Series 2.—Ten rabbits were used, of which 6 were treated with neutroflavine and 4 were kept as controls. Each rabbit was fed a quantity of trichinous rabbit meat containing approximately 2,400 encysted larvae. Treatments were begun 7 days after the meat was fed and continued for various periods. Each treatment consisted of an intravenous or an intramuscular injection of about 2 cc. of a 1% aqueous solution of neutroflavine. The results obtained were essentially similar to those of Series I.

Summary.—The data show that injections of neutroflavine into rabbits experimentally infected with *Trichinella spiralis* produced what appears to be a marked diminution in the number of larvae or the total destruction of the larvae. Presumably the larvae were destroyed in the circulation by the drug, since the best results were obtained with 10 to 12 consecutive daily intravenous injections of neutroflavine at a stage of the disease when the larvae are most abundant in the circulation.

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Influence of Morphine on Intestinal Activity in Experimental Obstruction.

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Two factors have previously been emphasized by this laboratory as contributing to late diagnosis in acute bowel obstruction, absence of local physical findings[1] in simple obstruction and mistrust in the value of enemas as a diagnostic criterion.[2] We here emphasize a third factor, namely, that in a large number of cases of intestinal obstruction at the University Hospital the administration of morphine has been responsible for delay in diagnosis.

This study is concerned with the effect of morphine in experimental intestinal obstruction, with particular reference to whether or not the sentinel warning of audible peristaltic rushes is ablated by the use of morphine.

* This work was supported by Grant 188 allowed by the Committee on Scientific Research of the American Medical Association.

[1] Wangensteen, O. H., and Lynch, F. W., PROC. SOC. EXP. BIOL. AND MED., 1930, **27**, 674.

[2] Wangensteen, O. H., and Goehl, R. O., *Arch. Int. Med.*, 1930, **46**, 669.

It has been indicated that the response of the human intestine and that of experimental animals is not the same to injections of pituitary extract.[3] In this study preliminary tracings on 2 normal dogs and 8 hospital patients with ileostomy or colostomy, fistulous openings were obtained both before and after administration of morphine. This was done to make certain that comparable responses were obtained in the normal intestine of the dog and man after morphine administration.

Ten dogs were operated upon and intestinal obstruction of the simple variety was established in the lower ileum by severing the gut and inverting the ends. One to 6 days later tracings were made by inserting balloons mounted on rubber catheters into the obstructed ends of the bowel. The abdominal wall was then closed around the protruding catheter with clips. The catheters were attached to water manometers which recorded the findings on the revolving smoked drum. Morphine sulphate in 20 mg. doses was administered intravenously. In some cases the doses were repeated in larger amounts. In addition to the kymographic tracings auscultatory observations over the abdominal wall with a stethoscope were made both before and after administration of morphine. In a few instances the balloon on the catheter was placed in the end of the proximal bowel and an encircling ligature was placed around the bowel and catheter and the end of the bowel further invaginated by a pursestring and a few interrupted sutures. The distal bowel was treated similarly and both catheters were brought out through stab wounds. In 2 instances after the intestinal obstruction had been established by severing and inverting the ends of the bowel, auscultatory observations alone were made without opening the abdomen to make tracings.

In the case of the hospital patients the balloons were inserted directly through the ileostomy and colostomy openings into proximal and distal segments of the bowel, and 10 mg. of morphine sulphate were administered intravenously.

In the normal bowel of 8 human patients and 2 dogs the results following morphine injection uniformly indicated an almost immediate increase in intestinal tone followed by an increase in peristaltic activity. The response was more marked in the small bowel tracings than in the large bowel. These observations are in complete accord with the recently published work of Plant and Miller[4] and Gruber[5] and his associates.

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[3] Carlson, H. A., PROC. SOC. EXP. BIOL. AND MED., 1930, **27**, 777.

[4] Plant and Miller, *J. Pharm. and Exp. Therap.*, 1926, **27**, 361.

[5] Gruber, Greene, Drayer and Crawford, *J. Pharm. and Exp. Therap.*, 1930, **38**, 389.

In the 10 dogs with simple obstruction of the bowel the response to morphine as shown in the tracings was essentially the same as in the normal bowel. Stethoscopic examination of the abdomen after administration of morphine revealed not only a persistence of the loud intestinal noises found previous to morphine administration, but there appeared to be an actual increase in loudness and frequency of peristaltic rushes. Subsequent doses of morphine resulted in similar but less forceful responses. In one instance the administration of 20 mg. morphine sulphate was followed by a prompt response within 2 seconds. In other instances the response came in 4 seconds and in one it was delayed 14 seconds. Within 3 minutes there were heard by stethoscope at intervals of 15-20 seconds powerful peristaltic rushes with a constant gurgling, churning, peristaltic activity between them. In one dog these sounds were so loud as to command one's immediate attention at a distance of 3 feet away with the unaided ear. Within 20 minutes these loud peristaltic rushes reached a frequency of about one every 5 seconds and by the end of one hour subsided to one every half to one minute apart. The less audible, more or less constant gurgling peristaltic activity persisted between the rushes. At the end of 2½ hours the gurgling peristaltic noises were still definitely heard. When a 50 mg. dose of morphine was repeated at this time, a similar response was evoked except that the rushes were not quite so loud nor did they persist as long. This was confirmed by kymographic tracings in which a second and third dose of morphine of 50 and 100 mgs. respectively provoked successively less marked responses.

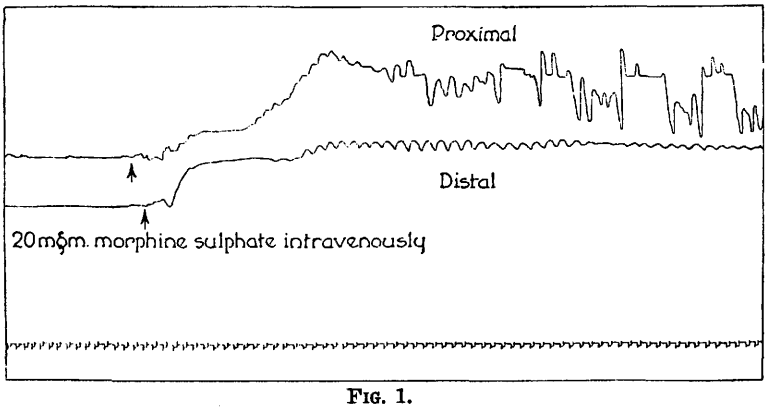

FIG. 1.
Ileum obstructed 5 days. Dog 32, 9-4-30.
The above figure shows a kymographic tracing of the lower ileum obstructed 5 days. The upper curve represents the proximal obstructed segment; the lower curve, the distal segment. The arrows indicate the time of injection of the morphine.

Since this study was started the abdomens of 5 patients with acute intestinal obstruction have been auscultated before and after the administration of morphine preliminary to operation. In all instances the loud intestinal gurgling noises have persisted after the morphine was given. In the diagnosis of obstruction the concomitant occurrence of the peristaltic rushes at the height of the pain is of great importance. When the pain is assuaged the interpretation of the significance of the persistent intestinal noises, which are not silenced by morphine, is more difficult to evaluate.

Conclusions.—Morphine increases the intestinal tone and peristaltic activity of the obstructed intestine of the dog. Loud intestinal borborygmi which may be heard with the stethoscope early in intestinal obstruction are not silenced by the administration of morphine.

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Influence of Hyperventilation on Experimentally Produced Gastric Secretion.

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During the course of an investigation by one of us[1] of the effect of vagal stimulation on the production of gastric secretion, it was observed that artificial ventilation considerably diminished the volume of the secretion. To ascertain the factors involved in this effect the following experiments were performed on dogs anesthetized with a chloralose and urethane mixture given intravenously.

1. Gastric secretion was obtained by vagal stimulation in the neck. The right and left nerves were stimulated alternately for 10 minutes each throughout the experiment. 2. Hyperventilation was applied. 3. Hyperventilation was continued at the same rate using an artificial air-carbon-dioxide mixture.

A study was made of the gastric juice, the collecting tubes being changed every 10 minutes. Total and free acid were determined by titration, and total chlorides by the method of Wilson and Ball.[2]

[1] Vineberg, A. M., *Am. J. Physiol.*, in press.

[2] Wilson, D. W., and Ball, E. G., *J. Biol. Chem.*, 1928, **79**, 221.