

THE MODE OF GAS TRANSPORT BY ELASMOBRANCH GILL

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Previous work in this laboratory has shown that the mode of gas transport in biological units can be defined by determining the value of 2 parameters.

K_1 = mean expired water - arterial O_2 gradient

K_2 = arterial - mean expired water CO_2 gradient

The precise mechanisms involved in O_2 and CO_2 transport across the elasmobranch gill have not been elucidated. Methods were developed which permit the experimental determinations of these parameters in Squalus acanthias.

Assuming that the amount of O_2 furnished by the gill is equal to the amount of O_2 removed by the gill circulation then

$$K_1 = P_{IO_2} - PaO_2 - \frac{\text{Cardiac output}}{\text{Gill Water Flow}} \times \frac{1}{\alpha O_2} C_{aO_2} - C_{vO_2}$$

$$K_2 = PaCO_2 - P_{ICO_2} + \frac{\text{Cardiac output}}{\text{Gill Water Flow}} \times \frac{1}{\alpha CO_2} C_{vCO_2} - C_{aCO_2}$$

Cardiac output and gill water flow were determined by dye dilution technique, αO_2 and αCO_2 obtained from standard tables, and the other values measured directly. Nine fish were studied with the following results: K_1 and K_2 were never zero and were never simultaneously negative. Thus, neither simple passive diffusion nor counter-current exchange are the mode of gas exchange in Elasmobranch gill. In animals maintained for relatively long periods in sea water pens there is increasing positivity of K_1 and K_2 . This finding suggests that with an unfavorable environment gas transport across the gill becomes increasingly ventilation - perfusion or diffusion limited.

Of great interest was the finding in all animals of a positive K_2 whose magnitude could not be explained on the basis of maldistribution or diffusion limitation in the gill. This suggests that a steady state activity gradient for CO_2 may be maintained between arterial plasma and expired water. Since the isolated positive K_2 was small and the determination of its value is technically difficult, further work will be required to define the significance of this observation.

UREA SYNTHESIS IN LIVERS OF DOGFISH AND LUNGFISH*

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Elasmobranchs are ureotelic vertebrates. They not only maintain a high concentration of urea in their body fluids but also excrete urea at rates comparable to those of mammals. Lung-

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