Hodler et. al. have demonstrated that the probable site of bicarbonate regulation in the dogfish is the gill membranes. It seemed of interest to perform parallel studies with respect to H^+ metabolism Intravascular infusion of HCl leads to no significant change in urinary pH which remains fixed at a value of approximately 5.6 suggesting that renal regulations is not involved. Arterial pH falls from approximately 7.6 to approximately 6.9 following the intravascular infusion of 10 meq. of HCl. Within 60-120 minutes after infusion, arterial pH and bicarbonate concentrations return to control values suggesting either excretion of H^+, buffering of H^+ or both processes. Measurements of mean whole body pH after H^+ infusion demonstrate that the major amount of H^+ infused is not buffered intracellularly. This finding raises the possibility of direct excretion of H^+ by the gill membrane. Attempts to directly measure gill excretion of H^+ by the divided box technique were not successful and will require further investigation by more refined techniques.

Because definite H^+ transfer from blood to sea water could not be demonstrated, an attempt was made to demonstrate H^+ transfer in the reverse direction. 0.1 N HCl was added to sea water in the anterior compartment of a divided box. Under these conditions, arterial pH fell sharply, but this decrease was caused by an increase in plasma CO_2 tension. Paradoxically fish placed in this type of acid environment developed significant increases in plasma bicarbonate in response to respiratory acidosis! Similar experiments in which HCO_3^- was added to anterior compartment sea water also produced severe respiratory *acidosis.* Apparently significant changes in external pH interfere with normal CO_2 exchange across the gills. The mechanism of this interference remains to be elucidated.

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Mean Whole Body Intracellular pH in the Dogfish

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Following a suggestion originally made by Waddell and Butler, a technique has been developed for the determination of mean whole body intracellular pH. This technique uses the weak acid 5, 5-dimethyl-2, 4-oxazolidinedione (DMO) as a pH indicator system. Assuming equal activities of the non-ionized HDMO in intra- and extracellular water at equilibrium and equal Kas in both fluids then

$$\frac{(H^+)e}{(H^+)i} = \frac{(DMO^-)}{(DMO^-)e}$$

Simultaneous measurements of total body water, extracellular fluid volume, arterial plasma pH and extracellular HDMO-DMO^- concentrations permit the calculation of mean whole body intracellular pH. Intracellular pH was measured in ten dogfish. Mean extracellular pH averaged 7.46 units while

mean whole body intracellular pH measured 6.97 pH units. Intracellular pH in the dogfish is not significantly different from that found in man and in the dog. The pH gradient between extra- and intracellular water averages 0.44 pH units indicating that the H^+ concentrations of intracellular water is 2.7 times as large as that of extracellular water.

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Extracellular Volume (Sucrose Space) In The Dogfish

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The extracellular fluid volume (E.C.F.) is not completely defined conceptually. It is now generally accepted that the volumes of distribution of sucrose and inulin more closely approximate E.C.F. than the volumes of distribution of other test substances. These substances appear to be appropriate both because they are biologically inert and because, in general, they do not penetrate cell membranes. To our knowledge, no previous measurements of E.C.F. in the dogfish have been made. Investigation of the metabolism of sucrose reveal that a relative plateau of plasma sucrose concentration is reached four hours after the intra-vascular administration of 0.50 gms. of sucrose. This plateau is based on the fact that no excretion occurs across the gills, and, urinary excretion, although present, is quite small. For practical purposes, urinary excretion may be disregarded and E.C.F. calculated as follows:

$$\text{E.C.F. (liters of plasma water)} = \frac{\text{Total sucrose injected}}{\text{Plasma sucrose concentration} \times 0.93 \quad (\text{time} = 4 \text{ hrs.})}$$

Measurements of the E.C.F. in 17 dogfish averaged 0.65 ± 0.51 L. which amounted to $20 \pm 3.5\%$ of total body weight.

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Total Body Water (T.B.W.) and Intracellular Body Water In The Dogfish

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Textbooks generally state that total body water (T.B.W.) in fish is equal to 80% of total body weight. This statement oversimplifies the results of the data on which it is based. There is good evidence to indicate that T.B.W. varies from species to species and from individual to in-