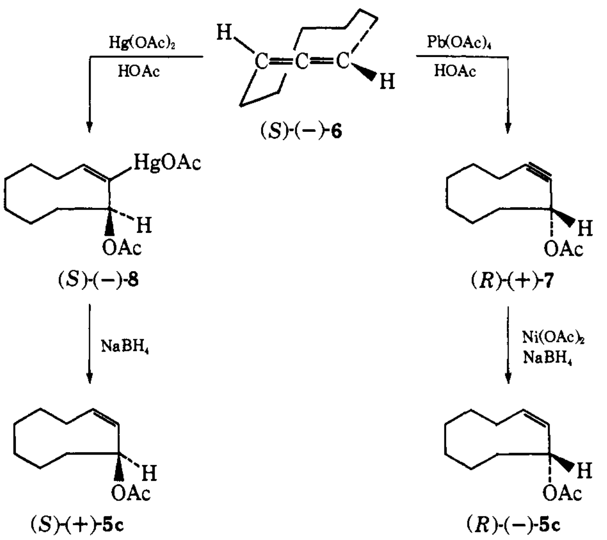
trans isomerism. The exclusive formation of the cis isomer probably reflects product development control.

Scheme II



The absolute configuration of 1,2-cyclononadiene was established by relating the stereochemistry of the products of lead tetraacetate oxidation and oxymercuration of (−)-**6** to the *cis*-3-alkoxycyclononenes derived from **2**. Treatment of **6**, $[\alpha]^{25}\mathrm{D}$ −14.6°, with lead tetraacetate in acetic acid afforded as the major product (+)-3-acetoxycyclononyne (**7**), $[\alpha]^{25}\mathrm{D}$ +7.6° Stereospecific hydrogenation of **7** ($[\alpha]^{25}\mathrm{D}$ +16.3°) gave (−)-*cis*-3-acetoxycyclononene (**5c**), $[\alpha]^{25}\mathrm{D}$ −9.3° (Scheme II). Acetoxymercuration of (−)-**6**, $[\alpha]^{25}\mathrm{D}$ −14.6°, in glacial acetic acid, afforded (−)-**8** (isolated as the mercuri chloride, $[\alpha]^{25}\mathrm{D}$ −0.8°) which upon demercuration with sodium borohydride gave the *opposite* enantiomer of **5c**, (+)-*cis*-3-acetoxycyclononene, $[\alpha]^{25}\mathrm{D}$ +1.1°.[12] The conversion[1] of (+)-*cis*-3-hydroxycyclononene (**9**) to (+)-**5a** establishes the absolute configuration of (+)-**9** as *S*.[1] Similarly, treatment of (+)-**9** with acetyl chloride gave (+)-**5c** which must also have the *S* configuration. This series of reactions establishes that acetoxy-, alkoxy-, and hydroxymercuration of (−)-**6** all occur principally by an anti addition[13a] with the topology of the reaction such that electrophilic attack by $^+$HgX occurs only from the "outside" of the ring.[1,2] However, the reaction of (−)-**6** with lead tetraacetate proceeds by a syn addition to the carbon–carbon double bond.[13b] This is compelling evidence that (−)-1,2-cyclononadiene must have the *S* configuration[13c] in order for the latter reaction to afford (−)-**5c** with the *R* configuration.

The absolute configuration of the oxymercurial **8** was also related to the dibromocyclopropane **2** by electrophilic cleavage of the carbon–mercury bond with bromine. Thus, treatment of (−)-2-acetoxymercurial **8** and the corresponding (−)-2-methoxymercurial with bromine in carbon tetrachloride afforded (−)-**4c** and (−)-**4a**, respectively, which have the *S* configuration.[14]

On the basis of the above data, we may unequivocally conclude that (−)-1,2-cyclononadiene has the *S* configuration and that the (−)-*cis*-3-alkoxycyclononenes above have the *R* configuration. It is significant to note that the absolute configuration assigned to (−)-**6** is the *opposite* to that predicted by Lowe's rule[15] which is based upon the helical model of optical activity originally proposed by Brewster.[16] It is also worthy of note that the chiral cyclopropylidene derived from (−)-**2** by the action of methyllithium[3] affords (−)-**6** by a mode of ring opening that is controlled by relief of torsional strain rather than by steric effects.[17]

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[12] Both **7** and **5c** gave satisfactory elemental analyses and the proposed structures are consistent with their ir, nmr, and mass spectral data.

[13] (a) However, nitratomercuration of (−)-**6** under syn oxymercuration conditions with mercuric nitrate in methylene chloride occurs *via* a syn addition to the carbon–carbon double bond (unpublished results with R. F. Richter). (b) We have established that the lead tetraacetate oxidation of the acyclic allene, (+)-2,3-pentadiene, also occurs *via* a syn addition, affording (+)-4-acetoxy-2-pentyne (unpublished results with R. N. Brummel). (c) Since submission of this communication, (+)-1,2-cyclononadiene has been assigned the *R* configuration on the basis of a rigorous ORD–CD correlation. Our own results corroborate this assignment. We are indebted to Professor Moore for informing us of his results prior to publication: W. R. Moore, H. W. Anderson, S. D. Clark, and T. M. Ozretich, *J. Amer. Chem. Soc.*, **93**, 4932 (1971).

[14] Our results unequivocally establish that bromination of (*S*)-(−)-**6** in methanol proceeds by a trans addition affording (*S*)-(+)-**4a**: L. R. Byrd and M. C. Caserio, *J. Amer. Chem. Soc.*, **93**, 5758 (1971).

[15] G. Lowe, *Chem. Commun.*, 411 (1965).

[16] However, Brewster's more general helical model correctly predicts the sign of the rotation of (+)-**6**, if the estimated contributions to the rotatory power include the methylene chain.;[13c] J. H. Brewster, *J. Amer. Chem. Soc.*, **81**, 5475 (1959).

[17] Consideration of a sterically controlled process leads to the wrong assignment of the absolute configuration of (−)-**6**: G. Krow, *Top. Stereochem.*, **3**, 31 (1970).

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*Book Reviews**

Core Experiments in General Chemistry. By R. S. Drago and T. L. Brown (University of Illinois). Allyn and Bacon, Inc., Boston, Mass. 1970. xii + 196 pp. Limp binding. Price not stated.

This laboratory manual is an abbreviated version of "Experiments in General Chemistry," 3rd edition, and is intended for a course in which laboratory time is limited. Unusual features are the preparation of geometrically isomeric coordination compounds and preparation of organic polymers (cuprammonium rayon; phenol-formaldehyde resin).

Cours de Chimie. Tome 2. By M. Garric (Lycée Michel Montaigne). Dunod, Paris. 1971. xxxii + 464 pp. 84F.

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* Unsigned book reviews are by the Book Reviews Editor.

This limp-bound volume is a textbook for a unified course, covering both inorganic and organic chemistry with liberal doses of kinetics, thermodynamics, and valence theory. It includes exercises, an appendix of tables, an index, and a bibliography that contains a surprisingly large representation of books in English, in addition to a number in French translation.

Aspects of Terpenoid Chemistry and Biochemistry. Edited by T. W. Goodwin (University of Liverpool). Academic Press, London and New York. 1971. xiii + 441 pp. $24.50.

This book consists of twelve chapters which comprise the proceedings of the second Phytochemical Society symposium on terpenoids, held in Liverpool in April 1970. The promptness of publication is gratifying. Five of the chapters deal with biosynthesis (general terpenoid, monoterpenes, carotenoids, quinones, and chromanols), and the others cover biochemistry of sesquiterpenoids, juvenile hormones, abscisic acid, gibberellins, ecdysones, carotenoid chemistry, and algal carotenoids. The texts are very carefully prepared, and the bibliographies are so extensive as to be valuable as comprehensive reviews. Three indexes (Author; Genus and Species; Subject) put a seal on a well-done job.

Treatise on Analytical Chemistry. Part II. Volume 14. Analytical Chemistry of Inorganic and Organic Compounds. Edited by I. M. Kolthoff (University of Minnesota) and P. J. Elving (University of Michigan). Wiley-Interscience, New York, N. Y. 1971. xvii + 444 pp. $24.95.

The latest volume in this important and enormous work will be of major value to the organic chemist, for all but the first chapter (Chlorine, Bromine, and Iodine, by E. C. Olson) deal with determination of functional groups: Unsaturation, by S. T. Hirozawa; Acyl Groups, by A. S. Inglis; O-, N-, and S-Alkyl Groups, by A. S. Inglis; Ethers and Epoxides, by R. T. Hall and R. D. Mair; and Organic Peroxides, by R. D. Mair and R. T. Hall. As usual in this series, each chapter begins with a section on the general properties and behavior of the substances under consideration. These sections are the weakest part of the work, as they are so often written without a critical feel for the subject and are prone to contain misleading, incomplete, or outdated information. The heart of the work, however, is to be found in large sections dealing with analysis, and these are very good. The comprehensive treatments are well documented, and much information is presented in tables. There is much practical information in the form of experimental procedures, with directions for preparation of reagents and drawings of apparatus where appropriate. There is a 10-page subject index specific to this volume.

Controlled Test Atmospheres. By G. O. Nelson (Lawrence Radiation Laboratory). Ann Arbor Science Publishers, Inc., Ann Arbor, Mich. 1971. xii + 247 pp. $17.50.

This book is devoted to methods of preparing mixtures of gases of precisely known composition, and includes a chapter on air purification and one on flow-rate and volume measurements. It is intended for analytical chemists, air pollution engineers, and others concerned with producing, controlling, or testing atmospheres. There is an extensive appendix of tables of useful data on atmospheric components and potential contaminants, a bibliography of 399 references, and a modest subject index.

Single-Crystal Elastic Constants and Calculated Aggregate Properties. Second Edition. By G. Simmons and H. Wang (Massachusetts Institute of Technology). The MIT Press, Cambridge, Mass. 1971. xv + 370 pp. $15.00.

This book consists mostly of tabulated computer print-out material reproduced by photo-offset lithography. The tables consist of a series devoted to single crystals, giving elastic stiffness and elastic compliance values, and a series devoted to macroscopically isotropic random aggregates of crystals, for which Young's modulus, shear modulus, Poisson's ratio, bulk modulus, compressibility, velocity of compressional waves, and velocity of shear waves are given, using the bounds calculated according to the methods of Voigt, Reuss, Hashin, and Shtrikman. References to the original data are given; and there is a compound index.

Essentials of Biochemistry. By M. Toporek (Thomas Jefferson University). Appleton-Century-Crofts, New York, N. Y. 1971. ix + 396 pp. $5.95.

This limp-bound book presents biochemistry at a more elementary level than is commonly available, for use in lower division undergraduate courses for nonspecialists, in which biochemistry is either a part or the whole. There are review questions, references, and an index.

Handbook of Chemistry and Physics. 52nd Edition. Edited by R. C. Weast (Consolidated Natural Gas Service Co., Inc.). The Chemical Rubber Co., Cleveland, Ohio. 1971. xxvii + 2311 pp. $24.95.

This perennial handbook, which has been a helpful friend to students and practicing chemists for more than two generations, has not been reviewed in this journal for a long time, and it is appropriate to record how it has grown. The many owners of the familar stubby volumes of earlier editions may be surprised at the new format; the pages have expanded from $4^3/_4 \times 7$ in. to $7^3/_8 \times 10^3/_8$ in., and the weight from $2^3/_4$ to $6^1/_2$ lb. The larger pages have allowed the thickness to be reduced (the 44th edition, for example, had 3004 pages). The contents have been more sharply subdivided, so that there are now five sections, each effectively a book itself and separately paginated: Mathematical Tables (191 pp); The Elements and Inorganic Compounds (551 pp); Organic Compounds (771 pp); General Chemical (238 pp); General Physical Constants (229 pp); Miscellaneous (297 pp), and a 34-page overall index.

There is ample evidence of on-going revision, amplification, and up-dating. The process of converting to SI units has been begun (an enormous task). The long section on properties of solutions as a function of concentration, which includes organic and inorganic materials, from ammonium chloride to rabbit urine, has been revised, along with several lesser sections (*e.g.*, description of the elements; strengths of bonds, etc.). There are also a number of additions, mostly in the form of physical-chemical data (*e.g.*, thermal data for pure metals; conductivities of aqueous solutions, etc.). The advent of the space age is appropriately recognized by the inclusion for the first time of a group of tables of physical data for the planets, their satellites, and asteroids; the sole chemical content in its 12 pages is one column on one page dealing with atmospheric compositions. An unfortunate terminology has been allowed to flourish in one part of this section: no chemist familiar with a centrifuge would head columns with the coined term "*centrifical* force," and a physicist would not use the term *force* for a quantity with dimensions of cm/sec^2, which is acceleration.

Although this volume contains a staggering amount of information clearly presented, it cannot be accepted as the last word, or even the most recent word, in many areas. For example, the section entitled "Definitive Rules for Nomenclature of Organic Chemistry" reproduces the 1957 rules of the IUPAC Commission for hydrocarbons and heterocyclic rings, but completely omits the rules regarding functional groups, which were published in 1965. It is to be hoped that this serious omission will be rectified in the next edition. This example suggests that other sections may be similarly out of date.

The "Organic Compounds" section of the review copy ends at p C-771, yet the Table of Contents lists a table on ion-exchange resins beginning on p C-775. Presumably this is a binding error, although p C-772 is blank, and the omission may be more far-reaching.

The shortcomings are small compared to the magnitude of the work and its overall value, and the publishers have again produced a volume that will be a substantial service to the profession.