XLI. STUDIES IN BLOOD GLYCOLYSIS.
PRELIMINARY OBSERVATIONS.

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This study was undertaken to determine the factors concerned in glycolysis in blood incubated at 37°. It is clear from the work of a number of observers—Schmitz and Glover [1927], Stammers [1926] and Chahovitch [1926]—that (1) sterile blood loses its sugar if kept at room or body temperature; (2) the rate of glycolysis varies in different species.

Glycolysis was studied under the following conditions, *viz.* (1) in whole blood after varying periods of starvation and after feeding, (2) in laked corpuscles, (3) in serum, (4) in cyanide blood, (5) in washed erythrocytes, (6) in washed erythrocytes and glucose solution.

Method.

Our observations have been confined mainly to dog's blood. About 2 cc. of blood were drawn from one of the leg veins and incubated at 37° for a variable period; samples were taken therefrom before incubation and at intervals of 30, 60 and 120 minutes for sugar estimation by MacLean's method. During the process of taking blood asepsis was observed although it was found that this precaution was not necessary at any rate for incubation periods not extending beyond 3 hours.

It will be seen on reference to Table I that the rate of glycolysis is greatest during the first hourly period of incubation; it is greater in blood samples taken about 2 hours after the ingestion of food than after a day's starvation and it decreases considerably after 2 days' starvation.

Effect of cyanide.

To determine whether glycolysis in blood is largely or entirely an oxidative process, blood was mixed with different quantities of cyanide solution in normal saline as follows: 2 cc. blood samples were taken and mixed with 1 cc., 0·5 cc. and 0·2 cc. of 0·3 % KCN solution and the total volume was made up to 3 cc. with normal saline. A control containing 2 cc. blood and 1 cc. saline was also set up. Preliminary glucose estimations were made and the samples were incubated at 37° in small test-tubes. It will be noticed

(Table II) that the quantity of cyanide used has no effect on glycolysis in whole blood and there is no relationship between the quantity of cyanide used and the degree of glycolysis.

Table I.

	Blood-sugar in mg./100 cc.	Rate of glycolysis in mg. glucose per 100 cc. ½ hour	1 hour	2 hours
(*a*) Two hours after food:				
	108·5	19	28	48·5
	104·5	19·5	42·5	53·5
	97	5	24	35
	111	9	22	37
	Average	13·1	29	43·5
(*b*) Starvation (1 day):				
	87	13	24	39
	105·5	8·5	25	31·5
	101	10	22·5	38
	102	—	—	33
	Average	10·5	23·8	35·4
(*c*) Starvation (2 days):				
	71·5	4	11	13·5
	73	13	15	20
	90·5	2·5	8	25
	Average	6·5	11·3	19·5

Table II.

	Composition of incubated blood sample: Blood cc.	KCN cc.	Saline cc.	Blood-sugar in mg./100 cc.	Rate of glycolysis in mg. glucose per 100 cc.: 1 hour	24 hours
(1)	2	1	—	82	10	34
(2)	2	0·5	0·5	82	10	22
(3)	2	0·2	0·8	82	8	22
(4)	2	—	1	60	—	30

Table III.

Composition of incubated sample	Sugar in mg./100 cc.	Rate of glycolysis in mg. glucose per 100 cc.: 1 hour	24 hours
(*a*) Serum	114	2	—
	113	5·5	—
	115	4	—
	111	6	—
	Average	4·4	
(*b*) 2 cc. serum + 1 cc. erythrocytes	104	20	—
(*c*) 2 cc. glucose solution in saline + 1 cc. erythrocytes	172	8	65
(*d*) 2 cc. glucose solution in dist. water + 1 cc. erythrocytes (laked corpuscles)	172	6·5	13

Observations were then made on glycolysis in serum, in laked blood and in glucose solutions in the presence of intact washed erythrocytes, to note the rate of glycolysis and the part played by the corpuscles, if any, in the pheno-

menon. Glycolysis was found to occur to a slight degree in the course of 1 hour in incubated serum and in laked corpuscles in contrast to the findings of Katyama [1926] (Table III, *a*, *d*) and to be greater in serum or glucose solutions in the presence of intact washed erythrocytes (Table III, *b*, *c*).

The results obtained above in (*c*) and (*d*) are not affected by the substitution of glucose dissolved in serum for an ordinary glucose solution.

Discussion.

In connection with the increased glycolysis after the ingestion of food as compared with the amount of glycolysis in the blood from a starving animal, three possible factors at least must be taken into consideration.

(1) Increased percentage of sugar in the blood.

(2) Increased amount of glycolytic substance in the blood.

(3) Effect of increased amount of insulin released (following the ingestion of food) on the tissue cells leading to an increased liberation of the substance concerned with glycolysis.

Observations on these points are being continued.

Further, the question arises as to the factors concerned in glycolysis and the nature of the process of glycolysis. It might be supposed that the latter is one of oxidation but our observations confirm those of Abraham and Altmann [1927] in that cyanide, which inhibits oxidising enzymes, has no effect on the glycolytic power of blood.

From the result that glycolysis proceeds most rapidly in whole blood as compared with the rate of glycolysis in serum, glucose solutions + intact erythrocytes and glucose solutions + laked erythrocytes, it may be inferred that there are factors present in both serum and erythrocytes which are essential for the increased glycolysis observed. Further work is being done to elucidate this point.

Summary.

1. Starvation decreases and the administration of food increases the rate of glycolysis in blood.

2. The factors responsible for glycolysis in blood are present in both erythrocytes and serum.

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