THE EFFECT OF MERCURY ON CHLORIDE SECRETION BY THE ISOLATED PERFUSED RECTAL GLAND OF SQUALUS ACANTHIAS.

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The purpose of the experiments reported here was to examine the effect of mercury on the transport of chloride by the isolated perfused rectal gland of the shark. Rectal glands were perfused in vitro with dibutyryl cyclic AMP 5 x 10^{-5}M and theophylline 2.5 x 10^{-4}M to obtain sustained rate of chloride secretion, as previously described (Am J Physiol. 1977; 233:F198-F306).

Initial experiments demonstrated that mercuric chloride, a soluble inorganic salt of mercury, inhibits chloride secretion by the isolated perfused rectal gland in a dose dependent way (Figure 1). The effect of mercuric chloride was readily apparent at a concentration of 10^{-6}M and maximal and irreversible at 10^{-4}M.

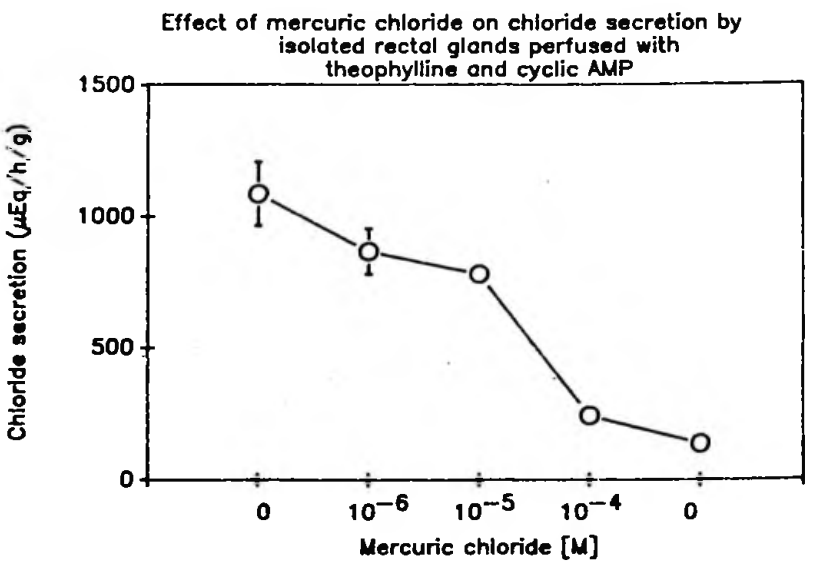

Figure 1. Dose response effect of mercuric chloride on chloride secretion by the isolated rectal gland. Mercuric chloride significantly inhibited chloride secretion at 10^{-5}M and maximally and irreversibly at 10^{-4}M.

Because mercury binds to SH groups we tested the effect of another compound, p-chloromercuribenzoyl sulfonic acid, that as mercury binds to sulfhydryl groups. This compound also had an inhibitory effect on chloride secretion (Table 1) that was irreversible, suggesting that intact sulfhydryl groups are necessary for the secretion of chloride by the rectal gland.

TABLE 1
EFFECT OF p-CHLOROMERCURIBENZOYLSULFONIC ACID ON CHLORIDE SECRETION BY THE ISOLATED RECTAL GLAND PERFUSED WITH THEOPHYLLINE AND CYCLIC AMP

PCMBS concentration	Chloride secretion uEq/hr/g
0	1,279 ± 81
10^{-5}M	651 ± 197
0	710 ± 319

Values are mean ± SEM. n=4.

Mercury is a powerful diuretic with its main site of action on the thick ascending limb of the loop of Henle an epithelia analogous to the rectal gland of the shark. Because organic mercurial compounds are generally more active than inorganic compounds we next tested the effect of mersalyl, . In three experiments mersalyl was added to the perfusate at a concentration of 10^{-4}M after a control period of thirty minutes duration. The perfusion with mersalyl lasted for thirty minutes and was followed by another control period of thirty minutes duration. As shown in figure 2, mersalyl at this concentration had no effect on chloride secretion by the rectal gland.

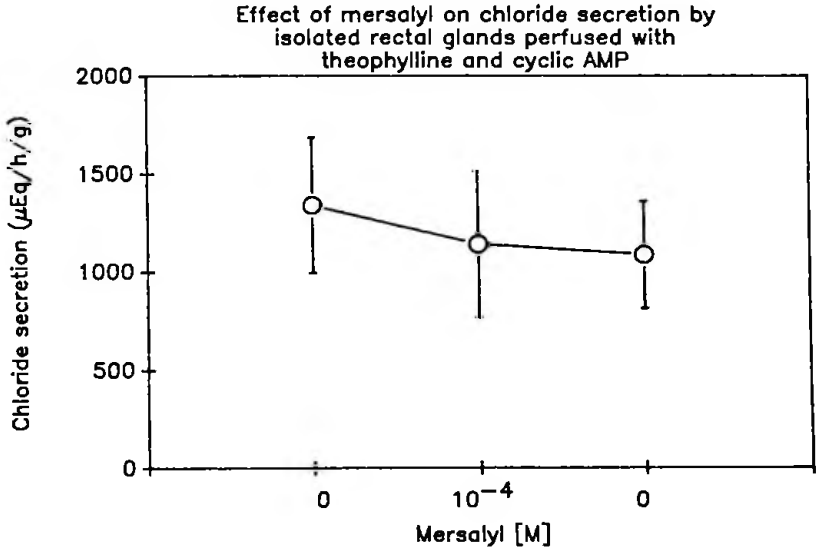

Figure 2. Mersalyl at a concentration of 10^{-4}M had no effect on chloride secretion by isolated perfused rectal glands.

The lack of an effect of mersalyl, an effective inhibitor of the transport of chloride in the thick ascending limb of the kidney a tissue analogous to the rectal gland, cannot be explained at present. In the kidney, organic mercurials are more effective as diuretics than inorganic compounds. However, not all organic mercury compounds are effective, only those than can release inorganic mercury. The effect of organic compounds is highly dependent on pH, they are more effective the more acid the pH (Excerpta Medica, Amsterdam, 1973, pp 124-134). It is possible that at the pH of 7.6 of the perfusate mersalyl is ineffective as an inhibitor of chloride transport. On the other hand, the effect of inorganic mercury is independent of pH in the kidney and inhibits chloride transport in the rectal gland confirming that pH plays a major role in the effectiveness or lack thereof of organic mercurials.

In summary, inorganic mercury and p-chloromercuribenzoyl sulfonic acid, compounds that bind to sulfhydryl groups, inhibit stimulated chloride secretion by the isolated perfused rectal gland. The inhibitory effect of these compounds may be related to their capacity to bind to sulfhydryl groups. If that is so, the mechanism for the transport of chloride requires active sulfhydryl groups.

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