

on the generalization of a concept of transportation forms in contra-distinction to forms of a compound which can only be described by formulas represented in the usual manner of structural chemistry. It would also be necessary, before we can wholly explain the reactivity of the transportation form as contrasted to the ordinary form in its relation to the various variables, to know the arrangement of the electrons within the compound and the rôle which the electrical forces<sup>17</sup> play in the activity of the transportation form.

It is intended to report later in greater detail the experiments which are now in progress.

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### PROTEUS HENRICENSIS NOV. SPEC.

A MICROORGANISM believed not to have been previously described has recently been isolated from putrefying material. The characteristics of this bacillus are such that it may be placed in the classification of Castellani and Chalmers, but not in the classification of Bergey, *et al.*

The genus *Proteus* Hauser<sup>1</sup> is defined as "highly pleomorphic rods." Filamentous and curved rods are common as involution forms. Gram-negative. Actively motile, possessing peritrichous flagella. Produce characteristic amoeboid colonies on moist media and decompose proteins. Ferment dextrose and sucrose but not lactose. Do not produce acetyl-methyl-carbinol.

The tribe *Proteae* Castellani and Chalmers, 1918,<sup>2</sup> is defined as "Bacillaceae growing well on ordinary laboratory media, not forming endospores, aerobic, without fluorescence or pigmentation, but liquefying gelatin." The tribe may be divided into genera as follows:

(A) Rapid gelatin liquefaction; do not ferment lactose; mostly Gram positive—*Proteus*.

(B) Slow gelatin liquefaction; ferment lactose; Gram negative—*Cloaca*.

The isolated microorganism has the following characteristics:

Rods: 0.5 to 0.7 by 1.0 to 3.0 microns, occurring singly and in pairs. Actively motile. Gram-negative. No spores.

<sup>17</sup> Compare J. N. Mukherjee und B. N. Ghosh, *J. Ind. Chem. Soc.* 1, 213 (1924).

<sup>1</sup> Bergey, *et al.*, "Manual of Determinative Bacteriology," 1923, page 209.

<sup>2</sup> Castellani and Chalmers, "Manual of Tropical Medicine," third edition, 1919, page 943.

Aerobic and facultative anaerobic.

Gelatin colonies: Irregular, spreading, rapidly liquefying.

Gelatin stab: Rapid, stratiform liquefaction.

Agar colonies: Opaque, gray, spreading.

Agar slant: Thin, bluish-gray, spreading.

Broth: Great turbidity, with thin, bluish pellicle.

Milk: Slightly acid, becoming markedly alkaline in forty-eight hours. Quick peptonization.

Indol formation abundant.

Acetyl-methyl-carbinol not formed.

Nitrates not reduced.

H<sub>2</sub>S formed. Lead acetate turned brown.

Acid and gas in dextrose, xylose, trehalose and galactose.

Acid in glycerol.

No acid or gas in lactose, sucrose, mannitol, dulcitol, raffinose, levulose, arabinose, inositol, maltose, dextrin, salicin or sorbitol.

Not pathogenic for guinea pigs or rabbits.

This organism appears to be closely related to *Proteus diffuens* Castellani, 1915. It differs from *diffuens* in that it peptonizes milk, produces indol and does not liquefy coagulated blood serum. No information is at hand as to the action of *P. diffuens* on xylose and trehalose.

The name *Proteus henricensis* is suggested.

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### THE RELATION OF TEMPERATURE TO HYDROGEN-ION CONCENTRATION OF BUFFER SOLUTIONS

THE influence of temperature on optimum hydrogen-ion concentration for diastatic activity of malt has been discussed by Olsen and Fine.<sup>1</sup> The experimental evidence submitted showed that with "water suspensions of a mixture of wheat and malted barley flours . . . containing different amounts of dilute acid and alkali [HCl and NaOH were used] . . . the optimum pH changes from about 4.3 at 25° C. to beyond 6.0 at 69° C." These authors "suggested that this change is due to the increased activity of the hydrogen-ions present and that these apparently different pH measurements would represent approximately equal hydrogen-ion activities if measured at the temperature of the reaction."

Similar observations have been made for other enzymes. More than thirty-five years ago O'Sullivan and Tompson<sup>2</sup> observed for invertase that "the most

<sup>1</sup> Olsen, Aksel G., and Morris S. Fine. *Cereal Chem.*, Vol. I (1924), pp. 215-221.

<sup>2</sup> O'Sullivan, C., and F. W. Tompson. *Jour. Chem. Soc.*, Vol. 57 (1890), 834-931.

favorable amount of acid . . . decreases with rise in temperature," and Compton<sup>3</sup> has pointed out that the optimum temperature for maltase "is dependent on the H<sup>+</sup> concentration of the medium."

Recently Lüers and Nishimura<sup>4</sup> have reported observations on the basis of which they conclude that Olsen and Fine were in error. These authors used a highly active amylase preparation and soluble starch in strong acetic acid-acetate buffer solutions and found no change in optimum pH as the temperature was raised from 15 to 70° C.

Lüers and Nishimura in drawing their conclusions failed to take into account that different buffer solutions respond differently to changes in temperature. McIntosh and Smart<sup>5</sup> found the hydrogen-ion concentration of acetate buffers to remain constant between room temperature and 70° C., and Walbum<sup>6</sup> later reported extensive measurements on a number of buffers. Some of these were found not to change in hydrogen-ion concentration as the temperature was raised from 10–70° C., while certain others changed markedly. The following figures are quoted from Walbum:

Buffer	20° C.	70° C.	Difference
	pH	pH	pH
Borate .....	9.23	8.86	–0.37
Citrate .....	4.96	5.14	+0.18
Glycin-NaOH .....	8.53	7.48	–1.05

Recent measurements by Hoffman and Gortner<sup>7</sup> have shown that the pH of dilute solutions of hydrochloric acid and sodium hydroxide also respond to changes in temperature.

Inasmuch as Lüers and Nishimura were making their determinations with acetate buffer mixtures which, according to McIntosh and Smart, do not change with change in temperature, their results not only harmonize with those of Olsen and Fine but tend to corroborate the suggestion that the observed differences were due to changes in the activity of the hydrogen-ions. The different results obtained in these two cases emphasize the importance of proper selection of buffer solution where the reactions occur at temperatures other than that at which the acidity is measured.

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<sup>3</sup> Compton, A. Proc. Royal Soc., Vol. 88B (1915), 408–417.

<sup>4</sup> Lüers, H., and S. Nishimura. *Woch. f. Brauerei*, Vol. XLIII (1926), pp. 415–416.

<sup>5</sup> McIntosh, J., and W. A. M. Smart. *The Brit. J. Expt. Pathology*, Vol. I, 1920) 9–30.

<sup>6</sup> Walbum, L. E. *Biochem. Zeitschrift*. Vol. 107 (1920), 219–228.

<sup>7</sup> Hoffman, Walter F., and R. A. Gortner. *Colloid Symposium Monograph*, Vol. II (1925), 262–269.

## THE NATIONAL ACADEMY OF SCIENCES

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*Thermionic emission and the "universal constant" A:* EDWIN H. HALL. Richardson, in his "Emission of Electricity from Hot Bodies" (1916), has given three derivations of the equation  $I = AT^2 e^{\frac{bo}{\tau}}$ . The first of these, beginning on page 28 and ending on page 33, has been much criticized. The third, running from page 35 to 39, follows the quantum theory and reaches a result, as to the value of A, not very different from that recently found by Dushman in a similar way. The second derivation, given on a single page, 33 to 34, is admirably simple and direct, but Richardson felt obliged to give it up, because of a misgiving as to assigning thermal energy to the free electrons within a metal, though this conception of their condition is a familiar and natural one. The purpose of the present paper is to show that such a misgiving lacks justification, and to restore, with some modifications, suggested by the dual theory of electric conduction, Richardson's "classical kinetic theory" of thermionic emission.

*The minimum values of positive quadratic forms:* H. F. BLICHFELDT, Stanford University. Having given a positive definite quadratic form in  $n$  variables, the important question as to the least numerical value of this form, expressed as a function of  $n$  and the determinant  $D$  of the form, the variables being allowed to take on only integral values (not all zero), has received a good deal of attention. The minimum in question is  $|gD|^{1/n}$ , where  $g$  is a function of  $n$  only. Superior limits to  $g$  were given by Hermite, Korkine and Zolotareff, Minkowski and the author. Exact limits are known for  $n=2, 3, 4, 5$ , to be  $4/3, 2, 4, 8$ , respectively. In the present communication the author states that the exact limits for  $n=6, 7, 8$  are  $64/3, 64, 128$ , respectively.

*Pressures in discharge tubes:* W. H. CREW and E. O. HULBERT, Naval Research Laboratory. The increase in the pressure of the gas in a discharge tube due to the discharge has been measured for those pressures normally used in discharge tubes, from about 0.1 to 30 mm of mercury, for helium, hydrogen, oxygen, nitrogen, air, carbon monoxide and carbon dioxide. The pressure increase is regarded as due to two chief causes, one, the increase in temperature of the gas, and the other, the dissociation of the molecules of the gas into atoms or less complex molecules. Therefore, from the observed pressure increments, the temperatures and the amounts of dissociation of the gas in the discharge have been determined. A long slim discharge tube, 300 cm in length and 9 mm in internal diameter, and a large tube, 80 cm in length and 34 mm in internal diameter, were used in turn. The pressures below 1 mm of mercury were measured by a striation gauge. This consisted of a second discharge tube (joined to the main tube) excited by direct current calibrated so that the shift of the striations of the positive column with pressure was known. The pressures from 3 to 30 mm of mercury were measured by an oil manometer.