

After intravenous injection L-glucose was determined isotopically (labeled with C¹⁴) and chemically as the difference between total reducing substance (Somogyi-Nelson) and glucose oxidase. The mean of the urine to plasma ratio was 0.32 ± 0.0046 S.E. ($n = 14$) with a plasma concentration of $11.0 \text{ mg}\% \pm 2.0$ S.E. In two of these animals PAH excretion was measured as an index of tubular functional activity. At plasma levels of $1 \mu\text{g/ml}$ the U/P ratios ranged from 14-30 in one instance and 90-120 in the other. (We would like to thank Dr. Robert Wolbach for these PAH determinations.)

Our finding of D-glucose in the urine of the aglomerular goosfish is in agreement with earlier studies (Malvin, Bull. Mt. Desert Island Biol. Lab. 5:12, 1965). The significant difference ($P 0.001$) of the U/P ratio in comparison to L-glucose implies that although diffusing into the tubular urine, L-glucose is not reabsorbed as D-glucose. The U/P ratio for L-glucose below 1.0 is evidence that there is no net secretion of this sugar and confirms data in the rat kidney (Stolte et al., The Physiologist 10:316, 1967).

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EFFECT OF PHLORIZIN AND EPINEPHRINE ON RENAL GLUCOSE REABSORPTION IN Squalus acanthias

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We studied the effect of graded doses of phlorizin on renal reabsorption of glucose in nine female dogfish, free-swimming in live cars. The procedure and analytical techniques used were those previously described (Bull. MDIBL. 6:2, 1966). After a control period, the phlorizin was

Table 1

EFFECT OF GRADED DOSES OF PHLORIZIN ON GLUCOSE REABSORPTION
(First line shows mean values for all control periods)

BW kg	KW g	Phlorizin mg/kg	\dot{V} ml/hr	GFR ml/hr	Glucose load mg/hr	T _G mg/hr	R _G %
--	--	0	1.5	11.4	9.4	9.1	96
3.8	8.3	2.6	0.7	3.0	2.3	1.1	43
4.7	13.2	2.1	4.5	14.5	13.4	5.6	41
4.1	10.0	12.2	0.3	0.7	0.2	0.1	31
3.5	11.0	14.3	0.6	2.8	1.2	0.5	41
4.0	12.3	12.5	2.6	4.1	2.2	0.9	43
5.7	19.5	17.5	5.0	15.6	20.0	3.0	15
3.9	8.8	25.6	1.7	5.1	4.0	0.8	19
3.7	11.3	27.0	1.1	4.4	3.6	0.1	2
3.7	8.5	54.0	2.7	7.6	5.0	0	0

Table 2

EFFECT OF EPINEPHRINE ON RENAL GLUCOSE REABSORPTION

Fish	BW kg	KW g	State	\dot{V} ml/hr	P_G mg/ml	U_G mg/ml	GFR ml/hr	Load mg/hr	$U_G X V$ mg/hr	T_G mg/hr	T_G/GFR
3			C	1.3	0.50	.132	7.2	3.6	.17	3.4	0.47
			E	4.1	0.60	.093	14.4	8.6	.37	8.2	0.57
			E	4.4	0.67	.061	13.2	8.9	.26	8.6	0.65
4			C	1.7	0.70	.025	8.3	5.8	.04	5.8	0.69
			E	3.5	0.75	.032	10.2	7.4	.11	7.3	0.71
			E	5.6	0.88	.018	12.2	9.9	.10	9.8	0.80
5			C	1.2	0.50	.163	5.4	2.7	.19	2.5	0.46
			E	2.7	0.61	.112	7.9	4.8	.30	4.5	0.57
			E	5.0	0.68	.085	11.0	7.5	.42	7.0	0.64
6	4.5	17.0	C	0.45	1.16	.229	2.4	2.8	.10	2.7	1.12
			E	0.9	1.22	.099	3.7	4.5	.09	4.4	1.20
7	4.24	16.6	C	1.1	1.00	.262	4.6	4.6	.29	4.3	0.93
			E	4.4	1.03	.144	10.9	11.3	.64	10.6	0.97
			E	4.3	1.06	.059	5.6	6.9	.25	6.6	1.20
12	3.7	7.7	C	0.7		.038	4.6	3.1	.03	3.0	0.65
			E	1.8		.025	6.5	4.5	.05	4.4	0.66
			E	4.3		.022	12.0	8.3	.10	8.2	0.68

C = Control period.

E = Period following 2 ml epinephrine, 1-1000, 1M.

given intravenously in 6-8 ml sea water; urine collection periods were resumed one hour later. Pertinent data are displayed in Table 1.

Note that glucose reabsorption is markedly inhibited at phlorizin dosages of 2 mg/kg BW. At 50 mg/kg reabsorption is completely blocked and glucose clearance is equal to the clearance of inulin ($C_G/C_{In} = 7.75/7.62 = 1.02$). This total blocking effect was first demonstrated quantitatively by Shannon (J. Cell. and Comp. Physiol. 5:301, 1934) in the dogfish at phlorizin dosages of 300-400 mg/kg. Note also that GFR is generally but not consistently reduced following administration of the drug.

We had previously used the augmenting effect of epinephrine on GFR in the dogfish to study the relationship of reabsorbed glucose to GFR in this animal at high plasma glucose levels (Bull. MDIBL 6:36, 1966). At that time it appeared that epinephrine itself might have increased renal glucose reabsorption. This effect was re-examined at normal plasma glucose levels in eight female dogfish. In six of these epinephrine produced a substantial increase in GFR and the parameters of glucose reabsorption under these and control conditions are set forth in Table 2.

Note that administration of epinephrine is followed by an increase in GFR, generally more than twofold and that this, in turn, is associated with a parallel increase in glucose reabsorption (T_G). The ratio T_G/GFR is not significantly different in the two groups; its control values have a mean of 0.72, following epinephrine the mean of these ratios is 0.78. From this it appears most unlikely that any of the increase in the rate of glucose reabsorption is due to a specific action of epinephrine.

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EFFECT OF PHLORIZIN ON PHOSPHATE EXCRETION IN THE SPINY DOGFISH, Squalus acanthias

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Phosphate excretion is diminished in dogs and chickens by administration of phlorizin. Pitts and Alexander (Am. J. Physiol. 142:648, 1942) proposed that glucose competes with phosphate for reabsorption and that when phlorizin interferes with the reabsorption of glucose the competition is eliminated so that phosphate reabsorption increases. Ferguson and Wolbach (Am. J. Physiol. 212:1123, 1967) proposed that tubular secretion of phosphate, readily demonstrated in chickens, might be directly blocked by phlorizin. The effect of phlorizin on phosphate excretion in the spiny dogfish was studied to help us discriminate between these two postulates.

Eight female dogfish were prepared as described by Boylan and Antkowiak (Bull. of Mt. Desert Island Biological Laboratory 6:2, 1966). Inulin clearance was used as a measure glomerular filtration rate. Phosphate concentrations in blood plasma and urine were estimated using a modification of the procedure of Fiske and SubbaRow. The rates of phosphate filtration and excretion were calculated during a one-hour collection period preceding phlorizin injection and during two similar collection periods following intravascular phlorizin injection. The dogfish were at least 20 hours post-absorptive and no glucose was given them.