THE VAGUS NERVE AND THE CARDIO-GASTRIC REFLEX

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We first demonstrated the reflex effect of the heart on the stomach in 1948 [1, 3]. It was shown that the mechanical vibratory cardiac stimulation not only affected the heart itself, but also produced a reflex effect on stomach movements. We confirmed the existence of this cardiogastric reflex by stimulating the heart with current from an induction coil [2].

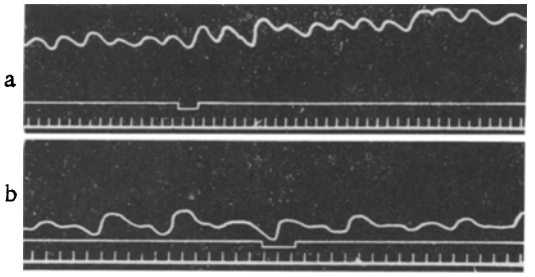
In the present study, we have made a first attempt to determine the nervous pathways involved in this reflex. We have shown previously [3], by selectively damaging different parts of the nervous system, that the reflex disappears only when the damage includes the medulla oblongata, which therefore appears to contain the reflex center. The nervous pathway of the reflex is still unknown. To determine it, we sectioned both vagi at their origin from the medulla.

METHOD

The experiments were carried out on bulbospinal frogs. The brain was sectioned immediately rostral to the medulla. After 30-40 minutes, after recovery from shock, the experiments were begun. The heart and stomach were exposed, and their movements recorded by levers on a drum for a period of 30-40 minutes. Two metal electrodes were then firmly fixed to the heart at a separation of 1 mm, and stimulation from an induction coil was applied. The primary of the coil was connected to a 6 volt storage battery; the voltage to the heart was suprathreshold,

Change in Gastric Motility Following Stimulation of the Heart with an Induction Coil

Type of change	Number of experiments	
	With vagi intact	Vagi sectioned
Increase in frequency of peristaltic waves	43	1
Increased height of waves	14	2
Reduced height of waves	–	1
Appearance of well-marked peristalsis, which did not occur before the experiment	4	–
No noticeable change in peristalsis	9	36
Total number of experiments.	70	40



Reflex change in gastric motility in the frog following cardiac stimulation before and after vagotomy. a) Increase in gastric contractions and increased gastric tone following stimulation of heart with current from an induction coil; b) after bilateral vagotomy; cardiac stimulation has no effect on gastric motility. Curves, from above downwards: gastric contractions, stimulus marker, time marker (30 seconds)

and the distance between the primary and secondary coils was 10-11 cm. The stimulus was maintained for 30-60 seconds, or more. The vagi were then cut, and after 30-40 minutes a further record of gastric movements was made for 20-30 minutes; this curve was used as a standard for comparison. Stimulation from the induction coil was once more applied, after which the stomach movements were again recorded for 20-30 minutes. In this way continuous recordings were made for a total period of 1 hour. At the end of the experiment, the average number of gastric contractions in equal 4 or 5 minute periods before and after cardiac stimulation were compared; measurements were also made of the amplitude of the contraction and of gastric tone.

RESULTS

Consistent results were obtained in 40 experiments in which the vagi were cut. They are shown in the Table. For comparison, results of experiments carried out previously [2], in which the vagi were not sectioned, are also given.

In 87% of the experiments in which the vagi were intact, stimulation of the heart with current from an induction coil caused a reflex increase in gastric motility, while after vagotomy, cardiac stimulation was without effect and in 90% of the experiments the gastric motility remained unchanged.

After cardiac stimulation in animals with sectioned vagi, there was, as a rule, no noticeable change in the tone of the gastric musculature; only in one single case was there a slight increase, while in one it was reduced; when the vagi were intact, there was an increased tone in 60% of the experiments.

We have therefore shown that the effect is conveyed from the heart to the stomach through the vagi, and, as has already been shown previously [3], through the medulla.

SUMMARY

In previous experiments on frogs and dogs, reflex effects on the stomach had been shown to follow mechanical or electrical stimulation of the heart.

In the present work, an attempt was made to trace the path of this reflex. In a frog, both vagus nerves were divided at the site of their exit from the brain. It was found that stimulation of the heart no longer affected the gastric movements.

The reflex also disappeared when the medulla was destroyed, while the vagi were left intact.

Therefore, the cardio-gastric reflex is effected through the vagi, and the medulla is the central link of the reflex arc.

LITERATURE CITED

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[3] V. P. Ryumin, Byull. eksptl. biol. i med., No. 1, pp. 23-26 (1958).

* In Russian.