Dogfish Coelomic Fluid: II. Acid-Base Characteristics

Eugene D. Robin
University of Pittsburgh Medical School

The coelomic fluid of the dogfish, S. acanthias is markedly acid as compared with plasma, showing an approximately 60-fold hydrogen ion gradient. The function of this fluid and the mechanism responsible for the steep hydrogen ion gradient are not known. It seemed of interest to investigate the possible function of this fluid as an area of buffering. The relationship between plasma and coelomic fluid composition was investigated after the intravascular injection of the following:

1. 1.5 gm of sucrose (12 fish)
2. 1.0 gm of 5, 5 Dimethyl-2, 4-oxazolidinedione, D.M.O. (6 fish)
3. 40 mM of $NaHCO_3$ (6 fish)
4. 2 meq of H_2SO_4 (6 fish)

The results are as follows:

1. Sucrose is virtually excluded from coelomic fluid for periods up to 24 hours (10 of 12 fish). From this standpoint, coelomic fluid resembles "intra" and not "extra" cellular fluid.

2. At equilibrium (4-6 hours) the distribution of D.M.O. obeys nonionic diffusion so that $\frac{(H^+)pl}{(H^+)CF^-} = \frac{(DMO^-)CF}{(DMO^-)pl}$

3. At the end of one hour, a substantial portion of infused HCO_3^- is buffered in coelomic fluid ($\triangle$pH plasma = +0.64; $\triangle$pH C.F. = to .37). The amount of HCO_3^- buffering in this compartment must be considered in computing overall HCO_3^- balance in the dogfish.

4. At the end of one hour, there is no buffering of infused H_2SO_4 in coelomic fluid ($\triangle$pH plasma = -0.17; $\triangle$pH C.F. = +0.15). Whether this represents H^+ exclusion, exclusion of sulfate; a circulatory phenomenon. or some other mechanism remains to be elucidated.

Acid-Base Characteristics Of Perivisceral Fluid Of The Turtle, Pseudemys Scripta Elegans

Eugene D. Robin
University of Pittsburgh Medical School

Homer Smith (1929) demonstrated that the perivisceral fluid of semi-aquatic turtles was unusually alkaline in pH and that its bicarbonate concentration was approximately 2 to 2.5 times the bicarbonate concentration of turtle plasma. It seemed of interest to investigate the changes in acid-base parameters in perivisceral fluid that were produced by modifying plasma pH.

During control conditions plasma values were as follows: pH averaged 7.72 (16 observations); pCO_2 averaged 21 mmHg (15 observations) and plasma bicarbonate concentration averaged 36.6 mM/L (15

observations). Corresponding values in perivisceral fluid were as follows: pH = 8.12; pCO_2 = 20 mmHg and HCO_3^- = 94.3 mM/L.

The effect of three types of experimental procedures on plasma and perivisceral fluid acid-base parameters were determined:

1. Intracardiac administration of 10 meq. of H_2SO_4
2. Intracardiac administration of 30 meq. of $NaHCO_3$
3. Intracardiac administration of 50 meq. of Diamox

The results were as follows:

	PLASMA						PERIVISCERAL FLUID					
Procedure	pH units		pCO_2 mmHg		HCO_3^- mM/L		pH units		pCO_2 mmHg		HCO_3 mM/L	
	*C**	*E***	*C*	*E*	*C*	*E*	*C*	*E*	*C*	*E*	*C*	*E*
Acid Administration	7.75	7.19	16	49	30.6	22.9	8.08	7.72	12	20	52.6	36.6
HCO_3^-	(See below)											
Diamox Administration	7.74	7.66	16	15	30.6	22.8	8.03	7.96	15	15	70.0	51.1

*C** - Control
*E*** - Experimental

These results indicate the following:

1. Turtle perivisceral fluid is alkaline as compared to plasma and contains a bicarbonate concentration that is approximately 2.5 times that of plasma.

2. CO_2 tensions in plasma and perivisceral fluid are equal during control circumstances. Since these CO_2 tensions were directly measured, this observation constitutes experimental proof of the equality of CO_2 tensions across cell membranes.

3. Intracardiac administrated H^+ is buffered in perivisceral fluid as well as plasma. The degrees of buffering in these two compartments are roughly comparable so that perivisceral fluid may serve an important buffer site against fixed acids generated during metabolism.

4. CO_2 tension rises in both plasma and perivisceral fluid following H^+ administration suggesting that ventilation in the turtle is not mediated via changes in extracellular pH or CO_2 tension.

5. Following $NaHCO_3^-$ infusion in approximately half of the animals. there is no evidence of bicarbonate buffering in perivisceral fluid; in the other half, infused bicarbonate is buffered in this field. The reasons for this discrepancy are not apparent.

6. Diamox administration leads to extracellular metabolic acidosis in the turtle with equivalent acid-base changes in both plasma and perivisceral fluid.

(This work supported by grants from the National Institutes of Health, United States Public Health Service (H-5059) and an institutional grant from the American Cancer Society (IN-58).