α-[(Dibutylamino)ethyl]-4-pyridinemethanol (4b) was prepared by the procedure used for **4a**: yield of **4b** as dipicrate, 46%; mp 108–111 °C (EtOH). Anal. ($C_{28}H_{34}O_{15}N_8$) C, H, N.

2-Cyanophenanthridine (12) was prepared by adapting the method of Newman and Boden.[24] The yield of **12** was 79%: yellow crystals; mp 221–222 °C; IR (KBr) 2220 cm^{-1} (CN). Anal. ($C_{14}H_8N_2$) C, H, N.

2-Phenanthridinecarboxaldehyde (13). Compound **12** (32.3 g, 0.147 mol) and 17.1 g of NaOH in 300 mL of water were heated under reflux for 20 h. The mixture was filtered to recover 3.7 g of **12**. The pH of the filtrate was adjusted to 2 by adding 6 M HCl to produce a finely divided tan precipitate, which was collected using a sintered glass funnel. The tan solid was dissolved in approximately 1 L of boiling dimethylformamide, treated with charcoal, and filtered. Water was added to the cooled filtrate to precipitate finely divided white crystals, mp 316–318 °C, which weighed 23.8 g.

Freshly distilled $SOCl_2$ (30 mL) and 5.05 g of the foregoing solid were heated under reflux for 6.5 h. Most of the thionyl chloride was removed by reduced pressure distillation and the remainder by codistillation with dry benzene at reduced pressure to yield 5.26 g of a pale yellow powder of 2-phenanthridinecarboxoyl chloride hydrochloride: mp 237–247 °C dec; IR (KBr) 1725 cm^{-1} (C=O); derivative, 2-(ethoxycarbonyl)phenanthridine (80%), mp 96–97.5 °C (C_2H_5OH). Anal. ($C_{16}H_{13}NO_2$) C, H, N.

To 2-phenanthridinecarboxoyl chloride hydrochloride (11.1 g, 0.04 mol) in 40 mL of dry, ice-cooled THF under a N_2 atmosphere was added dropwise, with stirring during 2 h, 18.3 g (0.072 mol) of $LiAl(OBu\text{-}t)_3H$ in 225 mL of dry THF. The mixture was kept at 0–5 °C for 30 min, the ice bath was removed, and stirring was continued for 1 h. Chloroform (200 mL) was added and the resulting mixture was poured into 500 mL of ice–water. The precipitate which resulted was removed by filtration and discarded. The filtrate was extracted repeatedly with $CHCl_3$, and the $CHCl_3$ extract was washed with Na_2CO_3 solution, dried ($MgSO_4$), and concentrated to yield 7.7 g of light yellow solid: mp 171–180 °C; TLC (alumina–CH_2Cl_2) R_f 0.69 (**13**, major) and 0.21 [2-phenanthridinylmethanol (**14**), minor].

The crude product was purified by chromatography using Florisil (Fisher 60–100 mesh, 3.5 × 35 cm) and Et_2O. Aldehyde **13** was the first component to be eluted from the column. Evaporation of Et_2O left a white powder, mp 185–188 °C, which was sublimed at 120 °C (0.15 mm) to yield **13** (59%): mp 185–199 °C; IR (KBr) 1685 cm^{-1} (C=O); ^1H NMR δ 10.2 (s, C*H*O, 1), 9.4 (s, 1, aromatic), 9.0 (s, 1, aromatic), 8.8–7.6 (m, 6, aromatic).

Crude **14** was obtained by further elution. An analytical sample of **14** was obtained by further column chromatography: basic alumina, Woelm activity I, 2.5 × 15 cm for 3 g of mixture, and $CHCl_3$ as developer. Evaporation of $CHCl_3$ left a nearly white solid: mp 135–137 °C; IR (KBr) 3200 cm^{-1} (OH). Anal. ($C_{14}H_{11}NO$) C, H, N.

α-[(Dibutylamino)methyl]-2-phenanthridinemethanol (5). To dimethylsulfonium methylide[5] (10 mmol) at 0 °C in 15 mL of Me_2SO was added, with stirring, 1.3 g (6.3 mmol) of **13** in 60 mL of THF. Stirring at 0 °C was continued for 30 min and then for 1 h as the solution warmed to room temperature. Ice–water (150 mL) was added and the mixture was extracted with Et_2O. To eight-ninths of the ethereal solution was added 3.0 g of dibutylamine. Ether was removed by distillation, and the residue was heated to 150 °C for 30 min under nitrogen. After reduced pressure distillation of the volatiles, a bright orange viscous liquid (1.4 g) remained as the residue. This was chromatographed (Florisil, Fisher, 60–100 mesh, 2.5 × 20 cm, Et_2O). The lead band was **5**: yield 1.1 g (65%); yellow oil; IR (neat) 3380 cm^{-1} (OH); ^1H NMR (CS_2) δ 7.5–9.7 (m, 8), 4.7–5.0 (2 d, 1), 4.0 (s, 1), 2.4–2.7 (m, 6), 0.8–1.7 (m, 14). Anal. ($C_{23}H_{30}N_2O$) C, H, N.

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(24) M. S. Newman and H. Boden, *J. Org. Chem.*, **26**, 2525 (1961).

Book Reviews

Goodman and Gilman's The Pharmaceutical Basis of Therapeutics. Sixth Edition. By Alfred Goodman Gilman, Louis Goodman, and Alfred Gilman. Macmillan, New York. 1980. xvi + 1843 pp. 18.5 × 26 cm. $45.00.

The sixth edition of this classic textbook of pharmacology continues the philosophy and objectives of the earlier editions. Several major changes deserve emphasis. The section on general principles has been expanded and divided into three chapters, including a new introductory treatise on "Principles of Therapeutics". Pharmacokinetic data have become available at an accelerating rate, and there is thus continued attention to this topic. Fundamental discussion is presented in Chapter 1, and a practical approach to the optimal utilization of this information is presented in a major new unit which includes both explanatory text and readily utilized tables for a large number of drugs. The basic mechanisms of clinically relevant interactions are analyzed for individual drugs, and an index of drug interactions has been prepared for ready reference. Other major changes include a new chapter on "Neurohumoral Transmission and the Central Nervous System". An entire new section of the textbook is concerned with toxicology.

This sixth edition of "Goodman and Gilman" will prove invaluable to every researcher, practitioner, and student involved with the use, development, or dispensing of drugs.

Staff

The Chemistry of Heterocyclic Compounds. Volume 39. Triazoles: 1, 2, 3. By K. Thomas Finley. Series editors, Arnold Weissberger and Edward C. Taylor. Volume editor, John A. Montgomery. Wiley, New York. 1980. ix + 349 pp. 16.5 × 24 cm. $100.00.

For the medicinal chemist the investigation of novel compounds with interesting pharmacological activity is often synonymous with the investigation of novel heterocyclic systems. The search for compounds with a particular type of biological activity, however, may extend across the classical lines of heterocyclic research and involve the synthesis of structures based on many different heterocyclic systems. In this complex area of organic chemistry where each heterocyclic system is associated with its own unique physical properties, synthetic methods, and chemical behavior, such studies would be formidable if the investigator did not have a ready access to the appropriate heterocyclic literature. Such access has been provided by "The Chemistry of Heterocyclic Compounds". "Triazoles: 1, 2, 3", the 39th volume in this series, is a comprehensive review of the monocyclic 1,2,3-triazole literature

based on a search of "Chemical Abstracts" through 1976. The volume was designed to complement several other recent reviews on this subject and, thus, deals primarily with synthetic methods. It does not discuss the physical properties or practical utility of this triazole system and treats its chemistry only when it is useful for the conversion of one 1,2,3-triazole system to a second with different substituents or substitution patterns.

The subject matter has been organized into chapters and sections, each of which deals with a specific type of substituent or substitution pattern. The first three chapters, for example, describe synthetic methods for 1,2,3-triazole systems with one, two or three alkyl or aryl substituents; each chapter is subdivided to describe specific methods for each of the possible substitution patterns. Subsequent chapters treat the functional group substituents, such as halogen, carboxyl, carbonyl, amino, alkoxy, alkylthio, nitro, sulfonyl, etc. The triazolines, triazolinones, triazolium, and mesoionic systems are also covered. Each chapter consists of a discussion of the methods available for the preparation of that particular type of compound with some indication of the best methods and those that show promise with further development. The discussion is followed by a tabular presentation of the compounds currently in the literature. A combined subject and author index at the end of this volume is of particular value for its complete alphabetical listing of authors.

This review should be of value to chemists already engaged in research on the 1,2,3-triazole system and a primary reference for those who wish to begin.

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A-Z of Clinical Chemistry. By W. Hood. Halsted Press (a Division of Wiley), New York. 1980. vii + 386 pp. 14 × 22 cm. $19.95.

This book can serve as a handy reference to anyone working or studying in the area of clinical chemistry. The format is that of an alphabetical listing of terms, test names, and disease states which will be commonly encountered, along with a brief note of explanation for each. The subjects covered appear to be very comprehensive. In addition certain of the entries direct the reader to other literature on the subject. It could prove highly useful as a memory aide for the student or professional, but it can only be considered a starting point if detailed information is required.

Staff

Tumors that Secrete Catecholamines. By Ronald Robinson. Wiley, New York. 1980. xii + 132 pp. 15.5 × 23.5 cm. $40.00.

This volume represents a labor of love by Dr. Robinson, who for many years has been a clinical biochemist with a special interest in catecholamine secreting tumors, pheochromocytomas, and neuroblastomas. He has had experience in the identification of the tumors through their secretory products, i.e., catecholamines, their precursors, and metabolic conversion products. The author begins with a review of the biochemical pathways important in the synthesis and degradation of catecholamines, as well as the effects and physiology of catecholamines. In Chapter 2, the tumor biology of neoplasms of sympathetic nervous tissue is described, which provides a rationale and justification for the importance of measuring catecholamine-related material in these patients. The author then gives a detailed study of the biology of pheochromocytoma with respect to its secretion of catecholamines. These chapters are useful because most of the biologic effects caused in humans by pheochromocytomas are related to catecholamine effects in addition to providing the basis for diagnosis of these tumors through monitoring of catecholamines. The author is at his best in describing and reviewing the available tests for catecholamines. It is in this portion of the text that his extensive experience in developing and evaluating these tests is clearly apparent. His analysis and data are excellent with extensive references. The references are somewhat more heavily slanted toward the European and British literature, but this is not a major problem. Little mention is made of the potential utility of serum catecholamine metabolite determination in neuroblastoma or the newer technologies using high-pressure liquid chromatography. An excellent discussion of the potential for false positives available to the clinician in evaluating the laboratory tests is presented. The final chapters of the book present explicit methods for measuring catecholamines and their metabolites with detailed procedures which have been reliable in the author's laboratory and presented an adequate experimental detail to provide for the reproduction of these procedures. In summary, the book is an excellent review of the importance and methods for determining levels of catecholamines and their metabolites in patients with proven or suspected tumors of sympathetic tissue. The author's extensive experience with the classical methods makes this small book an excellent addition to the library of clinical chemists or others dealing with either the clinical or basic aspects of these tumors. This book will also be of use to clinicians involved in the care of patients and to medicinal chemists as a brief introduction to the practical pharmacology of the catecholamine-secreting tumors.

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Organophosphorus Chemistry. Volume 11. Specialist Periodical Reports. By D. W. Hutchinson and S. Trippett, Senior Reporters. The Chemical Society, Burlington House, London. 1980. ix + 288 pp. 14.5 × 22.5 cm. $145.00.

This excellent summary of research on organic compounds containing phosphorus, which covers work published between mid 1978 and mid 1979, follows the format of previous editions. The individual chapters are authored by the same experienced reporters who worked on Volume 10, except that B. J. Walker (who also reports on "Tervalent Phosphorus Acid") has replaced D. J. H. Smith as the reporter for "Ylides and Related Compounds".

In my review of Volume 8 of "Organophosphorus Compounds", I complained that the price ($44.00 in 1977) might inhibit purchases by individual researchers. The price of the present edition will undoubtedly cause even many libraries to think twice before sending in their orders. Few investments, however, are likely to be as valuable for individuals or laboratories engaged in research on phosphorus chemistry.

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Organic Chemistry: A Series of Monographs. Volume 43. Thermal Electrocyclic Reactions. By Elliot N. Marvell. Academic Press, New York. 1980. ix + 422 pp. 15 × 22.5 cm. $51.00.

Of the three main groups within the large category of pericyclic reactions, both sigmatropic shifts and cycloadditions have received considerable attention in reviews and monographs. The present volume constitutes the first comprehensive review of electrocyclizations, the third one of these groups. As the title implies, only thermal reactions are considered, and the photochemical area is largely omitted. To compile the myriad of examples, which are treated in this volume, from the diverse chemical literature is a Herculean task for which Professor Marvell is to be highly commended. This book will surely be a delight to physical-organic chemists.

This volume begins with a brief and highly readable summary of the various theories which have been developed to cover electrocyclic reactions. Examples of the energetics of "allowed" as well as of "forbidden" reaction pathways are considered throughout the book. After the theoretical material, the text is organized according to the number of electrons involved and the number of atoms over which these electrons are spread (e.g., Chapter 6: "Six Electron Five-Atom Systems"). Within each chapter a variety of atomic arrays is considered, including an increasing number of heteroatoms as the complexity of the basic reaction systems increases.

Since the other two more publicized classes of pericyclic reactions are finding increasing application in organic syntheses, this book promises to result in greater utilization of this reaction

class for synthetic purposes. Numerous existing syntheses are cited within each chapter, although, with one exception, this is not apparent from the table of contents. Innumerable examples of ring expansions and preparations of polycyclic compounds, cage molecules, strained rings, etc. are found throughout the text. There is a subject index, albeit a rather brief one.

The text has been carefully prepared and there appear to be only a few trivial typographical errors. This reviewer finds only two faults with this work. First, much of the earlier history of these reaction types has been omitted, but this minor fault should be forgiven. The theory of pericyclic reactions really dates back only to 1965, with the development of the Woodward–Hoffmann rules for orbital symmetry conservation in concerted processes. Furthermore, these theoretical developments coincided with the advent of widespread usage of modern instrumentation which greatly facilitated the structure identification necessary for the delineation of these reactions. Second, although there is prolific use of formulas and equations throughout the book, there are still large numbers of compounds listed by name and reference only, which detract from the readability and utility of some of the material.

For all those chemists concerned with potential syntheses of unsaturated carbocyclic and heterocyclic structures, reference to this volume is highly recommended.

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Books of Interest

Interferon and Interferon Inducers. Modern Pharmacology–Toxicology. Volume 17. Clinical Applications. By Dale A. Stringfellow. Marcel Dekker, New York. 1980. ix + 329 pp. 15.5 × 23.5 cm. $39.50.

Pharmanual. A. Comprehensive Guide to the Therapeutic Use of Cefsulodin. By L. D. Sabath and M. Finland. S. Karger A.G., Basel. 94 pp. 15.5 × 22.5 cm. $12.00.

Biochemistry. Second Edition. By Lubert Stryer. W. H. Freeman, San Francisco. 1981. xxvii + 949 pp. 21 × 26.5 cm. $29.95.

Metal Carcinogenesis Testing. By Max Costa. The Humana Press, Clifton, NJ. 1980. xiii + 164 pp. 16 × 23 cm. $29.50.

High-Performance Liquid Chromatography. Volume 2. Advances and Perspectives. By Csaba Horvath. Academic Press, New York. 1980. xiii + 341 pp. 16 × 23.5 cm. $39.50.

Ribavirin. A Broad Spectrum Antiviral Agent. By Roberts A. Smith and William Kikpatrick. Academic Press, New York. 1980. xiii + 237 pp. 16 × 23 cm. $21.00.

Physiology of the Hypothalamus. Volume 2. Handbook of the Hypothalamus. By Peter J. Morgane and Jaak Panksepp. Marcel Dekker, New York. 1980. xvi + 680 pp. 18 × 26 cm. $145.00.

Behavioral Studies of the Hypothalamus. Volume 3. Parta Handbook of the Hypothalamus. By Peter Morgane and Jaak Panksepp. Marcel Dekker, New York. 1980. xiv + 499 pp. 18 × 26 cm. $93.50.

Medicinal Chemistry, Proceedings of the 6th International Symposium on Medicinal Chemistry, Brighton, United Kingdon, September 4–7, 1978. By M. A. Simkins. Wiley, New York. 1979. 477 pp. 17 × 25 cm. $94.00.

Encyclopedia of Chemical Technology. Third Edition. Volume 10. By Kirk-Othmer. Wiley, New York. 1980. xxvi + 962 pp. 19 × 26 cm. $145.00.

Encyclopedia of Chemical Technology. Third Edition. Volume 11. By Kirk-Othmer. Wiley, New York. 1980. xxvi + 995 pp. 19 × 26 cm. $145.00.

Vitamin D. Molecular Biology and Clinical Nutrition. Volume 2. By Anthony W. Norman. Marcel Dekker, New York. 1980. x + 800 pp. 15.5 × 23.5 cm. $85.00.

Drug Treatment, Principles and Practice of Clinical Pharmacology and Therapeutics. By Graeme S. Avery. ADIS Press, Balgowlah, Australia. 1980. xvi + 1382 pp. 19 × 27 cm. $45.00.

Personal Computers in Chemistry. By Peter Lykos. Wiley, New York. 1981. xi + 262 pp. 15 × 23.5 cm. $27.50.

Annals of the New York Academy of Sciences. Volume 348. Lipoprotein Structure. By Angelo M. Scanu and Frank R. Landsberger. New York Academy of Sciences, New York. 1980. 436 pp. 15 × 23 cm. $77.00 (cloth).

Advances in Chromatography. Volume 19. By J. Calvin Giddings, Eli Grushka, Jack Cazes, and Phyllis R. Brown. Marcel Dekker, New York. 1981. xv + 312 pp. 15.5 × 23.5 cm. $39.75.