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Production of acid secretion in the mouse isolated stomach by electrical field stimulation

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In the mouse isolated stomach preparation, the absence of blood-borne endocrine feedback between antrum and body offers a simplified way of studying the coupling between vagus nerves and oxyntic cells. We have investigated the effect of electrical stimulation and its neural dependence in this preparation.

Mice of either sex (Charles-River, 23–26 g) having had free access to food and water were anaesthetized with ether. Polyethylene cannulae were tied into the pyloric and fundic parts of the stomach, the oesophagus ligated and the stomach lumen washed with warm oxygenated mucosal solution (in mM, NaCl 135; KCl 4.8; MgSO₄ 1.2; CaCl₂ 1.3 and glucose 31.6). The stomach was placed in a 40 ml organ bath containing buffered serosal solution at 37°C (in mM, NaCl 118; KCl 4.8; MgSO₄ 1.2; KH₂PO₄ 0.14; Na₂HPO₄ 15.9; CaCl₂ 0.65; and glucose 31.6) and gassed with 95% O₂ and 5% CO₂. The stomach was continuously perfused with mucosal solution at 1 ml/min and the perfusate passed over a pH electrode system adjusted to raise the intragastric pressure to 18 cm H₂O. A pair of platinum ring electrodes (ring diam. 5 mm, wire diam. 0.5 mm) was lowered to lie either side of the stomach to stimulate the region of the fundic glands. The ring electrode was preferred to a plate electrode to reduce the current requirement. Field stimulation was achieved with square wave pulses, 0.5 ms, 10 v and 10 Hz from a Grass 5D9 stimulator and monitored on an oscilloscope.

Characteristically, stimulation for 10 min increased gastric acid secretion with a latency of 3–4 min and reaching a plateau after 7–8 minutes. Compared to the effects of histamine added to the bath, the latency and plateau were not significantly different although time to reach plateau was considerably shorter for

Reference

BORN, G.V.R. & HUME, M. (1967). Effects of the numbers and sizes of platelet aggregates on the optical density of plasma. *Nature (Lond.)*, **215**, 1027–1029.



Figure 1 Continuous pH recording of the lumen perfusate from an isolated whole mouse stomach perfused at 1 ml/min. At S, field stimulation was applied across the stomach at 10 Hz, 10 v, 0.5 ms for 10 minutes. At H, histamine (10^{-5} M) was added to the organ bath and washed out at W.

field stimulation (Figure 1). Field stimulation could be repeated at 30 min intervals at least 3 times without showing a decline.

Pharmacological analysis of field stimulation was investigated using two responses in the same stomach separated by 30 min while the stomach was equilibrated with antagonists added to the bath. The response to the second stimulation expressed as a percentage of the first was $115.2 \pm 13.7\%$ (mean \pm s.e. mean, $n = 13$) in control experiments. Tetrodotoxin (10^{-7} M) completely blocked the second stimulus ($n = 3$) without reducing the response to histamine (10^{-5} M) indicating that field stimulation involved a neural process. Hexamethonium (5×10^{-5} M) reduced the second stimulus significantly to $23.7 \pm 7.0\%$ ($n = 6$) suggesting the involvement of ganglia. Atropine reduced the response to $70.7 \pm 13.7\%$ ($n = 6$) at 10^{-8} M and to $2.8 \pm 2.3\%$ ($n = 6$) at 10^{-7} M.

Field stimulation therefore apparently stimulates gastric acid through a cholinergic, presumably vagal, mechanism.

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