

Figure 2. Plasma concentrations and intracellular amounts in muscle fibres of killifish following transfer from FW to SW. Each data point represents two fish. Three tissue samples were taken from each fish. Plasma concentrations Mean \pm S.E. (n=2). Intracellular amounts Mean \pm S.E. (n=6).

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COMPARTMENTALIZATION OF FLUID IN THE MAMMALIAN RENAL PAPILLA: INTERSTITIAL FLUID MOVEMENT IN CHANNELS AROUND THE COLLECTING DUCT

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IN a previous study (B. Schmidt-Nielsen, Y. Patel, P. Patel and S. Zell, Bull. MDIBL, 13: 1108-113, 1973) it was found that the interstitial fluid removed from the mammalian renal papilla by a centrifugation method (B. Schmidt-Nielsen, Am. J. Physiol., 230:514-521, 1976) is hypoosmotic to the cells of the papilla by 200 to 300 mOs in the undisturbed antidiuretic cat. (In osmotic diuresis the interstitial fluid has a higher osmolality than the cells.) This finding does not agree with the usual assumption that the urine in the collecting duct during antidiuresis is concentrated by diffusion of water into a hyperosmotic interstitium.

To compare the osmolality of interstitial fluid with that of collecting duct fluid micro-punctures were performed on the renal papilla of the golden hamster. The following protocol was used: first, a sample of collecting duct fluid was taken, then interstitial fluid (0.2 nl), then

again a collecting duct fluid sample. The samples were all taken at the same level of the papilla. Interstitial fluid from about 200 - 500 μ from the tip was consistently hypoosmotic to the collecting duct fluid (Figure 1). Interstitial fluid from within 50 μ of the tip was isosmotic to collecting duct fluid at the same level. Injections of Alcian Blue into the interstitium 200 - 500 μ from the tip showed that the dye in the course of 10 - 20 minutes distributed itself in an area of about 100 - 200 μ in diameter. Dye injected within 50 μ of the tip distributed itself within seconds under the epithelium of the entire tip. It was seen in the gross specimens to move toward the cortex in channels. The dye moved with a rate of 200 μ /sec. from the tip toward the outer medulla. In the cortex the dye distribution pattern was similar to that described for lymphatics.

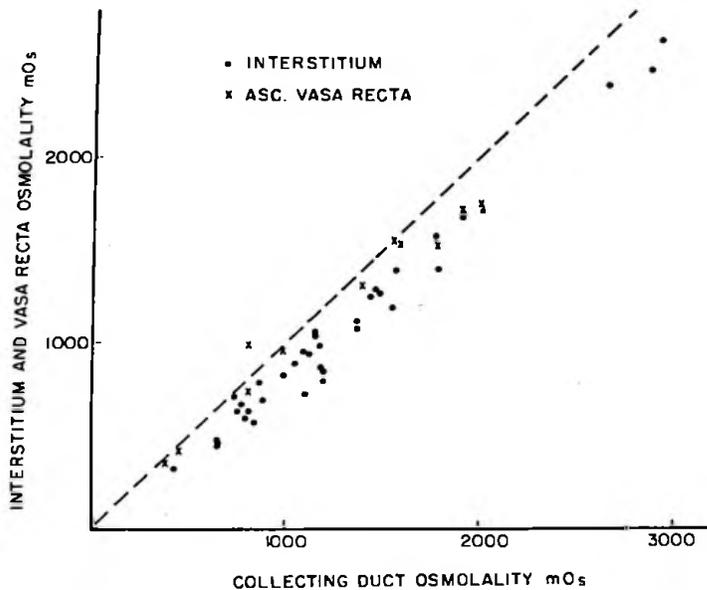


Figure 1. Micropuncture data from the hamster renal papilla. Osmolality of the interstitial fluid (•) and osmolality of vasa recta plasma (x) plotted on the abscissa against the osmolality of the collecting duct fluid (average of sample taken immediately before and after the interstitial fluid sample was collected).

Light microscopy revealed that the dye was present in channels surrounding the collecting ducts. Figure 2 shows an electronmicrograph of such a channel. The average diameter of the channels was 0.5 μ wide. It is suggested that solutes cross pelvic papillary epithelium from the urinary space and that an osmotically concentrated solution moves upward along the collecting ducts in the channels. This concentrated compartment between interstitium and collecting duct could draw a hypoosmotic fluid from the collecting duct lumen to the interstitium, according to the model by Patlak (C. S. Patlak, D. A. Goldstein and J. F. Hoffman, *J. Theor. Biol.*, 5: 426-442, 1963).

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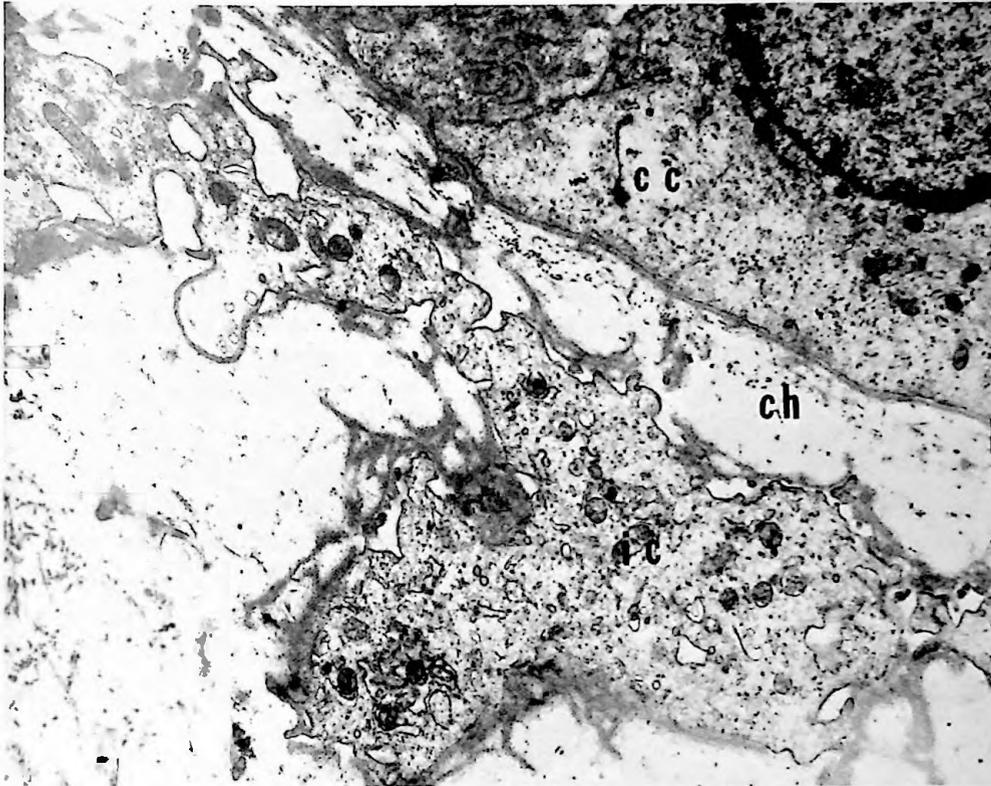


Figure 2. Electronmicrograph showing the channel next to the collecting duct. It was in these channels that the Alcian Blue was seen following injection of the dye within 50μ of the papilla tip. The channel (ch) is bordered by the basal lamina of the collecting duct cells (cc) and by the interstitial cell (ic).

SODIUM DEPENDENT CHLORIDE SECRETION IN THE RECTAL GLAND OF THE SPINY DOGFISH, *Squalus acanthias*

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The secretion of chloride by the rectal gland of the spiny dogfish, *Squalus acanthias*, appears to be dependent on the continued activity of Na-K-ATPase. Experiments using isolated perfused rectal glands have shown that ouabain 10^{-4} blocks completely and irreversibly the chloride secretion by the gland. Since chloride is the ion actively transported across the rectal gland epithelium, it has been postulated that the active movement of chloride into the cell is linked with the passive movement of sodium down its electrochemical gradient across the basolateral cell membrane. The gradient for sodium flow depends on the maintenance of a low intracellular concentration of sodium by Na-K-ATPase. The movement of chloride into the cell would thus be dependent on the sodium concentration outside the cell. The experiments reported here were designed to test this hypothesis.