movement of the stimulus in the cell.

When the mitotic apparatus of a flattened cell is shifted to an excentric position, the furrow first appears in the cell margin closer to the mitotic apparatus and then later in the more distant margin. The distance from the center of the spindle to the closer and distant margins was measured, as was the time interval between the appearance of the two furrows. The relation between the duration of the time interval and the difference in spindle to margin distances is linear over a spectrum of distance differences. It may be assumed that the time interval between appearance of the close and distant furrows is occasioned by the difference in distance the stimulus must travel. These relations permit calculation of the rate of movement of the stimulus between mitotic apparatus and surface, and in 29 determinations the average rate was 6.2 μ/min.

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RELATIONSHIP BETWEEN THE SECRETION AND RESORPTION OF ELECTROLYTES AND FLUID SECRETION BY THE KIDNEY OF THE EEL *Anguilla rostrata*

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One of the primary roles of the kidney of sea water-acclimated fishes is the excretion of divalent ions while the kidney of fresh water-acclimated forms serves mainly to eliminate excess water. Glomerular filtration rate is abolished in the aglomerular teleost, and is usually lower in marine glomerular fishes compared to fresh water fishes. In anadromous fishes, it is usually higher in the fresh water than in the sea water adapted form. The opposite was found in the catadromous eel (Schmidt-Nielsen and Renfro, this volume). The present report explores the relationship between the secretion and resorption of electrolytes and the fluid secretion.

Urine and plasma samples, obtained in the experiments described, were analyzed for magnesium, calcium, sodium, potassium, and chloride in addition to the determinations of radioactive PEG and inulin.

Serum Na, K, and Cl concentrations of sea water fish were slightly higher than those of fresh water fish, while Ca and Mg concentrations were higher in fresh water fish (Table 1). The osmotic concentration of the urine and the concentrations of the different ions were consistently much higher in sea water than in the fresh water adapted eels (Table 1).

To determine if any of the ions secreted could be responsible for the secretion of fluid into the tubule, the amount of each ion resorbed or secreted by the kidney was plotted against the amount of water resorbed or secreted. In each case a relatively linear relationship was obtained (Figure 1, a, b, c, d, e). This relationship existed between water and all ions analyzed with the exception of the points associated with net Mg secretion in sea water-acclimated eels. This is caused by the more pronounced Mg secretion in sea water- than in fresh water-acclimated eels. The line for the freshwater water-acclimated eels was shifted to the right compared to the line for sea water-acclimated eels. The amount of this shift for Na and for Cl is approximately equal to the average difference in C_{H_2O}

TABLE I

OSMOLALITY AND ELECTROLYTE CONCENTRATIONS IN SERUM AND URINE OF SEAWATER AND FRESHWATER ACCLIMATED *Anguilla rostrata*

	Serum		Urine	
	FW	SW	FW	SW
Osmolality (mOsm/l)	264 ± 7.1 * (7)	308 ± 10.7 (4)	42.5 ± 2.7 (46)	154.6 ± 13.8 (17)
Sodium (mM/l)	133.1 ± 4.7 (7)	152.5 ± 4.9 (4)	11.9 ± 1.0 (45)	38.4 ± 5.4 (19)
Chloride (mM/l)	82.5 ± 9.8 (9)	128.5 ± 8.8 (4)	5.9 ± 0.7 (37)	55.4 ± 7.0 (13)
Potassium (mM/l)	1.9 ± 0.26 (7)	2.3 ± 0.35 (4)	1.9 ± 0.26 (45)	5.89 ± 0.63 (19)
Calcium (mM/l)	2.62± 0.11 (7)	2.3 ± 0.22 (4)	0.99± 0.12 (42)	6.63 ± 0.69 (18)
Magnesium (mM/l)	0.87± 0.15 (7)	0.77± 0.13 (4)	0.43± 0.004 (48)	14.08± 3.73 (18)

* mean ± standard error (n)

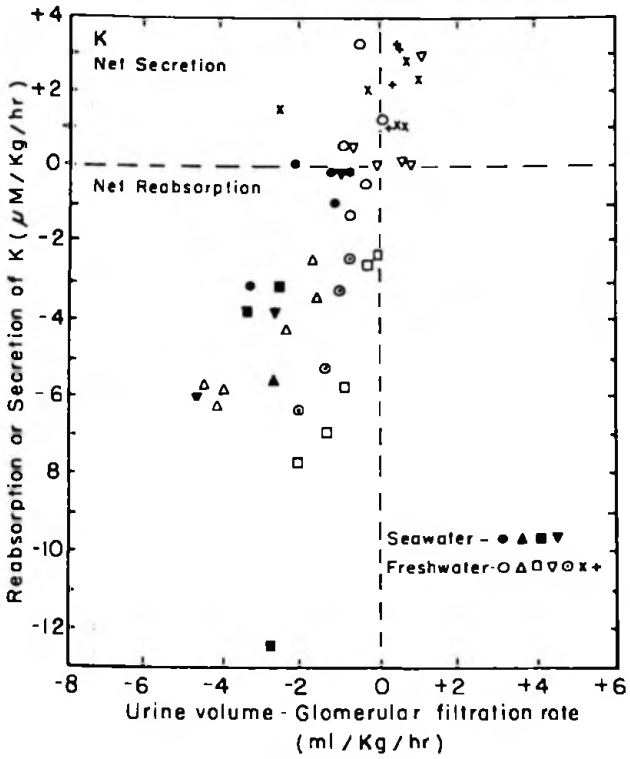

Figure 1 (a) Potassium

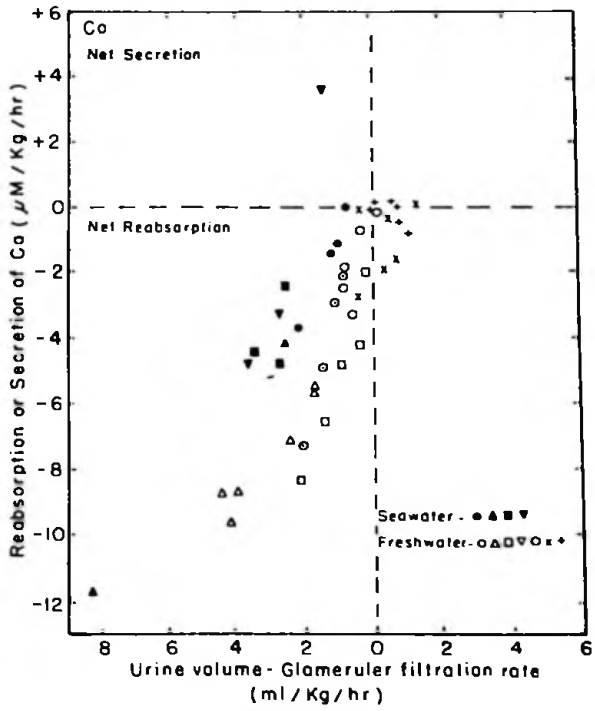

Figure 1 (b) Calcium

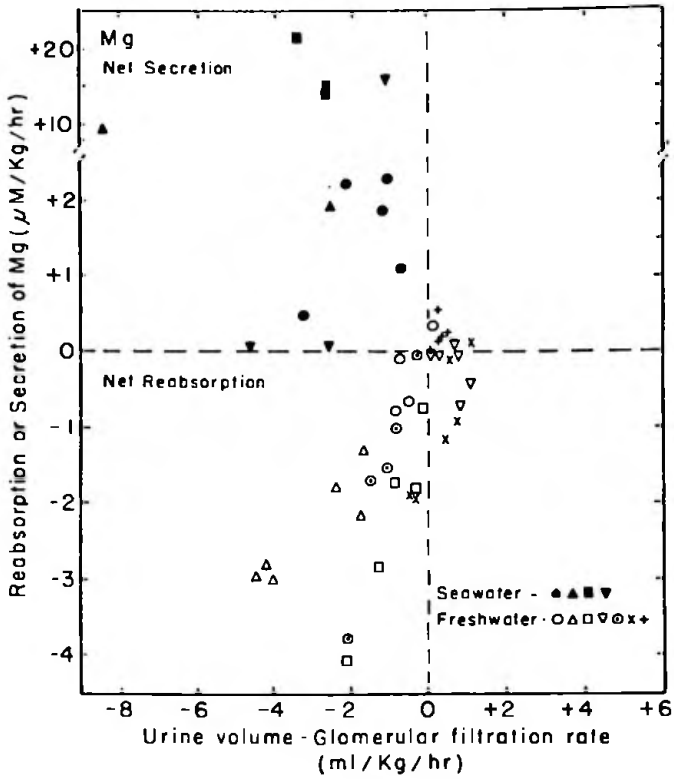

Figure 1 (c) Magnesium

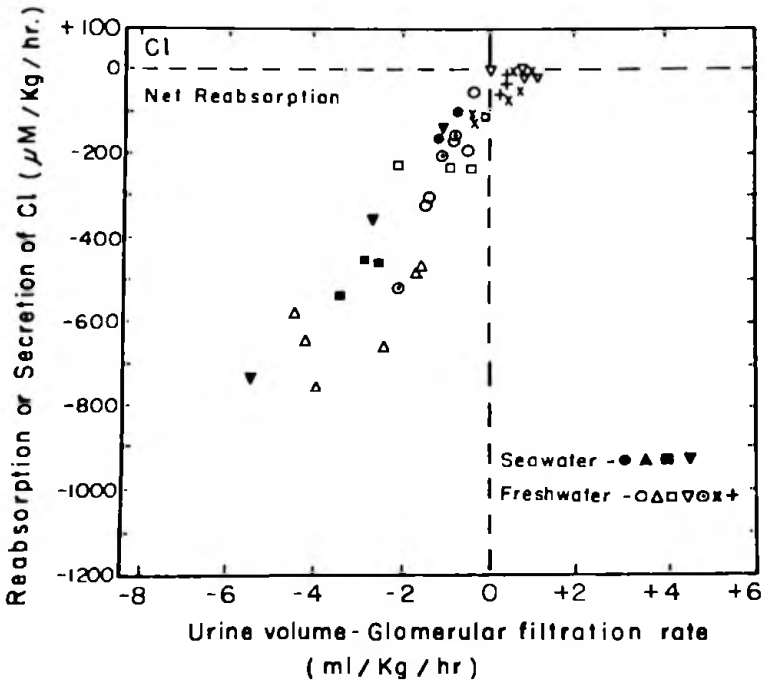

Figure 1 (d) Chloride

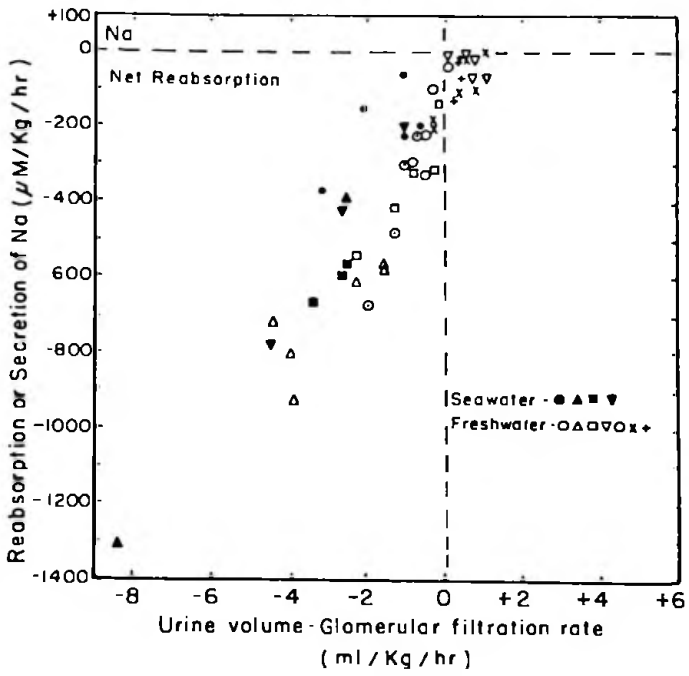

Figure 1 (e) Sodium

Figure 1. (a) Potassium, (b) calcium, (c) magnesium, (d) chloride, and (e) sodium net resorption or net secretion versus water net resorption or net secretion are represented in the graphs. Each type of symbol represents measurements on one fish. Net resorption was arbitrarily assigned a negative value in all plots.

(1.15 ml/kg hr.). This shift indicates that a greater volume of water is excreted in the urine of fresh water-acclimated eels. In many cases the urine volume exceeded the GFR. This indicated secretion of water. The ions Mg, Ca, and K all show net secretion. K secretion shows the best linear relationship with water secretion. However, the ratio of ions to water secreted (3mM/1) is so low that it cannot account for movement of water into the tubule. However, secretion of ions such as Na and Cl in one segment of the nephron (proximal segment) may be masked by resorption in another segment (distal segment).

There was no significant difference in the two groups of fish with regard to GFR. It may be theorized that the euryhaline eel does not alter its GFR but increases its urine flow in fresh water by secretion of a solution isosmotic to the plasma into the proximal tubule. Aglomerular teleosts, which lack the distal segment, produce an isosmotic urine presumably by salt secretion in the proximal segment. In the eel, subsequent resorption of the salts in the distal tubule which has a low water permeability produces a dilute urine. Fluid secretion into the proximal tubule causes a greater volume of fluid to be delivered to the distal segment and thereby increases the volume of dilute urine excreted.

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