

dally from the convoluted area. This systematic grouping leads to segmental subdivisions of the kidney along its longitudinal axis, in that areas composed largely of tubular convolutions alternate with those composed primarily of countercurrent arrangements.

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DEMONSTRATION OF A RENAL OSMOREGULATORY MECHANISM IN THE SPINY DOGFISH, Squalus acanthias

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We examined the renal response to hypoosmotic environment in 5 female dogfish (1.6 - 4.2 kg BW) maintained in an aerated tank thermostated at 10-12°C for periods of 24 to 42 hours. Tank osmolarity lowered by the addition of fresh water, ranged from 320 to 630 with an average of 459 Mosmol L⁻¹: The pH of the tank was checked twice daily and Tris buffer added to keep this value at about 7.6. The fish appeared vigorous throughout the period of observation (hypoosmolarity). Control data are presented from 9 fish treated similarly in undiluted seawater. Both control and diluted animals received 200 mgs inulin as a 10% solution intravenously 24 hours prior to study.

Since these observations were incidental to micropuncture, data were not collected in the free swimming state. The animals, anaesthetized with nembutal and curare, were placed ventral side up on a V-board, the gills being perfused with seawater (control group) or from the tank (diluted group). Urine for clearance periods was collected via a polyethylene catheter in the urinary papilla. A single blood sample was drawn from the dorsal aorta at the conclusion of the urine collection periods.

Urine and plasma were analyzed for inulin (resorcinol-thiourea method), urea (modified Berthelot reaction) and total osmolarity (Adv. Instr. Osmometer). Sodium and potassium concentrations in these samples were read in a Baird KY2 flame photometer.

Mean plasma and urine concentrations and the derived parameters of renal function for control (seawater) and experimental (diluted seawater) groups are set out in the table.

The normal difference in osmolar concentration between dogfish plasma and the sea (about 50 mosmol/L) was increased to an average of 300 mosmol/L. In response, urine osmolality, normally about 150 mosmols/L below plasma (U/P osm 0.85), fell to an average of 360 mosmols/L below existing plasma osmolality in the diluted group (U/P osm 0.53).

Reduction in concentration of the measured plasma constituents (Table 1) may be accounted for in part by the entry of free water down its activity gradient into the fish but it is apparent from the table that excretion of these substances is markedly augmented.

The increase in urine flow (1 ml/hr x kg) in the hypoosmotic group was effected by an increment in GFR (0.6 ml/hr x kg) as well as by reduction in tubular reabsorptive rate (0.4 ml/hr x kg). At the time of measurement urea excretion averaged over 400% above control values and plasma urea concentration had fallen proportionately to the fall in plasma osmolality ($\Delta[P_{osm}] = \Delta[P_u] = -21\%$). Sodium excretion averaged 57% above control and plasma conc. of Na with its at-

Table 1

	Environment	
	Seawater	Diluted seawater
Urine volume, ml/hr x kg BW	0.38	1.35
GFR, ml/hr x kg BW	1.96	2.56
U/P, inulin	5.2	1.9
P _{osm} , mosmol/L	995	766
U _{osm} , mosmol/L	841	403
U/P _{osm}	0.85	0.53
[P _u], mM/L	348	274
[U _u], mM/L	94	142
U/P _u	0.27	0.52
Urea excretion, mM/hr x kg BW	0.04	0.19
P _u /P _{osm}	0.37	0.35
[P _{na}], meq/L	266	234
[U _{na}], meq/L	281	124
Sodium excretion, meq/hr x kg BW	0.107	0.17

tendant anion, accounted for a decrement in plasma osmolality equal to that accounted for by urea.

In the seawater group total plasma osmolality exceeds $2 \times \text{Na} + \text{urea}$ by more than 100 mosmols/L. This osmolality gap is due for the most part to TMAO which in Squalus acanthias has a plasma concentration of about 74 mM/L (Cohen et al, Am. J. Physiol. 194:229, 1958). In the hypo-osmotic group the osmolality gap is nearly obliterated (see table) indicating that in the dogfish, as in the lemon shark (Goldstein, Am. J. Physiol. 215:1493, 1968) TMAO is preferentially excreted in the adjustment to a dilute environment.

Augmentation of renal excretion of urea, TMAO and salt and the lowered plasma concentration of these constituents were anticipated responses to the hypoosmotic challenge. Of greater interest is the finding that the dogfish nephron is capable of increasing its rate of free water excretion tenfold, a feat approaching the dilutional capacity of the mammalian kidney.

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METABOLIC CONTROL OF PYRIMIDINE SYNTHESIS IN THE OVARY OF Squalus acanthias
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Prior studies had demonstrated that dehydrogenase enzymes of the ovary of Squalus acanthias were activated by the administration of gonadotropins. In the endocrine tissues of mammals the dehydrogenase enzymes of the pentose phosphate pathway are intimately concerned with steroidogenesis and other aspects of cellular function including cell replication.