be due either to stimulation of rectal gland nerves or depolarization of the cell membrane of the secretory cells that would activate chloride secretion. Veratrine at concentrations ranging from 0.005 to 0.5 mg/ml did not alter basal oxygen consumption in four different isolated cell preparations (38.8±6.8 in basal conditions vs 39.3±6.8 after veratrine). Theophylline and dibutyryl cyclic AMP stimulated oxygen consumption after veratrine by an average of 85%, a value not different from that observed in the absence of veratrine, this stimulation was returned to basal levels by 10^{-4} M ouabain.

Summary. Isolated rectal gland cells are able to maintain a stable rate of oxygen consumption until the oxygen tension is very low. As expected, the critical pO_2 in the medium for stimulated cells is higher than that seen under basal conditions. Oxygen consumption is linked to ion transport in a way consistent with coupled transport of both sodium and chloride into individual rectal gland cells across their plasma membrane. The failure of veratrine to stimulate oxygen uptake in isolated rectal gland cells devoid of neural connecting suggests that its stimulating effect in the whole perfused gland operates via rectal gland nerves and is due to the release of a neurotransmitter.

SOMATOSTATIN INHIBITION OF RECTAL GLAND SECRETION

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Somatostatin has been shown to inhibit the action of several peptide hormones in different systems. In the rectal gland somatostatin (1.4×10^{-7}M) completely inhibits the stimulatory effect of vasoactive intestinal peptide (VIP) on chloride secretion by isolated perfused rectal glands and on the accumulation of cAMP by rectal gland slices (Stoff et al., Am. J. Physiol., 237:F138-F144, 1979). The present experiments were undertaken to evaluate the effect of somatostatin on rectal gland secretion induced by other agents, including veratrine, adenosine, cAMP and theophylline, and forskolin. Fresh isolated rectal glands of Squalus acanthias were perfused as previously described (Silva et al., Am. J. Physiol., 233:F298, 1977).

In confirmation of Erlij et al (Bull. MDIBL, 21:74-76, 1981), perfusion with either veratridine, 2×10^{-5}M or comparable amounts of veratrine (3 mg/100 ml) stimulated chloride secretion to about 4 x basal levels. The increase in secretion was most marked during the first 10 min period after the addition of the agent, with progressive reduction thereafter. When veratrine was superimposed on somatostatin, 1.7×10^{-7}M in 4 experiments, no stimulation was observed (Figure 1).

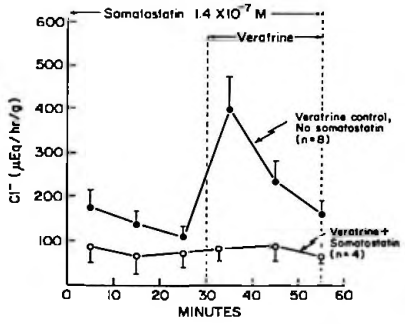

Figure 1.--Effect of somatostatin on rectal gland stimulation by veratrine. In the control experiments without somatostatin, 4 experiments were done with veratridine, 2×10^{-5}M and 4 with veratrine, 3 mg/100 ml. Because there was no significant difference between the two preparations, these results were combined. Values are mean ± s.e.

By contrast, adenosine (10^{-5}M) elicited a prompt increase in rectal gland secretion when infused in the presence of somatostatin at a concentration of either 1.4×10^{-7}M (n=3) or 1.4×10^{-6}M (n=2) Figure 2). When the administration of somatostatin was interrupted and that of adenosine continued, secretion remained the same or fell in 3 experiments, but increased slightly in 2 others.

Forskolin (10^{-5}M), a compound that directly activates adenylate cyclase (Seamon et al, PNAS, 78:3363-3367,

1981), also stimulated rectal gland secretion, both alone (Figure 3) and in the presence of 1.4×10^{-7}M somatostatin

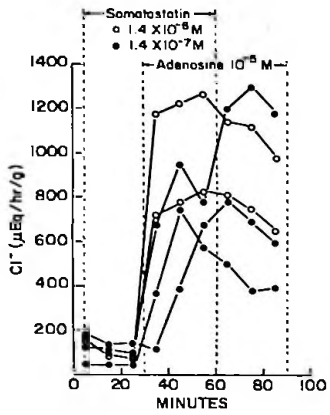

Figure 2.--Effect of somatostatin on rectal gland stimulation by adenosine.

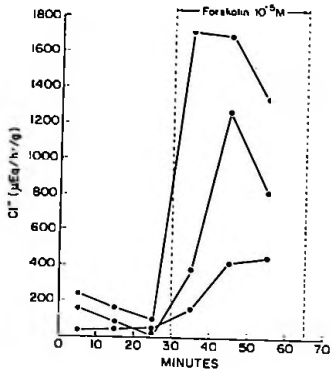

Figure 3.--Stimulation of isolated perfused rectal gland by forskolin.

(Figure 4). In one instance, secretion appeared to increase slightly when somatostatin was interrupted, compatible with the possibility of an incomplete inhibition by somatostatin.

When superimposed on a background of 1.4×10^{-7}M somatostatin, dibutyryl cAMP, 0.5 mM and theophylline .25 mM also regularly elicited an increase in chloride secretion. However, in comparison with control perfusions in which somatostatin was omitted, the stimulation appeared to be delayed and blunted (Figure 5).

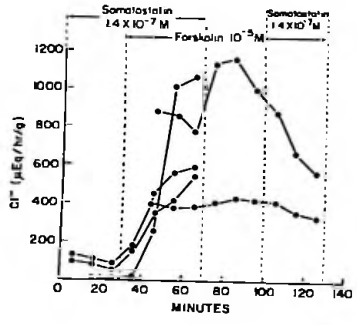

Figure 4.--Effect of somatostatin on rectal gland stimulation by forskolin.

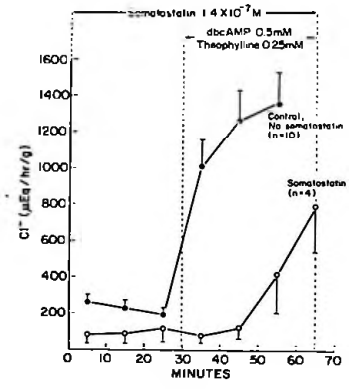

Figure 5.--Effect of somatostatin on rectal gland stimulation by dibutytyl cAMP and theophylline. Values are mean ± s.e.

Somatostatin is a potent inhibitor of the rectal gland's response to both VIP and the neural depolarizing agents veratrine and veratridine. In conjunction with the observation that veratrine fails to increase oxygen consumption by isolated rectal gland cells (Silva et al., this issue), these results strengthen the hypothesis that veratrine stimulates the release from rectal gland nerves of the neurotransmitter VIP. The fact that somatostatin markedly inhibits VIP but exerts little or no inhibition on forskolin and adenosine suggests a specific point of action on the VIP-receptor-adenylate cyclase complex. The unexpected finding that somatostatin delays and blunts the stimulatory effects of cAMP-theophylline suggests additional sites of action, either on the cellular entry of exogenous cAMP, or related to the influence of theophylline. Although we cannot exclude a post-cAMP locus of action, this seems unlikely to be the predominant mechanism because of the minimal inhibition observed with adenosine and forskolin, two agents that act via the generation of cAMP.