

Seven fish, weighing 0.9 to 1.7 kg, were anesthetized with pentobarbital (18 mg per kg) and curare (0.3 mg per kg). The gills were continuously perfused with sea water (13-15° C) at 21/min. The dorsal and ventral surfaces of the kidney were exposed through a longitudinal incision and the fibrous capsular material was carefully removed. Hydrostatic pressure was measured in peritubular capillaries through micropipettes, using the Landis technique, and in the dorsal aorta via PE 50 polyethylene tubing and a water manometer. In 4 fish the renal arterial and renal venous portal system were injected separately with microfil (Canton Bio-Medical Products) in order to determine the anatomical relationship of the dual vascular supply to surface nephrons.

The peritubular capillaries on the surface of the kidney were found to be derived exclusively from the renal venous portal system. During control conditions the mean dorsal aortic pressure was 14.4 ± 2.1 cm HOH and the capillary pressure was 1.9 ± 0.1 cm HOH. Epinephrine administered intramuscularly as Adrenalin chloride 1-1000 in doses of 100 μ g to 1000 μ g per kg caused a one-fold rise in dorsal aorta pressure to 30.1 ± 4.6 cm HOH ($p < 0.01$) which was sustained for periods exceeding 2 hours. Despite the marked increase in aortic pressure, there was no apparent change in peritubular capillary pressure during experimental periods, which averaged 2.0 ± 0.2 cm HOH ($p < 0.5$).

This study suggests that alterations in dorsal aortic pressure are not transmitted to the renal venous portal system, from which peritubular capillaries are formed. The effect of epinephrine in the elasmobranch, to reduce renal tubular reabsorption is therefore apparently not related to an elevation of intrarenal hydrostatic pressure.

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EFFECT OF INTRARENAL HYDROSTATIC PRESSURE ON SODIUM REABSORPTION IN THE PROXIMAL TUBULE OF Necturus maculosus

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Recent studies in the mammal have shown that several extra-epithelial factors, such as renal blood flow and the oncotic and hydrostatic pressure of peritubular capillaries, influence the rate of net fluid reabsorption from the proximal tubule of the kidney. A reduction in oncotic pressure or an increase in hydrostatic pressure results in reduced removal of interstitial fluid, formed by the isotonic reabsorption of tubular fluid. These factors are thought to decrease net outflux either by increasing sodium concentration in expanded lateral cellular channels and basal infoldings to a value which exceeds the gradient established by the sodium pump or by increasing backflux into the cell or across the wall of the tubule into the lumen. In the present experiments the mechanism responsible for decreased net outflux, when capillary hydrostatic pressure is increased, was studied in Necturi using micropuncture analysis.

Adult Necturi, maintained at 15-18° C, were anesthetized with tricaine methane-sulfonate (0.6 g/liter) and prepared for micropuncture. Amphibian Ringer-bicarbonate solution was infused continuously throughout the experiment into a superficial liver vein at 0.04 ml/min. The flux of fluid was estimated in an early portion of the proximal tubule, under conditions of stopped flow, using the split-droplet method of Gertz. The length and diameter of the droplet were mea-

sured with an eye-piece micrometer. The average slope for each droplet sequence was estimated to determine the half-time of reabsorption or influx ($t_{1/2}$), such that $t_{1/2} = \frac{\ln 0.5}{\text{average slope}}$. Water flux (J_v) was calculated from the formula $J_v = \frac{0.345r}{t_{1/2}}$, where r represents the radius of the droplet. The rate of net reabsorption or outflux was estimated from the $t_{1/2}$ of isolated droplets containing amphibian's Ringer's bicarbonate solution. Influx into the lumen was measured as the rate of expansion of isolated droplets containing raffinose (non-reabsorbable solute) in water (200 m Osm/L). Hydrostatic pressure in peritubular capillaries was determined using the Landis technique. The anatomical relationships of the renal vascular supply was studied from casts of the renal venous portal system and renal arterial system made with microfil (Canton Bio-Medical Products).

The mean hydrostatic pressure of peritubular capillaries, formed by the renal venous portal system, was 2.67 ± 0.15 cm HOH (mean \pm S.E.) and the pressure in renal arterioles was 10.20 ± 0.52 cm HOH, during control conditions. After ligation of the vena cava, proximal to the kidneys, the pressure in peritubular capillaries rose significantly to 5.50 ± 0.36 cm HOH ($p < 0.001$), but was unchanged in renal arterioles, 9.25 ± 1.28 cm HOH. The control $t_{1/2}$ was 20.67 ± 2.15 min and J_v was $2.17 \pm 0.28 \times 10^{-5}$ mm³/mm² sec. Net reabsorption was reduced when hydrostatic pressure was increased. The $t_{1/2}$ increased to 123.59 ± 34.23 min ($p < 0.005$) and J_v was reduced to $0.58 \pm 0.10 \times 10^{-5}$ ($p < 0.001$). Passive influx, measured as the rate of expansion of a droplet containing raffinose, increased during the experimental period. The control $t_{1/2}$ decreased from 6.43 ± 0.64 to 4.08 ± 0.48 min ($p < 0.01$) and J_v increased from $5.84 \pm 0.69 \times 10^{-5}$ to $8.63 \pm 0.84 \times 10^{-5}$ mm³/mm² sec ($p < 0.02$).

This study shows that increased peritubular capillary pressure reduces net reabsorption from the proximal tubule in the amphibian, with a renal venous portal system, as well as in the mammal. The mechanism of this response is due, at least in part, to increased passive backflux into the lumen. Since active reabsorption is related to the electrical-chemical gradient across the tubular wall, the steady state sodium concentration and electrical gradient during control and experimental condition will be measured in order to determine the effect of increased hydrostatic pressure on active outflux.

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THE ELECTROPHYSIOLOGY OF THE GASTRIC MUCOSA OF A FRESHWATER ELASMOBRANCH

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It has previously been established that the isolated gastric mucosae of 3 species of marine elasmobranchs, so far examined, differ in electrical properties from those of other vertebrates (Science 129:1224-25, 1959; Sharks, Skates and Rays ed. P. W. Gilbert, R. F. Mathewson, and D. P. Rall, Johns Hopkins Press, Baltimore, Maryland, 1967, pp. 299-315). Since the electrolyte balance and the urea metabolism of a freshwater elasmobranch, Potamotrygon spp. (Science