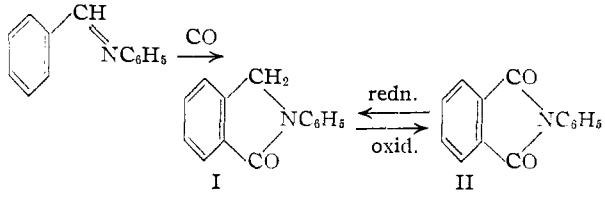
5.26; N, 6.70. Found: C, 80.26; H, 5.47; N, 6.92.

The structure was established by direct comparison with an authentic sample of 2-phenylphthalimidine (I) prepared by reduction of N-phenylphthalimide (II).[2] Compound I was also oxidized to II. Thus, a new synthesis of a phthalimidine has been demonstrated. This is the first example of a dicobalt octacarbonyl-catalyzed reaction in which carbon monoxide becomes attached to an aromatic nucleus.



I II

This reaction failed with nickel catalysts or when water or alcohol was present as the solvent.

In a similar way *p*-hydroxybenzaldehyde anil yielded 70% of 6-hydroxy-2-phenylphthalimidine, m.p. 215–216°.

Anal. Calcd. for $C_{14}H_{11}O_2N$: C, 74.67; H, 4.89; N, 6.22. Found: C, 74.88; H, 4.80; N, 6.42.

1-Naphthaldehyde anil afforded an analogous compound, $C_{18}H_{13}ON$, m.p. 177° in 96% yield. Two structures are possible for this compound as ring closure can occur at the 2- or 8-position. We believe the closure was at the 2-position to yield 2-phenylbenz[e]isoindolin-1-one (III) because the N-phenylnaphthalimide, m.p. 165°, formed on oxidation proved different from N-phenyl-1,8-naphthalimide, m.p. 202°, prepared from 1,8-naphthalenedicarboxylic acid.

Anal. Calcd. for $C_{18}H_{13}ON$: C, 83.38; H, 5.01; N, 5.40. Found (for III): C, 83.68; H, 4.98; N, 5.65; (for IV): C, 83.55; H, 5.05; N, 5.28.

2-Naphthaldehyde anil yielded 2-phenylbenz[f]-isoindolin-1-one (IV), m.p. 254°, in 80% yield. This structure was established by oxidation to N-phenyl-2,3-naphthalimide, m.p. 278°, identical with an authentic sample[3] prepared from 2,3-naphthalenedicarboxylic acid and aniline. The fact that ring closure occurred in the 3-position in this case is noteworthy since most ring closure reactions of 2-substituted naphthalene derivatives take place in the 1-position.

(2) C. Graebe, *Ann.*, **247**, 288 (1888).

(3) M. Freund and K. Fleischer, *ibid.*, **402**, 51 (1914).

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CATHOMYCIN. I. ISOLATION AND CHARACTERIZATION

Sir:

We have isolated in crystalline form a new antibiotic from broths of a new actinomycete. This antibiotic, designated cathomycin, shows clinical promise.[1]

The first papers on cathomycin from these laboratories were presented before the Annual Symposium on Antibiotics.[2] The production[3] of cathomycin by *Streptomyces spheroides*, the antimicrobial properties,[3–5] and the absorption and distribution in mice[6] have been reported. Cathomycin is highly effective for staphylococci resistant to other antibiotics.[3,4]

The isolation of the antibiotic from the broth was accomplished by the following steps. A crude residue from the filtered and evaporated broth was dissolved in water, and the solution was acidified to *ca.* *p*H 2. A precipitate formed which was separated and dried. The precipitate was triturated with acetone and the insoluble material was removed. The acetone solution was evaporated *in vacuo* and the residue was triturated with methanol. The insoluble material was removed, and the methanol filtrate was evaporated *in vacuo*. The methanol-soluble residue was triturated with petroleum ether which dissolved most of the dark-colored substances. The remaining residue was dissolved in dilute sodium hydroxide and then hydrochloric acid was added to cause precipitation. The dried precipitate was triturated repeatedly with ether, and the ether extract was evaporated. The amorphous residue crystallized from aqueous acetone or ethanol or mixtures of petroleum ether and acetone or ethanol.

Cathomycin is a pale yellow compound which has been obtained in two crystalline forms, one melting at 152–154° (most common), the other at 170–172°. It is optically active; $[\alpha]^{25}D$ −27° (*c* 1 in 1 *N* sodium hydroxide) and $[\alpha]^{25}D$ −44° (*C* 1 in pyridine).

Potentiometric titration in a mixture of water and acetone (3–4) showed two acidic functional groups, $pH_{1\ 1/2}$ *ca.* 4.7, equivalent weight 653, and $pH_{2\ 1/2}$ *ca.* 10, equivalent weight 660–680. Determination of acidic groups by the ultraviolet absorption method, gave values of $pH_{1\ 1/2}$ 3.8 and $pH_{2\ 1/2}$ 9.2.

The principal maxima in the ultraviolet absorption spectra of solutions are as follows: 307 mμ, $E^{1\%}_{1\ cm}$ 600 in 0.1 *N* sodium hydroxide; 324 mμ, $E^{1\%}_{1\ cm}$ 390 in 0.1 *N* hydrochloric acid–methanol; 304 mμ, $E^{1\%}_{1\ cm}$ 350 in *p*H 7 phosphate buffer.

The infrared spectra of the two crystalline forms are different. However, when the two forms are dissolved in acetone, followed by rapid precipitation with petroleum ether, the spectra of the precipitates are identical. The principal bands in the infrared spectra of the precipitates, examined as a Nujol mull, expressed in microns are: 5.8–6.0 (broad), 6.10, 6.21, 6.30, 6.49, 6.63, 7.4–7.6, (broad-shoulder), 7.78, 7.96, 8.27 (weak), 8.60 (shoulder), 8.7 (shoulder), 9.13, 9.40, 10.0–10.1 (broad), 10.28, 10.60 (broad), 12.0–12.30 (broad), 12.60–12.75 (broad), 13.07 and 13.39.

(1) H. J. Robinson, E. Alpert and R. F. Sterner, manuscript in preparation.

(2) Third Annual Symposium on Antibiotics, November 2, 3 and 4, 1955, Washington, D. C.

(3) H. Wallick, D. A. Harris, M. A. Reagan, M. Ruger and H. B. Woodruff, "Antibiotics Annual, 1955–1956," Welch and Marti-Ibanez, Medical Encyclopedia, Inc., New York, N. Y., in press.

(4) B. M. Frost, M. E. Valiant, L. McClelland, M. Solotorovsky and A. C. Cuckler, *ibid.*, in press.

(5) W. S. Verwey, A. K. Miller and M. K. West, *ibid.*, in press.

(6) W. S. Verwey, M. K. West and A. K. Miller, *ibid.*, in press.

An ebullioscopic determination of the molecular weight of cathomycin in isopropyl alcohol–water azeotrope gave a value of 592 ± 25. A solubility analysis of a sample showed a purity of 98.8%. Additional work on the solubility analysis is continuing. The composition of cathomycin is $C_{30}H_{36}N_2O_{11}$ or a very closely related formula.

Acknowledgment.—We are grateful to Dr. Nelson Trenner and Mr. Robert Walker for infrared analyses; Dr. J. B. Conn for molecular weight determination; Mrs. Helen Gager and Mr. Fred Bacher for titrations and ultraviolet absorption analyses and to Mr. R. N. Boos and his associates for the microanalyses.

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BOOK REVIEWS

Chemisorption. By B. M. W. TRAPNELL, M.A., Ph.D., Lecturer in Chemistry, Liverpool University. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1955. vii + 259 pp. 14.5 × 22 cm. Price, $6.80.

Chemists interested in adsorption or catalysis, and even physical chemists generally, owe a debt of gratitude to Dr. Trapnell for writing this unique and timely volume. For such a relatively short monograph it was doubtless wise to adopt a selective rather than comprehensive treatment. In so doing he omits very large areas of the subject and bypasses many of its more controversial aspects. But in exchange he obtains space for an extensive treatment of selected areas, particularly his own specialty of adsorption of gases by metal filaments and evaporated films. Here he feels safe from complications due to possible *ab*sorption or to contamination.

He has, as he says, "concentrated on the aspects of the subject which seem to me best understood." There is only occasional mention of gaseous adsorption by "powders," and none of adsorption from solutions.

The chapter headings are revealing. After a brief Introduction (a kind of sampler of the subject), they are: Experimental Methods (33 pp.); Velocities of Adsorption and Desorption—I. Activation Energies (37 pp.); Velocities . . . II. Velocity Constants and the Dependence of Velocity Upon Coverage (23 pp.); Adsorption Isotherms (31 pp.); The Heat of Adsorption (30 pp.); Mechanisms of Chemisorption (31 pp.); The Mobility of Adsorbed Layers (17 pp.); Catalytic Specificity (18 pp.); Mechanisms of Catalytic Reactions (25 pp.).

The presentation is admirably lucid in general, even in areas of theory which are highly speculative. An occasional derivation suffers from lack of precise definition of terms or symbols. Applications of theory to experiment are somewhat less satisfying, because of the small number of cases usually discussed, and because of a tendency to accept as certainly known some conclusions which others may consider highly debatable.

In the chapter on catalytic specificity it is stated that high catalytic activity requires, among other things, a weak but rapid chemisorption of the reactants. (Desorption of products is later said to be of secondary interest.) It seems that the spacing of sites must be rather unfavorable for chemisorption but of course not too much so. The relation of catalytic activity to *d* character of the transition metals is incorrectly stated on p. 227, but oversights of this kind and typographical errors are practically absent.

The final chapter deals only with isomerization and exchange reactions of hydrogen, with the interaction of ethylene and hydrogen isotopes, and with hydrocarbon cracking. In the first case the relations to measured chemisorptions are clear, but they become rapidly less so in the other two cases.

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The Nitrogen Metabolism of Micro-organisms. By B. A. FRY, B.A., Ph.D., Lecturer in Microbiology in the University of Sheffield. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1955. ix + 166 pp. 10.5 × 17 cm. Price, $2.00.

In this excellent monograph, the comprehensive subject coverage is organized according to the various steps of the nitrogen cycle, with separate chapters on nucleic acids, amino acid absorption and on the action of chemotherapeutic agents. This organization has the sole disadvantage of splitting metabolism of amino acids into two distant chapters. Outstanding features of the book are: (a) the frequent inclusion of excellent background discussions of biochemical fundamentals; (b) clarity, accuracy and selectivity in documentation of major points and (c) lucid explanations of the various important experimental approaches as they come to bear on the subject matter, *e.g.*, use of biochemical mutants. (However, not all approaches receive full treatment, *e.g.*, enzyme induction and growth factor replacement technique.)

The lucid style is supported by excellent typography. Illustrations, plates and tables are clear and well explained. Chemical equations are rather compressed.

It is stated in the preface that, although examples are drawn from experiments with bacteria, fungi, algae and protozoa, the main emphasis is naturally on the first two of these groups. Actually, there are not a half-dozen citations given to experiments with algae and protozoa. This seems unduly limited. Nevertheless this book must be considered as outstanding among present references for comprehensive coverage and selective documentation. Certainly the author has achieved his aim "that advanced students. . . and research workers . . . will find it a convenient and concise introduction to one important section of microbiological biochemistry."

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High Polymers. Volume III. Mechanism of Polymer Reactions. By G. M. BURNETT, Department of Chemistry, The University, Birmingham, England. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1954. xv + 493 pp. 16 × 23.5 cm. Price, $11.00.

This book is a new and completely revised version of Mark and Raff's "High Polymeric Reactions," which was the original Volume III of this series. The differences between the two books provide a dramatic illustration of the amount of progress which was achieved in polymer chemistry during the intervening decade. The original edition reviewed in some detail a major part of the material then available. Sheer bulk would make such an approach impracticable today. The new edition is organized entirely on the basis of general principles and theoretical analyses, with selected specific cases chosen as illustrations.