acid, the corresponding chloride III (X = Cl) was obtained, m.p. 93–96°.

Anal. Calcd. for $C_{17}H_{15}Cl$: C, 80.16; H, 5.89; Cl, 13.95. Found: C, 80.48; H, 5.91; Cl, 13.66.

Synthesis of 1,4-Naphthohydroquinone-2-carboxanilide and 1,4-Naphthoquinone-2-carboxanilide[1]

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Truit[2] reported that various derivatives of 2-acylamino-3-alkyl-1,4-naphthoquinone possess amebicidal activity. Buu-Hoi[3] reported that 1-naphthylamine, 1,5-naphthylenediamine, and similar derivatives of 2-chloro-1,4-naphthoquinone were capable of inhibiting the growth of *Mycobacterium tuberculosis*. N,N-Diethyl-4-chloro-1-hydroxy-2-naphthamide, ethyl 4-chloro-1-hydroxy-2-naphthalate and N-phenethyl-4-chloro-1-hydroxy-2-naphthamide were shown by Franzen and Binkley[5] to exhibit low antiprotozoal activity. It seemed quite likely that various substituted amide derivatives of 1,4-dihydroxy-2-naphthoic acid and the corresponding 1,4-naphthoquinone-2-carboxamide should be interesting biologically.

Experimental[5,6]

1,4-Dihydroxy-2-naphthoic Acid.[7]—When this compound was made according to the procedure of Homeyer and Wallingford,[7] a red oil was often obtained in the preparation of the intermediate compound, diethyl 1,4-dihydroxy-2,3-naphthalate. This difficulty was overcome when NaH was substituted for $NaOC_2H_5$ in the condensation of ethyl phthalate and ethyl succinate, and by running the reaction in anhydrous ether. The melting point of diethyl 1,4-dihydroxy-2,3-naphthalate[7] was raised from 62–64° to 74–74.5° when the product was recrystallized twice from petroleum ether (b.p. 30–60°).

1,4-Naphthohydroquinone-2-carboxanilide.—To a suspension of 16 g. (0.123 mole) of aniline hydrochloride in 800 ml. of acetonitrile was added 17.5 ml. of triethylamine followed by 25 g. (0.123 mole) of 1,4-dihydroxy-2-naphthoic acid and 54 g. (0.125 mole) of 1-cyclohexyl-3-(2-morpholinyl-(4)-ethyl) carbodiimide metho-*p*-toluenesulfonate. After stirring for 48 hr. at room temperature, the 1-cyclohexyl-3-(2-morpholinyl-(4)-ethyl)urea metho-*p*-toluenesulfonate was removed by filtration, and washed with 100 ml. of acetonitrile. The organic layers were combined and the solvent removed under reduced pressure. The crude product was dissolved in ether and the solution washed with *N* hydrochloric acid, *N* sodium bicarbonate, and finally water until the aqueous layer remained clear. Drying over $MgSO_4$ and removal of the ether yielded 12 g. of a mixture of yellow and red crystals. The crude material was dissolved in hot 95% ethanol, and subsequent cooling to room temperature gave red crystals (135 mg.), m.p. 215° dec. The structure of this compound remains unknown.

Anal. Calcd. for $C_{34}H_{24}N_2O_6$ (quinhydrone): C, 73.17; H, 4.39; N, 5.07. Found: C, 74.83; H, 4.47; N, 7.20.

Concentration of the mother liquor gave 10 g. of crude 1,4-naphthohydroquinone-2-carboxanilide. Five recrystallizations from benzene gave 3.70 g. (11%) of light tan crystals, m.p. 212° dec.

Anal. Calcd. for $C_{17}H_{13}NO_3$: C, 73.28; H, 4.71; N, 5.06. Found: C, 73.12; H, 4.87; N, 5.24.

Infrared absorption in KBr, 2.9 (OH), 3.1 (N–H), 6.2, and 6.3 μ (C=O); ultraviolet absorption in EtOH, λ_{max} 270 and 360 mμ; λ_{min} 245 and 328 mμ.

1,4-Naphthoquinone-2-carboxanilide.—To 260 mg. of 1,4-naphthohydroquinone-2-carboxanilide in anhydrous ether was added 2 g. of silver oxide and 2 g. of $MgSO_4$. The reaction mixture was stirred in the dark for 4 hr. The solution was filtered to remove the excess silver oxide and the $MgSO_4$. The ether solution was concentrated to yield 240 mg. of bright red-orange crystals. Recrystallization from anhydrous ether yielded 212 mg. (82%) of product, m.p. 140–141°.

Anal. Calcd. for $C_{17}H_{11}NO_3$: C, 73.50; H, 4.00; N, 5.05. Found: C, 73.26; H, 4.04; N, 5.36.

Infrared absorption in KBr, 3.1 (N–H), 6.1, 6.3 (C=O), and 5.9 μ (quinone C=O); ultraviolet absorption in EtOH, λ_{max} 252 and 334 mμ; λ_{min} 310 mμ.

Reaction of 1,4-Dihydroxy-2-naphthoic Acid with Benzyl Bromide.—To 10 g. (0.05 mole) of 1,4-dihydroxy-2-naphthoic acid in 50 ml. of ethanol and 25 ml. of water was added 40 ml. of 7 *N* KOH and 33 ml. of benzyl bromide over a 20 min. period. After cooling to room temperature, 300 ml. of water was added and the aqueous solution acidified with glacial acetic acid. Extraction of the solution with $CHCl_3$ and distillation of the $CHCl_3$ layer at 45° (0.58 mm.) resulted in a yellow sirup. The sirup was layered with anhydrous ether in a stoppered flask. White crystals separated after 2 weeks, 7 g., m.p. 142–143° (from ether). The analytical results are not in agreement with those expected for benzyl 1-hydroxy-4-O-benzyl-2-naphthalate.

Anal. Calcd. for $C_{25}H_{20}O_4$: C, 78.12; H, 5.20. Found: C, 85.00; H, 5.70. Calcd. for $C_{24}H_{20}O_2$: C, 84.70; H, 5.88.

When 1,4-naphthalenediol was treated with benzyl bromide and 7 *N* KOH and the reaction mixture worked up in the usual manner, dibenzyl 1,4-naphthohydroquinone was isolated. Recrystallization from ether gave white crystals, m.p. 142–143°. A mixture melting point with the product isolated previously caused no depression. The compound isolated was dibenzyl-1,4-naphthohydroquinone.

Acetylation of 1,4-Dihydroxy-2-naphthoic Acid with Acetic Anhydride or Isopropenyl Acetate.—Refluxing 1 g. of 1,4-dihydroxy-2-naphthoic acid with 10 ml. of acetic anhydride and 0.5 g. of sodium acetate for 1.5 hr. yielded 1,4-diacetoxynaphthalene,[8] recrystallized from ethanol, m.p. 124–125° (lit.[7,8] 125–127°). Refluxing 1 g. of 1,4-dihydroxy-2-naphthoic acid with 10 ml. of isopropenyl acetate and 1 drop of sulfuric acid for 2 hr. gave upon work-up, 220 mg. of 1,4-diacetoxynaphthalene, m.p. 125–126°.

(1) Supported by Grant CY3231, U. S. Public Health Service.

(2) P. Truit, F. M. Wood, and R. Hall, *J. Org. Chem.*, **25**, 1460 (1960).

(3) N. P. Buu-Hoi, *Bull. Soc. Chim.*, **11**, 578 (1944).

(4) J. S. Franzen and S. B. Binkley, *J. Org. Chem.*, **24**, 992 (1959).

(5) Analyses by Micro-Tech Laboratories, Skokie, Ill.

(6) All melting points are corrected. The infrared spectra were run on a Perkin-Elmer Infracord spectrophotometer and the ultraviolet spectra were taken on a Beckman DU spectrophotometer.

(7) A. H. Homeyer and V. H. Wallingford, *J. Am. Chem. Soc.*, **64**, 798 (1942).

(8) F. Russig, *J. Prakt. Chem.*, **62**, 30 (1900).

Book Reviews

Steroid Reactions: An Outline for Organic Chemists. By CARL DJERASSI. Holden-Day, Inc., San Francisco, Calif., 1963. vi + 657 pp. $9.75.

The last two decades have seen an enormous increase in the volume of literature on steroid chemistry. In a survey of reactions characteristic of this field both the steroid chemist and the general organic chemist face the dilemma of a complete literature search without sacrificing a significant slice of one's working time which, otherwise, could be spent in the laboratory. Prof. Djerassi, who is so well known for his contributions to steroids, has now come out with a book which every chemist in the field will receive with relief.

The book under review can be considered more appropriately as a catalog or atlas rather than a text book as it illustrates the examples without much description. It is divided into 14 sections, each devoted to a given reaction. Each section is composed of a comprehensive collection of examples of some particular reaction, which has been widely employed for steroids, and has been modified to suit specific requirements in individual cases.

The briefness of each example expertly incorporating the vital data and reaction conditions together with editorial notes where necessary, enables the reader to make selections according to his needs at a glance. The separate bibliography for each section is also very helpful for tracing the original papers.

A literature search for less known reactions causes frequently more difficulties and frustration when long hours of work in the library are rewarded by only a handful of informative sentences. The present book offers an up-to-date encyclopedia of selected reactions which have been widely employed in steroid chemistry. However, examples of those reactions have been omitted which have not received wide attention, such as reactions at the C_{17} side chain, *cis-trans* modifications of ring junctions, addition of alicyclic and heterocyclic rings to the steroid nucleus, etc. Any reader of this book who is familiar with steroid chemistry will miss such examples which could have been easily incorporated in an additional section dealing with miscellaneous reactions, without exceeding the limits of this book. Inclusion of such additional sections would have made this publication even more valuable and comprehensive.

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Spectrophotometric Analysis of Drugs Including Atlas of Spectra. By IRVING SUNSHINE and S. R. GERBER, Cuyahoga County Coroner's Office, Cleveland, Ohio. Charles C Thomas, Springfield, Ill., 1963. xvii + 235 pp. $10.50.

The introduction of spectroscopic techniques for qualitative and quantitative analyses in clinical and forensic toxicology will be greatly assisted by the appearance of this book. A detailed experimental procedure for the preparation of samples for ultraviolet and infrared spectra determination from blood, urine, and stomach-content specimens should prove useable even by those previously untrained in spectroscopic techniques. As the authors indicate, a catalog of reference spectra must be kept by each analyst since the appearance of new drugs is too rapid to allow for publication of atlases of spectra. A very excellent start has been provided in this book, however, for ultraviolet absorption spectra of 143 common drugs in acidic and basic solvent are presented, along with 268 infrared spectra. In most cases spectra of the therapeutic agent as a KBr pellet and in chloroform solution are given. In all cases the spectra are easily read and are sufficiently large for each comparison with experimentally obtained curves.

For no apparent reason, the authors indicate specifically that a "Perkin-Elmer Model 221 recording infrared spectrophotometer" is necessary equipment for the infrared analyses while the fact that the ultraviolet absorption spectra were determined using a "Beckman DK2 recording ultraviolet spectrophotometer" was mentioned only on the dust cover. This may prove misleading to the toxicologist wishing to initiate these techniques, for a number of infrared spectrophotometers are available with "scale expansion," the special feature required by this analysis.

A table beginning on page xi lists the ultraviolet spectra in order of increasing wave length of major absorption bands. This provides a rapid method for finding the curves for comparison with the unknown. Unfortunately, the authors made no attempt to provide some similar procedure for expediting the comparison of infrared spectra. A modification of the "Sadtler" procedure might prove valuable.

The presentation of the infrared curves is excellent; however, the ultraviolet spectra were not replotted from the instrument curve and thus are not linear in wave length, providing some difficulty in determining the exact wave length of long wave length maxima. Furthermore, the curves are plotted in optical density which limits their usefulness to the chemical spectroscopist.

The index indicates the generic names of all agents by presentation in all capitals, but synonymous names are included. Unlike many indexes this one indicates the page number of the curves by both the generic and synonymous names providing the reader a rapid reference to the atlas of spectra.

In spite of the few disadvantages mentioned above, the book will prove of interest to any scientist who is concerned with infrared and/or ultraviolet absorption spectroscopy of organic compounds.

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Physiologic Pharmacology. Volume 1. WALTER G. ROOT and FREDERICK G. HOFMANN, Ed. Academic Press, New York, N. Y., 1963. xvi + 703 pp. 15.5 × 23.5 cm. 158s.6d ($22.00).

This is the first volume in a proposed series of ten volumes and the first of three volumes on drugs acting predominantly on the central nervous system. Volume 1, a multi-authored work, is concerned with depressant drugs. The emphasis on "physiologic" in the title and Foreword for the series may be somewhat misleading in its implication. This first volume is no more "physiologic" and, in view of the definition of pharmacodynamics or pharmacology, could be no more "physiologic" than a standard, authoritative textbook, such as Goodman and Gilman.

Most multi-authored books suffer from an unevenness in quality of presentation which can only be circumvented, to some degree, by rigid editorial policy and review. The wide range in quality of the twelve chapters of the first volume lead one to hope that the editors will exercise stricter supervision of contributions to the forthcoming volumes. The chapter on alcohols and that on tolerance and physical dependence are worthwhile contributions to the pharmacologic literature. The material in the two chapters on general anesthetics is more extensive than that usually found in textbooks, but one could wish for greater analytical treatment. The three chapters on the tranquilizers provide a much needed, comprehensive source of material not available in standard textbooks. However, the three chapters on the sedatives and hypnotics and the chapter on strong analgesics are neither as complete nor as well presented as similar chapters in currently available textbooks. Editorial review of the chapter on the nonnarcotic analgesics failed to correct a number of inconsistencies. The breadth of literature covered in the latter chapter, although very extensive, is treated with a minimum of critical evaluation. In the reviewer's opinion this lack of analytical criticism is to be regretted.

The chief value of "Physiologic Pharmacology, Vol. I" is that it collects in one book broad, factual, and somewhat critical review articles on related subjects. In view of some of the shortcomings of this first volume, and the cost of the whole series, it is to be recommended for the departmental library rather than for personal desk use.

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Pharmaceutical Firms U. S. A. & Canada, 1964. 72 pp., paperback, 27 × 21 cm. $12.00. **European Pharmaceutical Firms, 1964.** 84 pp. $18.00. Noyes Development Corp., Pearl River, N. Y.

These publications list major and minor pharmaceutical firms in the U. S. A. and Canada, 4000 firms in 15 European countries, and major and minor ones in India and Japan, with their addresses. Many, though not the majority of American listings, also contain the names of the officers of the companies, their subsidiaries, and their 1962 annual sales. Those not treated as extensively may be suspected to consist of a president, a telephone, and an office–salesroom–manufacturing plant combination. This description certainly holds for many of the European listings. This latter set also presents short market research surveys, valuable for overseas trade.

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