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The Determination of the pH of Blood Serum with the Quinhydrone Electrode.

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Since the work of Cullen[1] and others on the determination of the pH of serum with quinhydrone, some investigators have had difficulty with this method, because of the rapid drifts in potentials. Cullen, Wilson[2] and others have reported that satisfactory quinhydrone serum pH determinations can be made by reading potentials rapidly at noted times and extrapolating in order to obtain the potential at zero time.

In a recent study at this laboratory it was necessary to perform a large number of dog serum pH determinations, and it seemed desirable to check the colorimetric method by an electrometric method. When parallel pH determinations on dog serum were made with the colorimetric method, using the Hastings bicolorimeter[3] and with quinhydrone at room temperature (24° to 26°) it was found that the 2 methods agree to within 0.02 pH. The quinhydrone method is very rapid and convenient, and since it is free from the personal factor of matching colors, it has, in our hands, been more reliable than the colorimetric method. The procedure is briefly as follows:

The electrode vessel consists of 2 ordinary glass tubes which fit snugly one inside the other, a rubber connection which holds the tubes in any desired relative position, and a platinum wire sealed into the inner tube. The inner tube contains mercury through which metallic contact to the platinum wire can readily be made. The outside tube is 8 cm. in length, and 4 mm. in inside diameter, so that its total capacity is about 1 cc., although these dimensions can be varied at will. By moving the inner tube up or down through the outer tube, liquid can be conveniently drawn up or expelled.

For the determination the vessel is filled with a clear saturated solution of quinhydrone in boiled neutral distilled water to the 0.2 cc. mark. Then, at a time noted with a stopwatch, serum is

[1] Cullen and Biilman, *J. Biol. Chem.*, 1925, lxiv, 727; Cullen and Earle, *J. Biol. Chem.*, 1928, lxxvi, 565.

[2] Wilson, D. W., Paper presented before the American Society of Biological Chemists, 1930 meeting, Chicago.

[3] See Clark, "Determination of Hydrogen Ions," 3rd edition, 169-170.

drawn up to the 0.4 cc. mark. A small air bubble, about .01 cc. or less, is also drawn in, which is important for stirring and mixing the 2 solutions. This is accomplished by inverting the tube 6 or 8 times. Liquid junction is made to a saturated calomel cell by clamping the tube upright in a beaker containing saturated KCl. The potential is measured at 30 seconds, and again at 40, 50, and 60 seconds. The drift in potential between 30 and 60 seconds is usually 2 millivolts, and it is assumed that the drift between zero time and 30 seconds would have been one millivolt greater, or 3 millivolts. The calculation is best illustrated by a particular case. If the observed potentials at 30 and 60 seconds are +9 and +11 millivolts, respectively, then it is assumed that at zero time the potential is +9—3 or +6 millivolts. From the conventional constants for quinhydrone at 25°, (saturated calomel), $pH = \frac{.453 - E \text{ observed}}{.059}$. This gives a $pH = 7.58$ at 25°. Assuming a change in pH with change in temperature of —.012 pH per degree, this would become $7.58 - (13.0 \times 0.012 = 7.58 - 0.16 = 7.42$ at 38°.

By using equal volumes of serum and saturated quinhydrone solutions, uniformity in the speed of formation and in the concentration of the quinhydrone solution are insured, and thus a uniform drift in potential is obtained. The drift is less rapid than if serum is saturated with quinhydrone, as Wilson[2] has pointed out, while the pH of the serum is not appreciably altered by this dilution.

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Production of Experimental Lobar Pneumonia in the Dog.*

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Until the work of Cecil and Blake[1] lobar pneumonia had not been produced constantly and successfully in the lower animals. These authors employed the *Macacus syrichtus,* a Philippine monkey which is apparently more susceptible to the pneumococcus than the other varieties. Their method consisted simply of intra-

* This work has been conducted under a grant from the Douglas Smith Foundation for Medical Research of the University of Chicago.

[1] Blake, F. G., and Cecil, R. L., *J. Exp. Med.*, 1920, xxxi, 403.