

PHYSIOLOGY

Responses to Localized Distension of the Oesophagus in Decerebrate Sheep

THE reflex nature of contractions of the oesophagus stimulated by oesophageal stretch has been described in a number of species. In our experiments in addition to the oesophageal responses to distension of itself the effects on parotid salivary secretion, reticulum and rumen movements have been examined in decerebrate preparations of sheep. The distension was delivered and the responses to it recorded from balloons introduced through the mouth or through an incision in the mid-cervical oesophagus into the lower cervical or thoracic regions of the oesophagus. In three experiments on preparations anaesthetized with pentobarbitone sodium after decerebration the thorax was opened and the responses of the thoracic oesophagus observed directly. The effects of oesophageal distension on the reticulum, rumen and salivary responses were judged by its modification of previously established reflex responses of these structures.^{1,2}

The balloons used were 2-3 cm. long and were distended to diameters up to 2-3 cm. with air. When retained in the same position moderate distension of such a balloon evoked a series of contractions of the oesophagus. These increased in frequency up to degrees of distension beyond which oesophageal contractions were not observed. If the balloon was left free to move it was delivered, after its distension, by a series of contractions into the reticulo-rumen. The contractions were not accompanied by buccopharyngeal or upper cervical oesophageal movements of swallowing. The responses of the oesophagus to distension of itself were not observed after the intravenous administration of *d*-tubocurarine chloride (0.1 mgm./kgm.), decamethonium iodide (0.5-0.75 mgm./kgm.) or after the vagus nerves were cut in the neck. They persisted after the administration of atropine sulphate (1 mgm./kgm.). Contractions of the oesophagus evoked by stimulation of the peripheral end of a vagus nerve cut in the neck similarly persisted after the administration of atropine but were not obtained after *d*-tubocurarine or decamethonium had been given. Striated muscle was identified in the regions of the oesophagus the responses of which were studied.

The effects of oesophageal distension on parotid salivary secretion, reticulum and rumen contractions varied according to its degree and the region stimulated. Moderate distension, particularly of the first 2-3 cm. and of the last 2-3 cm., of the thoracic oesophagus was frequently followed by increased parotid salivary secretion and by the initiation, or if already present, by an increase in the frequency, of reticulum and rumen contractions. Greater degrees of distension inhibited previously established parotid salivary, reticulum and rumen responses. The most efficacious stimulus was the distension of a balloon in the lower part of the cervical oesophagus when it was left free to be moved by the oesophageal contractions into the stomach. With balloons held in the one position the greatest effects were obtained from distension of the last 2-3 cm. of the thoracic oesophagus, similar but weaker responses were evoked from stimulation of first 2-3 cm. of the thoracic oesophagus. The effects were obtained after oesophageal contractions were annulled with *d*-tubocurarine. Less regularly similar but weaker responses

were evoked from intermediate regions of the thoracic oesophagus and from the lower 2-3 cm. of the cervical oesophagus.

Reticulum stretch alone or combined with that of the reticulo-ruminal orifice modified the oesophageal contractions stimulated by distension of itself. The effects varied from an absolute inhibition to a temporary cessation of oesophageal contractions during each contraction of the reticulum and rumen stimulated by stretch of the reticulum and reticulo-ruminal orifice. In four experiments distension of a balloon in the reticulum led to an increased frequency of the contractions of the most caudal regions of the thoracic oesophagus.

These results suggest that the two functionally distinct regions of the thoracic oesophagus characterised as sphincters by Dougherty and Meredith³ from cinefluorographic observations may be particularly significant from a sensory point of view, and also add to the evidence which suggests that the activity of the oesophagus in ruminants may be modified by conditions or activity in the stomach^{4,5}.

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A. F. SELLERS

Division of Veterinary Physiology
and Pharmacology,
University of Minnesota,
St. Paul 1, Minnesota.

D. A. TITCHEN

Physiological Laboratory,
University of Cambridge.
June 2.

¹ Titchen, D. A., *J. Physiol.* **141** (1958).

² Comline, R. S., and Titchen, D. A., *J. Physiol.*, **139**, 24 P (1957).

³ Dougherty, R. W., and Meredith, C. D., *Amer. J. Vet. Res.*, **16**, 96 (1955).

⁴ Dougherty, R. W., Habel, R. E., and Bond, H. E., *Amer. J. Vet. Res.*, **19**, 115 (1958).

⁵ Stevens, C. E., and Sellers, A. F., *Amer. J. Vet. Res.*, **20**, 461 (1959).

Curative Effect of Selenium Upon the Incisor Teeth of Rats deficient in Vitamin E

THE original description of the protective action of selenium against the exudative diathesis in chicks on torula yeast diets was given by Schwarz *et al.*¹ Following this significant finding, a good deal of research has been done on the possible vitamin E properties of this element and Schwarz *et al.*'s findings were confirmed.² Selenium was also found to be protective against liver necrogenic diets in rats^{3,4}. It did not reverse the dialuric acid haemolysis test⁴ and was ineffective in preventing resorption gestation in rats⁵ or in averting muscular dystrophy in rabbits, on vitamin E-free diets⁶. The selenium was usually given as sodium selenite or selenate, selenious acid, or selenocystine. The levels used in the diets varied from 0.1 to 10 p.p.m. selenium.

A characteristic degeneration of the enamel organ and whitening of the normally orange-coloured incisor teeth of the rat occur in vitamin E deficiency. Aterman⁷ has recently reported that sodium selenite in a liver necrogenic diet at a level of 9 p.p.m. selenium and fed to weaning rats did not protect the incisor teeth against depigmentation, though it averted liver necrosis.

I have conducted experiments which show that selenium has a protective action upon the enamel organ and tooth pigment, but my methods differed