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EFFECTS OF CHANGES IN TEMPERATURE ON BODY FLUID pH IN THE DOGFISH, Squalus acanthias

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The operational definition of normal pH of biological fluids is of general interest. In particular, changes in temperature as these affect H^+ activity in poikilothermic forms is of fundamental importance.

The thermodynamic basis of pH measurement does not strictly permit the comparison of pH values obtained at different temperature since $E_T = E^o - \frac{RT}{F} 1n_a H^+$ and E^o must be arbitrarily defined at any temperature. However, biological systems present the problem of interpretation of pH measurements of various body fluids over a range of temperatures. The effects of varying body temperature from 2° C to 23° C was therefore investigated in the dogfish. pH measurements were performed on blood, celomic fluid, urine and sea H_2O. Measurements were made at the actual temperatures of the fish and compared to measurements made by using an electrode maintained at the other temperature to which the fish was ultimately subjected. The animal was maintained at each of the two temperatures for two hours before the body fluid samples were obtained:

1) Normal blood pH in the dogfish shark obtained in the wild state is 7.78 ± .06 (S.D.). This pH suggests that the pH of dogfish at ambient temperature is identical with other forms including amphibia and reptiles maintained at similar temperatures.
2) In vitro temperature coefficient of blood differs markedly from that of celomic fluid and urine. In blood there is approximately 0.013 ΔpH/° C change in temperature over the entire temperature range studied. In celomic fluid and urine the temperature coefficient depends on the temperature range being used. At relatively low temperature (2° - 5° C) these fluids have temperature coefficients similar to blood. At higher temperatures (>12° C) the temperature coefficient of these fluids is small (≅ 0.002). As a result, measurements of pH gradients based on in vitro measurements lead to gross errors.
3) In vivo modification of temperature leads to considerable changes in H^+ gradients between plasma and these two body fluids.

The implications of these findings for a fundamental understanding of the effect of temperature on H^+ are being further investigated.

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