response of this organ. The rate of the emptying time of the stomach seems a negligible factor as it was demonstrated that some of the meal of the different foodstuffs passed through the pylorus at about the same time.

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Is the Cystic Bile Resorbed in Toto?

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Notwithstanding the great body of evidence accumulated during the last 7 years tending to show that the gall bladder discharges the bulk of its contents after meals, it has lately been reaffirmed that the primary function of this organ is to resorb the cystic bile *in toto* for the purpose of returning it to the general circulation, and that "under normal conditions, whatever passes into the gall bladder through the cystic duct, never passes out again through the cystic duct."

Although this hypothesis has had the effect of stimulating research in a difficult field, it owes its existence largely to teleological reasoning. Thus, to one investigator it offers the best theory for explaining the formation of gall stones and the occurrence of hydrops of the gall bladder[1]; to another, it is justified by the assertion that no one has explained why a biliary reservoir is necessary for digestion[2]; to a third the interpretations of the results of cholecystography are easier and the manifestations less contradictory if it is assumed that the bile enters the gall bladder not to be stored there and in time expelled, but to be resorbed *in toto* by the gall bladder mucosa.[3]

Yet it is to be questioned whether, in the 7 years that have elapsed since this theory was first promulgated, any proof that the cystic bile is resorbed *in toto* has ever been advanced. Believing that this theory is susceptible to proof or disproof we have undertaken to block the cystic duct in cats in such a way as to avoid trauma to the gall bladder or interference with its vascular drainage—a method successfully employed by both Sweet and Halpert in their experiments. With the outlet blocked it is reasonable to expect that the gall blad-

[1] Halpert, Bela, *Arch. Surg.*, 1929, xix, 1037.

[2] Sweet, Joshua, *Annals Surg.*, 1929, xc, 939.

[3] Blond, Kasper, *Arch. f. klin. Chir.*, 1928, cxlix, 662.

der would entirely empty itself by absorption within one to 3 days, if the above theory is correct. That such is not the case is indicated by the following experiments.

If a cat be fed a meal of meat on the evening before an operation, the gall bladder will be found distended with light green, watery bile the next morning. Since in most cats the cystic duct is convoluted, a bend can be selected for ligation which lies to one side of the main cystic artery, vein and lymph channels. At the convexity of such a bend the duct can be ligated without causing hemorrhage or interruption of vascular drainage. (Incidentally, there are usually accessory veins on the gall bladder that drain directly into the liver). Also, if cat-gut be employed, ligation can be accomplished under sterile conditions without causing noticeable inflammation of the duct or peritoneal adhesions. Forty-eight hours later (during which interval the animal has demonstrated perfect recovery from the operation) examination of the cat under anesthesia shows that the gall bladder has diminished from one-half to one-third of its original volume and that inspissation has changed its contents from a light green, watery fluid to a dark green, semi-solid mass. Furthermore, application of the Pettenkofer test indicates the presence of large quantities of bile salts in the unabsorbed residue.* Thus, while the water content of the bile has been largely removed, neither bile pigment nor bile salts have been efficiently resorbed in this long interval.

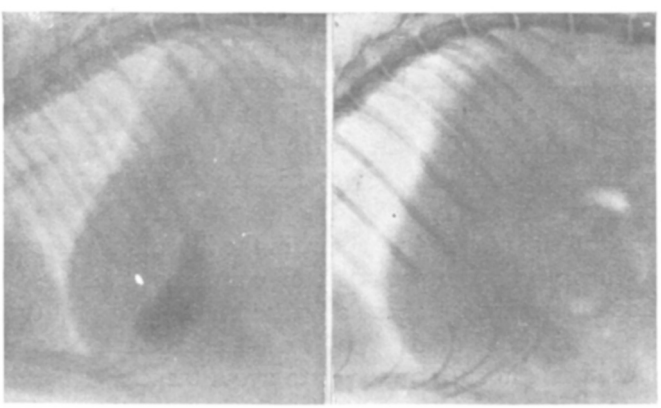

FIG. 1.

Left hand picture shows X-ray of gall bladder of Cat A-21 two hours after gall bladder was filled with a 10% solution of sodium iodide. Right hand picture, taken an hour and a half later, shows disappearance of shadow, following absorption of the iodide.

* For these chemical tests we are indebted to Professor E. B. Carmichael of the Department of Physiological Chemistry.

Further evidence that the absorptive capacity of the gall bladder has not been impaired by operative procedures may be demonstrated in the following way. If at the end of 48 hours the inspissated bile is aspirated from the fundus of the gall bladder, and replaced with 2 cc. of 10% solution of sodium iodide, X-rays of the living animal will reveal the disappearance of the iodine shadow within 3 hours after the operation (Fig. 1).

These experiments thus confirm the observation of Sweet[2] that sodium iodide is absorbed by the mucosa of the *vesica fellea,* but even more they indicate the difficulty of maintaining that the contents of the gall bladder are resorbed *in toto* or that the primary "function of the gall bladder is to receive and return to the body the bile which is formed during the intervals between active digestion."

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Reaction of the Gall Bladder to Stimulation of Visceral Nerves.

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In a recent article[1] evidence was presented to show that both human and animal gall bladders are subject to the control of reflexes originating in the gastro-intestinal tract; that in unanesthetized cats faradic stimulation of the *pars pylorica* of the empty stomach induces contraction of that organ and reflex emptying of the gall bladder; and that faradic stimulation of any part of the alimentary tube from stomach to caecum will inhibit the contraction of a gall bladder that is emptying after a meal of egg-yolk.

Since then, employing similar methods (*i. e.,* sewing insulated electrodes to various internal surfaces) these observations have been extended to the colon and rectum of the cat (3 animals), and to the peritoneal surface of the abdominal musculature (1 animal), thereby showing that faradic stimulation of certain parts of the gut-tract or body-wall that are supplied by sacral and thoracic nerves, respectively, also induces inhibition of the emptying gall bladder.

Using a modification of this method, by means of which electrodes may be wrapped around nerve trunks and insulated from surrounding parts, it has been found possible to stimulate the nerves of the

[1] Boyden, E. A., and Birch, C. L., *Am. J. Physiol.,* xcii, 287; Birch, C. L., and Boyden, E. A., *Ibid.,* 301.