ties are introduced. By solving exactly the secular equation in form (3) instead of (1), we obtain resonance and excitation energies independent of $\alpha$ without having to assume the $\beta$'s and $S$'s constant for all distances and for different atoms. Each $S$ is calculated using Slater functions. The parameters $\rho_r$, $\eta$, and $\beta_{1.33}$ (see (24) of ref. 1) are determined, as before, to fit experimental data. The variation of $\rho$ with distance now found is less than half as rapid as before; $-\beta_{1.33}$ is increased from 44.5 to about 56 kcal.; and $\eta$ is reduced from 4 to about 1.9.[3]

The improvement in our computations has been obtained without sacrificing essential simplicity and ease of computation; the results support the general validity of the molecular orbital approximation.

(3) In sec. 14, we indicated that 4 is a reasonable value for $\eta$. Actually the present value is much more reasonable, since corrections previously neglected (cf. footnote 30) reduce the estimated $\eta$ to about 1.5.

RYERSON PHYSICAL LABORATORY
UNIVERSITY OF CHICAGO ROBERT S. MULLIKEN
CHICAGO, ILLINOIS CAROL A. RIEKE

RECEIVED APRIL 12, 1941

## THE ACTION OF METHYLAMINE WITH NITROUS ACID

*Sir:*

In view of the experience of one of us (L. U. S.) in the successful quantitative determination of methylamine by the evolution of nitrogen on treatment with nitrous acid [Van Slyke, *J. Biol. Chem.*, **9**, 185 (1911)] it seems strange that methylamine should differ so greatly from *n*-butylamine in its reactivity with nitrous acid in aqueous hydrochloric acid solution [Whitmore, *et al.*, THIS JOURNAL, **54**, 3441 (1932); **63**, 1118 (1941)]. Apparently, the difference is due to the difference between an aqueous hydrochloric acid solution and an acetic acid solution containing no mineral acid and relatively little water. We now find that a solution of 1 mole of methylamine in 1 liter of glacial acetic acid when added to 5 moles of powdered sodium nitrite gives no appreciable action. On addition of 100 ml. of water, reaction starts and continues until about half a mole of nitrogen has been evolved. The reaction then slackens. An additional 100 ml. of water starts the reaction and finally gives, on heating, nearly half a mole of nitrogen. The gases were passed through dry-ice traps and a scrubber containing alkaline potassium permanganate. The chief organic product of the reaction was methyl acetate. The only other product isolated was a trace of methyl nitrite.

Apparently, the excess of nitrous acid and the minimum amount of water cut down the hydrolysis of methylamine nitrite earlier observed. It is also probable that the acetate ion with its cloud of electrons can make a more effective attack on the side of the carbon opposite the nitrogen than can hydroxyl ions, water molecules or chloride ions.

This work is being continued.

ROHM AND HAAS COMPANY L. U. SPENCE
PHILADELPHIA, PENNSYLVANIA
THE PENNSYLVANIA STATE COLLEGE
STATE COLLEGE, PENNSYLVANIA FRANK C. WHITMORE
J. D. SURMATIS

RECEIVED MAY 6, 1941

## *p*-AMINOBENZOIC ACID AND TYROSINASE ACTIVITY

*Sir:*

Since *p*-aminobenzoic acid has been reported to have chromotrichial activity [*Science*, **93**, 164 (1941); *J. Biol. Chem.*, **138**, 441 (1941)], we investigated its influence on dopa reaction and noted [*Proc. Soc. Exp. Biol. Med.*, **47**, May (1941)] it to modify enzymatic formation of melanin. Using the Warburg apparatus [kindly placed at our disposal by Reverend J. B. Meunzen, F.G., at Fordham University], we determined its effect on the kinetics of tyrosinase action. In numerous experiments, the detailed data of which are about to be published, we found that the aerobic oxidation of tyrosine and that of dopa is retarded by *p*-aminobenzoic acid, but that of *p*-cresol is accelerated. Qualitatively, aniline has the same influence as *p*-aminobenzoic acid; quantitatively, the effect of the latter is greater than that of the former.

In a typical set of experiments a reaction mixture was employed consisting of 0.4 ml. of 0.0463 *M* *p*-cresol, 1 ml. of McIlvaine buffer (*p*H 6.5), 0.5 ml. (2.5 mg.) of gelatin solution, 1 ml. of appropriately diluted enzyme solution [kindly furnished by Dr. J. M. Nelson, Columbia University; isolated from *psalliota campestris* and containing approximately 200 hydroquinone-catechol units and 50 cresolate units per ml. measured at 25°], and 1.1 ml. of water or 0.1 ml. of water and 1.0 ml. of 0.01 *M* solution of the test substance. All the determinations were made at a temperature of 37.2°, the rates of oxygen uptake were calcu-

lated from the straight line portion of the oxygen uptake–time curve on the basis of 1 cu. mm./min. for *p*-cresol-tyrosinase, and the influence of the test substances on the induction period was recorded (Table I).

TABLE I

INFLUENCE OF *p*-AMINOBENZOIC ACID AND STRUCTURALLY-RELATED COMPOUNDS ON OXIDATION OF *p*-CRESOL CATALYZED BY TYROSINASE

| Test substance | Induction period | $O_2$ uptake cu. mm./min. |
|---|---|---|
| None (control) | Standard | 1.00 |
| *p*-Aminobenzoic acid[a] | Shortened | 3.63 |
| *m*-Aminobenzoic acid[a] | Shortened | 2.49 |
| *o*-Aminobenzoic acid[a] | Shortened | 2.10 |
| Aniline | Shortened | 1.75 |
| *p*-Hydroxybenzoic acid[a] | Unaltered | 1.13 |
| Sulfanilamide | Shortened | 1.03 |
| Benzoic acid | Lengthened | 0.99 |

[a] Sodium salt.

It is apparent that the three isomeric aminobenzoic acids accelerate the rate of oxygen uptake more than any of the other substances studied, the para compound always having the greatest influence. The acceleration due to aniline is enhanced by a carboxyl and diminished by a sulfonamide group in the para position. The response to *p*-aminobenzoic acid is only slightly weaker when sulfanilamide is present simultaneously, the former having apparently a higher affinity for the enzyme than the latter. Whether *p*-aminobenzoic acid accelerates an oxidation (*i. e.*, *p*-cresol) catalyzed by tyrosinase or retards it (*i. e.*, tyrosine, dopa), its influence is always more pronounced than that of sulfanilamide. Their observed opposite effects lend credence to the suggestion that their antagonistic behavior with respect to bacteria is due to a common point of attack in bacterial enzyme systems [D. D. Woods, *Brit. J. Exptl. Pathol.*, **21**, 74 (1940)]. The significance of the activity of *p*-aminobenzoic acid in oxidation processes catalyzed by tyrosinase, reported to have an influence on blood pressure [H. A. Schroeder and M. H. Adams, *J. Exptl. Med.*, **73**, 531 (1941)], is being studied in experiments on hypertension.

RESEARCH LABORATORY OF THE INTERNATIONAL VITAMIN CORPORATION AND THE WARNER INSTITUTE FOR THERAPEUTIC RESEARCH
NEW YORK, N. Y.
W. A. WISANSKY
GUSTAV J. MARTIN
S. ANSBACHER

RECEIVED MAY 20, 1941

# NEW BOOKS

**Qualitative Analysis and Chemical Equilibrium.** By T. R. HOGNESS, Professor of Chemistry, and WARREN C. JOHNSON, Associate Professor of Chemistry, University of Chicago. Revised edition. Henry Holt and Company, 257 Fourth Ave., New York, N. Y., 1940. xvi + 538 pp. 33 figs. 15 × 22.5 cm. Price, $2.90.

The appearance of a revised printing is a good indication of the reception accorded the previous edition (review in THIS JOURNAL, **59**, 2080 (1937)). The new book is larger by some 120 pages, the revision having been fairly extensive, involving considerable rewriting and insertion in all chapters except II, IV, IX and the Appendix. Chapter I has a more extensive treatment of ionic structure; II, VI and VIII present the subject on the basis of the Brönsted theory; and more or improved problems and examples appear in several chapters.

The really significant changes have been made in Section II, the Experimental Part, now divided into numbered chapters. The experimental philosophy of the first edition was a small scale adaptation of the Fresenius qualitative procedure, based on the premise that ordinary large test-tube and funnel work has little merit in the acquisition of skill, deftness and scientific appreciation. The revision profits from experience: the procedures have been changed here and there, amplified, and presented, where necessary, in alternate forms, to permit their use with small filters and funnels or centrifugal settling of precipitates. The section on anion analysis has been extended and improved, and the chapter on Preparation of Substances for Analysis is now very well done.

The literary style and methods of presentation are simple and matter-of-fact; typography, printing and paper are excellent (the reviewer does not like the press style which omits periods after abbreviations, and zero's before decimal points). The first edition has been a popular text; the revision should be received even more favorably.

ALLEN D. BLISS

---

**A Laboratory Guide for Organic Chemistry.** By E. WERTHEIM, Professor of Organic Chemistry in the University of Arkansas. Second edition. The Blakiston Company, 1012 Walnut Street, Philadelphia, Penna., 1940. 550 pp. 24 illustrations. Price, $2.50.

The second edition of this book contains 169 experiments dealing with the preparation, properties, and identification