order to change the reaction. In this connection it is well to remember that considerable fixed acid is lost with the bile, as Wangensteen[5] found that a human with a biliary fistula secreted about 0.4 gm. NaCl daily.

In many previous studies too numerous to mention here, the presence of a mild degree of acidosis has been quite usual, while a few investigators have found it to be of such a high grade as to regard it as a primary factor in the accompanying cachexia. The material here reported consists of CO_2 and blood chloride estimations on 8 animals, part with biliary fistulas and part with cholecystnephrostomies. From the accompanying table it may be seen that there are no significant changes in the acid-base equilibrium. The average CO_2 before operation was 39.5, exactly that taken at the conclusion of the experiments (39.5). The average preoperative blood chloride was 290 mg. per 100 cc. and at the conclusion of the experiments was 293 mg. per 100 cc.

These animals were all on mixed diets and the onset of the cachexia was prompt and typical. It seems, therefore, that one is justified in concluding that if the typical picture may be reproduced without changes in the reaction of the animal that this factor is not fundamental and does not play an etiological rôle in cachexia cholepriva.

7212 P

A Study of the Dog's Stomach and Liver for Substances Effective in Pernicious Anemia.

OSCAR RICHTER, A. C. IVY AND A. F. MEYER.

From the Department of Physiology and Pharmacology, Northwestern University Medical School and Cook County Hospital.

Since gastrectomized dogs do not develop pernicious anemia,[1] it is pertinent to determine whether substances effective in pernicious anemia are present in the liver and stomach of dogs.

We have prepared dog's "desiccated whole stomach" according to the standard method and have given the preparation orally to patients with pernicious anemia. We have made extracts of the dog's

[5] Wangensteen, O. H., Complete Biliary Fistula, *J. Am. Med. Assn.*, 1929, **93**, 1199.

[1] Ivy, Morgan and Farrell, *Surg. Gynec. and Obst.*, 1931, **53**, 611.

liver and have injected them subcutaneously. We have also fed dog's liver to pernicious anemia patients. These materials were prepared from recently sacrificed dogs.

Dog's desiccated whole stomach. In a previous report,[2] the desiccated whole stomach of dogs was fed to 2 pernicious anemia patients in doses of 50 gm. (dry powder) per day for from 8 to 12 days without observing a response. Later both of these patients responded typically, one to oral equine liver and the other to liver extract subcutaneously. We have extended these experiments to include 5 additional pernicious anemia patients, making a total of 7 patients. A slight increase in both red cell count and reticulocytes occurred in one patient. All patients, except one, when placed on equine liver extract responded typically.

Isaacs and Sturgis[3] obtained remissions from feeding from 30 to 60 gm. of desiccated hog's whole stomach. Our results indicate that if the active principle is present in dog's whole stomach, it is present only in smaller amounts than found in the hog's stomach. Larger doses of dog's desiccated stomach were not used because of the difficulty in getting patients to take larger doses voluntarily over a period of adequate length to be significant.

Dog's liver. Six pernicious anemia patients received extracts of dog's liver prepared according to the standard method. The extract of from 45 to 155 gm. of liver was administered subcutaneously during a 10-day period. Three of the patients, one receiving the extract of 45 gm., one 90 gm., the other 140 gm. of liver, showed some evidence of a response, which, however, is questionable. (Table I.)

TABLE I.

Patient	Red Cells		Hemoglobin		Reticulocytes	
	Before	After	Before	After	Before	After
R. Bu.	1.26	1.37	34	38	0	0.4
B. Ko.	1.52	1.58	32	34	0.2	2.4
S. Ga.	1.33	1.98	39	49	0	2.0

At least they did not show a progressive decline in the blood picture as did the other patients. (It should be remarked that all patients included in this report had red cell counts varying from 1.7 to 0.7 millions.) We interpret these results as indicating that if the dog's liver contains extractable substances (*i. e.*, extractable by the usual method) effective in pernicious anemia, they must be

[2] Ivy, Richter and Kim, *Am. J. Physiol.*, 1932, **101**, 59.

[3] Sturgis and Isaacs, *J. Am. Med. Assn.*, 1929, **93**, 747.

present in a concentration of less than ¼ of the concentration found in cattle, equine and hog liver.

That the principle effective in pernicious anemia is present in dog's liver is shown by the results to follow. Because it is possible that the effective substance is present in dog's liver but is difficult to extract by the usual method, we fed from 100 to 250 gm. of dog's liver daily to 5 pernicious anemia patients (10 days).

TABLE II

Patient	Red Cells		Hemoglobin		Reticulocytes		Liver
	Before	After	Before	After	Before	After	gm. daily
G. Pe.	0.70	0.80	22	22	0	4.2	100
F. St.	1.97	3.35	60	82	0	5.8	200
J. N.	0.67	1.74	18	42	0	18.0	250
M. Re.	1.4	1.92	33	47	0	12.0	250
E. Sc.	1.18	0.80	26	23	0	0.4	200

Three of the 5 (Table II) patients responded without question. One of the patients (G. Pe.) receiving 100 gm. daily failed to respond definitely, and one receiving 200 gm. showed no response. One of these patients (E. Sc.) responded typically to subcutaneous equine liver; the other (G. Pe.) unusually promptly. From these results, it is evident that the material effective in pernicious anemia is present in dog's liver, but very probably not in the concentration (available) found in hog, equine or cattle liver.

Summary. (1) desiccated whole dog's stomach does not contain the material effective in pernicious anemia to the extent that desiccated whole hog's stomach does, and (2) the material effective in pernicious anemia is present in dog's liver, but in less concentration than in cattle, equine and hog liver.

Note: Since our manuscript was submitted, an article by Strauss and Castle (This Journal, p. 360) has appeared which reports that "the content of potent material in canine liver extracts appears to be only about one-fifth that of hog liver."