ART. V.—A NEW FUNCTION OF THE OPTIC THALAMI.

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THE influence of the nervous system on the peristalsis of the intestinal canal is one of the most intricate questions in experimental physiology. That nerve centres have an influence on the intestinal movements has been shown by the researches of Budge and Valentin, who state that irritation of the optic thalami, corpora striata and the tubercula quadrigemina excite the peristaltic movements. Schiff has seen movements of the intestine ensue after irritation of the medulla oblongata, cerebral and cerebellar peduncles and pons varolii. Longet* obtained results so variable that he was not able to come to any conclusion.

Ludwig and Haffter from experiments on rabbits arrived at the conclusion, that the splanchnics had neither an inhibitory nor an exciting effect on the intestinal movements, and after section of the splanchnics there ensued neither increased peristalsis nor diarrhœa.

Pflüger † first observed after irritation of the splanchnics that the small intestines became quiet or rather were inhibited by a direct action on ganglia seated in the walls of the intestine.

Nasse ‡ found the splanchnics not only to contain inhibitory but also exciting fibres, and that irritation of the dorsal segment of the cord arrested the intestinal movements.

Ludwig and Kupffer arrived at the same conclusion as did Nasse.

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* Longet, *Traite de Physiologie*, tome premier, Paris, 1868.

† *Ueber das Hemmungs-Nerven System für die peristaltischen Bewegungen der Gedärme*, Berlin, 1857.

‡ *Beiträge zur Physiologie der Darmbewegung*, Leipzig, 1866.

That there is an inhibition by the central nervous system on the intestinal movements is proved by the researches of Goltz,* when he removed the medulla in frogs and found the peristalsis much more active.

Wilson Philip † observed a long time back that the movements of the small intestines continue a long time after removal of the cerebro-spinal axis.

I‡ have already shown in another place that in the optic thalami are seated centres inhibiting the rhythmic movements of the sphincters of the rectum and vagina. It subsequently occurred to me to determine if any centres existed inhibiting the intestinal movements. That centres exciting intestinal movements exist has been proven by other observers whose results I can also confirm.

Method :—The animals employed were cats and rabbits, which were fastened on Czermak's holder and etherized. Then two holes were trephined into the skull for the entrance of the electrodes. The location of these trephined openings was made directly over the optic thalami. The electrodes consisted of needles insulated to near their points by sealing wax. The induction current sent through them was derived from the secondary coil of a DuBois apparatus. The cell driving the apparatus was a small zinc and carbon one. The strength of the current was such as to be strongly felt by the tongue. Then in rabbits under ether the abdomen was opened and the normal rate of peristalsis of the abdomen and the remaining part of the small intestines watched. The temperature was about 85° F. After the normal rapidity of the intestinal movements was determined, then the electric current was turned on, when the small intestines came to rest in diastole.

This arrest of persistalsis was not due to vaso-motor irritation, as the electric excitation was made some distance above the seat of the monarchical vaso-motor centre; and if this centre was irritated, then anæmia of the intestine would be produced, which state, according to Nasse, produces lively

* *Pflüger's Archiv*, 1872, p. 616.

† Longet's *Nerven-System.* Erster Band, Leipzig, 1847.

‡ *Journal of Physiology*, vol. 11, No. 1.

peristalsis. During the irritation the blood-vessels of the intestine did not become pale, but, on the contrary, became hyperæmic, by the exposure to the air. It has been stated by Van Braam Houckgeest that anæmia arrests peristalsis, but this is contradicted by the experiments of Sanders Ezn, who affirms that the amount of blood in the vessels has no influence whatever on the peristalsis.

That these centres of inhibition were not seated in front of the optic thalami, was proven by experiments where the needles were inserted in front of the thalami, and no arrest of the peristalsis took place. That these inhibitory centres are not seated behind the optic thalami, is rendered probable, as only weak currents were used, and when the needles were pushed backward, no arrest of intestinal movement took place. Further, in cats, after section behind the thalami, the peristaltic movements of the duodenum became quite active. The method of operating on cats was as follows: The animals were bound down on Czermak's holder, etherized, a trephine placed on each side of the skull behind and above the mastoid processes, and an opening made in the skull. Then the abdomen was opened, and a section of the brain made behind the thalami with a spear-shaped knife. After the section, the usually quiet peristaltic movements became much more active.

The intestinal movements may be compared to those of the heart. Like the heart, the intestine can move independent of the central nervous system, from the ganglia of Meissner and Auerbach. Simple excision of a length of the intestinal canal proves this fact. Like the heart, it is under the excitation of nerves running in the splanchnics and pneumogastrics; like the heart, the peristalsis is under the inhibitory control of nerve fibres running in the splanchnics, having their remote inhibitory connection in the thalami optici; like the heart, the movement of the intestine is under the control of drugs, which paralyze the inhibition of the splanchnics, as takes place when atropin and nicotin are given; like the heart, the peristalsis is influenced by emotions, for fright causes a movement of the bowels by a paralysis of the intestino-inhibitory mechanism, thus allowing the exciters of peristalsis full control.

Appended are some of the experiments upon which the preceding statements are based:

Exp. 1.—Rabbit. Etherized; two holes trephined into the skull; abdomen opened, and the peristalsis found to be quite active; electrodes thrust through the trephined opening into optic thalami, when a weak induction current was turned on, the peristalsis of the duodenum and small intestines was arrested in diastole. One experiment was repeated several times with the same result.

Exp. 2.—Rabbit. Etherized; trephined; bowels exposed; needles thrust into the optic thalami, when the electric current arrested the peristalsis.

Exp. 3.—Large rabbit. Etherized; trephined; abdominal contents laid bare; electrodes pushed into the thalami, when the duodenum was arrested in diastole.

Exp. 4.—Small rabbit. Etherized; trephined; bowels laid bare; electrodes thrust into the optic thalami, when the peristalsis of the small intestines was arrested.

Exp. 5.—Small rabbit. Etherized; trephined; intestines exposed; electrodes thrust into the optic thalami, when the peristaltic movements were arrested.

Exp. 6.—Small cat. Chloroformed; trephined near the mastoid process; abdomen opened, and the peristalsis of the duodenum watched. A section was made behind the optic thalami, when the duodenum exhibited lively movements, which soon came to rest.

Exp. 7.—Medium-sized cat. Chloroformed; trephined behind and above the mastoid process; bowels laid bare by section of the abdominal muscles; section behind the optic thalami, when the peristaltic movements of the duodenum became increased, the adjacent portions of the small intestine being also more active.