

effect in every instance whereas GFR rose in only 3 of 5 dogfish tested. This, in turn, corresponded with Clarke's (1933) original demonstration of a doubling of the urine volume characterized by marked increase in urine/plasma ratios with no change in the sucrose (glomerular) clearance.

To test the notion that intrarenal hemodynamic factors may affect tubular reabsorption by raising hydrostatic pressure in peritubular blood, we infused intravenously massive volumes of dogfish plasma (100 ml into a 4 kg dogfish). Urea excretion was slightly elevated by this procedure but hemolysis occurred and enough trauma seemed to be involved to render the results inconclusive. Angiotensin amide (Hypertension-CIBA) was not tested since it was found to have only a transitory, insignificant effect on blood pressure in Squalus. Norepinephrine (levarterenol), which in contrast to teleost species appears to predominate over epinephrine in elasmobranchs (E. M. Stabrovskii, Zh. Evol. Biokhim. Fiziol. 5:38, 1969), was found to have no effect on urine flow in one dogfish and transitory antidiuretic effect in another. In the clearance periods immediately following administration of 0.5 mg per kg intramuscularly, the GFR dropped markedly, but this was accompanied by either a fall or no rise in urea,  $\text{Cl}^-$  and TMAO clearances, in contrast to the characteristic adrenalin response in Squalus.

In preliminary experiments p-aminohippuric acid (PAH), tubular transfer rates ( $T_m$ ), and glucose reabsorption were found not to be affected by adrenalin when the simultaneous clearances of urea,  $\text{Cl}^-$  and TMAO were typically augmented.

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## $\text{Na}^+$ AND $\text{Cl}^-$ TRANSPORT ACROSS THE MUCOSA OF FLOUNDER INTESTINE

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Experiments with mammalian small intestines have shown there is a potential difference (PD) across the mucosal membrane with the serosa being the positive (Curran, Fed. Proc. 24: 993, 1965). This PD is interpreted as being due to the active transport of the Na ion from mucosal to serosal side. Glucose can increase the potential difference. Ouabain can inhibit it. Little is known regarding the ion transport in fish intestine. Our previous report (PSEBM 118:933, 1965) showed that flounder intestine did not transport D-glucose transmucosally against a concentration gradient. The question arises, in what process are the ion(s) transported across the flounder intestine, and can this process be affected by glucose?

Winter flounders (Pseudopleuronectes americanus) were kept in a live car more than 7 days after being caught. A piece of small intestine, about 2 cm distal from pylorus, was cut and mounted in a lucite Ussing flux chamber. Seven ml of fish Ringer medium was pipetted into the chamber on each side of the mounted section of intestine and was bubbled with 5%  $\text{CO}_2$ -95%  $\text{O}_2$ . PD was measured through two calomel electrodes attached to agar-NaCl bridges. As shown in Figure 1, a negative PD ranging from 1-5 mV and a short circuit current ( $I_{sc}$ ) ranging from 10 to 30  $\mu$ Amps with respect to the serosal side were observed, when Forster Fish Ringer ( $\text{NaCl-HCO}_3^-$  Ringer) was used as a bathing fluid. In  $\text{Na}_2\text{SO}_4$  Ringer, the PD and  $I_{sc}$  shifted from negative to positive, with respect to serosal. In choline methylsulfate Ringer, either a low negative

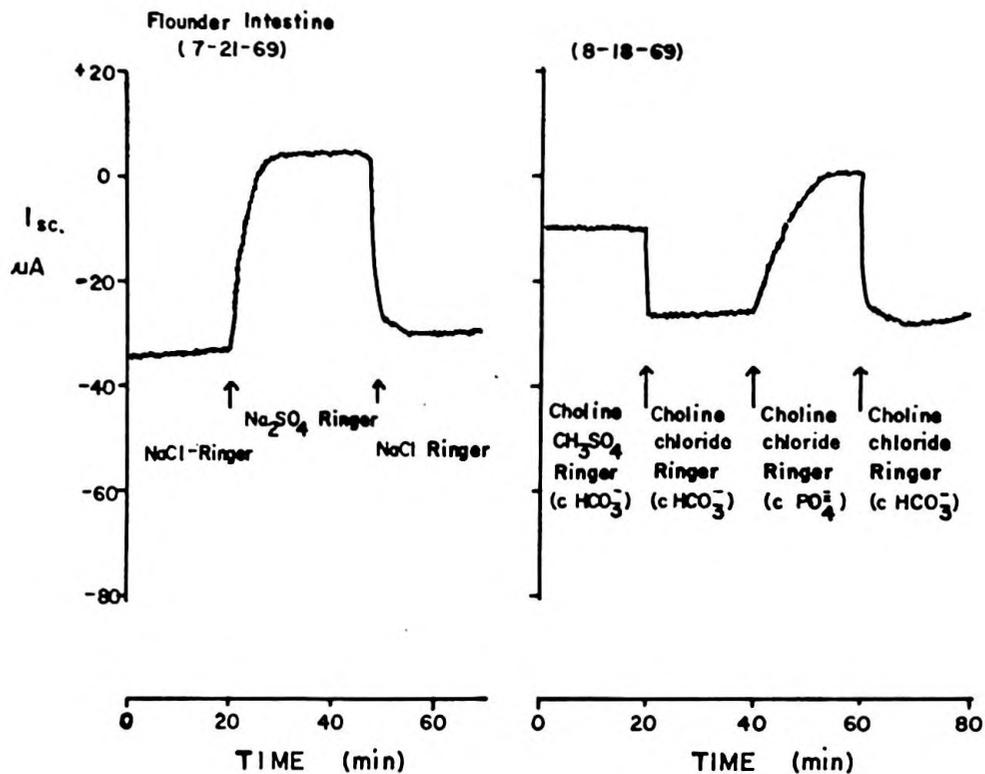


Figure 1.

or no PD and  $I_{sc}$  across the intestinal membrane was observed. However, in choline chloride Ringer, a negative PD and  $I_{sc}$  were observed and these were usually greater than those observed in  $NaCl-HCO_3^-$  Ringer as well as being sensitive to the presence of  $HCO_3^-$  ion.

Measurement of the flux of Na and Cl ions during the short circuit period was performed with the use of the radioactive isotopes,  $^{22}Na$  and  $^{36}Cl$ . Ratio  $\frac{M_{m \rightarrow s}}{M_{s \rightarrow m}}$  for Cl ion was found to be 2.20, and 3.3 for Na ion. Addition of glucose to both sides of the chamber or only to the mucosal side increased the negativity of PD and  $I_{sc}$ . These data suggest that Na and Cl ions are actively transported from mucosal to serosal side of flounder intestine with a PD negative to the serosal side which is contrary to data from observations of mammalian intestine.

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#### OXYGEN CONSUMPTION IN THE INTESTINAL MUCOSA AND GILL FILAMENTS OF FRESH-WATER AND SALT-WATER TELEOSTS

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In teleosts, osmotic regulation is largely mediated by the intestines and the gills. Although the intestine plays no role in this respect in fresh-water species; marine species drink and transport monovalent ions and water across the intestinal epithelium. The gills of fresh-water species absorb ions from the water against a concentration gradient; whereas the gills of their marine counterparts actively secrete ions. The gills and intestines of euryhaline teleosts have