USE OF RESISTANCE PICKUP UNITS FOR RECORDING GASTROINTESTINAL MOVEMENTS

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The present paper describes the use of resistance pickup units for recording gastrointestinal movements in series experiments on dogs.

The units were thin elastic rubber tubes 1-2 cm long and 1-1.5 mm in diameter tightly packed with microphone carbon powder. The carbon was in contact with the cleaned ends of flexible wires, PVC*-insulated. The outgoing ends of the wires passed through a housing (best made of "Lucite") and were soldered into the pins of a tube base fixed at the remote end of the housing (Fig. 1).

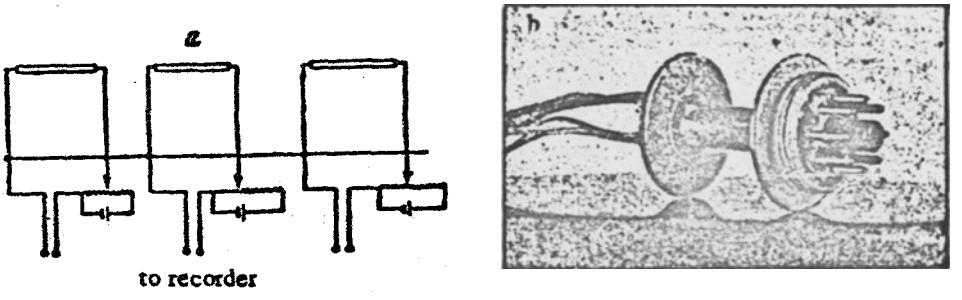

Fig. 1. a) Wiring circuit of carbon pickups and, b) the plastic housing with tube base used to bring the leads out from the peritoneal cavity.

The peritoneum was opened under general anaesthesia and the sterile pickups attached to the selected part of stomach or intestine with knotted bandages. The outgoing leads, together with part of the housing remaining inside the peritoneum, were coated with grease and fixed to the peritoneal incision. Damage to the base pins was avoided by covering them with a metal cap. The dogs withstood the operation well. This method of bringing out internal leads was devised by A. D. Golovsky, of the Department of Normal Physiology, Kirov Academy of Military Medicine.

A low DC current was passed through the pickup during the postoperative period; the pickup resistance changed with the movement of the section to which the unit was fixed; recordings were made on a recording oscillograph.

The movements of stomach, intestine and gall bladder were recorded during periodic movement and under food stimuli. Several areas of digestive tract were found to move together in periodic movements; as the duration

* polyvinyl chloride

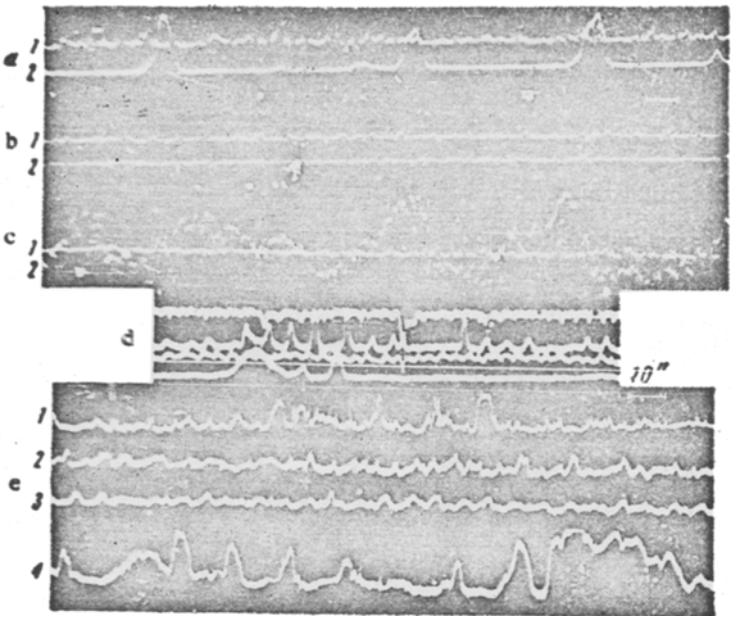

Fig. 2. The motor activities of various gastrointestinal areas recorded with the transducers.
a) Simultaneous recordings of contractions in the 12-finger gut (1) and stomach (2) during work; b) the same, during rest; c) the same in response to inflation of a balloon (250 cm^3); d) simultaneous recordings of respiratory, small intestine, gall bladder and stomach movement (from top to bottom); e) motor activity of stomach on feeding 250 g of bread: 1) before; 2) after 30 min 3) after 2 hours, 4) after 4 hours.

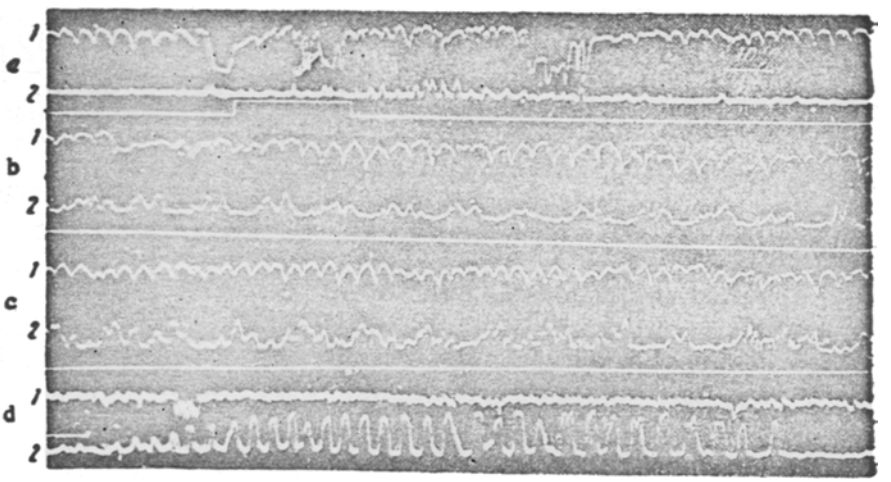

Fig. 3. Activity of gall bladder on eating 100 g of meat.
a) Instant of ingestion; b) after 1 hour; c) after 2 hours; d) small intestine activity; 1) respiration; 2) intestinal contractions.

of rest increased the movements gradually became weaker and ceased. Food caused small local contractions which became stronger over 4-5 hours, resembling contractions occurring during work (Fig. 2).

The units were also used to record movements in the isolated duodenum (Fig. 2,d). The pickup was attached to a drainage tube inserted in the duodenal cavity. The secretory and motor activities can be studied during the whole digestion process in this way.

As the units are small they do not stimulate the mechanoreceptors, so the continuous rhythmic contractions observed by normal balloon methods are absent.

When the movements of stomach and isolated duodenum were recorded together it was found that they were strongly correlated. No contractions occurred in the latter at rest. The movements in both organs begin together.

Food initiates small local contractions which persist during secretion, and as secretion falls off and the gastric juice becomes less acid the contractions become stronger, passing over to periodic infrequent strong contractions, rest supervening after a definite interval.

Figure 3 shows a record of gall bladder activity.

The activities of gall bladder and intestine can be recorded without fixing the pickup by inserting it through a fistula tube. Here also the small size and high sensitivity facilitate recordings during digestion without stimulating the mechanoreceptors in the gall bladder.

SUMMARY

Carbon pickup units for registration of motor activity from different portions of the digestive tract and of the gall-bladder under different conditions of series experimentation are described. Units are implanted in the areas under study, and output terminals are soldered to the pairs of a plastic coil which is fastened in the abdominal wall.