(c) A considerable number of subthalamic fibers cross the midline caudal to the mammillary bodies and terminate on the opposite side in the same manner as the homolateral fasciculus.

The most pronounced symptom following a lesion in the subthalamic nucleus of Luys was a hypertonic condition of the muscles. This varied in degree from a mild hypertonicity to a marked spasticity according to the extent of the lesion. The hypertonicity was usually most pronounced on the side opposite the lesion, affected the muscles of the legs more than those of the body and the hind leg more than the front. The hypertonicity was accompanied by an awkwardness in handling the corresponding muscles. The movements were slow, deliberate, halting and inaccurate, lacking the rhythm of a normal movement.

The animals showed an increase in temperature of from 2 to 3 degrees, and a rate of heart beat which was 15 to 45 beats more than normal. There was a partial recovery from all these symptoms within a few days after the operation.

This is a preliminary report.

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Conditions Affecting the Emptying-Time of the Human Gall-Bladder.

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One of the authors reported the occurrence of sex differences in the contraction rate of the human gall-bladder.[1] Since then ten additional cases have been examined which, with the others, seem to establish the fact that the average emptying time of the gall-bladder in young women is considerably quicker than in young men. But as yet no explanation of this has been forthcoming; nor, indeed, of individual differences between members of the same sex.

Believing that gall-bladder action might be correlated with the rate at which a meal moves through the intestinal tract, a number of these individuals were given a barium meal and its course followed for several days.* In addition, the contents of the fasting stomach

* The gastro-intestinal examination was made under the direction and through the generous cooperation of Professor Hartung of the Department of Roentgenology.

were titrated, following which the patient was given a standard Ewald meal. The changing acidity of the stomach was then determined by the fractional method and the results plotted against the contraction curve of the gall-bladder (Fig. 1).

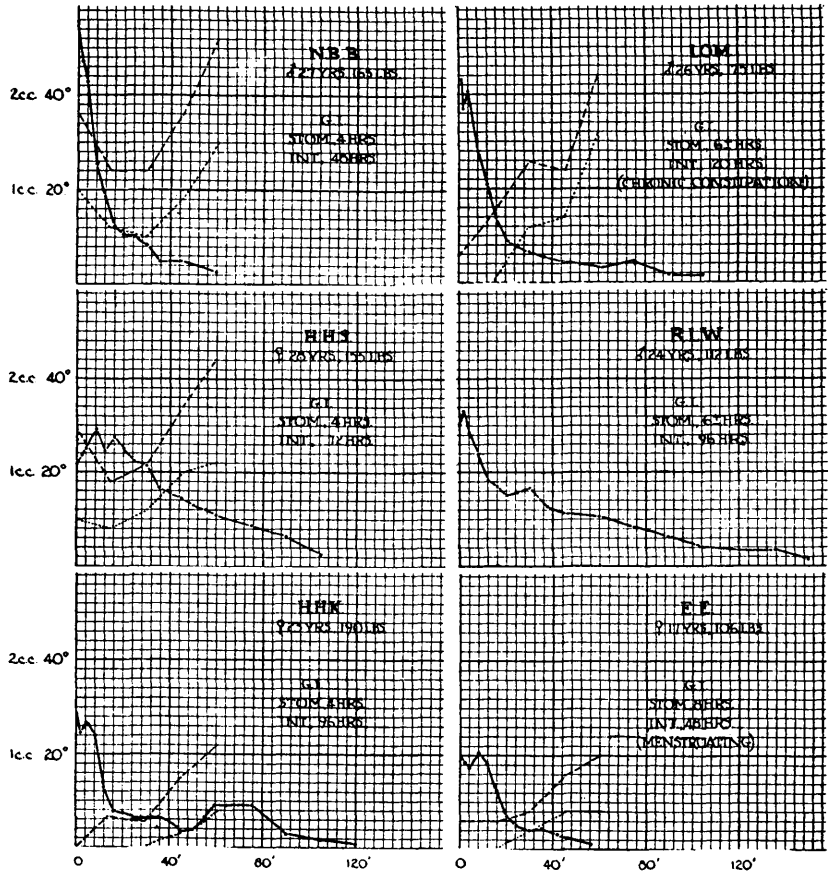

FIG. 1.

Comparing emptying time of gall-bladder with gastric acidity and with the motility of the stomach and intestine. CC., cubic inches of bile in gall-bladder; 40′, 80′, 120′, minutes after a meal; 20°, 40°, degrees of gastric acidity; dot and dash line, contraction curve of gall bladder after standard meal of egg yolk and cream (dots indicate successive x-rays); dash line, total acidity; dotted line, free acid in stomach following standard Ewald meal; STOM., emptying time of stomach (barium meal); INT., length of time required to pass barium meal through the intestine. R. L. W. In this individual two attempts were made to titrate the gastric contents, but in neither instance could the stomach tube be retained.

The primary object in testing the stomach was to eliminate from the series any individuals with gastric ulcer or carcinoma, gastritis, pernicious anemia and nervous disorders. But no such conditions were found, so that the stomach of these individuals may be considered normal. Although it was not expected that the amount of free acid present in the fasting stomach could influence the gall-bladder, since the meal of egg yolk (by which the action of the gall-bladder was tested) would probably neutralize the acid, it is possible that some of the gastric juice might have been pushed ahead of the meal by the first increment of egg yolk, which (as viewed under the fluoroscope) passes immediately into the duodenum. If such is the case no correlation was found to exist between the amount of acid in the fasting stomach and the emptying of the gall-bladder. Thus the gastric acidity of N. B. B. (Fig. 1) whose gall-bladder emptied very fast, is virtually the same as that of H. H. S., whose gall-bladder emptied very slowly (*cf.* also case N. B. B., who had a high initial acidity, with L. O. M., who had no free acid in the fasting stomach). Nor could any correlation be established between the emptying time of the stomach and of the gall-bladder, for in the three cases at the left of Fig. 1 the stomach contents were evacuated in four hours, while the gall-bladder behaved very differently in the three individuals. An even more striking contrast appears in cases E. E. and H. H. K., in which the gall-bladders reacted the same, but the emptying time of the stomachs was markedly different.

Again, a comparison of the six cases in Fig. 1 reveals a lack of correlation between the gall-bladder and the motility of the intestinal tract. The most striking case is that of L. O. M., who had chronic constipation associated with an anomalous loop of the colon, 120 hours being required to move a barium meal through the intestine. Yet this individual was one of the two cases (out of 12 males) in which the gall-bladder emptied the fastest.

Of special interest is case E. E., in which the gall-bladder was tested during the first day of menstruation. Nevertheless the rate of emptying seems not to differ from that of H. H. K. and others who were examined during the intermenstrual period. The smelling of food has no effect upon the emptying of the gall-bladder, and gravity is not a retarding factor since the contraction curve of an individual x-rayed when reclining may be duplicated several months later, when the same person is x-rayed in a standing position.

A theory has been advanced which attributes the expulsion of bladder bile to the milking action of peristalsis.[2] But Whitaker has shown that egg yolk and barium may pass through the intestinal

tract of a cat without affecting the gall-bladder.[3] Recently, a human case showed little if any response for six hours, during which time two fatty meals were eaten and a bowel movement recorded. The next day, following other meals the gall-bladder was nearly emptied. It is, therefore, questionable whether peristalsis plays any rôle in emptying the biliary reservoir. This is confirmed by the following experiment (Fig. 2) designed to eliminate all expulsive factors but the *tunica muscularis* of the *vesica fellea.*

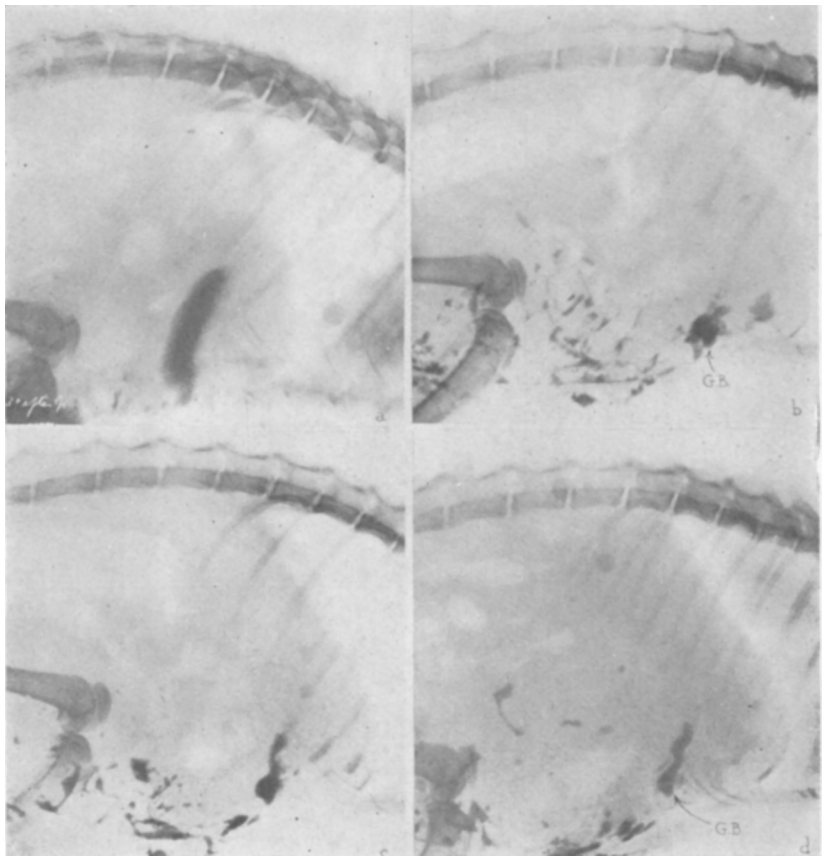

FIG. 2.

The gall-bladder of a cat was filled with lipiodol and the common bile duct severed just above the point where it entered the duodenum (the intestinal end being tied). Before the abdomen was closed lipiodol was observed to be emerging from the cut end of the duct. Three hours later an x-ray was taken (Fig. 2a), the cat being then in good condition, Little if any bile had entered the peritoneal cav-

ity notwithstanding the struggle accompanying the emergence of the animal from ether anesthesia. By the next morning much of the contents of the gall-bladder had been emptied spontaneously (as frequently happens during fasting[4]), proving that the orifice of the bile duct had not been closed by adhesions. At this time the gall-bladder was relaxed (G. B., fig. 2b). Eight minutes after feeding egg yolk, however, the gall-bladder elongated, as if under tonus (2c), and in the course of the next few hours expelled additional amounts of lipiodol into the cavity (2d). But in no case was the purported sucking action of intestinal peristalsis operative, since the bile duct had been severed from the intestine.

In conclusion, one must therefore assume that the mechanical passage of food through the intestinal tract is not a factor in the emptying of the gall-bladder.

[1] Boyden, E. A., PROC. SOC. EXP. BIOL. AND MED., 1927, xxiv, 353-358.
[2] Burget, G. E., *Am. J. Physiol.*, 1925, lxxiv, 583.
[3] Whitaker, L. R., *Am. J. Physiol.*, 1926, lxxviii, 418.
[4] Boyden, E. A., PROC. SOC. EXP. BIOL. AND MED., 1927, xxiv, 157-162.

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The Importance of the Carbonate Ion in Physiological Activity.

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In the course of a study of the response of the guinea pig uterus to pituitrin when the ionic environment of the uterus was varied, the carbonate ion was found to be of importance in determining the magnitude of the response. The carbonate ion seems to exert its influence of itself, and not to be merely reflecting a change in calcium or hydrogen ion activity. This is shown by the following experimental results.

Whenever the carbonate ion activity was increased there was a diminished response of the uterus to pituitrin. This was true whether the carbonate ion activity was increased (a) by increasing the bicarbonate activity and CO_2 tension proportionately so that there was no change in pH; (b) by increasing the bicarbonate activity alone with an increase in pH; or (c) by decreasing the CO_2 tension alone, which also resulted in an increased pH.