CHARACTERIZATION OF UREA TRANSPORT AND WATER PERMEABILITY IN MICROPERFUSED BUNDLE ZONE NEPHRON SEGMENTS FROM *SQUALUS ACANTHIAS*

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Urea is extensively reabsorbed by the kidney of elasmobranch fish. Based on micropuncture studies, Schmidt-Nielsen et. al. suggested (Bull. MDIBL 6:35, 1966) that in the dogfish, *Squalus acanthias*, urea reabsorption occurred after the proximal tubule and before the collecting ducts. We examined the possibility that active urea transport proceeds in one of these intervening segments, namely in distal I segments (DS-I) (Lacy and Reale, Anat. Embryol. 173:163-186, 1985). This bundle zone nephron segment immediately follows the diluting segment (see below) and is located proximal to the beginning of the collecting ducts. Kidneys from male dogfish were sectioned sagitally and immersed in chilled, balanced elasmobranch bicarbonate-buffered Ringer (ERB) solution containing 350 mM urea. Single DS-I tubules were dissected from the peritubular sheath and perfused and bathed in vitro with ERB at 14° to 16°C. Fluid transport (J_v) was assessed from the difference in the concentration of ^{3}H[methoxy]inulin in samples of perfused and collected fluid. Urea concentrations were measured with a commercial BUN kit (Sigma) (Bull. MDIBL 27:110, 1987-88). The results of 14 paired observations in 5 tubules of J_v and urea transport (J_{urea}) are shown below.

V_0 nl min^{-1}	J_v nl min^{-1} mm^{-1}	J_{urea} pmol min^{-1} mm^{-1}
7.75 ± 0.97	-1.80 ± 0.30	-164 ± 34

These data indicate that, at a constant rate of perfusion (V_o), net fluid secretion obtains in the DS-I of the dogfish kidney. Hence, the apparent decline in axial urea concentrations in this nephron segment (Bull. MDIBL 27:110, 1987) are referable to dilution of tubular urea, secondary to the secretion of water into the lumen.

As noted above and described in part previously (Bull. MDIBL 25:24, 1985; 26:61, 1986; 27:128, 1987) the intermediate IV (INT-IV) segment exhibits many of the dissipative and active transport characteristics of amphibian and mammalian diluting segments. In the present experiments we sought to verify this conclusion by measuring the water permeability of the INT-IV segment under conditions of a transepithelial osmotic gradient. INT-IV segments were dissected and perfused as above. The urea concentration of the luminal fluid was reduced to 150 mM (osmolality = 650 mOsM). Peritubular bathing solutions contained 350 mM urea (850 mOsM). At an average perfusion rate of 7.04 ± 0.74 nl min^{-1}, the osmotic water permeability coefficient. P_f, averaged -1.43 ± 0.52 x 10^{-6} cm sec^{-1} (n=31). By comparison, in mammalian diluting segments (thick ascending limbs of Henle) P_f ranges from ≈ 5-20 (Am. J. Physiol. 246:F745-F756, 1984). Hence, it is reasonable to conclude that the water permeability of the INT-IV segment is extremely low, consistent with the view that this bundle zone tubule serves as a diluting segment. (This work was supported by grant DCB 87-02159 from the National Science Foundation)