

in the fish cells, and carbonic anhydrase is inhibited, the system cannot move, because conditions are the same inside and outside the cell. These speculations are set down as incentive to further study.

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1965 #28

UREA SPACE IN Squalus acanthias

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Urea is an important chemical factor in osmotic regulation in elasmobranchs. High concentrations of urea found in body fluids of these species are apparently related to very low extra-renal and renal loss of metabolically generated urea. In addition, certain elasmobranch tissues appear to have special mechanisms for urea transport. In mammals, it is generally accepted that cell membranes are freely permeable to urea, and that final volume distribution of urea is equal to total body water. Little information is available concerning the volume of distribution of urea in elasmobranchs.

The volume of distribution of C^{14} urea was measured in 9 animals and compared to total body water as measured by n-acetylanthipyrine (NAAP), a substance known to distribute itself throughout total body water. The volume of distribution was also compared to the volume of distribution to chemical analogues of urea, methylurea and thiourea. The C^{14} urea space was found to be 64% of total body weight as compared to NAAP space of 66% total body weight. These values were not significantly different. Methylurea and thiourea spaces were essentially the same as urea space. The correspondence between urea and NAAP spaces suggests equality of urea concentration across most cell membranes of this animal at equilibrium.

1965 #29

STUDIES OF LACTATE METABOLISM IN Squalus acanthias

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Measurements of blood lactate concentrations in the spiny dogfish, Squalus acanthias, have demonstrated concentrations that are substantially higher than those reported in other vertebrates. The mechanism of this high blood lactate concentration was investigated. In one phase of the study arterial lactate concentration was measured in 3 groups of animals: group A - 12 fish maintained in a salt water pen in the laboratory; group B - 12 fish maintained in live cars floating in the bay; and group C - 11 fish sampled on the boat within one minute of capture by hand line. The values were as follows: group A, 9.1 ± 5.3 mEg/L; group B, 6.9 ± 4.3 mEg/L; group C, 1.0 ± 0.2 mEg/L. The resting endogenous blood lactate concentrations of dogfish in their natural habitat appear to be similar to those of man.

The ability of elasmobranch gill to excrete lactate was investigated. Lactate concentrations

were determined in arterial and mixed venous (duct of Cuvier) bloods and cardiac output was measured with the dye dilution technique. The study showed that there was little excretion of lactate across the gill membrane over a wide range of lactate concentrations. In approximately half of the animals, mixed venous blood contained lower lactate concentrations than arterial blood, indicating gill production of lactate. Infusion of buffered sodium lactate (pH 7.5) did not result in augmented gill excretion.

The renal mechanism for the handling of lactate was investigated by simultaneous measurements of lactate and C^{14} inulin clearances. Lactate to inulin clearance ratios averaged 0.31 over a wide range of arterial lactate concentrations indicating lactate reabsorption by the renal tubule. As a result of this avid net reabsorption total urinary excretion of lactate is low.

Lactate concentrations in coelomic fluid averaged approximately 1/20 of simultaneously determined arterial lactate levels indicating that little lactate is excreted into this compartment.

It was also shown that $\frac{(H^+ \text{ blood})}{(H^+ \text{ coelomic fluid})}$ did not equal $\frac{(\text{Lactate}^- \text{ coelomic fluid})}{(\text{Lactate}^- \text{ blood})}$

Therefore lactate transport in coelomic fluid does not obey ionic diffusion.

Thus the normal resting lactate of the "wild" animal in the bay appears similar to that found in other vertebrates. Following capture, enhanced anaerobic glycolysis resulting from vigorous muscular exercise and an unfavorable environment leads to increased lactogenesis. Because gill and renal excretion are limited, lactate concentrations continue to be sharply elevated. Although not specifically measured in this study, the functional capacity of dogfish liver to metabolize lactate must likewise be sharply limited.

1965 #30

ROLE OF $Na^+ - K^+$ ADENOSINE TRIPHOSPHATASE IN THE RECTAL GLAND OF Squalus acanthias*

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An adenosine triphosphatase located in the membrane fraction of many tissues has been implicated in active ion transport. This enzyme is activated by Na^+ and K^+ together, but by neither ion alone. That activity stimulated by Na^+ and K^+ is totally inhibited by the cardiac glycoside, ouabain. ATP-ase activity fitting the above definition has been found in the rectal gland of the dogfish, a sodium chloride secreting organ. Properties of this enzyme system in the dogfish rectal gland were defined. Methods of preparation and assay were identical to those previously described (Palmer and Nechay, J. Pharmacol. 146: 92, 1964). Activity in the whole homogenate is of the order of 1.2 μ moles of inorganic phosphorous formed per mg of wet tissue weight per hour. This value is threefold higher than avian salt gland homogenates prepared in a similar manner. Only small amounts of activity were found in the nuclear and mitochondrial centrifugal fraction, most of the activity was in the supernate after the mitochondria had been separated. Enzyme activity was maximal at 37°C. A Q_{10} was calculated between 22° and 37° of 1.46. Maximal ion activation occurred at concentration of 20-100 mM Na^+ and 4-20 mM K^+ , values similar to mammalian systems previously studied in spite of the large difference in extracellular fluid

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