Efflux rate constants (fraction of exchangeable ion content effluxes per hour) were calculated using the formula: $k = 1/t \ln CPM\text{-}1/CPM\text{-}2$, where t is the experimental time period in hours and CPM-1,-2 refer to the radioactive counts in the animal at the state (-1) and end (-2) of an experimental time period. The initial CPM injected into the animal were calculated from a diluted sample of the injection solution. Effluxes were calculated as the product of k X the Na space X the blood Na concentration, assuming a Na space of approximately 50 ml/100g (preliminary calculations indicate that this value is reasonable) and a blood Na concentration of 550 mM/l (Evans, ibid.).

The rate constant of Na efflux from M. glutinosa is $14.7 \pm 5.9 \times 10^{-4}$ per hour (mean +/-S.E., N=7) which translates into an efflux of 40 $\mu M.100g^{-1}.hr^{-1}$, nearly identical to that described for elasmobranchs (Evans, Ibid). Thus, it appears obvious that, despite the fact that the Na gradient across the hagfish is minimal (ca. 50 mM vs. ca. 300 mM in teleosts and elasmobranchs), this species maintains an extremely low Na permeability. One must conclude, therefore, that low ionic permeability is the primitive vertebrate condition, which has been retained by both freshwater teleosts and elasmobranchs, but altered to a substantial ionic permeability by the marine teleosts. The reasons for this change during the evolution of the marine teleosts are unknown. Supported by NSF PCM 81-04046 to DHE.

CHARACTERIZATION OF TWO ZONES IN THE RENAL TISSUE OF THE LITTLE SKATE, Raja erinacea MICH

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The unique arrangement of the renal tubules of the marine elasmobranchs (see M. Elger and H. Hentschel, Verh. Dtsch. Zool. Ges. 1982:267 and Verh. Anat. Ges. 77:589-590, 1983), has been correlated with the ability of the kidney to reabsorb 98% of the filtered urea (J. Boylan, Comp. Biochem. Physiol. 42A:27-30, 1972; B. Schmidt-Nielsen, In: Transport Mechanisms in Epithelia, Munksgaard, Copenhagen 608-621, 1973).

Chemical analyses (for the technique see B. Schmidt-Nielsen et al., Am. J. Physiol. 244:F472-F482, 1983) were performed on microdissected tissue samples of two different zones of the kidney of the little skate.

Histological investigation of the kidney revealed a zone of bundles forming a thin cap on the dorsal side of the kidney, Figure 1a. The bundles contain the following segments: the neck segment and the initial part of the proximal tubule segment I, together forming a hairpin loop, the distal segment forming a second loop, and parts of the collecting duct system. The mass of the tissue beneath the bundle zone is mainly composed of the end of the proximal tubule segment I, the proximal tubule segment II, the beginning of the intermediate segment, and parts of the initial segment of the collecting duct system, Figure 1b.

Values for the water content of the tissue, osmolality, concentration of urea, Na^+ and K^+ are given in Table 1. The values were derived from two experimental groups of skates: the first was kept in running sea water (SW), the second was acclimated for 5 days to 70% sea water.

The ratios of urea concentration in the bundle zone over urea concentration in the ventral tissues were 0.822 ± 0.010 (SW) and 0.857 ± 0.031 (70% SW), the ratios of Na^+ concentration were 1.143 ± 0.034 (SW) and 1.143 ± 0.040 (70% SW).

The finding of a lower concentration of urea in the bundles seems to support the hypothesis of Thurau (1970) and Boylan (1972), who speculated on passive reabsorption of urea via countercurrent mechanisms. The anatomical together with the chemical results give evidence of an environment with low urea concentration around the final tubular segment. However, the presence of such a mechanism would not exclude active transport coupled to Na-transport in other parts of the complicated nephron (B. Schmidt-Nielsen et al., 1973).

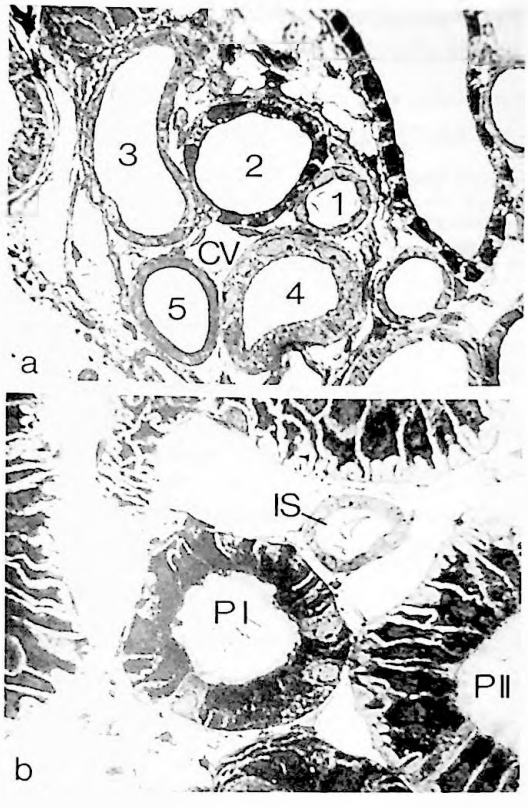

Figure 1a.--Cross section of a bundle. The five tubules are 1. the neck segment, 2. the initial part of the proximal tubule segment I, 3. the intermediate segment, 4. the distal segment, and 5. the late part of the initial collecting tubule. CV = central vessel, which is blind ended in the bundle and joins the venous sinusoids of the renal portal system in the mesial tissue. x 437

Figure 1b.--Part of the mesial (= ventral) tissue. Proximal segments (the end of the first proximal segment P I and the second proximal segment PII)and a convolute of the initial collecting tubule (not shown on this micrograph) are surrounded by venous sinusoids in this zone. A ciliated intermediate segment (IS) leads from the end of PII to the bundle zone. x 4]2

TABLE I.

	Tissue water (%)	mOsm/l	Urea mM/l	Na mM/l	K mM/l
Seawater					
Dorsal bundles	81.3 ± 0.43	1032.65 ± 21.07	341.68 ± 11.02	172.77 ± 9.01	73.48 ± 3.61 (n=13)
Ventral tissue	79.07± 0.43**	1030.55 ± 18.97	415.6 ± 12.8§§	151.5 ± 3.14*	75.18 ± 2.29 (n=13)
Serum		951.5 ± 10.21	400 ± 6.95	278 ± 31.66	5.5 ± 1.47 (n=4)
70% seawater					
Dorsal bundles	84.98± 0.17	835.55 ± 21.86	248.1 ± 8.2	147.65 ± 2.49	58.63 ± 1.36 (n=20)
Ventral tissue	83.28± 0.19§	781.11 ± 11.66	287.7 ± 9.84§	129.18 ± 2.65§	57.2 ± 2.24 (n=19)
Serum		743 ± 27.6	266 ± 36.3	216 ± 15.39	7.02 ± 3.43 (n=5)

$\bar{X}$ ± SEM; * $p < 0.05$ ** $p < 0.01$ § $p < 0.005$ §§ $p < 0.001$

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PERFUSION STUDIES ON SINGLE GLOMERULI OF THE ATLANTIC HAGFISH, Myxine glutinosa (L.)

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A special arrangement of its renal apparatus makes Myxine glutinosa especially suitable to be used as an experimental model to study glomerular filtration characteristics (Stolte, H., Eisenbach, G.M., Single nephron filtra-