

FURTHER STUDIES ON RENAL GLUCOSE TRANSPORT IN Squalus acanthias: EFFECT OF EPINEPHRINE

A. Y. Silverman, Barbara Gerstein, and John W. Boylan, State University of New York, Buffalo, N. Y.

Adrenalin diuresis was demonstrated in Squalus acanthias by Clark (Bull. M.D.I.B.L. 1932). The response is associated with an increase in systemic blood pressure and did not occur in the aglomerular toadfish, Opsanus tau (Toth, Am. J. Physiol. 126:347, 1949). A marked rise in glomerular filtration rate (GFR) accompanies the diuresis (McCrary *et al.*, Bull. M.D.I.B.L., p. 38, 1954).

We have used the adrenalin response in Squalus acanthias to study the apparent dependence of renal glucose reabsorption on glomerular filtration rate; this finding and the procedure and methods used in the present study have been described (Bull., M.D.I.B.L. 6:Report #2, 1966).

Adrenalin hyperglycemia, a universal mammalian characteristic, could not be demonstrated in 8 dogfish which received 3 mg adrenalin IM and in which plasma glucose concentration was followed at intervals for three hours. In 4 of these fish no change in plasma glucose concentration could be detected; in 4 a slight lowering of the concentration occurred.

In 7 female dogfish, free-swimming in live car, urine was collected for a control study following which plasma glucose concentration was raised by IV infusion and 3 mg adrenalin (Parke-Davis Adrenalin Chloride 1-1000) given IM. The parameters of glucose reabsorption for these control (c) and adrenalin (E) treated animals are given in the table.

The marked elevation in GRF together with the striking increments in filtered glucose load are apparent in the table. Equally apparent is the absence of a tubular maximum for glucose reabsorption. Indeed, the process appears to extend indefinitely with extension of the filtration rate.

The increase in glucose reabsorption (T_G) is, however, greater than the increase in GFR. This is demonstrated by the ratio T_G/GFR which appears in the last column of the table. In spontaneous variation of GFR at high plasma glucose concentrations (Bull. M.D.I.B.L. 6:Report #2, 1966) this ratio had a mean value of $1.6 \pm .35$. The mean value in the present study is 2.5. This increment in reabsorbed glucose per ml GFR may be a direct effect of adrenalin on renal tubular cells, although no such effect could be detected in microperfusion studies on the proximal tubule of the rat (Deetjen and Boylan, Fed. Proc. 25:392, 1966).

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Table
EFFECT OF EPINEPHRINE ON RENAL TUBULAR REABSORPTION OF GLUCOSE

Fish # wt. kg.	Procedure	\dot{V} ml/hr	P_G mg/ml	U_G mg/ml	GFR ml/hr	Load mg/hr	$U_G \cdot \dot{V}$ mg/hr	T_G mgs/hr	T_G/GFR
30 3.9	C	1.61	1.24	0.37	8.38	10.4	0.61	9.79	
	E	7.95	4.29	8.50	36.7	157.	67.5	89.5	2.44
33 4.55	C	2.44	0.56	0.17	13.	7.28	.415	6.87	
	E	5.03	4.09	8.50	19.4	79.3	42.8	36.5	1.88
36 3.8	C	2.02	1.26	0.74	14.8	18.65	1.49	17.16	
	E	6.12	4.70	13.5	31.3	147.2	82.6	64.6	2.06
	E	6.36	4.60	9.3	39.4	181.5	59.2	122.3	3.10
	E	5.52	4.24	8.5	23.4	99.3	46.9	52.4	2.2
38 2.8	C	0.64	0.6	0.34	4.45	2.67	0.22	2.45	
	E	3.66	5.24	1.20	21.8	114.3	4.39	109.9	4.98
	E	3.56	3.92	1.37	21.8	85.5	4.87	80.63	3.7
41 4.6	C	1.52	1.02	0.43	9.83	10.02	0.65	9.37	
	E	3.99	4.60	14.8	19.87	91.4	59.0	32.4	1.6
	E	3.61	3.94	9.7	18.23	71.8	35.0	36.8	2.0
42 2.9	C	.97	1.0	.23	7.49	7.49	.223	7.27	
	E	2.81	6.58	24.2	15.8	104.	68.	36.	2.3
	E	2.75	4.88	16.6	15.3	74.7	45.6	29.1	1.9
43 2.85	C	1.51	0.66	0.18	7.98	5.27	0.27	5.	
	E	5.41	6.56	17.2	17.7	116.	93.1	32.9	1.86
	E	5.1	5.32	10.6	20.8	111.	54.1	56.9	2.7