

## A SATISFACTORY METHOD FOR DEMONSTRATING GASTRO- INTESTINAL MOVEMENT ON THE FROG\*

BY H. P. RUSH, M.D., PORTLAND, ORE.

**F**LUOROSCOPIC observations of the frog have given us a simple yet satisfactory method for demonstrating gastrointestinal movements. Anyone who has frequently attempted to demonstrate these movements by direct observation has doubtless had the experience so nicely stated by Auer, "When the abdominal cavity is opened a hush seems to fall upon the viscera." Mention has been previously made of fluoroscopy on the frog by Cannon, although the greater part of his work seems to have been done with mammals.<sup>1</sup> I believe where circumstances will not permit the training and keeping of such animals, the frog work described here will be a helpful substitute, and might be used to advantage in connection with the method previously described by Patterson.<sup>2</sup>

The method I have contrived is founded upon three fundamentals: (1) a small x-ray unit with fluoroscope; (2) a common laboratory animal, the grass frog, care being taken to choose a large, well nourished individual; (3) a gastrostomy two or three days previous to the demonstration.

For best results the frog should be fed two or three days before the work is to start, as most laboratory frogs are in a hibernating condition. Active digestion will thus be brought about by the time the animal is ready for observation. Live worms, flies or insects of any kind offer a good diet.

The gastrostomy, a simple operation, is a necessity for the best results, because of the easily elicited reflexes which occur when the opaque meal is given orally. Almost invariably, even though the frog has no esophagus worth mentioning, passage of a small stomach tube for introduction of the barium, will initiate vomiting and inhibition of the normal movements. The operation consists of removing a small portion of the ventral abdominal wall, measuring 1 x 0.5 cm., on the left side, starting the incision about half way down the abdomen. Care must be taken not to incise one of the parietal branches of the abdominal vein, as much hemorrhage usually results fatally within a few days. If these veins are avoided, this being easily accomplished, the operation will be practically bloodless. Gently push the left lung aside

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with blunt forceps and pick up the stomach, guarding against trauma. Two or three stay sutures can now be taken to hold the organ in place after which it is opened by a short linear incision. I used an over and over suture around the edges, only one row being necessary for stomach wall, muscle and skin. It has been more satisfactory in my work if the stomach incision

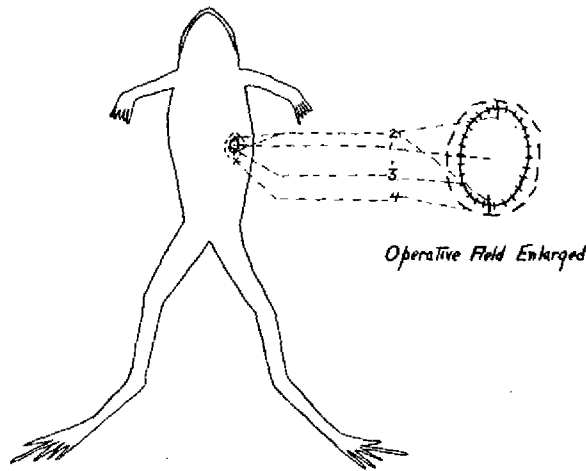


Fig. 1.—1. Gastrostomy opening. 2. Stay sutures used to hold stomach wall in place while incision is made. 3. Over and over stitch. 4. Purse string suture, applied just before the tube is put in place.

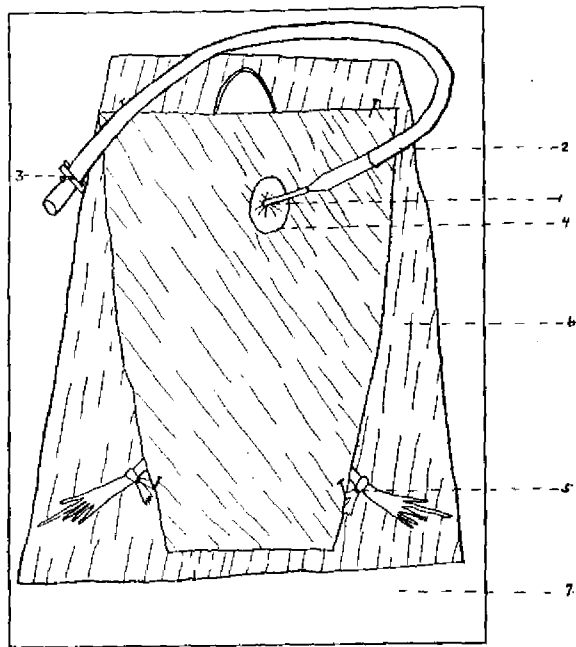


Fig. 2.—1. Gastrostomy with tube in place. 2. Tube for introduction of acid. 3. Clamp. 4. Opening in moistened covering. 5. Gauze lashes to hold animal in place. 6. Moistened cotton beneath frog. 7. Frog board.

was made in the body of the stomach and not too close to the cardia. This seems to lessen inhibitory reflex stimulation. This operation need not be performed aseptically as the frog is practically immune from infection. Ether anesthesia is used for these animals, and the skin is washed well after the

operation to remove any excess fumes that might still be present. The animal is allowed two or three days for the healing of the wound and then, after decerebration, a small rubber tube 0.3 cm. in diameter and about 2 cm. in length is placed in the opening and held intact by a purse string suture, the suture going through the tubing. I decerebrated by destroying all brain substance anterior to the cephalic margins of the tympanic plates. A period of thirty to sixty minutes was allowed for the animal to fully recover from shock.

The frog is placed on a frog board and tied in position. Small gauze lashes tied as loosely as possible about the legs and these in turn pinned to the board, give less reflex disturbance than to pin the feet down directly. There should be a layer of cotton moistened with water beneath the animal and one also to cover it. These should not be allowed to dry out.

I have been using a mixture of barium sulphate and ordinary starch, the starch holding the barium in suspension. About one or two cubic centimeters are given through the tube in the gastrostomy by means of a pipette.



Fig. 3.—1 and 4. Body of stomach. 2 and 5. Colon. 3. Pyloric antrum. 6. Peristaltic wave seen in pyloric region. 7. Pylorus opening. 8. Material moving down intestinal tract.

A small rubber tube with a cannula in one end is filled with 0.1 to 0.2 per cent HCl, clamped off at the free end with hemostats and by means of the cannula connected with a tube in the gastrostomy.

The preparation is placed under the fluoroscope and the animal moved about so as to obtain the best possible view. While the filled stomach is under observation a few drops of the acid should be allowed to enter. This can be accomplished by releasing the hemostats for an instant, the tubing being raised at the same time. Within two or three minutes deep peristaltic waves will be seen passing down the wall of the stomach. From time to time the barium will be observed to pass into the duodenum. Care must be taken in this work not to over distend the stomach, as this will inhibit the movements sought. The activity of the colon may also be observed at the same time, providing a barium meal has been given the day before observing.

Frogs thus prepared have been kept in good condition for over a week, daily observations being made on them. It should be pointed out that there is a real danger with these animals of local necrosis of the area surrounded

by the purse string suture. However, this does not occur for three or four days.

Fig. 1 shows the location of the incision. Fig. 2 shows the preparation ready for observation. Fig. 3 shows diagrammatically the results obtained by this method.

#### REFERENCES

- <sup>1</sup>Cannon, W. B.: The Mechanical Factors of Digestion.
- <sup>2</sup>Patterson, T. L.: JOUR. LAB. AND CLIN. MED., 1920, v, 674.
- <sup>3</sup>Marshall, A. Milnes: The Frog; Anatomy, Histology and Embryology.