A PRELIMINARY NOTE ON THE BUFFERING OF OH^- BY THE KIDNEY OF SQUALUS ACANTHIAS

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Renal H^+ secretion in the mammal is accompanied wholly or in part by the reaction $OH^- + CO_2 \longrightarrow HCO_3^-$ in membranes facing the basal or antiluminal surface of the nephron. On the other hand, the marine elasmobranch (and probably the marine teleost) appears to buffer OH^- during acid secretion by a different mechanism, not involving CO_2 (Swenson and Maren, Am. J. Physiol. Renal Fluid and Electrolyte section, Vol. 250, 1986).

We titrated the kidneys of S. acanthias with NaOH in vitro to see if they had any special buffering power. As controls, we used rectal gland, muscle and plasma from the same animals; in each case 0.4 g of tissue was homogenized with about 5 ml water and then titrated with 0.1 N NaOH from the initial pH (6.4-6.8), except for the diluted plasma (7.4), to pH 11. Since urine of this species has a pH (5.8) just 2 units below that of plasma, we show the μeq NaOH necessary to raise pH from 7.8 to 9.8.

The mean titration values from tissues of 3 fish adjusted to 1g wet tissue are, in microequivalents: kidney 212; rectal gland 100; muscle 96; plasma 18. From this, we tentatively say that the kidney appears to have special buffering power.

We may compare these data with actual H^+ secretory rates assuming that this demands equal rates of OH^- buffering. Based on 1 kg body weight, normal acid output is 33 μeq/hr and Imidazole buffer stimulated rate is 390 μeq/hr (Swenson and Maren, vide supra). The kidney weight/kg is about 5 g, so the above titration shows buffer potency of 1060 μeq. With no renewal or recycling of endogenous buffer, this would work for about 32 (1060 μeq / 33 μeq per hr) hours in the normal fish.

Since normal amino acid residues buffer well in this range, it may not be necessary to postulate a special protein for this purpose. However, we are studying this problem presently and hope to find the chemical basis for the "hydroxyl reaction" in fish kidney. It is not inconceivable that such a reaction is also part of the renal buffering in mammals.

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