further as a possible explanation for the greater frequency of epileptic convulsions at or near the time of meals.

The fact that the non-ketogenic diet with the excessively acid-ash failed to have any influence on the number of convulsions and failed to sustain the hydrogen-ion concentration of the blood within normal limits, indicates a more or less specific value of the ketogenic diet in this respect so far as its effect on the epileptic subject is concerned. Since the concentrations of acetone bodies in the blood and the urine were found to be elevated during the alkaline-ash period very distinctly above the levels for the acid-ash periods, it is evident that the relationship between the degree of ketosis and the frequency of convulsions previously reported holds only when the ketogenic diet is one with an acid or neutral ash. Finally, it may be tentatively concluded from the foregoing results that the ketogenic diet with an acid-ash is the most efficient so far studied in controlling convulsions in that group of epileptic subjects who respond at all to the dietary form of therapy.

[1] McQuarrie, I., and Keith, H. M., *Am. J. Dis. Child.*, 1927, xxxiv, 1013.
[2] Lennox, W. G., *J. Clin. Inv.*, 1927, iv, 429.

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Expulsion of its Contents as a Function of the Gall Bladder.

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Since the introduction of methods that visualize the gall bladder, many opinions have been expressed as to the mechanism of its emptying. These can be divided into 2 groups: (a) that the gall bladder has a passive rôle in this process, and (b) that the gall bladder empties due to the contraction of its own musculature. We wish to present further evidence that expulsion of its contents is an inherent function of the gall bladder and acts independently of purely mechanical factors.

The chief extrinsic agencies suggested as causing the discharge of bile from the gall bladder are: (1) variations in intra-abdominal pressure, (2) intestinal peristalsis, (3) elastic recoil following relaxation of the common-duct sphincter, and (4) the washing out of the gall bladder by hepatic bile.

(1) The fact that the gall bladder may remain full for many days during fasting and that violent struggling associated with tube feeding in the cat produces no discharge of its contents[1] is sufficient evidence that variations in intra-abdominal pressure, within physiological limits, do not cause emptying of the gall bladder.

(2) Vigorous intestinal peristalsis produced by physostygmine as well as the normal movement of a barium meal through the intestine without effect upon the gall bladder containing iodized oil,[1] would seem to rule out intestinal peristalsis as a significant factor.

(3) Though the common duct be completely excluded, a fat meal will induce emptying of the gall bladder through a cannula in the cystic duct (Copher[2]), or the cut end of the common duct (Boyden[3]). Also in one of our cats whose gall bladder had been filled with iodized oil, the hepatic and common ducts were injected from the gall bladder after the ingestion of fat without the discharge of any of the oil into the duodenum. This can scarcely be interpreted in any other manner than as evidence against a reciprocal mechanism and even suggests occasional antagonism of the common-duct sphincter to the expulsive action of the gall bladder.

(4) As Graham has stated, "The real question, however, is not whether contractions occur but whether they are able to empty the gall bladder."[4] He reported that the gall bladder did not empty if the hepatic ducts were occluded and from this he inferred that intrinsic contractions of the gall bladder wall, aside from the factor of elastic recoil, were insufficient to empty that viscus. In fact one of the most recent reports concludes that "muscular contraction is not the only factor involved, and that elasticity and the ebb and flow of fresh bile from the liver play an important part."[2] We accept as critical in the evaluation of these factors the effect of fat feeding on the gall bladder with hepatic bile excluded. Consequently we have repeated this procedure and find that in the cat with all the hepatic ducts tied off (as proven at autopsy) the gall bladder has responded to fat feeding in the characteristic manner by the discharge of over 90% of its contents into the duodenum. These results are similar to those obtained by Higgins and Mann[5] except that the emptying process was carried much further in our experiment, and is obviously impossible of explanation on the basis of mechanical factors such as washing out by hepatic bile or elastic recoil.

We have considered in succession the mechanical processes which have been suggested as causing discharge of bile from the gall bladder and have seen that increased intra-abdominal pressure and intes-

tinal peristalsis under physiological conditions do not produce this effect; that the discharge of material from the gall bladder is even at times initiated against the antagonism of a closed common-duct sphincter and that the usual extensive emptying of the gall bladder proceeds normally in the cat with all of the hepatic ducts tied, far beyond any extent that could be explained on the basis of elastic recoil. The conclusion seems unescapable that the expulsion of its contents in response to fat feeding is a vital function inherent in the gall bladder musculature and independent of extrinsic and mechanical factors.

[1] Whitaker, L. R., *Am. J. Phys.*, 1926, lxxviii, 411.

[2] Copher, G. H., and Illingworth, C. F. W., PROC. SOC. EXP. BIOL. AND MED., 1927, xxv, 172.

[3] Boyden, E. A., and Birch, C. L., PROC. SOC. EXP. BIOL. AND MED., 1927, xxiv, 827.

[4] Graham, E. A., *Surg. Gyn. and Obst.*, 1927, xliv, 153.

[5] Higgins, G. M., and Mann, F. C., *Am. J. Physiol.*, 1926, lxxviii, 339.

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Effect of Thyroxin on Growth Rate and Carbon Dioxide Production of Chick Embryo.

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The data presented here represent the attempt at studies made to analyze the influence of thyroxin upon the pre-natal development of the chick. The technique employed was the same as previously described by the writer[1] for injecting substances into the air sac of the incubating hen's egg. The thyroxin was dissolved in dilutions of sterile distilled water just alkaline (NaOH) to litmus so that the required dose was contained in 0.25 cc. The controls were injected with the same amount of alkaline water.

Experiments were made to determine the appropriate dosage that would be within physiological limits. It is necessary to explain that before the sixth and eighth days of incubation the albumen lies between the air sac and the developing chorio-allantois. Thus an injection placed in the air sac previous to this age would be diluted by its absorption into the albumen. A test dose of 1/300 mg. of thyroxin was given before the start of incubation. This dose proved toxic, so the experiment was repeated giving 1/600 mg. before in-