

ley of the Department of Zoology, have indicated androgenic activity for the diketone II at a total dose of 2.5 mg. (26 to 83% increase in comb weight over the controls). A total dose of 0.012 mg. of testosterone propionate resulted in 40% increase. The keto alcohol I has given inconclusive results. Further investigation of physiological effects in other species awaits the preparation of additional material.

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SYNTHESIS OF VITAMIN A

Sir:

The appearance of an article by Schwarzkopf and collaborators¹ on the synthesis of vitamin A by the reduction of vitamin A esters with lithium aluminum hydride prompts us to record experimental work carried out in these laboratories.

Ethyl β -ionylidene acetate² was reduced with lithium aluminum hydride in 85% yield to β -ionylidene ethyl alcohol following the method of Milas and Harrington³ [b. p. 112–114° at 0.4 mm.; $\lambda_{\text{max}}^{\text{isooctane}}$ 2840 Å., $E_{1\text{cm}}^{1\%}$ 1205]; *trityl ether* (m. p. 132–134°) *anal.* Found: C, 88.13; H, 8.47; $\lambda_{\text{max}}^{\text{isooctane}}$ 2850 Å., $E_{1\text{cm}}^{1\%}$ 733.

Oxidation of β -ionylidene ethyl alcohol with manganese dioxide by the method used to convert vitamin A to the aldehyde⁴ produced a mixture of two stereoisomeric β -ionylideneacetaldehydes in 60% yield separable by chromatography into essentially equal amounts of *nor*- β -ionylideneacetaldehyde⁵ [b. p. 90–95° at 10⁻² mm.; n_{D}^{25}

1.5780; $\lambda_{\text{max}}^{\text{isooctane}}$ 2650 Å., $E_{1\text{cm}}^{1\%}$ 567 and 3150 Å., $E_{1\text{cm}}^{1\%}$ 760, *anal.* Calcd. for C₁₅H₂₂O: C, 82.57; H 10.09. Found: C, 82.14; H, 10.36. *Semicarbazone*: m. p. 195–196°; $\lambda_{\text{max}}^{\text{chloroform}}$ 3230 Å., $E_{1\text{cm}}^{1\%}$ 1330; *anal.* Found: C, 69.56; H, 8.82; N, 15.29]⁶ and *iso*- β -ionylidene acetaldehyde⁵ [b. p. 80–85° at 10⁻² mm.; n_{D}^{25} 1.5780; $\lambda_{\text{max}}^{\text{isooctane}}$ 3180 Å., $E_{1\text{cm}}^{1\%}$ 904. *Anal.* Found: C, 82.14; H, 10.33. *Semicarbazone*: m. p. 175–176°; $\lambda_{\text{max}}^{\text{chloroform}}$ 3175 Å., $E_{1\text{cm}}^{1\%}$ 1000. *Anal.* Found: C, 70.16; H, 9.07; N, 15.03]. *nor*- β -ionylideneacetaldehyde was condensed with acetone in the presence of aluminum *t*-butoxide whereby the previously described C₁₈-ketone was obtained⁷ in 80–85% yield; $\lambda_{\text{max}}^{\text{isooctane}}$ 3360 Å.; *semicarbazone*: m. p. 186–188°; $\lambda_{\text{max}}^{\text{chloroform}}$ 3490 Å., $E_{1\text{cm}}^{1\%}$ 1680. The C₁₈-ketone was converted by the Reformatsky reaction to the C₂₀-hydroxyester which was dehydrated by iodine to vitamin A ester and the latter saponified to vitamin A acid, m. p. 179–180°; $\lambda_{\text{max}}^{\text{ethanol}}$ 3500 Å., $E_{1\text{cm}}^{1\%}$ 1415. From *iso*- β -ionylideneacetaldehyde there was obtained a more difficultly characterizable C₁₈-ketone exhibiting a broad band at 3340–3370 Å. indicating a mixture of the *nor* and *iso* forms. This ketone afforded vitamin A acid in the same yield as that obtained from the *nor* series (25%); m. p. 180.5–181.5°; $\lambda_{\text{max}}^{\text{ethanol}}$ 3530 Å., $E_{1\text{cm}}^{1\%}$ 1510; mixed m. p. with acid from *nor* series, 180–181°. Both vitamin A acids on reduction with lithium aluminum hydride gave vitamin A exhibiting a single, well-defined maximum at 3260 Å., $E_{1\text{cm}}^{1\%}$ 1330 (80% yield) as measured in isooctane.

(6) The β -ionylidenealdehydes semicarbazones prepared by Kuhn and Morris, *Ber.*, **70**, 858 (1937), and by van Dorp and Arens, *Rec. trav. chim.*, **67**, 459 (1948), apparently have the *nor* configuration.

(7) Arens and van Dorp, *Rec. trav. chim.*, **65**, 338 (1946); Heilbron, Jones and O'Sullivan, *J. Chem. Soc.*, 866 (1946); Karrer, Jucker and Schick, *Helv. Chim. Acta*, **29**, 704 (1946).

(1) Schwarzkopf, Cahnmann, Lewis, Swindinsky and Wuest, *Helv. Chim. Acta*, **32**, 443 (1949).

(2) Karrer, Salomon, Morf and Walker, *ibid.*, **15**, 878 (1932).

(3) Milas and Harrington, *THIS JOURNAL*, **69**, 2247 (1947).

(4) Ball, Goodwin and Morton, *Biochem. J.*, **42**, 516 (1948).

(5) The names *nor*- and *iso*- β -ionylideneacetaldehyde denote stereochemical relationships to β -carotene. The *nor* (normal) aldehyde is obtainable from β -carotene by oxidation—Wendler, Rosenblum and Tishler, *THIS JOURNAL*, in press.

RESEARCH LABORATORIES
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NEW BOOKS

Oxidation-Reduction Potentials in Bacteriology and Biochemistry. By L. F. HEWITT, Ph.D., B.Sc., F.R.I. C., Acting Director, Serum Research Institute, Carshalton, Surrey. Fifth Edition. Published by the London County Council, 1948, and may be purchased, either directly or through any Bookseller, from Staples, Ltd., 14, Great Smith Street, Victoria Street, Westminster, S.W.1. 130 pp. 17 × 25 cm. Price, 4s. 6d. By post, 4s. 10d.

The last previous edition of this small monograph was published in 1936. The present fifth edition follows the pattern of earlier ones. The first chapter contains a brief

outline of the theory of oxidation-reduction reactions and the mathematical expressions relating oxidation-reduction potentials to the components of the reactions. The second chapter describes the methods for measuring oxidation-reduction potentials and gives tables of oxidation-reduction indicators. The third chapter deals with oxidation-reduction systems of biological interest. In the fourth chapter, the bacteriological applications of oxidation-reduction studies are described. This fourth chapter is the most important in the monograph, since it constitutes the best review of the work in this particular field—a field to which the author himself has made many contributions. The monograph concludes with two short

chapters, one on the polarograph and one entitled, "General Conclusions."

An excellent bibliography covering about twenty-four pages further increases the value of this monograph. The number of new contributions made in this field during the last decade is, however, conspicuously small and is probably in part due to a diversion of interests during the war years.

ERIC G. BALL

Kinetics of Chemical Change in Solution. By EDWARD S. AMIS. Formerly Associate Professor of Chemistry, Louisiana State University; also Senior Research Chemist, Carbide and Carbon Chemicals Corporation, Oak Ridge, Tenn. At present Professor of Chemistry, University of Arkansas. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1949. ix + 332 pp. illustrated. 14 x 21.5 cm. Price, \$5.00.

Amis presents a very good summary of his book in the preface. After discussing the order of reactions, he considers the Arrhenius equation. Because molecules often are polar and sometimes ionize, dielectric behavior is treated at length and chapter three which discusses the work in this field by Debye, Onsager, Kirkwood, Jaffé and others is a useful summary. Absolute rate theory is developed after a detailed presentation of earlier treatments. Photochemistry, chain reactions, homogeneous and heterogeneous catalysis are treated in the concluding chapters. A visit to the library verified the supposition that Lewis in the index meant G. N., W. K. or J. R., although by reading the text I could only find out that there was a G. N., which I knew before. Reaction kinetics shows almost infinite variety so that any treatment hits the high spots only. Amis has chosen a very interesting set of reactions to treat and has done the job well. This book is a valuable addition to the literature of reaction kinetics.

HENRY EYRING

An Introduction to the Chemistry of Carbohydrates. By JOHN HONEYMAN, Lecturer in Organic Chemistry, University of London, King's College. Oxford University Press, 114 Fifth Ave., New York 11, N. Y., 1949. 143 pp. 14.5 x 23 cm. Price, \$4.50.

This small book serves as an excellent though brief textual summary of the present status of the chemistry of the carbohydrates. Most of the modern methods and techniques are delineated. It is intended to meet the needs of English students "reading for an Honours degree in Chemistry" but it should also be useful for others desiring to keep abreast of recent developments through a rapid survey of this field.

M. L. WOLFROM

BOOKS RECEIVED

July 10, 1949–August 10, 1949

MANSON BENEDICT AND CLARKE WILLIAMS, Editors, "Engineering Developments in the Gaseous Diffusion Process." First Edition. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 18, N. Y. 1949. 129 pp. \$1.25.

A. V. BLOM. "Organic Coatings in Theory and Practice." (Elsevier's Polymer Series.) Elsevier Publishing Company, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. New York, Amsterdam, London, Brussels. (Printed in the Netherlands by N. V. Drukkerij and G. J. Thieme Nijmegen.) 298 pp. \$6.00.

RAY Q. BREWSTER. "Organic Chemistry." Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, N. Y. 1949. 409 pp. \$6.00.

G. CHARLOT AND D. BEZIER. "Methodes Modernes D'Analyse Quantitative Minerale." Second Edition, Revised. Masson et Cie. Editeurs, 120, Boulevard Saint-Germain, Paris VI°. 685 pp.

FRITZ FEIGL. "Chemistry of Specific, Selective and Sensitive Reactions." Translated by Ralph E. Oesper. Academic Press, Inc., 125 East 23rd Street, New York, N. Y. 1949. 740 pp. \$13.50.

ROSS AIKEN GORTNER. "Outlines of Biochemistry." Third Edition. Edited by Ross Aiken Gortner, Jr. and Willis Alway Gortner. Chapman and Hall, Limited, London. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1949. 1078 pp. \$7.50.

R. H. GRIFFITH. "The Practice of Research in the Chemical Industries." Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. 1949. 184 pp. \$3.25.

P. H. HERMANS. "Physics and Chemistry of Cellulose Fibres." (Elsevier's Polymer Series.) Elsevier Publishing Company, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 534 pp. \$9.50.

R. HOUWINK, Editor. "Elastomers and Plastomers. Manufacture, Properties, and Applications." (Elsevier's Polymer Series. Vol. II.) Elsevier Publishing Company, Inc., 215 Fourth Avenue, New York 3, N. Y. 515 pp. \$9.00.

HENRY A. LARDY, Editor. "Respiratory Enzymes." Revised Edition. Burgess Publishing Company, 426 South Sixth Street, Minneapolis 15, Minnesota. 1949. 290 pp. \$4.50.

C. EDMUND MARSHALL. "The Colloid Chemistry of the Silicate Minerals." Vol. I. of *Agronomy*. A series of monographs prepared under the auspices of The American Society of Agronomy. Academic Press, Inc., 125 East 23rd Street, New York, N. Y. 1949. 195 pp. \$5.80.

PAUL NIGGLI. "Probleme der Naturwissenschaften. Erläutert am Begriff der Mineralart." Verlag Birkhäuser, Basel, Switzerland. 1949. 240 pp. 18.50 Swiss francs.

F. F. NORD, Editor. "Advances in Enzymology." Vol. IX. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 760 pp. \$9.00.

A. PHILIPPOVICH. "Die Betriebsstoffe für Verbrennungskraftmaschinen." Foreword and Introduction to the Series "Die Verbrennungskraftmaschine" edited by Hans List. Springer Verlag, Vienna, Austria. 1949. 206 pp.

S. C. ROTHMANN, Editor. "Constructive Uses of Atomic Energy." Harper and Brothers Publishers, 49 East 33rd Street, New York 16, N. Y. 1949. 258 pp. \$3.00.

"Surface Chemistry." Papers presented for a discussion at a joint meeting of the Société de Chemie Physique and the Faraday Society held at Bordeaux from 5 to 9 October 1947 in honour of Professor Henry Devaux published as a Special Supplement to Research a Journal of Science and its Applications. Butterworths Scientific Publications, London. 1949. Interscience Publishers, Inc., (American Edition) 215 Fourth Avenue, New York 3, N. Y. 334 pp.

JOHN TUTIN, Editor. "Atomic Energy Yearbook." Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, N. Y. First published, 1949. 236 pp. \$3.85.

C. J. S. WARRINGTON AND R. V. V. NICHOLLS. "A History of Chemistry in Canada." Sir Isaac Pitman and Sons (Canada) Limited, 381-383 Church Street, Toronto, Ontario, Canada. 1949. 502 pp. \$4.50.

GREGOR WENTZEL. "Quantum Theory of Fields." Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 1949. 220 pp. \$6.00.