hemolysis. This delayed hemolysis to the author's knowledge has not been described for any substance or substances. This delayed hemolytic effect probably results from the gradual softening of the red cell resultant from the emulsifying action of triethanolamine on certain of its constituents with eventual complete dissolution of its structure.

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Oxygen Capacity and Hemoglobin Content of Normal Blood of Men.

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(Introduced by Henry Laurens.)

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It is almost universally recognized that Haldane's figure for the oxygen capacity of human blood (18.5 vol. p. c.) is too low. In spite of this the old standard is still used. A recent text book[1] states that "the standard (referring to Haldane's) is regarded by American workers as too low," and Drinker,[2] in describing a hemoglobin standard, writes that "although the blood of normal men in this country . . . . contains on the average 16.6 gm. of hemoglobin which would correspond to an oxygen capacity of about 22 p. c., it was thought best to keep Haldane's standard for the present." It appears unreasonable to accept as a standard a scale on which every normal blood is well over 100 p.c. Haldane's figure was based on an original series of 12 men[3] and substantiated later by a second series of equal size.[4] Although Haldane's method of analysis has long since outlived its usefulness, and we now have an accurate and simple method for determining blood oxygen, no extensive observations on normal subjects have been reported.

We have determined, during the winter months, the oxygen capacity of the blood of 115 healthy male students ranging in age from 18 to 30, most of whom were born and have always lived in the South. Specimens were taken during the morning, oxalated (20 mg. per 10 cc.), and determinations made the same afternoon. The

[1] Wright, Samson, *Applied Physiology*, 1929, 3rd Ed., 205.
[2] Drinker, C. K., *Oxford Medicine*, **2**, 538.
[3] Haldane, J., and Smith, L., *J. Physiol.*, 1900, **25**, 331.
[4] Haldane, J., *J. Physiol.*, 1900, **26**, 497.

blood was oxygenated at room temperature with a gentle stream of air bubbles and the oxygen capacity determined on 2 cc. samples in the Van Slyke-Neill[5] constant volume manometric apparatus, the oxygen being determined directly by absorption with the sodium hydrosulphite reagent to which sodium anthroquinone-β-sulphonate was added as a catalyser. The determinations were checked within 0.2 cc. on two machines. The results are given in Fig. 1.

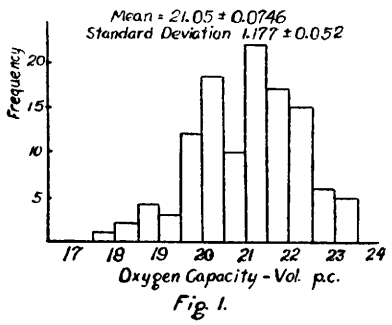

Fig. 1.

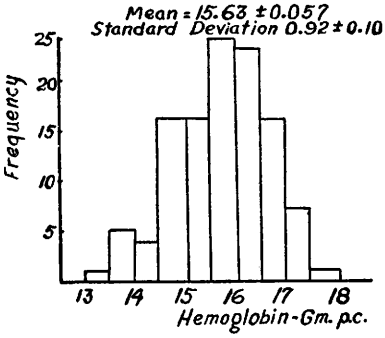

Fig. 2.

The hemoglobin content was calculated from the oxygen capacities and is expressed in Fig. 2. Haldane,[4] accepting the results of Hüfner, regarded 18.5 cc. of oxygen as equivalent to 13.8 gm. of hemoglobin, or 1.34 cc. of oxygen = 1 gm. of hemoglobin. This figure is the one accepted today and is supported by the fact that 1 atom of iron in the hemoglobin molecule unites with 2 atoms of oxygen[6] and that the molecular weight of hemoglobin is a multiple of about 16,750, each unit containing 1 atom of iron.[7]

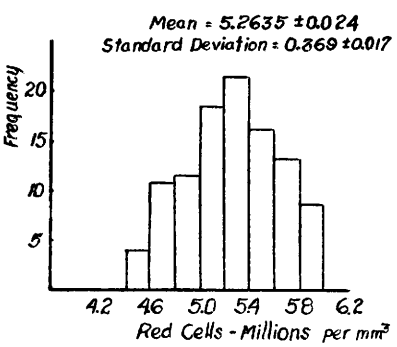

Fig. 3.

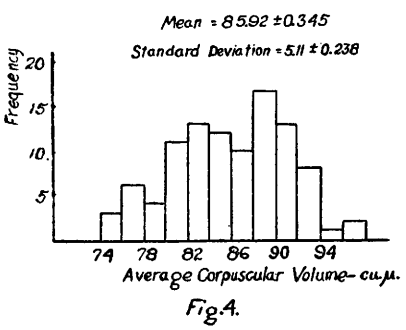

Fig. 4.

[5] Van Slyke, D. D., and Neill, J. M., *J. Biol. Chem.*, 1924, **61**, 523.

[6] Peters, R. A., *J. Physiol.*, 1912, **44**, 131.

[7] Adair, G. S., *Proc. Roy. Soc.*, 1925, 109A, 292.

Red cell counts on 100 of the subjects were made by 2 observers checking within 0.2 million. Oxalated blood was used after first finding that it checked with determinations on fresh blood. See Fig. 3.

Hematocrits were made on the same 100 subjects by the Van Allen[8] method. Ponder[9] has shown that no hematocrit, and particularly one like the Van Allen, where the blood is first diluted with an "isotonic fluid," is above question. We chose the Van Allen method because it is simple, because it gives good checks, and because we found that it can be used with oxalated bloods without the necessity of making corrections. The average on 20 subjects using freshly drawn blood was 44.3 p.c. and on oxalated blood which had stood up to 3 hours was 44.7. Since blood is diluted about 50 times in the Van Allen tubes, the tonicity due to the initial addition of 0.2 p.c. sodium oxalate is negligible. The following table shows that the Van Allen method gives lower results than are obtained on centrifuging undiluted heparinized blood. It will be observed that about 8.5 p.c. of the observed reading must be added

TABLE I.

Conditions		Hematocrit*	Av. Corp. Vol.*
Van Allen method	30 min. at 2200 RPM	44.4	84.4
Heparinized blood 100 × 4 mm. tubes	45 " at 2800 RPM	46.7	88.8
Oxalated blood 100 × 4 mm. tubes	45 " at 2800 RPM	42.9	81.5

*Average of 40 subjects. Red count = 5.26. Hb = 15.74 mg.

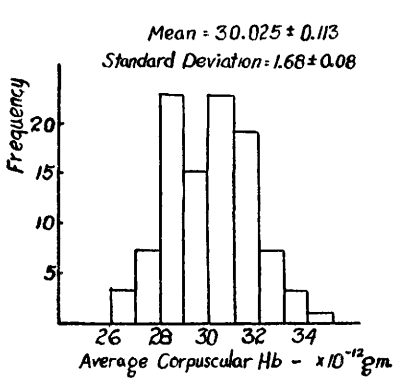

Fig. 5.

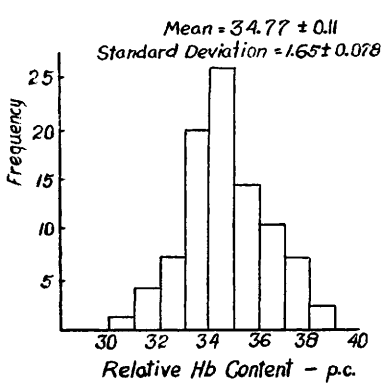

Fig. 6.

[8] Van Allen, C. M., *J. Lab. Clin. Med.*, 1925, **10**, 1027.

[9] Ponder, E., and Saslow, G., *J. Physiol.*, 1930, **70**, 18.

to the oxalated blood to make it equal the observed reading of the heparinized blood.

The average corpuscular volumes were calculated and the results expressed in Fig. 4. Doubtless the wide variation in our results was in part due to errors in the hematocrit determinations, the true range by our method probably lying between 80 and 92 cu. μ.

The average hemoglobin content of the red cells is shown in Fig. 5. The relative hemoglobin content of the cells is shown in Fig. 6. This is obtained by dividing the hemoglobin content of the cell by the volume of the cell.

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X-Ray Studies of Motility of Gastro-Intestinal Tract of Rachitic Rats with Healed Bone Lesions.

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We previously reported certain observations on the motility of the gastro-intestinal tract of a large number of normal and rachitic rats. It was found that the motility of the gastro-intestinal tract of rachitic rats was markedly altered, and in every case we found a hypomotility.[1]

This study was undertaken to ascertain whether the motility of the gastro-intestinal tract of rachitic rats returned to normal after the bone lesions of the rats were healed.

Three young rats of the same age were fed a rachitic diet for a period of 4 weeks, at the end of which time typical rachitic bone lesions were found in each animal. Gastro-intestinal examinations demonstrated a hypomotility of the gastro-intestinal tract.

TABLE I.

Rats	Stom. Emp. Time	Sm. Int. Emp. Time	Colon Emp. Time
3 rachitic rats	7 hrs. 25 min.	8 hrs. 25 min.	90 hours
The same rachitic rats healed with Viosterol	7 " 15 "	8 " 15 "	88 "
2 normal rats	6 " 18 "	7 " 32 "	65 "

[1] Menville, L. J., Blackberg, S. N., and Ané, J. N., PROC. SOC. EXP. BIOL. AND MED., 1929, **26**, 758.