1974 #19

INFLUENCE OF CO_2 ON ACID SECRETION AND ELECTRICAL PROPERTIES OF GASTRIC MUCOSA FROM *Squalus acanthias*

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Among gastric mucosae that of the dogfish (*Squalus acanthias*) is unique in being reported to secrete HCl at high rates without developing a potential difference (Hogben, Science 129:1224, 1959). Since the tissue is relatively thick it seemed likely that CO_2 diffusion was rate-limiting on acid secretion under usual in vitro conditions as has been shown for the thinner frog mucosa (Kidder and Montgomery, Am. J. Physiol. 227:300, 1974). Removal of this inhibition, by using higher CO_2 tensions, might alter the electrical properties of the dogfish stomach.

The stripped mucosa was mounted as a flat sheet in an Ussing-type chamber. Serosal solutions were those of Hogben. Potential difference (PD) was measured by KCl/calomel electrodes in the fluid streams; resistance by ΔPD/ΔI during a 1 sec., 20 μ A current pulse; acid secretory rate by pH stat. Temperature was 18±1° C, and all tissues were carbachol stimulated. Values reported ± SEM, significance determined by t-test.

Seven tissues were alternated (1 h periods) between 5 percent CO_2 and 10 percent CO_2 in oxygen (both sides) for a total of 15 h in each condition. During the last half of each period, J_H (net H^+ secretion) in 5 percent CO_2 was 1.89±0.16 $\mu Eq/cm^2 \cdot hr$, and in 10 percent CO_2, 2.71±0.19. This 60 percent increase is significant at the 1 percent level. PD in 5 percent CO_2 was -0.6±0.5 mV (at 45 min into the period, reference mucosal = zero), while in 10 percent CO_2 it was -1.8±0.6 mV; this difference is significant when

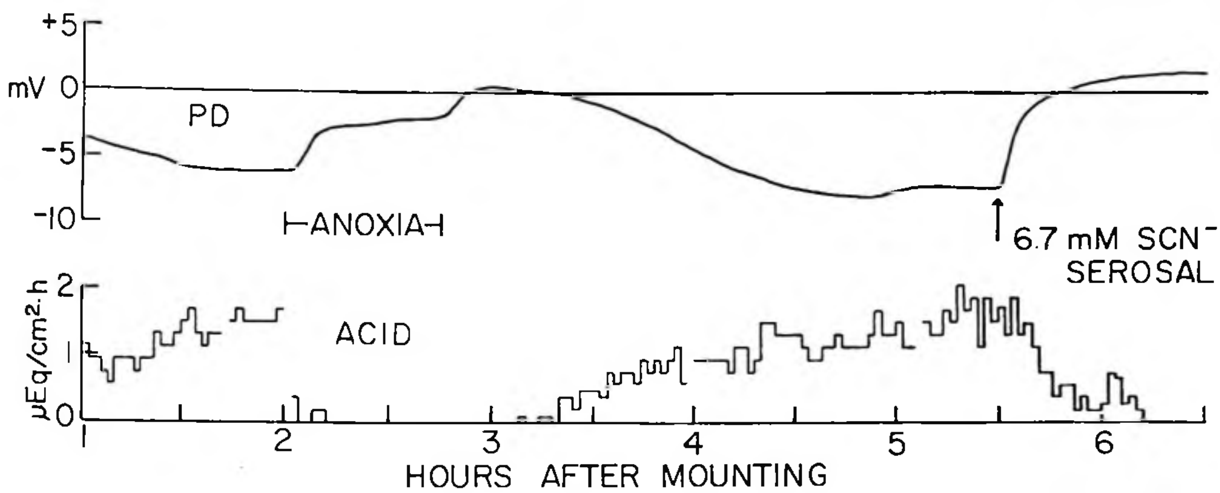

Figure 1

adjacent periods are compared as pairs. Tissue resistance was 425±46 $\Omega \cdot cm^2$ in 5 percent, and 426±38 $\Omega \cdot cm^2$, which is not different. In a few experiments, 20 percent CO_2 caused a decrease in J_H, as in the frog.

Figure 1 shows the responses of a typical tissue in 10 percent CO_2 to anoxia and thiocyanate. The PD changes are well correlated with changes in J_H, and are similar to those expected in the frog with reduced chloride, except that the magnitude of the PD is less. This suggests electrogenic pumps for H^+ and Cl^- in the dogfish, with H^+ somewhat more active than Cl^- accounting for the serosal negative PD. A non-specific shunt pathway might be attenuating a large fraction of the PD which given the high tissue resistance, implies that the series resistance of the pumps is higher per unit gross area than in the frog.

It seems clear that the dogfish gastric mucosa is CO_2-limited in 5 percent CO_2, giving higher J_H and a significant PD in 10 percent CO_2. This corroborates the hypothesis explaining the CO_2 effect in frog stomach, and suggests that 10 percent CO_2 can be used to further stimulate H^+ secretion in dogfish as well as frog. Given these results, HCl secretion in the dogfish gastric mucosa can no longer be regarded as electrically neutral and thus unique.

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1974 #20

THE ROLE OF C_3-OH FOR BOTH TRANSPORT PATHWAYS OF D-GLUCOSE IN RENAL TUBULAR CELLS OF THE FLOUNDER (*Pseudopleuronectes americanus*)

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Evidence has been presented previously (A. Kleinzeller and E. McAvoy, J. Gen. Physiol. 62, 164, 1973; A. Kleinzeller, P.M. Griffin, R. Rittmaster, and E.M. McAvoy, Bull. MDIBL 13, 67, 1973) that at the antiluminal face of the flounder renal tubule, D-glucose is transported into the cells by two distinct pathways: (1) a pathway shared with methyl-D-glucopyranoside, requiring a free C_2-OH in the D-*gluco*-configuration; and (2) a pathway shared with 2-deoxy-D-glucose and D-mannose, requiring a free C_1-OH. We have also found that 3-O-methyl-D-glucose slightly inhibited the entry of methyl-α-D-glucopyranoside into the renal cells suggesting competition for a shared transport site. Such result raised the possibility that a free hydroxyl on C_3 of the sugar molecule is not required for interaction with