

PERMEABILITY CHARACTERISTICS OF THE GOOSEFISH NEPHRON*

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It has been reported that the urine of the aglomerular fish Lophius americanus contains trace amounts of glucose. We were interested first in verifying and quantifying this observation and then in determining the mechanism by which glucose appears in the urine. All glucose concentrations were determined using the Glucostat reagent which is specific for β -D-glucose. Glucose was found to be present in the urine of all fish examined. The average concentration in urine collected from 11 fish immediately upon capture was 0.67 mg %, range 0.29-1.39 mg %. This was essentially the same concentration found in urine 24 hours after capture. Urine to plasma ratios were followed in Lophius after injection of phlorizin and exogenous glucose. After injection of either glucose or phlorizin the U/P ratios for glucose increased from about 0.02 to 0.12. These observations suggest that glucose diffuses into the tubular urine and is actively reabsorbed. If the transport system is inhibited with phlorizin or the inward leak increased by elevated plasma levels of glucose proportionally more glucose escapes reabsorption, resulting in elevated U/P ratios. Additional experiments were done in which the excretion of exogenous inulin was measured. Inulin was detected in the urine of Lophius after intramuscular injection. Inulin U/P ratios were slightly lower than control glucose ratios and were unaffected by phlorizin or glucose loading. However, it is not clear whether inulin enters the urine by crossing the tubular epithelium or the bladder wall.

THE ALKALINE GLAND OF THE SKATE: BIOELECTRIC PROPERTIES AND CHARACTER OF THE SECRETION

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This is a continuation, and final report, of studies on the alkaline (Marshall's) gland previously abstracted in this Bulletin. It was previously shown (see 1961 report) that the sodium and potassium concentrations of gland fluid are about twice that of plasma. Using the techniques of Ussing as well as potential measurements made in situ, it appears that the secretory (luminal) surface of the gland is negative to the serosal by about 16 millivolts. This suggests that cation distribution is passive. Since Cl^- concentration in gland fluid is about the same as in plasma, and HCO_3^- greatly exceeds that of plasma, we believe that the anions are actively transported from serosa to mucosa. The net flux of Cl^{36} is in this direction, as is the net accumulation of CO_2 .

pH and CO_2 measurements, and acidimetric titration of gland fluid, show that of the total CO_2 present, about 35% is $\text{CO}_3^{=}$. The presence of this ion, and its colligative properties, serve to explain the fact that the osmotic and electromotive activity of the gland fluid is less than

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would be ordinarily expected for electrolyte solutions of the usual monovalent type. The alkaline properties of the gland fluid are satisfactorily explained by primary secretion of OH^- , with buffering by CO_2 . The process is catalyzed by carbonic anhydrase in two of the species (R. erinacea; R. ocellata) studied but not in R. stabuloforis. If the enzyme is inhibited in the two former species during production of fluid, the accumulation of OH^- and CO_2 is decreased.

Histologic studies show a highly active epithelial surface. There are vesicular nuclei, well developed Golgi apparatus, abundant mitochondria, apical basophilia and brush border. The secretory surface is backed by dense connective collagenous tissue interspersed with smooth muscle. The gland is very vascular.

The function of the gland remains unknown. Its fundamental interest for us lies in its alkaline secretion and anion pump, which also provide a useful analogy to gastric and pancreatic secretions. A final publication is being submitted to Comparative Biochemistry and Physiology.

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ALVEOLAR GAS EXCHANGE IN THE HARBOR SEAL, Phoca vitulina

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Data concerning alveolar gas exchange in the seal are sparse. The use of a rapid acting infrared CO_2 analyzer and a specially designed face mask permitted the determination or calculation of the various gas exchange parameters. Studies were performed in duplicate in 6 young female animals. The mean values obtained were as follows: PaCO_2 : 49 mm of Hg; V_E : 4.5 liters/min; respiratory frequency: 22 breaths/min; CO_2 production: 174 ml/min; O_2 consumption: 217 ml/min; respiratory exchange ratio: 0.80; alveolar ventilation: 2.6 liters/min; physiologic dead space: 89 ml; calculated alveolar oxygen tension: 100 mm of Hg.

The following conclusions are indicated:

1. The basal alveolar CO_2 tension of the seal is significantly higher than that of the resting human.
2. Minute volume, alveolar ventilation, respiratory dead space, resting oxygen consumption and CO_2 production and alveolar O_2 tensions are in the same range as those found in the human when corrected for the difference in mass of the two species.
3. The resting respiratory exchange ratio is consistent with the high protein intake of this animal.

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INTRACELLULAR ELECTROLYTE PATTERNS IN DOGFISH. I. ERYTHROCYTE

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The composition of plasma and extracellular fluid in the elasmobranch differs markedly