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Concerning the Mechanism of Contraction of the Gall-bladder in the Guinea Pig.

F. S. DUBOIS AND G. H. KISTLER. (Introduced by E. A. Boyden.)

From the Departments of Anatomy and Physiology, University of Alabama.

After studying the evacuation of bile in the opossum and the cat by cholecystographic methods,[1] and having found that in the opossum contractions of the gall-bladder sufficiently great to be recorded by moving pictures may be induced by faradic stimulation of its wall,[2] it has seemed desirable to investigate anew the extent to which the biliary vesicle is under control of the nervous system. Bearing in mind the emphasis recently placed by Boyden[3] upon species differences in the reactions of mammalian gall-bladders, we have chosen to begin with the guinea pig—that species in which the gall-bladder appears to be more sensitive to a variety of stimuli than in any other vertebrate yet described.[4]

All experiments were conducted with the animal under nembutal anesthesia and with the liver gently everted over the costal margin. This routine exposure gave access to the gall-bladder, to the cystic and hepatic ducts and to the structures in the lesser omentum. A heart lever attached to the fundus of the gall-bladder recorded contractions of the vesicle on a smoked drum. To evaluate changes due to respiration and other extraneous movements, a second lever was attached to a bile duct near the hilus of the liver. The possibility of the spreading of the current to the wall of the gall-bladder was ruled out by the fact that faradic stimulation of the stomach, bowel, hepatic ducts and adjacent portions of the liver failed to cause contraction of the biliary vesicle.

With the apparatus thus arranged, marked contractions of the gall-bladder were recorded when the following were stimulated with a weak faradic current: (1) the viscus itself, (2) the duodenal portion (ampulla) of the common bile duct, (3) either vagus nerve in its cervical portion and (4) certain poorly defined cords of the lesser omentum posterior to the common bile duct. Following contraction induced by direct stimulation of its wall the gall-bladder usually relaxed to its previous tone level. After the contraction

[1] DuBois, F. S., and Hunt, E. A., *Anat. Rec.*, 1932, **54**, 289.

[2] DuBois, F. S., and Kistler, G. H., *Anat. Rec.*, 1933, **55** (Suppl.), 14.

[3] Boyden, E. A., *Proc. Am. Physiol. Soc.*, 1933, **10**.

[4] Mann, F. C., and Higgins, G. M., PROC. SOC. EXP. BIOL. AND MED., 1927, **24**, 931.

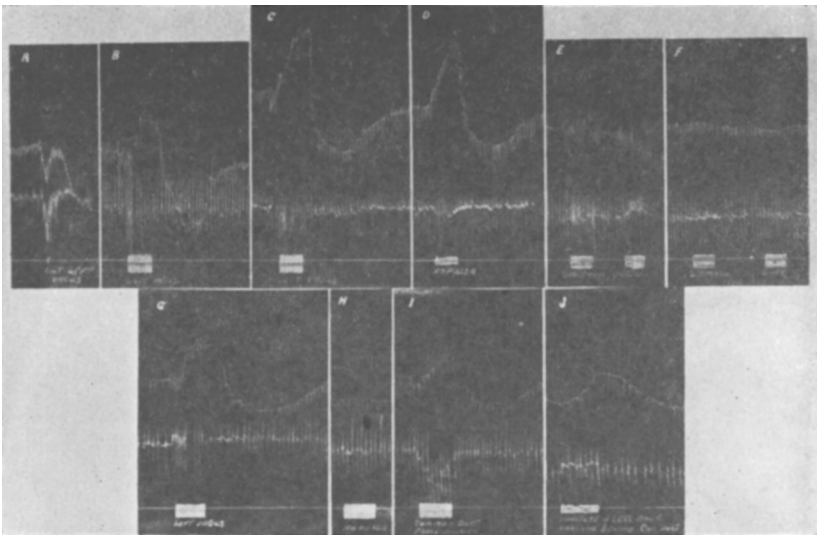

FIG. 1.

Contraction of the gall bladder. Upper tracing indicates tone of gall bladder. Lower tracing indicates movements extraneous to gall bladder (see text).

Left vagus nerve severed (A). Common bile duct intact; weak faradic current applied to: left vagus nerve (B and C), ampulla (D), duodenum and jejunum (E), and stomach and liver (F). Common bile duct severed; stimulation of: left vagus (G), ampulla (H), hepatic end of severed duct (I), and cords of lesser omentum (J).

which resulted from stimulation of the vagus, and to a less extent after that which resulted from stimulation of the ampulla, the tone of the gall-bladder dropped far below that which preceded contraction. A similar rapid diminution of tone was observed following division of one vagus nerve in the neck. When the common bile duct was severed, stimulation of the ampulla no longer caused contraction of the gall-bladder, but the latter responded in the usual way to stimulation of its wall, to excitation of either vagus nerve, and to stimulation of the hepatic end of the severed bile duct. In the absence of histologic examination this finding seems to point to the existence of a direct nervous pathway from ampulla to gall-bladder along the wall of the common duct—in addition to the usual plexus which accompanies the vessels of the duodeno-hepatic ligaments. Furthermore, since the severing of the bile duct did not eliminate contraction of the vesicle, it would appear that peristalsis of the ampulla is not so important a factor in the evacuation of the gall-bladder of the guinea pig as has been postulated.[5]

[5] Burget, G. E., and Brocklehurst, R. J., *Am. J. Physiol.*, 1928, **83**, 578.

Lastly, it was observed that strong contractions of the gall-bladder could be induced by the direct application of pilocarpine to its wall. Atropine in small amounts, similarly applied, decreased the tone of the gall-bladder and rendered it refractory to pilocarpine, to excitation of the vagus nerves and to stimulation of the ampulla, but not to faradic stimulation of its wall. Adrenalin produced immediate and rather prolonged inhibition of the gall-bladder. This was present also after atropine.

In conclusion, the response of the gall-bladder to these autonomic drugs and to vagus stimulation suggests the existence in this organ of a thoracolumbar-parasympathetic nervous system antagonism—an hypothesis which is being subjected to further investigation.

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Studies on the Comparative Value of Intravenous Sclerosing Substances.

ALTON OCHSNER AND HOWARD R. MAHORNER.

From the Department of Surgery, Tulane University Medical School, New Orleans.

Ochsner and Garside[1] reported the results of their studies on the effect of intravenous injection of 20 different sclerosing solutions. This paper is a report of the continuation of that work, comprising a similar study of 9 additional solutions.

Method. The methods used were the same as those previously employed. Eighteen dogs were used, and 4 injections were made at different levels in the veins of each leg, thus making 16 injections of a sclerosing substance in each dog. Only one drug was used for each leg, but different drugs were sometimes injected into each leg of the animal. Five-tenths cc. of each of the following solutions were injected into 16 veins:

	%		%
Searle's sodium morrhuate	—5	Sodium morrhuate (own)	—10, 5
Sodium gynocardate	—5, 3, 2	Sodium hydnocarpate	—5, 3, 2

The area of injection was marked and subsequently the veins were cautiously removed under local anesthesia to prevent the dislodgement of thrombi. The more distal segments of vein were removed first.

[1] Ochsner, Alton, and Garside, Earl, *Ann. Surg.*, 1932, **96**, 691.