was no definite X-ray evidence of osteoporosis in any of the cases of hyperthyroidism in this study; the phosphatase results gave evidence of only slightly increased osteoblastic activity in some instances (Table I).

Summary. Studies with the Hamilton and Highman test[1] of parathyroid function have been performed in 6 patients with hyperthyroidism. The results compared with those obtained in normal subjects indicate increased circulating parathyroid hormone in the blood of 5 of the 6 thyrotoxic patients. This investigation is being continued to evaluate the significance of the findings.

8869 P

Liver as a Possible Site of the Emetic Action of Strophanthidin in Cats.

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Hanzlik and Wood[1] published an important paper on digitalis emesis in which they contend, with Hatcher and others, that the mechanism of the emesis is a reflex one. They conclude that the liver is probably the chief site of origin of the reaction but that other abdominal organs may be involved, at least experimentally, because in pigeons with the liver excluded from the circulation digitalis still produces vomiting. They agree with Dresbach and Waddell[2] that the heart has been pretty definitely excluded as the chief site of origin of this response.

In this laboratory the possible relation of the liver to strophanthidin emesis in the cat has been attacked by two methods. In one the attempt was made to denervate the liver as thoroughly as possible and in the other the organ was completely removed. Complete denervation of the liver by surgical means may prove to be an impossibility (a study of this problem is being made) but at least it can be deprived of the greater part of its nerve supply. We have used no new technic but have stripped the duodeno-hepatic artery, portal vein, and common bile duct of all accompanying nerve fibers, which were cut, together with all other structures entering the liver

1 Hanzlik, P. J., and Wood, D. A., *J. Pharm. and Exp. Therap.*, 1929, **37**, 67.

2 Dresbach, M., and Waddell, K. C., *J. Pharm. and Exp. Therap.*, 1926, **27**, 9; *ibid.*, 1928, **34**, 43.

along the portal vein, and have painted the duct and vein with 70% alcohol, or with 2% phenol or silver nitrate; in 2 cats we also cut the right phrenic nerve just above the diaphragm. In spite of all of these procedures some undegenerated nerve fibers were found between the liver lobules, sufficient time having been allowed for degeneration. However, we do not know whether they were mainly afferent or efferent. Twenty-one animals have been operated, some of them very thoroughly; but the limitations of the technic have been appreciated.

With few exceptions the cats were in good condition when injected, by the saphenous and superior mesenteric veins, intramuscularly, intraperitoneally, or into a lobe of the liver. Except for novocain used locally in the intravenous injections, no other anesthetic was employed. Control injections of water, normal saline, and water containing a trace of alcohol were made in amounts comparable to those of the strophanthidin solution and by the same channels.

Pure crystalline strophanthidin, kindly supplied by Dr. Walter A. Jacobs, of the Rockefeller Institute, was used in the form of a water solution.*

Result. Vomiting was produced in every cat with the exception of one, which showed very definite nausea but it never occurred in the control experiments.

In a second series of 4 cats the liver was completely removed by the 2-stage method of Soskin.[3] The method is comparatively simple and served our purpose well. No special attempt was made to prolong the lives of the animals after the final operation, although some of them were given glucose by vein. They survived from 5 to 12 hours.

One of these cats was injected 4 hr., 45 min., and one 9 hr., 13 min., after the excision of the liver. They received a total of 0.40 and 0.45 mg. per kg., respectively, in 2 doses about one-half hour apart, by muscle and the result was that both vomited repeatedly and in a perfectly typical manner after a latency of a little less than 40 minutes, this latency being well within the normal. One other cat was given 0.25 mg. per kg. by vein 3 hours

* The solution was made as follows: 25 or 50 mg. were dissolved in 3 or 4 cc. of 95% alcohol in a 50 cc. volumetric flask; this was filled about half-full with distilled water and placed in a water bath at 60° C. for 2 or 3 hours to drive off all but a trace of the alcohol; the volume was then made up to 50 cc. with sterile water and kept sterile. As one cc. of the solution contained 0.5 or 1.0 mg. of strophanthidin, only a very small amount of water was injected at any time.

[3] Soskin, S., *J. Lab. and Clin. Med.*, 1931, **16**, 382.

after removal of the liver. Fourteen minutes later there was profuse salivation and after a latency of 47 minutes it almost vomited; at the end of 2 hours it died in a vomiting-like convulsion. The fourth cat, in apparently good condition, received 0.25 mg. per kg. by muscle 7 hr., 45 min., after liver removal. Although the dose was repeated twice a half-hour or so after the first injection no emesis resulted; however, there was marked tachypnoea.

From the results of the denervation work it is probable that if actual complete denervation of the liver in the cat could be attained strophanthidin would still cause emesis; the dehepatization experiments lend support to the conclusion. Although each of the 2 dehepatized cats which vomited received double the normal minimal emetic dose, in order to increase the probability of response, it does not necessarily follow that the operated cats were greatly depressed. Nevertheless, the negative results in the fourth cat suggest that the abnormal metabolic state had lowered the reactivity, as one would expect.

Conclusion. Strophanthidin can induce emesis in cats after very extensive denervation of the liver, and also after dehepatization, thus confirming the results Hanzlik and Wood obtained with pigeons. How the vomiting is brought about in animals deprived of the liver, or its nerve supply, is a problem for further study.

8870 C

Presence of Cholesterol in Combined Form in Human Bile.*

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Early reports of the presence of cholesterol esters in bile have been questioned because the methods used for the determination of esters were open to criticism. Later work by Thannhauser[1] indicates that human bile contains only free cholesterol. A recent paper by Wright[2] reported that the cholesterol present in dog bile is also present as free cholesterol. He was unable, using an improved method of analysis, to find any evidence of cholesterol esters. In

* Aided by a grant from the Josiah Macy, Jr., Fund.

1 Thannhauser, S., *D. Arch. Klin. Med.*, 1922-1923, **141**, 290.

2 Wright, A., *J. Exp. Med.*, 1934, **59**, 407.