

1966 #6

# RECTAL GLAND FLUID-PLASMA RATIOS OF INULIN AND POTASSIUM IN THE SPINY DOGFISH

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Natural rectal gland fluid contains no positive blank with the inulin method of Schreiner. With plasma levels of 15 - 17 mg %, only immeasurable traces of inulin appear in rectal gland fluid.

The ability of the rectal gland to concentrate potassium has not been studied critically. Dr. Helen Cserr analyzed two species of Squalus acanthias and found rectal gland fluid-plasma levels of 6.7/3.3 and 8.5/3.9 mMoles/l. These data together with the analyses of Burger and Hess, Science, 131:670, 1960, indicate a concentration of potassium in rectal gland fluid of the same approximate percentage as sodium. These data indicate that further experimental analysis is worthwhile.

1966 #7

# FURTHER STUDIES ON EXTERNAL SODIUM FLUXES IN THE DOGFISH, Squalus acanthias

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Continuing the studies begun by Burger and Tosteson (Comp. Biochem. Physiol., in press, 1966) on the uptake of sodium by the head end of the spiny dogfish, work was done in the following areas: (1) a disappearance from plasma curve of injected  $\text{Na}^{22}$ , as a basis for quantitative calculations; (2) more data on uptake of  $\text{Na}^{22}$  by the head end of the fish; (3) efflux of injected  $\text{Na}^{22}$  by the head end; (4) uptake of injected  $\text{Na}^{22}$  by the skin alone, using a sea water bath containing  $\text{Na}^{22}$  in a plastic bag, ligated anteriorly behind the pectoral fins, and posteriorly before the cloaca. A rapid stream of running sea water was directed posteriorly, and there was no possibility that the head (gills and oral surface) were contaminated by leakage; (5) the effect on  $\text{Na}^{22}$  uptake by the head in a bath containing ouabain (1 m mole/l). In all bath experiments, the tail of the fish was placed in a plastic bag, ligated anteriorly of the cloaca, to avoid contamination of the bath by urine, rectal gland fluid, or feces. All bath experiments were performed at 9-10°C. Other methodology was that described by Burger and Tosteson above. Counting of  $\text{Na}^{22}$  was done with a Geiger tube on dried planchatted volumes.

The data secured is too voluminous for the present limitations of space, and will be presented as abstract summaries in the numerical order of the experiments given above.

1) A  $\text{Na}^{22}$  disappearance from plasma curve was obtained over a 9-hour period. It could be approximated by the sum of three exponential processes having time constants of 5 min, 1.43 hours, and 48 hours. Using this plasma disappearance curve and applying the superposition formula for linear systems, the assumption that the  $\text{Na}^{22}$  uptake from the sea water was constant gave an excellent fit between the calculated uptake curve and the observed appearance of  $\text{Na}^{22}$  in the plasma after it was placed in the sea water around the head.

2) For 2 fish, influx values were 0.93 and 0.70 m moles/kg hr (compare Burger and Tosteson).

3) For 3 fish, efflux values were 0.13, 0.17, and 0.17 m-moles/kg hr. Thus the ratio of influx to efflux was about 5.

4) In 2 fish, the influx by skin alone was 0.8 and 1.9 m-mole/m<sup>2</sup> hr giving an average of 1.4 m-mole/m<sup>2</sup> hr. Using Boylan's figure for gill area (0.37 m<sup>2</sup>/kg, John Boylan, personal communication) and assuming that the influx through the head is largely through the gill gives an average value for the gill influx per unit area of 2.2 m-mole/m<sup>2</sup> hr. This value is of the same order of magnitude as that of the skin.

In one experiment, the bag was ligated so tightly as to seriously impede circulation as determined by terminal cardiac puncture (low vol & low hematocrit). Here recoverable Na<sup>22</sup> was absent until end of experiment indicating that plasma levels are a complex of the rate of penetration and later distribution by the circulating blood.

5) Ouabain did not block the uptake of Na<sup>22</sup>.

6) Attempts to measure potential difference between sea water and blood (arterial and venous) failed because of A.C. interference.

While many, more precise measurements need to be taken, these data block out provisionally the magnitude of influx and efflux by the head end of the fish. The skin alone is not impermeable to Na, but its contribution is minor compared to the larger gill area. The fact that the skin alone is sodium permeable and has the same order of magnitude of permeability as does the gill seems to dispose of the possibility that in these head uptake experiments the sodium enters primarily by drinking small amounts of sea water. These data do not settle the matter as to whether uptake is passive or active. Further work is projected.

1966 #8

#### EFFECT OF ACTINOMYCIN D AND CYANIDE ON PROTEIN SYNTHESIS IN EMBRYOS OF Fundulus heteroclitus

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One of the central problems of embryology involves the mechanisms controlling the synthesis, regulation, and utilization of information for differentiation and morphogenesis. Presumably, the information carrier for cellular maintenance and special functions arises from genomic activity and is messenger RNA. This information is subsequently expressed by the activity of protein for which the RNA has been encoded. The investigations reported here have been concerned with the metabolic parameters which underlie the synthesis of RNA and protein during the early stages of development of the teleost embryo, Fundulus heteroclitus.

Previous studies of these investigators (Develop. Biol. 7:578-94, 1963 and Exptl. Cell Res., in press) demonstrated that: (1) Fundulus embryos develop normally to the blastula under anaerobic conditions or in cyanide; (2) the embryos are reversibly inhibited in post-blastular development while in cyanide; (3) ATP concentration is maintained at normal levels while the pre-blastular embryos are in cyanide, but is reduced reversibly at later stages; (4) the rate of pre-blastular glycolysis is increased by cyanide to maintain a normal rate of ATP synthesis while at