milk. The total calcium intake and the per cent. of the intake gained or lost are shown below:

AVERAGE DAILY INTAKE OF CALCIUM AND PER CENT. OF INTAKE RETAINED OR LOST.

Subject.	Diet.	Intake Grams Ca.	Per Cent. Calcium from Carrots.	Per Cent. Gain or Loss.
E. D. B.....	"Milk"	0.383	—	+16
R. S. E.....	"Milk"	0.383	—	+23
E. D. B.....	"Carrot"	0.315	55	+17
R. S. E.....	"Carrot"	0.315	55	− 7
E. H.....	"Carrot"	0.261	84	+ 4
E. W.....	"Carrot"	0.297	82	+27

40 (1500)

Sugar and oxygen relationships in the blood of dogs.

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Before subjecting the organism to certain experimental conditions capable of changing the sugar and oxygen relationships of dog's blood, it was thought advisable to determine the variations and relationships which might normally be encountered within the same individual at different times and in different individuals.

The blood sugar was estimated by the MacLean method. The capacity of the blood for oxygen and its actual oxygen content were determined by the Van Slyke technic. Specimens of blood from the external jugular veins of resting dogs were drawn by aspiration without exposure to the air, at intervals of one and one half or two hours over periods of six, or seven and one half hours. To date eleven such series of observations on eight dogs have been completed.

In view of the frequent statement in the literature that even a slight amount of hemorrhage may induce hyperglycemia and because loss of corpuscles would tend to reduce the oxygen-carrying capacity of the blood, the effects of loss of blood on the factors to be studied were examined. The total amount of blood in the body was assumed to be five per cent. of the body weight. Successive samples were drawn until about ten per cent. of the

total amount in the body had been removed before the final sample was taken. Although there were individual instances in which the blood sugar rose slightly above its initial value, it was usually found to progressively decrease. A slight but unmistakable decrease in the oxygen content and capacity of the blood was found following hemorrhage of this extent. Compare columns II and III, VI and VII, X and XI of Table I.

TABLE I.

Dog.	Date.	% Blood Drawn Previous to Final Sample.	Sugar in Mg. per 100 cc.				O_2 Capacity in cc. per 100 cc.				O_2 Content in cc. per 100 cc.				VIII-XII.	$\frac{XII}{VIII} \times 100$.
			Initial.	Final.	Average for Series.	Dev. from Mean.	Initial.	Final.	Average for Series.	Dev. from Mean.	Initial.	Final.	Average for Series.	Dev. from Mean.		
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.
A .	11- 6	11.6	76	77	75	5	23.1	22.2	23.0	0.8	15.6	14.7	15.2	0.5	7.8	66.1
	1- 6	8.3	78	68	73	5	28.7	26.9	26.3	2.5	21.7	18.5	19.0	2.7	7.3	71.6
B .	10-30	16.6	95	83	81	14	17.7	16.1	17.1	1.0	9.3	8.2	9.3	1.1	7.8	54.2
C .	10-31	8.6	63	76	67	14	19.9	15.5	17.9	2.4	13.5	7.4	10.3	3.2	7.6	56.9
	11- 7	10.1	72	69	65	11	20.6	16.5	18.1	2.5	9.8	10.2	10.0	1.6	8.1	55.2
D .	11-11	10.8	59	54	55	4	16.4	16.6	16.5	0.3	9.7	8.7	8.4	1.3	8.1	51.0
E .	11-20	14.0	62	51	59	7	22.1	19.7	21.4	1.7	13.3	9.6	11.6	2.0	9.8	54.2
	1-16	8.9	63	66	63	6	23.6	21.0	22.2	1.4	16.4	9.8	12.2	4.2	10.0	54.9
F..	12-18	9.8	72	69	71	2	24.5	23.2	23.4	1.1	16.6	14.0	14.5	2.1	8.9	61.9
G .	12-19	6.9	83	71	77	6	25.0	20.6	22.8	2.2	15.4	14.4	14.9	0.5	7.9	65.4
H .	1-15	7.5	74	71	74	3	27.6	26.6	27.2	0.6	22.0	19.0	19.0	3.2	8.2	69.9

Although the actual amounts of the blood sugar, oxygen content and capacity may vary somewhat when studied at different times in one individual, the average level assumed by each of these factors seems to be characteristic for the individual. See dogs *A*, *C*, and *E*, Table I. On the other hand, when the level of any one factor is compared in different individuals, wide variations are frequently found. Compare the sugars of dogs *A* and *E*, or the oxygen contents and capacities of *A* and *C*. Again variability of blood sugar seems to be characteristic of some individuals while constancy characterizes it in others. Because of this occasional variability, conclusions in the present paper are drawn only from averages of several determinations. The difference between the oxygen capacity and the oxygen content of the blood remains singularly constant from individual to individual under the conditions of our experiments. See column XIV, Table I.

Our experiments do not indicate that any immediate relationship exists between the sugar and either the oxygen capacity or oxygen content of the blood. There is a direct relationship, however, between the ratio of the oxygen content to the oxygen capacity, *i.e.*, the percentage saturation, and the sugar of the blood. From this it will be seen that the sugar varies in the opposite direction to the course which it takes in asphyxial hyperglycemia, which is a well-established phenomenon. This lack of agreement is, to our minds, apparent rather than real since the hyperglycemia of asphyxia is probably due directly, at least in part, to the increased amounts of adrenalin discharged under these conditions and only indirectly to the low content of oxygen. See columns IV and XV, Table I.

In a few experiments the relative volumes of the corpuscles and serum have been determined by a precision hematocrit. The content of oxygen per unit volume of corpuscles was then calculated and was found to bear a direct relationship to the blood sugar. The oxygen capacity per unit volume for the same experiments showed only slight variations. In these experiments the corpuscular volume might be taken as an index of the oxygen capacity of the blood. This confirms the observations noted above that there is a relationship between the blood sugar and the degree of saturation of the blood with oxygen. See Table II.

TABLE II.

Dog.	$\frac{O_2 \text{ Capacity}}{\text{Corp. Vol.}}$	$\frac{O_2 \text{ Content}}{\text{Corp. Vol.}}$	Sugar in Mg.	$\frac{IV}{III} \times 10$.
A.....	53	38	73	19
E.....	51	28	63	22
F.....	57	36	71	20
G.....	55	36	77	21
H.....	52	36	74	20