TABLE I.
Blood Pyruvate Values in mg per 100 cc of Whole Blood Before and 14 Hours After the Ingestion of 3 g of Citric Acid.

| Time | Subject 1 | | | Subject 2 | Subject 3 |
|---|---|---|---|---|---|
| 1. Before citric acid | 0.56 | 0.96 | 1.06 | 0.58 | 0.73 |
| 2. After " " | 0.58 | 0.70 | 1.03 | 0.72 | 0.67 |
| Δ, 1-2 | —0.02 | +0.26 | +0.03 | —0.14 | +0.06 |

expected from the report of von Euler and Högberg. Clinical effects and subjective complaints were likewise entirely absent in all of the present experiments. Blood lactate, which was also measured in 2 experiments, did not change. We are unable to offer any explanation for the divergence of these results from those previously reported but we may note that the details in the von Euler and Högberg report are scanty.

## 14795 P

## Evacuation of Gall Bladder in Female Patients with Pernicious Anemia.

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In an earlier study[1] it was observed that in male patients with pernicious anemia the rate of evacuation of the gall bladder was not significantly retarded by the disease, but that in a surprisingly large proportion of the cases studied roentgenologically, the gall bladder could not be visualized, notwithstanding the use of the intravenous method and the absence of any gall bladder history. Accordingly it seemed desirable to examine a comparable number of female patients.

The present report is based upon cholecystographic studies of 48 consecutive, unselected patients with pernicious anemia (23 males and 25 females). In this group, 42% could not be visualized (35% of the males and 48% of the females). Also, a review of the 31,311 necropsies recorded by the Department of Pathology for the 15-year period between 1926 and 1940, showed that of the 105 individuals having pernicious anemia, 32.4% had had either cholecystitis or cholelithiasis (or both) or had had the gall bladder removed. Furthermore the incidence of gall bladder disease increased progressively with age to the 8th decade—whereas Blalock[2] has shown that the greatest percentage of cases of biliary disease occurs in the fifth decade. These figures suggest that pernicious anemia increases the incidence of gall bladder disease and may have an etiological relation to it.

Evacuation of the gall bladder in 12 female patients (average age, 58 years) showed marked retardation over the group of female controls[3] (average age, 65 years); for in the first 40 minutes after the standard meal, the pernicious anemia group had evacuated only 71.5% of the contents of the gall bladder as against 84% by the controls. The difference is statistically significant, being nearly 3 times the standard error.

It would thus appear that patients with pernicious anemia are more likely to have developed cholecystic disease than other individuals of comparable age. When one asks what changes occur in this disease which might affect the gall bladder, the factor of increased excretion of fecal urobilinogen imme-

[1] Layne, J. A., and Boyden, E. A., PROC. SOC. EXP. BIOL. AND MED., 1940, **43**, 534.

[2] Blalock, Alfred, *Bull. Johns Hopkins Hosp.*, 1924, **35**, 391.

[3] Boyden, E. A., and Grantham, S. A., Jr., *Surg., Gyn., and Obstet.*, 1936, **62**, 34.

diately comes to mind. In patients in a state of relapse it may be increased several times its normal value and following liver therapy it sharply decreases.[4] It is conceivable, therefore, that excessive secretion of bile pigments into the biliary tract may have produced temporary obstruction of the cystic duct with consequent damage to the gall bladder wall.

The greater damage sustained by the female gall bladder, together with the slower rate of emptying in patients of this sex, may be explained on the basis of the greater susceptibility to gall bladder disease of women who have borne children,[5] for in all but 2 of the group the gall bladder had been subjected to the double insult of the stasis of pregnancy and that of pernicious anemia.

[4] Watson, C. J., *Arch. Int. Med.*, 1931, **47**, 698.

[5] *Cf.* Gerdes, M. M., and Boyden, E. A., *Surg., Gyn., and Obstet.*, 1938, **66**, 145.

## 14796

## Experimental Production of Negative Pressure in the Frontal Sinus.

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The clinical syndrome known as vacuum headache has long been recognized but there seems to have been no demonstration of a reduced pressure in the sinuses or of a mechanism capable of producing it. When one of us (Hilding[1]) demonstrated that negative pressure can be produced by normal ciliary action in the lower part of the respiratory tract, it was decided to determine if a similar mechanism would produce negative pressure in paranasal sinuses.

*Technic.* With the animal under ether anesthesia and with observance of aseptic technic two 16-guage hypodermic needles were inserted into one frontal sinus of each dog. The needles were introduced through small holes made through the scalp and bone. Each needle fitted into both the skin and the bone effectively enough to be airtight. One needle was connected to a water manometer and the other to a syringe containing the mucinous secretion to be injected. A third needle, introduced into the opposite frontal sinus and connected to another water manometer, acted as control.

The mucinous secretion was collected from the trachea of either the dogs used in these experiments or other dogs.

[1] Hilding, A. C., *Ann. Otol., Rhin., and Laryng.*, 1943, **52**, 816.

*Experiment 1.* A few cubic centimeters of mucus was injected into the left frontal sinus of animal 1 at 2:15 p.m. The first portion entered without resistance but soon a resistance was felt, which increased to +270 mm of water when the injection was finished and the needle closed. In two minutes the pressure had fallen to +83 mm and it passed zero and became negative between the fifth and the sixth minute. Twenty minutes later the manometer reading stood at —50 mm and it reached a maximal negativity of —59.5 mm forty-seven minutes after injection. It remained stationary for about 7 minutes and then rose to about —45 to —48 mm where it remained until 2 hours and 6 minutes after injection, when the experiment was terminated.

*Experiment 2.* At 9:51 a.m., 3.5 cc of mucus was injected into the left frontal sinus of animal 2. At 10:07 a.m. the manometer recorded —3 mm of water. It varied between —3 and +8 mm until 11:00 a.m. when the experiment was concluded and the sinus opened. The mucus was about gone. The ostium was unusually large and, although mucus was passing through, the ostium was not filled or occluded by the mucus.

*Experiment 3.* Seven cubic centimeters of foamy mucus was injected into the left frontal sinus of animal 3 at 11:06 a.m. The imme-