fall into Group I—Type A and Group II—Type A, respectively. Six strains, Nos. 16, 14, 13, 9, 7, 4, fall into the same group, III, and the same type, E. Of the remaining two, No. 21 falls into Group VI, Type A, and the other, No. 29, falls into Group VII—Type A.

The nine strains of pernicious anemia fall into the following groups: Four of them, Nos. 30, 31, 34, 23, fall into Group IV—Type A. Two, Nos. 26 and 23, fall into Group V—Types A and B. The remaining three into Group VI—Type A.

*Summary:* 1. A study of the sugar fermentation reactions of the strains of Monilia isolated from cases of pernicious anemia, shows that all act upon dextrose, levulose, maltose, galactose, dextrin and sucrose. The action on lactose, mannite and inulin varies with the different strains. These reactions can be used to distinguish these organisms from various stock strains of yeasts. They resemble closely those given by the stock strains of *Monilia psiliosis*.

2. Monilia isolated from other pathological conditions, in general, seem closely related to the pernicious anemia strains in type of growth, and fermentation reactions, although some slight differences are found in many strains.

We take this opportunity to express our appreciation to Dr. Moyer S. Fleisher for his cooperation and encouragement throughout this work.

This is a preliminary report.

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[2] Ashford, B. K., *Am. J. Med. Sci.*, 1915, cl, 680.

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## Simultaneous Cholecystography and Determination of Liver Function.

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Since the introduction of cholecystography by us three years ago, we have instituted many changes and modifications to enhance its value. A short time ago we substituted phenoltetraiodophthalein

for tetraiodophenolphthalein for several reasons. A smaller dose is required, the time of filling and emptying of the gallbladder is shortened, and the blood serum is stained so that readings on the excretion by the liver can be obtained.

The dose of phenoltetraiodophthalein is 0.04 grams per kilo of body weight, and is preferably given in the morning intravenously on an empty stomach. The dose need not exceed 2.5 grams. Lunch should be omitted, but if hunger demands, the diet should be limited to liquids without fats and low in proteins. Water is allowed. Roentgenograms are taken 4, 8 and 24 hours after the injection.

The solution is prepared by dissolving 2.5 grams phenoltetraiodophthalein in 30 or more cc. freshly distilled water, filtered and sterilized in a water bath for 15 or 20 minutes. A specimen of blood is taken before giving the dye and one-half hour afterwards. The blood is allowed to clot, preferably in an icebox and centrifuged. The serum is removed, alkalinized and compared with standards in a manner similar to the Rosenthal modification[1] of the phenoltetrachlorphthalein test for liver function.

The standards are prepared by dissolving 48 milligrams phenoltetraiodophthalein in 100 cc. distilled water. This is used as the 100 per cent solution, and 10 or 12 dilutions are made between 100 per cent and 5 per cent. A small amount of alkali must be added to the standards to keep them from fading. The correct amount for 4 or 5 cc. of standard is one drop of 5 per cent sodium hydroxide for standards between 60 and 100 per cent, 2 drops for standards between 25 and 60 per cent, and 3 drops for standards between 3 and 20 per cent. In arriving at the figure 48 milligrams, we have used the ratio of 1 to 12, for estimating blood volume, as is recognized by Erlanger and others.

Retention of less than 15 per cent of the dye in the blood serum one-half hour after injection of the dye, and less than 4 per cent one hour after injection is considered normal. Retentions of any greater amounts for the specified time are considered abnormal.

The largest amounts of retention have been found in patients having cirrhosis with ascites, and may be as high as 80 to 90 per cent one half hour after injection. Retentions almost as great have been seen in patients having acute hepatitis with cholangitis, usually with slight jaundice. An interesting and almost constant fact has been observed, viz., that a mild retention above normal, ranging between 17 and 35 per cent, is found in cases of cholecystitis. This is probably explained by the practically constant hepatitis accompanying cholecystitis.

Animal experiments are now being conducted to determine the comparative values of phenoltetraiodophthalein and phenoltetrachlorphthalein as agents for determining liver function. In these experiments we have used phenoltetrachlorphthalein in doses of 5 milligrams per kilo as recommended by Rowntree, Hurwitz, and Bloomfield,[2] but phenoltetraiodophthalein in doses of 40 milligrams per kilo because of the advantage, clinically, of obtaining a simultaneous cholecystogram. Satisfactory cholecystograms are not obtained with phenoltetraiodophthalein in doses much smaller than 40 milligrams per kilo. The amount of retention found in the blood of animals with normal livers, as well as those having liver necrosis of varying degree, produced by chloroform anesthesia, would very obviously be less with phenoltetrachlorphthalein than with phenoltetraiodophthalein, when using doses of 5 milligrams per kilo and 40 milligrams per kilo, respectively. Because of the chemical similarity of the two dyes, there is no reason to believe there would be much difference in the time of excretion by the liver, if they were given in equal doses. The average figures for normals after injection of phenoltetraiodophthalein are, as follows: 10 per cent for 15 minutes, 6.6 per cent for 30 minutes, 3.5 per cent for 45 minutes, and 2 per cent for 60 minutes. For phenoltetrachlorphthalein: 9.2 per cent for 5 minutes, 5.5 per cent for 10 minutes, 3.5 per cent for 15 minutes, and 2 per cent for 30 minutes. Chloroform is being used for production of liver injury and readings taken on the second day and continued until the liver has regained its normal excretory power. Only a limited number of experiments have been completed as yet, but, in every case, phenoltetraiodophthalein has shown retention as long or longer after production of the liver damage, as has phenoltetrachlorphthalein and without producing any toxic effects. This factor of greater sensitivity of phenoltetraiodophthalein, produced presumably by the larger dose, would seem to be quite a definite advantage, and has manifested itself in the few experiments conducted so far.

This is a preliminary report.

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[2] Rowntree, L. G., Hurwitz, S. H., and Bloomfield, A. L., *Bull. Johns Hopkins Hosp.*, 1913, xxiv, 327.