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Normal Osmotic Pressure of the Plasma Proteins of Man.*

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There have been many determinations of the "normal" osmotic pressure of the plasma proteins of human blood, namely, Starling,[1] Govaerts,[2] Krogh,[3] Schade,[4] Verney,[5] and Landis.[6]

It is our opinion that, with the exception of Schade's determinations, there is some possibility of considerable error in all of these determinations because the determinations were made from 12 to 48 hours after taking the blood from the veins, during which time an experiment carried out by us shows that peptization of the proteins can take place, thus increasing the number of colloid particles and the colloid osmotic pressure. In some of these measurements no attempt was made to keep the temperature constant during the period of measurement and equilibration. Moreover, fluids were used on the outside of the osmometer membranes which were not exactly those of the dispersion medium. Schade[7] has devised a method which we believe is accurate to 5%. It is based upon a method devised by Sorenson.[8] Determinations can be made by Schade's method in 15 minutes after temperature equilibrium has been reached, thus largely avoiding the danger of peptization. Moreover, temperature is kept constant to within 0.02-0.03° in a properly constructed bath during the period of measurement. In this method no solution of salts is placed upon the outer side of the semipermeable membrane (collodion). The plasma is put under a measured pressure and the rate of ultrafiltration is determined, then the pressure is changed and the rate of ultrafiltration is again determined. A curve of rate of filtration as ordinates and pressures as abscissae is constructed from these values. This is always a straight

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[1] Starling, E. H., *J. Physiol*, 1899, **24**, 317.

[2] Govaerts, P., *Bull. d. l'Acad. Roy. d. Med. d. Beligigne.*, 1924, **4**, 161.

[3] Krogh, A., *Anat. and Physiol. of the Capillaries*, Yale Univ. Press, New Haven, 1922.

[4] Schade, H., *Ergeb. d. Inn. Med. Kinderh.*, 1927, **32**, 425.

[5] Verney, E. B., *J. Physiol.*, 1926, **61**, 319.

[6] Landis, E. M., *Am. J. Physiol.*, 1930, **93**, 353.

[7] Schade, H., *Z. f. Klin. Med.*, 1924, **100**, 370.

[8] Sorenson, *Compt. Rend. d. Trav. du Laboratoire de Carlsberg*, 1917, **12**, 262.

line. The pressure corresponding to the point where this curve crosses the line of zero filtration rate is the osmotic pressure of the colloids which can not pass the collodion membrane. It must be remembered that the electric charge on the membrane has an influence on osmotic pressure and filtration rate. The values determined by this method, therefore, relate to a collodion membrane only.

Using Schade's method we have determined the osmotic pressure of the plasma proteins† for 6 normal persons.

TABLE I.

Osmotic Pressure of Plasma Proteins of Normal Human Blood at 37°C. (against collodion membrane).

Name	Colloid Osmotic Pressure in mm. Hg.	Plasma Proteins
		%
W. S.	20	
W. C.	20	9
E. G.	21	8.2
R. H.	25	6.6
E. G.	20	8
V. A.	20	
P.	23	6.4
Mean	21	

Landis[9] has shown that the pressure at the beginning of the human skin capillaries is about 32 mm. Hg. At the middle it is about 20 mm. Hg. and at the venous end it is about 14 mm. Hg. Our figures agree well with his "average" value for the middle of the skin capillaries. Values of osmotic pressure of plasma proteins above 30 mm. Hg. would seem too high for they would not allow of filtration of water out of capillaries into the tissue excepting in the glomerulus of the kidney.

† 0.4% sodium citrate was added to the plasma to prevent coagulation.

[9] Landis, E. M., *Heart*, 1930, **15**, 209.