102 pages devoted to a single compendium, and citations are very clear. The Latin names make a nice addition for saponin scientists, but the general index is only four pages long, which prevents it from being exhaustive in coverage.

In general, I found this book a pleasure to read, and I believe it would be an asset to the young scientists and the established investigators who are interested in natural products, as well as creating interest in the complex field of saponin chemistry and biology. It may be of general interest to readers of the *Journal of the American Chemical Society* because of the research to be done in the future on the interesting molecules particularly with the realization that so many saponins are included in our daily diet.

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Conformational Theory of Large Molecules: The Rotational Isomeric State Model in Macromolecular Systems. By Wayne L. Mattice (University of Akron) and Ulrich W. Suter (ETH, Zurich). Wiley: New York. 1994. xv + 449 pp. $54.95. ISBN 0-471-84338-5.

The rotational isomeric state (RIS) model has long been used by polymer chemists to describe chain statistics for macromolecules. Flory's monograph of 1969 (*Statistical Mechanics of Chain Molecules*. Wiley: New York, 1969) has been a standard reference for over 25 years, and there have been important advances in theory and application of the RIS model since then. The time is now ripe for an authoritative review. This book attempts to provide that review while also providing a self-study guide to those new to the field, and by and large, it succeeds.

The first six chapters present the fundamentals of the RIS model, and the next three describe applications to various synthetic polymers. Chapter 10 is concerned with the theory for intramolecular helixes and sheets, with application to conformational transitions in biopolymers like proteins or DNA. Chapters 11 and 12 deal with stars, grafts, and copolymers, and the book finishes with three chapters that present recent theoretical developments, including the introduction of time-dependence into the RIS partition function.

Both a strength and a weakness of the book is its narrow focus on the RIS model. There is much made of the mathematical machinery in the theory (and rightly so, in the collective opinion of these reviewers, given the advances since Flory's book), and the applications range over a wide number of polymers. However, the book lacks perspective because of its narrow focus on just the RIS model. Also, there is a strong bias toward synthetic polymers adhering to behavior under θ conditions. No attention is paid to polymer melts or glasses. It is somewhat surprising, given the expertise of the authors, that comparisons between RIS models and simulation modelings of the amorphous state are not discussed in greater detail. Biopolymer systems also fare poorly in terms of coverage. Clearly the authors have opted not to include computational conformational analysis as it relates to providing the input data to a RIS model. Nevertheless, a more extensive set of references of the methods of conformational analysis and the selection of force fields, probably in Chapter 3, would make the book a better resource for those interested in the molecular modeling of polymers.

The organization and level of presentation are suitable for an advanced graduate course in polymer chemistry or materials science, or for self-study by those not directly in the field whose preparation included Flory's book but who want a refresher that is current. Some very helpful features here are the sets of problems at the end of each chapter and the listing of a FORTRAN program to calculate the characteristic ratio C_∞. Libraries should definitely acquire a copy for reference.

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*Unsigned book reviews are by the Book Review Editor.

Optical Rheometry of Complex Fluids. By G. G. Fuller (Stanford University). Oxford: New York. 1995. xiv + 268 pp. $60.00. ISBN 0-19-509718-1.

This research monograph provides a comprehensive overview of the use of optical techniques to probe the structure and dynamics of complex polymeric and colloidal liquids. Optical methods have developed considerably in the last few years because they enable researchers to relate microstructure in complex liquids to macroscopic observables. Because the observables are often the macroscopic stresses and velocity gradients that accompany fluid flow, Fuller has included all of the methods pertinent to this volume under the umbrella of "optical rheometry". The use of this terminology in the title should not put off anyone: electrical and magnetic fields as well as flow commonly serve as the perturbing agent, and the resultant microstructural deformation may be quantified through a wide range of optical techniques, including polarimetry, ellipsometry, static and dynamic light scattering, Raman spectroscopy, laser doppler velocimetry, and dichroism−birefringence measurements. Previous references treat these techniques separately, but this volume provides a common foundation, both theoretical and practical, for the selection, design, and use of appropriate optical techniques. Hence this monograph is highly recommended for any researchers in the chemical sciences who have an interest in any type of optical technique for characterizing microstructure in complex liquids.

Although the monograph is self-contained, it is not an introductory text. It assumes familiarity with vector and tensor algebra and elementary electromagnetism. The monograph begins with a comprehensive but succinct review of plane wave and Green's function solutions of Maxwell's equations, polarization, and plane wave reflection and refraction. The key second chapter introduces Jones and Mueller calculus for simplified computation of the interaction of light with optical elements. Useful elementary examples from polarimetry are included here. The next four chapters utilize this mathematical foundation to introduce ellipsometry, static light scattering, dichroism and birefringence, Raman scattering, and dynamic light scattering, all from an "optical matrix" point-of-view. This presentation of such a wide range of techniques, unified by a common mathematical formalism, cannot be found in any other recent reference. An extensive chapter reviews microstructural theories of optical properties, thus connecting optical observables with microstructure in complex liquids. Next, two chapters introduce general considerations for the design of optical instruments and selection and alignment of optical components.

The monograph concludes with reviews of recent literature concerned with application of optical techniques in the study of polymeric and colloidal liquids, including five case studies which mostly focus upon microstructure and rheometry of polymeric liquids. The monograph's 193 references, especially those for the case studies, are complete and up-to-date. References in the introductory chapters point to resources that will enable any researcher to brush up on their mathematical skills and electromagnetism fundamentals. Overall, this monograph evinces Fuller's leadership in optical rheology and should be consulted by anyone who has a serious interest in either theoretical or practical aspects of this area.

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Fundamental and Applied Catalysis: Chemical Kinetics and Catalysis. By R. A. van Santen and J. W. Niemantsverdriet (Einhoven University of Technology). Plenum: New York. 1995. xi + 280. $69.50. ISBN 0-306-45027-5.

This text is one of what currently stands as a six-volume series under the title *Fundamental and Applied Catalysis* (series editors: M. V. Twigg and M. S. Spencer). The intent of the series is to build a reference library of information concerning the various aspects of catalytic phenomena which would be of use to a broad spectrum of scientists and engineers. The contribution reviewed here is another strong addition to the series and satisfies the above criteria quite well.

Although the title of this monograph might imply a broad survey of the subject, the reader will quickly find out that the primary focus of the text is a detailed discussion of the kinetics of catalytic reactions which occur on surfaces. With this aim in mind, the authors are quite successful. The text is divided into six chapters. The first presents a brief summary of the historical development of the field of catalysis. Chapter 2 (The Rate Equation) consists of a brief introduction to the study of kinetics including rate expressions, the steady state assumption, and the kinetics of reactions occurring on surfaces. Included in this section are discussions of autocatalysis and oscillating reactions in solution and on surfaces. Here and throughout the text, the authors provide clear introductory and summary passages to important ideas brought up in subsections in each chapter. Chapter 3 (Introduction to Catalytic Reactions) provides a brief overview of the better understood reaction mechanisms involved in heterogeneous catalytic reactions. Elementary reaction steps occurring at the surfaces of metals, metal oxides, solid acids (zeolites), and sulfides are discussed. In Chapter 4 (Collision and Reaction-Rate Theory), through the classical and quantum mechanical formulations of the partition function, macroscopic parameters such as equilibrium and rate constants are related to the microscopic properties of the molecules and surfaces involved in a reaction. Several examples are presented which illustrate the procedures by which rate constants may be calculated once the characteristic energies of a system are known. Chapter 5 (Medium Effects on Reaction Rates) continues the message of Chapter 4, but the discussion now turns to the effects that energy transfer and thermal accommodation have on the adsorption of molecules on surfaces. The effects of nonhomogeneous surface coverages and lateral interactions are also discussed. Chapter 6 (Microscopic Theory of Heterogeneous Catalysis) presents a discussion of how the ideas of the preceding chapters may be applied to the fundamental steps (adsorption, reaction, and desorption) involved in heterogenous catalytic reactions.

This text evolved from a course taught by the authors at the Eindhoven University of Technology and reads as such. It is very well written. The illustrations are, for the most part, quite good and clearly tied to points made in the text. I found very few typographical errors in my reading of this text, none of which disrupted the flow or meaning of the passage. Although a general reading list derived from specific references in the text is provided, many interesting observations about specific systems are without literature citation. This book will stand as an excellent introduction to and general reference for students and researchers interested in the kinetics of catalytic reactions which occur at surfaces.

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Seventeenth Texas Symposium on Relativistic Astrophysics and Cosmology. Edited by Hans Bohringer, Gregor E. Morfill, and Joachim E. Trumper (Max-Planck-Institut fur Extraterresriche Physik). Annals of the New York Academy of Sciences. New York Academy of Sciences: New York. 1995. 728 pp. $190.00. ISBN 0-89766-941-X.

The papers in this volume were presented at the Seventeenth Texas Symposium on Relativistic Astrophysics, which was held December 11−17, 1994, in Munich, Germany. The book presents topics such as binary pulsars, clusters of galaxies, large-scale structure, sources of gravitational radiation, X- and gamma-background, machos and dark matter, the solar neutrino problem, quasar absorption lines, inflationary cosmology, the galactic center, COBE results, high redshift quasars, and quantum gravity. This volume also includes "hot" topics such as the recent highlights of HST, ASCA, ROSAT, and GRO.

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Kirk-Othmer Encyclopedia of Chemical Technology, Volume 13: Helium Group to Hypnotics. Edited by Jacqueline I. Kroschwitz and Mary Howe-Grant. Wiley: New York. 1995. xxviii + 1100 pp. $295.00. ISBN 0-471-52682-7.

This is the 13th volume of a 25-volume encyclopedia set, four volumes being published each year. The fourth edition is similar in format to the earlier editions with updates to the entries as necessary and the addition of several new subjects. This volume contains 29 entries ranging from Helium Group to Hypnotics. This volume does not contain an index; however, paperback indexes are published every four volumes, and the supplement and index volumes are scheduled for publication in 1998.

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