

A greater percentage of young amebae-free animals than of old amebae-free animals or of young animals known to possess an infection of amebae common to the rat and mouse have become infected with these five amebae common to man.

Infections of *E. dysenteriae*, *E. coli*, and *C. laffleuri* have been experimentally transferred from rats harboring experimental infections of these amebae to other young amebae-free rats by feeding them the feces of the infected rats.

The amebae transferred from man to the rodent host have, in every case presented no apparent racial or morphological change during the period of the experiment. The data acquired in this investigation give interesting information on the questions of (1) morphological constancy of parasitic Protozoa, (2) host specificity of parasite, (3) the possibility of rodents acting as carriers of amebiasis.

Infections of *E. dysenteriae* in rats and mice apparently assumes a chronic form rather than an acute form as is reported in kittens.

52 (2284)

A modification of Duboscq-Pellin colorimeter for bicolorimetric work as in colorimetric pH determination without buffer mixtures.

By HSIEN WU.

[*From the Laboratory of Physiological Chemistry, Peking Union Medical College, Peking, China.*]

A colorimeter in which the combined color of two solutions is used as the standard is required for some purposes. The best illustration is the colorimetric determination of pH without standard buffer mixtures, where the color of the indicator in the unknown solution is matched with the combined color of an acid solution and an alkaline solution of the same indicator. Knowing the ratio of the depths of the two color solutions of the same concentration or the ratio of the concentrations of the solutions of the same depth, the pH of the unknown solution which matches with that of the combination can be calculated by means of an equation derivable from the mass action law and the theory of indicators or by referring to a curve determined experimentally.

Various devices have been used with more or less success for superimposing the colors by Bjerrum¹, Barnett and Chapman,² Barnett and Barnett,³ Gillespie,^{4, 5} and Myers.⁶ But since the Duboscq-Pellin colorimeter is more widely used than any other type of colorimeter, on account of the excellent optical system it possesses, it seems desirable to modify this instrument so that it can be used for bicolorimetric as well as for monochromimetric work. Such a modification would also avoid the unnecessary duplication of colorimeters.

The modification here described consists essentially in placing on one side of the colorimeter above the original stage a new cup, which is carried on a new stage fitted with an independent rack, pinion and vernier. Thus while one side of the instrument remains unchanged the other is fitted with two cups, each with its own adjustment and vernier, the upper of which is an entirely new addition and requires a new slit in the brass back of the colorimeter. This slit is 5 mm. above the original slit and is about 60 mm. long. The rack and pinion construction is identical with that of the original instrument.

The upper cup has the same capacity as an ordinary 50 mm. Duboscq cup, and the original cylinder is used. The metal casing extends almost to the top of the cylinder and is made from a brass tubing by cutting a window on each side, leaving two cylinders joined together by a pair of bands about 10 mm. wide. The lower cylinder is 15 mm. and the upper cylinder 8 mm. long. The windows facilitate the operation of cementing the glass parts and permit observation of the plunger when the cup is in position. The lower end of the casing is beveled to fit a similarly beveled glass disc, which is 5 mm. thick and projects about 1 mm. beyond the metal casing.

This casing is suspended from a stage rigidly attached to the rack and pinion. The upper part of the casing is provided with two pairs of keys, one pair above each metal band, by means of which it is held rigidly by the stage. The stage is provided with

¹ Bjerrum, N., *Die Theorie der alkalmetrischen und azidimetrischen Titrierung*. Stuttgart, 1914.

² Barnett, G. D., and Chapman, H. S., *J. Am. Med. Assn.*, 1918, lxx, 1062.

³ Barnett, G. D., and Barnett, C. W., *PROC. SOC. EXP. BIOL. AND MED.*, 1920-21, xviii, 127.

⁴ Gillespie, L. J., *J. Am. Chem. Soc.*, 1920, xlii, 742.

⁵ Gillespie, L. J., *J. Bact.*, 1921, vi, 399.

⁶ Myers, V. C., *J. Biol. Chem.*, 1922, liv, 675.

slots through which the keys can pass and by turning the casing through 90 degrees it can be instantly detached or placed in position.

The lower cup is similar to the ordinary Duboscq cup, but it is a little shorter and larger in diameter. The bottom of the metal casing is provided with a ring which fits accurately into the groove of the original stage. The casing is 52 mm. in outside diameter, 49 mm. in inside diameter, and 20 mm. high. The glass disc for the bottom is 2 1/2 mm. thick. The cylinder is made from pyrex tubing 48 mm. in diameter and 2 mm. thick.

The cup for the other side of the colorimeter is an ordinary Duboscq cup. Only the original disc is replaced by two discs, one on top of the other. These discs are of same thickness and made of the same glass as the discs for the upper and lower cups of the other side.

The vernier for the upper cup is so placed that it reads zero on the original scale when the plunger touches the bottom of the cup. The zero point of the lower cup is determined when the plunger and the bottoms of the two cups are in contact. The zero point of the cup on the other side is determined in the usual manner.

A preliminary testing of the instrument with phenol red has been made. For producing the acid and alkaline colors a 0.7 per cent KH_2PO_4 solution and 0.1 per cent Na_2CO_3 solution respectively were used according to Hatfield.⁷ Clark and Lub phosphate mixtures giving pH values from 7.0 to 8.0 were used as unknowns. The color solutions were prepared by adding 1 cc. of 0.008 per cent solution of phenol red to each 10 cc. of the buffer. The acid solution was placed in the inner cup and the alkaline solution in the outer cup. The unknown solution was placed in the cup on the other side. The cup for the unknown and the lower cup were set at $20 + Z$ mm. ($Z = \text{Zero error}$). Perfect matches were obtained by moving the upper cup.

The result of the testing with phenol red is shown in the accompanying table. If the readings are plotted against pH values a smooth curve is obtained. The value of pK for phenol red calculated by means of the equation

$$pH = pK + \log \frac{\text{Depth alkaline color}}{\text{Depth acid color}}$$

is 7.76 at 25-28° C. This agrees well with the result of Barnett and Barnett, who obtained the value 7.77.

⁷ Hatfield, W. D., *J. Am. Chem. Soc.*, 1923, xlv, 940.

pH of buffer	Reading of acid color	Reading of alkaline color (by difference)	$\log \frac{\text{Depth alk. color}}{\text{Depth acid color}}$	pK
7.0	mm. 17.1	mm. 2.9	1.23	7.77
7.2	15.6	4.4	1.45	7.75
7.4	13.9	6.1	1.64	7.76
7.6	11.8	9.2	1.89	7.71
7.8	9.7	10.3	0.03	7.77
8.0	7.6	12.4	0.21	7.79
Average				7.76

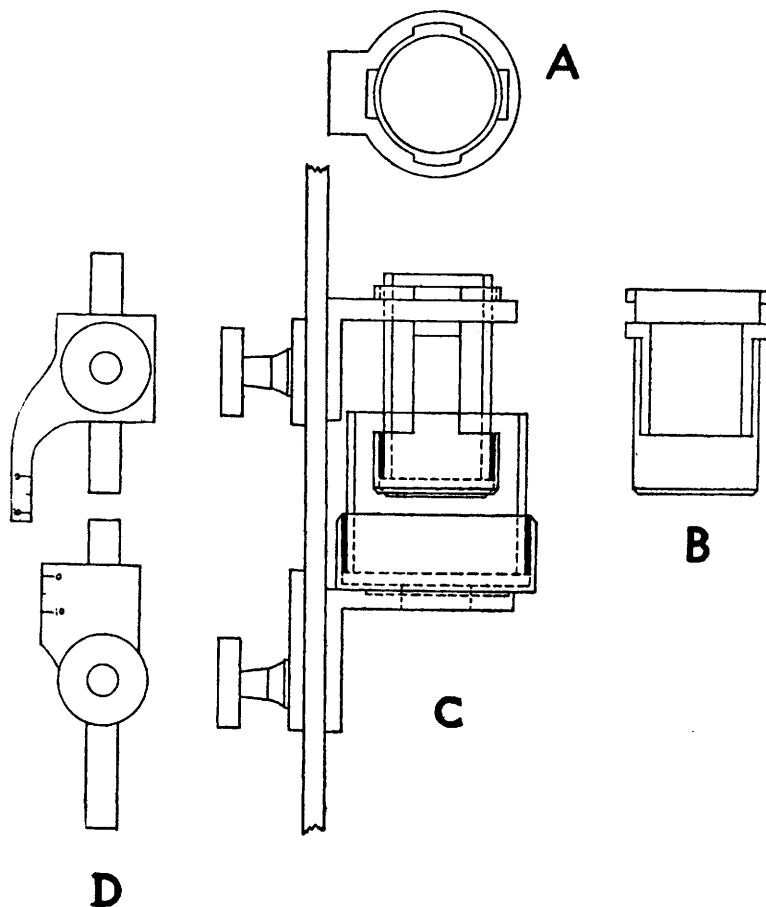


Diagram of modified Duboseq-Pellin colorimeter for bicolorimetric work.

A. Top view of upper cup casing and stage, showing slot and key arrangement.

B. Front view of upper cup casing.

C. Side view of both cups in position.

D. Back view of the colorimeter showing the relation of the slits and verniers.