TABLE I.

Average Values of "K" in Normal Individuals and Individuals with Heart Failure.

Subjects	Male		Female	
	No. cases	Average "K"	No. cases	Average "K"
Normal individuals	112	0.3743 ±0.00122	66	0.3877 ±0.00212
Rheumatic heart disease with failure	39	0.4227	28	0.4235
Syphilitic heart disease with failure	15	0.4400	2	0.4405
Hypertension and arteriosclerosis with failure	24	0.4405	24	0.4338
Miscellaneous heart disease with failure	16	0.4275	7	0.4320

"K" indicates a disturbance of cardiac dynamics which might well be found before clinical evidence of failure is available.

5019

Surface Tension of Egg Albumin Solutions.

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Although it is generally believed that egg albumin is a capillarilly active substance, contradictory statements are often found in literature. According to Clark and Mann[1] egg albumin increases the surface tension of water in very dilute solutions but lowers it in more concentrated solutions. It is impossible to draw any conclusion from the works of early investigators because most of them did not pay any attention to the reaction of the solution which is an important factor as shown by St. Johnston[2] and qualitatively by Bottazzi.[3] The latter found the minimum surface tension to be at the isoelectric point, while the former showed the reverse to be the case. The present study deals with the relation between surface tension and the hydrogen ion concentration of egg albumin solutions together with

[1] Clark, G. L., and Mann, W. A., *J. Biol. Chem.*, 1922, lii, 180.

[2] St. Johnston, J. H., *Biochem. J.*, 1927, xxi, 1314.

[3] Bottazzi, F., *Colloid Chemistry*, Edited by J. Alexander, Chemical Catalog Co., New York, 1928, Vol. ii, p. 121.

an approximate calculation of the cross-sectional area of the egg albumin molecule.

As we are interested in the equilibrium surface tension, the drop weight method as recommended by Harkins and Brown[4] was adopted, the only modification being that the liquid was pushed over instead of being sucked through the capillary. A necessary condition in this static method is that sufficient time must be allowed for the surface to reach equilibrium. It is well known from the work of Du Noüy[5] and others that the surface tension of a freshly prepared egg albumin solution decreases on standing to a constant value. For the most dilute solutions we used, more than an hour must be allowed to reach equilibrium, while with more concentrated solutions 15-20 minutes will suffice. Egg albumin was recrystallized 3 times from ammonium sulphate solution and dialyzed until no ammonia or sulphate could be detected. The stock albumin solution was sterilized by filtration through a Seitz filter. All solutions were made up with conductivity water under sterile conditions. The reaction was varied by addition of either HCl or NaOH and the pH values were determined electrometrically using a quinhydrone electrode. The amount of HCl or NaOH added was so small that its effect on surface tension may be neglected.[7]

We used egg albumin solutions ranging from 0.0000005 to 1%. Under no circumstance was the surface tension of the solution greater than that of pure water. At all concentrations the minimum surface tension was found at the isoelectric point, *viz.*, about pH 4.8. There are 2 maxima, one on the alkaline side and the other on the acid side of the isoelectric point. Four curves for the lower concentrations of albumin are shown in Fig. 1.

The difference between our results and those of St. Johnston may be explained by the fact that they used Sugden's method[6] which is essentially dynamic in nature, while the method we used is a static one. It has been pointed out by Price and Lewis[7] that the high surface tension observed at the isoelectric point is due to the absence on the particles of electric charge which lowers the surface tension. As the lowering of surface tension is due, in the first place, to the presence of egg albumin on the surface, we would expect the maximum lowering to occur at the isoelectric point, since at this reaction, on account of the absence of electric charge, more molecules or

[4] Harkins, W. D., and Brown, F. E., *J. Am. Chem. Soc.*, 1919, xli, 515.

[5] Du Noüy, P. L., *Surface Equilibria of Colloids*, Chemical Catalog Co., New York, 1926.

[6] Sudgen, S., *J. Chem. Soc.*, 1922, cxxi, 858; *Ibid.*, 1924, cxxv, 27.

[7] Price, H. I., and Lewis, W. C. M., *Biochem. J.*, 1929, xxiii, 1030.

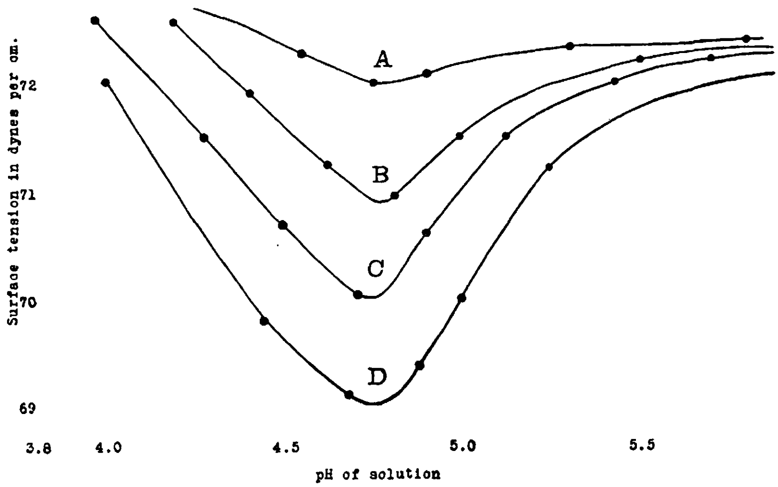

FIG. 1. Surface tension of egg albumin solutions at 18°C.
A. 0.0003%. B. 0.0006%. C. 0.001%. D. 0.002%.

molecular aggregates of egg albumin can be accommodated on a given surface if time is allowed for diffusion. In Sugden's method, the electric factor is more important than the concentration factor, because the molecules can not diffuse to the surface in the short time allowed for measurement, while in our case the surface concentration is more important than the electric factor.

Milner[8] has suggested a method for calculating the effective cross-sectional area of molecules from surface tension data. In Gibbs' adsorption equation,

$$u = -\frac{1}{RT} \cdot \frac{d\sigma}{d \log c}$$

the amount adsorbed per unit area u should be constant over a certain range of concentration if $d\sigma/d \log c$ is constant. This is true when the surface of the solution is covered by a single layer of molecules.

Knowing u the effective cross-sectional area a can be calculated by the relation $a = 1/uN$, where N is Avogadro's number. In our calculations concentrations instead of activities were used. This is justified as our solutions were so dilute that concentration and activity may be assumed to be identical. It is also assumed that the surface layer is monomolecular. As the concentrations are so low, it is not likely that the molecules adsorbed on the surface will pile up to form a multimolecular layer as suggested by McBain and Davis.[9]

[8] Milner, S. R., *Phil. Mag.*, 1907, xiii, 96.

[9] McBain, J. W., and Davis, G. P., *J. Am. Chem. Soc.*, 1927, xlix, 2230.

From the data shown in Fig. 1 we have plotted the minimum values of σ against log c and the curve obtained is a straight line with the slope of $d\sigma/d \log c = -1.59°$. It follows from this that

$$u = \frac{1.59}{8.31 \times 10^{7} \times 291} = 6.56 \times 10^{-11} \text{ mols. per sq. cm.}$$

$$a = \frac{1}{6.56 \times 10^{-11} \times 6.1 \times 10^{23}} = 2.5 \times 10^{-14} \text{ sq. cm.}$$

5020

Blood Volume in Hyperthyroidism.

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It is a well recognized fact that many patients with hyperthyroidism have disturbances of their cardiovascular system. With the increased demand for oxygen some compensatory mechanism must be at work in order to supply the needs of the tissues. The cardiac output and the velocity of blood flow have been repeatedly shown to be increased, and as a rule, this increase is in direct proportion to the basal metabolic rate.[1, 2] In the opposite condition, myxedema, Thompson[3] described a reduction in the blood volume and demonstrated its return to normal after the institution of thyroid treatment. Blotner, Fitz and Murphy[4] also observed a correlation between the basal metabolic rate and the total blood count expressed in corpuscles per square meter of surface area. The present report deals with the blood volume findings in individuals suffering from hyperthyroidism, before and after subtotal thyroidectomy.

The series studied consisted of 17 cases of exophthalmic goiter and one of toxic adenoma.* The total blood volume was measured by the carbon monoxide method.[5] All the determinations were made

[1] Fullerton, C. W., and Harrop, G. A., *Bull. Johns Hopkins Hosp.*, 1930, xlvi, 203.

[2] Blumgart, H. L., and Gargle, S. L., *J. Clin. Invest.*, 1928-29, vi, 18, (Proceedings).

[3] Thompson, W. O., *J. Clin. Invest.*, 1925-26, ii, 477.

[4] Blotner, H., Fitz, R., and Murphy, W. P., *J. Clin. Invest.*, 1928, vi, 4, (Proceedings).

* The first seven cases were studied in the Johns Hopkins Hospital and are reported by courtesy of Dr. G. A. Harrop.

[5] Chang, H. C., and Harrop, G. A., *J. Clin. Invest.*, 1928, v, 393.