[Calcd. for $C_6H_{10}N_2O_2$: C, 50.7; H, 7.10; N, 19.7. Found: C, 50.9; H, 7.11; N, 19.4].

Reaction of cycloserine with phenyl isocyanate provides the mono derivative (XIII), m.p. 197–198° [Calcd. for $C_{10}H_{11}N_3O_3$: C, 54.3; H, 5.01; N, 19.0. Found: C, 54.8; H, 5.4; N, 18.4]. Hydrochloric acid converts XIII to the hydrochloride of 5-aminoxymethyl-3-phenylhydantoin (XIV), m.p. 124–126°, $[\alpha]^{25}_{5461}$ 93° (*c*, 1 in H_2O) [Calcd. for $C_{10}H_{11}N_3O_3 \cdot HCl \cdot CH_3OH$: C, 45.5; H, 5.52; N, 14.5; Cl, 12.2. Found: C, 45.8; H, 5.42; N, 14.3; Cl, 12.4] whose infrared spectrum and properties are consistent with the hydantoin structure proposed. In alkali XIV is reconverted to the optically active derivative XIII.

3-Isoxazolidinone (XV), the parent ring of II, was prepared as follows: acid hydrolysis of 3-(isopropylideneaminoxy)-propionitrile[5] (XVI) to 3-aminopropionic acid hydrochloride (XVII), m.p. 150–151° [Calcd. for $C_3H_7NO_3 \cdot HCl$: C, 25.5; H, 5.70; N, 9.90; Cl, 25.1. Found: C, 25.3; H, 5.65; N, 9.98; Cl, 25.0]; esterification to ethyl 3-aminoxypropionate (XVIII), b.p. 87° (10 mm.), $n^{25}D$ 1.4328 [Calcd. for $C_5H_{11}NO_3$: C, 45.1; H, 8.33; N, 10.5. Found: C, 45.4; H, 8.43; N, 10.5]; and cyclization in base to XV, isolated as the hygroscopic potassium salt (XIV) [Calcd. for $C_3H_4NO_2K$: C, 28.8; H, 3.22; N, 11.2, mol. wt., 125. Found: C, 27.6, H, 3.59; N, 10.6, pK'_a 6.70, equiv. wt., 135] and also the silver salt (XX) [Calcd. for $C_3H_4NO_2Ag$: C, 18.6; H, 2.06; Found: C, 18.5; H, 2.17].

The infrared spectra of cycloserine (II) and the silver salts of cycloserine (I) and 3-isoxazolidinone (XX) are given in Fig. 1. The bands at 3.03, 3.09, 3.23, 6.17, 8.73, 9.04, 9.69, 10.16 and 12.12 microns, related to $-NH_2$ by deuteration studies, are absent in the 3-isoxazolidinone silver salt spectrum.

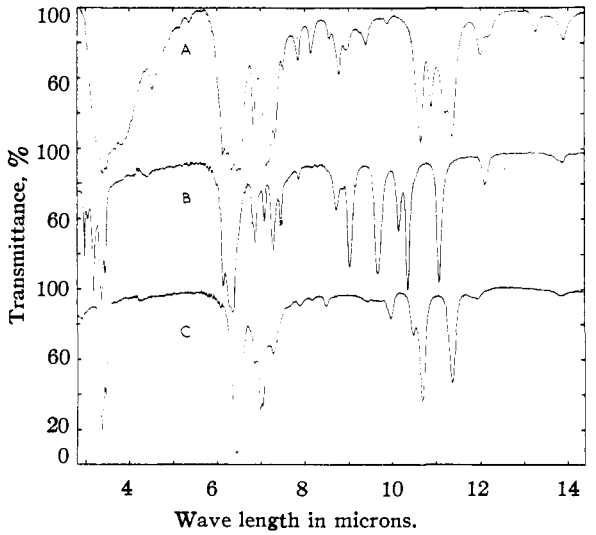

Fig. 1.—Infrared absorption spectra in mineral oil: A-cycloserine (II); B-cycloserine silver salt (I); C-3-isoxazolidinone silver salt (XX).

Additional confirmation has been obtained by syntheses by two independent routes and will be reported later.

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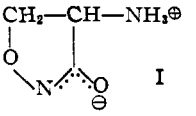
SYNTHESIS OF D-4-AMINO-3-ISOXAZOLIDONE

Sir:

A new antibiotic, oxamycin, has been isolated and shown by degradation to be D-4-amino-3-isoxazolidone (I).[1]



I

The synthesis of D-4-amino-3-isoxazolidone is described herein; the synthetic compound and oxamycin are identical.

DL-Serine was converted to its methyl ester hydrochloride (II) by Fischer esterification. On treatment of the ester II with ethyl iminobenzoate, DL-2-phenyl-4-carbomethoxy-2-oxazoline[2] (III) was obtained. The oxazoline ester III was then allowed to react with hydroxylamine and sodium ethoxide. Acidification of the reaction mixture afforded DL-2-phenyl-4-carbohydroxamido-2-oxazoline (IV), m.p. 176–179°. *Anal.* Calcd.: C, 58.20; H, 4.88; N, 13.60. Found: C, 58.38; H, 5.05; N, 13.41. Treatment of this hydroxamic acid IV with hydrogen chloride in dry dioxane yielded DL-α-benzamido-β-chloropropionohydroxamic acid (V), m.p. 153–155°. *Anal.* Calcd.: C, 49.40; H, 4.56; N, 11.54; Cl, 14.61. Found: C, 48.94; H, 4.49; N, 11.77; Cl, 14.31. When the hydroxamic acid was treated with 1*N* alkali followed by acidification, DL-4-benzamido-3-isoxazolidone (VI), m.p. 165–168° was formed. *Anal.* Calcd.: C, 58.24; H, 4.89; N, 13.59. Found: C, 58.45; H, 4.70; N, 13.37. The isoxazolidone VI was treated with a concentrated solution of methanolic hydrogen chloride to give DL-β-aminoxyalanine methyl ester dihydrochloride (VII), m.p. 128–131°. *Anal.* Calcd.: C, 23.20; H, 5.85; N, 13.53; Cl, 34.24. Found: C, 22.95; H, 6.19; N, 13.43; Cl, 32.27. (The ester VII and 4-acetamido-3-isoxazolidone were first obtained in the D series during structural investigation.)[1] Reaction of the ester VII with potassium hydroxide formed DL-4-amino-3-isoxazolidone (I), m.p. 138–141°, the racemate of oxamycin. *Anal.* Calcd.: C, 35.29; H, 5.92; N, 27.45. Found: C, 35.27; H, 6.04; N, 27.01.

This racemate was resolved with D-tartaric acid

(1) F. A. Kuehl, Jr., F. J. Wolf, N. R. Trenner, R. L. Peck, R. H. Buhs, I. Putter, R. Ormond, J. E. Lyons, L. Chaiet, E. Howe, B. D. Hunnewell, G. Downing, E. Newstead and K. Folkers, THIS JOURNAL, **77**, 2344 (1955).

(2) D. F. Elliot, *J. Chem. Soc.*, 589 (1949).

(5) H. Bruson, THIS JOURNAL, **65**, 23 (1943).

to give D-4-amino-3-isoxazolidone-D-tartrate, m.p. 165.5–166° (dec.), $[\alpha]^{25}D$ +41° (*c*, 0.7 water). Oxamycin D-tartrate also was prepared and had properties identical with the synthetic product. The synthetic salt was converted by Amberlite IR-120 resin to D-4-amino-3-isoxazolidone, $[\alpha]^{22}D$ +115° (*c*, 1.0 water). *Anal.* Calcd.: C, 35.29; H, 5.92; N, 27.44. Found: C, 35.09; H, 5.70; N, 26.88. The infrared spectrum of this compound was identical with that of oxamycin.

By use of L-tartaric acid, L-4-amino-3-isoxazolidone-L-tartrate, m.p. 165.5–166° (dec.), $[\alpha]^{24}D$ −41° (*c*, 0.7 water), was obtained from the racemate. Treatment of the tartrate with Amberlite IR-120 resin afforded L-4-amino-3-isoxazolidone, $[\alpha]^{22}D$ −115° (*c*, 1.0 water).

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RECEIVED MARCH 3, 1955

BOOK REVIEWS

Einführung in die Atomphysik. By WOLFGANG FINKELNBURG. Springer-Verlag, Reichpietschufer 20, Berlin W 35, Germany. 1954. xi + 543 pp. 17.5 × 25 cm. Ladenpreis: Ganzleinen DM 44.—.

This is a revised and up-to-date version of the second German edition (Springer, 1951) of Dr. Finkelnburg's book. An English translation of the second edition (McGraw-Hill, 1950) also exists.

The book is well written. It is illustrated with a remarkably fine collection of drawings and photographs beautifully printed. Like its predecessors it covers the broad field of atomic physics, including molecular structure and the solid state. The sections on the solid state and, especially, on nuclear physics have been considerably revised and expanded in this much improved version. It contains discussions of such diverse topics as atomic spectroscopy, mass spectroscopy, nuclear spectroscopy, quantum mechanics, atomic structure, the nuclear shell model, the construction of nuclear accelerators, the atomic bomb, the hydrogen bomb, and the construction and theory of transistors, presented at roughly the level of Born's "Atomic Physics," but covering much more ground with less attention given to the uniformly systematic development of all subjects. It was written for "—students, applied physicists, chemists and engineers." It is a good book for a quick review, or, perhaps, for use as a text book in a course for non-physicists, but because of its sometimes superficial presentation it appears unsuitable as a textbook for students of pure physics. The reader may not be as sanguine as the author concerning his prediction of discoveries which will connect together various dimensionless constants. But on the whole he will probably feel that the author has made a very worthwhile contribution to the literature of elementary atomic physics. The reviewer knows of no other book quite like it.

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The Identification of Organic Compounds. A Manual of Qualitative and Quantitative Methods. Fourth Edition. By STIEG VEIBEL, Dr. Phil., Professor of Organic Chemistry in the University of Technology, Copenhagen, G. E. C. Gad, Publisher, Vimmelskaftet 32, København K, Denmark. 1954. xv + 346 pp. 15 × 21.5 cm. Price, 45 sh.

It is very fortunate for American chemists that this excellent manual, which over a period of more than a quarter of a century has passed through several Danish editions, has now been published in English. It contains directions, with pertinent discussion, for determining the degree of purity of a substance and for effecting purification, for the detection of the elements and functional groups, the determination of the equivalent weight and for the preparation of derivatives. The determination of equivalent weight is effected in most instances by a quantitative estimation of a functional group, full directions being given. Thus the book covers quantitative as well as qualitative analysis. Although the procedures appear to be well chosen, there may be differences of opinion in some cases as to whether they are the best available.

The opening chapter, concerned with methods of purification and criteria of purity, is followed by one on procedures for determining the elementary composition. Directions are then given for determining the type of compound by reference to appearance, smell, taste, solubility, acid-base reactions, hydrolysis and behavior on ignition. The various classes of compounds are then treated according to the functional groups present. Extensive attention is given to color tests.

The directions are sufficient for the identification not only of simple organic compounds but of many rather complex substances. The book is well written and is to be recommended to all students and teachers of the subject.

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Atomic and Free Radical Reactions. Second Edition. Volumes I and II. A. C. S. Monograph Series No. 125. By E. W. R. Steacie, President, National Research Council of Canada, Ottawa, Ontario. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1954. Vol. I. x + 485 pp. Vol. II. iii + 487–901. 16 × 23.5 cm. Price, $28.00.

The second edition of Dr. Steacie's definitive work on atomic and free radical reactions attests ably to the remarkable research activity in the field over the eight years intervening since the appearance of the first edition in 1946. Despite every effort on the part of the author to conserve space, it has been necessary to make the second edition almost double the size of the first. Furthermore some 550 new references have been added to the bibliography, thereby making it necessary to abandon the luxury of footnote references in favor of the more economical terminal bibliography.

The basic organization of the first edition has been retained in the second. Two valuable new chapters on "Bond-Dissociation Energies" and "Types of Elementary Reactions" have been added. As the author points out in his preface, much of the recent work in free radical chemistry has been in the direction of higher precision. Consequently it has been necessary to rewrite much of the earlier material in the light of the more quantitative data which are now available.

This reviewer was particularly impressed by the thoroughness with which the author covers his subject. All work in the literature is covered to June, 1953, and in the main journals to September, 1953. Each topic is evaluated critically wherever conflicting data exist.