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APPARENT REFLEX REGULATION OF GILL WATER FLOW (VENTILATION) IN THE DOGFISH, Squalus acanthias

H. V. Murdaugh, Jr., E. D. Robin, and J. E. Millen, University of Pittsburgh, Pittsburgh, Pa., and University of Alabama, Birmingham, Ala.

The factors regulating the volume of water flow through the gills of fish are obscure. The use of spiracle water infusion to calibrate the dye dilution gill water flow technique allowed an opportunity to observe the relationship between respiratory rate and gill water flow.

Fresh sea water was circulated through the gills by means of two plastic cannulas inserted into the spiracles, and the opercular movements/unit time were counted. Opercular rate varied directly with gill water flow over a wide range of gill water flow. This mechanism operates so that the achievement of a given volume or pressure inside the respiratory chamber of the fish results in an opercular movement. Thus increasing rates of volume flow result in a greater respiratory rate. This reflex appears to be analogous to the Hering-Breuer reflex in man.

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SODIUM-POTASSIUM ACTIVATED ATP-ase IN DOGFISH TISSUES

W. W. Oppelt and R. F. Palmer, University of Florida, Gainesville, Fla.

There is evidence that Na^+ - K^+ activated, ouabain inhibited ATP-ase is involved in the active transport of ions. The enzyme has been found to be widely distributed in mammalian organs. Brain choroid plexus, rectal gland and stomach of the spiny dogfish, S. acanthias were analyzed for Na^+ - K^+ activated ATP-ase activity. Tissues from freshly killed fish were immediately frozen. Ten per cent wt/vol homogenates in 0.25 M sucrose and 0.001 M TRIS (pH 6.8) were prepared in all glass homogenizers and were centrifuged at 10,000 G to remove cellular debris, nuclei and mitochondria. The resulting supernatant was used as the enzyme source. Standard Na^+ - K^+ activated ATP-ase assay procedures were used (J. Pharmacol. 146, 92, 1964). Activity is expressed as μg inorganic phosphate split per mg wet weight tissue per hour. In 7 complete choroid plexi mean enzyme activity was 2.8, with a range of 1.0 - 3.9. In 6 rectal glands mean activity was 49.5 with a range of 41 - 59. In 2 samples of stomach wall, enzyme activity was 6.7 and 3.3. It thus appears that Na^+ - K^+ activated ATP-ase is found in these 3 tissues which are associated with active transport of ions. Rectal gland activity was the highest ever found in this laboratory for any tissue. In comparison, enzyme activity in rabbit brain is about 10, in rabbit kidney about 6, and in herring gull nasal gland about 6.5. It is interesting to speculate on the relationship between the very high rectal gland enzyme activity and the active transport of ions producing the hypertonic secretion of this gland (Physiol. Zool. 35, 205, 1962). The effect of ouabain, a specific inhibitor of this enzyme, on rectal gland secretion would be of great interest.