

purate was excreted more slowly than sodium benzoate in the mammal.

This phenomenon is of particular interest because Bunge and Schmiedeberg¹ demonstrated that hippuric acid is synthesized from benzoic acid and glycocoll in the kidney, while hippuric acid merely passes through it. It is interesting to speculate upon the possibility that the process of synthesis may bring about or be associated with a local vasodilation.

Among other drugs studied, nitroglycerine, one five-thousand solution, theobromine, one per cent. solution, and sodium indigo sulphonate, one per cent. solution, increased the glomerular circulation in a similar manner; and indigo sulphonate definitely stained the glomerular capsule blue. This shows that sodium indigo sulphonate is excreted through the glomeruli as well as through the tubules. Heidenhain² had demonstrated the excretion of this substance through the tubules but not through the glomeruli.³

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The bile factor in pancreatitis.

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We have investigated the bile factor in pancreatitis from two chief aspects, the anatomic and the experimental.

Anatomically, two mechanisms have been suggested whereby bile can be passed into the pancreatic duct. One is based on the possibility that an obstruction could occur at the exit of the common bile duct in a manner to convert the two ducts into a continuous channel. We studied the relationship of the common bile duct to the pancreatic duct and their mode of entrance into the

¹ Bunge, G. and Schmiedeberg, O., *Arch. exper. Path. u. Pharmacol.*, 1876, vi, 233.

² Heidenhain, *Pflüger's Arch. f. d. ges. Physiol.*, 1874, ix, 1; Hermann's *Handbuch der Physiol.*, 1883, v, 279-373.

³ We desire to thank Dr. F. B. Kingsbury for furnishing the sodium hippurate and for suggesting this phase of the problem.

duodenum in man in order to determine the percentage of instances in which there would be an anatomic basis for the foregoing hypothesis. Our data conclusively prove that the number of instances in which the anatomic arrangement in the relationship of the two ducts would permit bile to pass into the pancreatic duct is very small. The other possibility that the sphincter at the duodenal end of the common bile duct could contract and convert the two ducts into a continuous channel has been investigated. Our data show that in most instances in man the sphincter is located at a point where contraction will close both ducts and will not convert them into a continuous channel. In a very small percentage of instances a small bundle of muscle fibers is found in a position where possibly it could convert the two ducts into a continuous channel. While there is an anatomic basis for the possibility of converting the two ducts into a continuous channel, either by mechanical obstruction or possibly by the action of a sphincter muscle, the percentage of instances in which this could occur is very small.

Experimentally we followed three lines of investigation: (1) to estimate the possible pressure the existing physiologic mechanism could exert to inject bile into the pancreatic duct; this pressure we have found to be relatively low; (2) to inject sterile bile into the pancreatic duct at the maximal pressure that could occur in the common bile duct; this did not produce typical hemorrhagic pancreatitis, although definite damage of the pancreas sometimes occurred; and (3) to ligate the common bile duct in goats (a species in which the main pancreatic duct opens into the common bile duct); this does not produce acute pancreatitis.

Our investigation has proved that an anatomic and physiologic basis for the theory that reflux of bile may occur in the pancreatic duct does exist. The evidence indicates that such a reflux of bile may rarely be the cause of chronic pancreatitis. The number of instances in which the necessary anatomic conditions are present for such an occurrence is very small. The possibility of bringing into play a physiologic mechanism which can infiltrate the pancreas with sterile bile to an extent actually to produce acute pancreatitis is questionable. Granted that the necessary anatomic, physiologic and pathologic factors are present and that

the reflux of sterile bile under such conditions does produce pancreatitis, such cause for the condition must be very rare; few cases are on record. A reflux of bile could not have been the cause in any of our cases of acute pancreatitis. It should be noted that any mechanism which will afford the possibility for bile to pass into the pancreatic duct will also obstruct the flow of pancreatic juice. Furthermore, bile has been found in the pancreatic duct without acute pancreatitis. Pathologists should, in all cases of pancreatitis, examine the relationship of the two ducts to the duodenum and to each other in order to determine if it is anatomically possible for bile to pass into the pancreatic duct. Our data conclusively prove that we must look elsewhere for the explanation of the cause of most cases of pancreatitis.

171 (1918)

**A rapid method for the determination of the moisture content
of expressed plant-tissue fluids.**

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The moisture content of expressed plant saps can be measured by determining the refractive index of the sap using an Abbé refractometer provided with a special "sugar scale."

In a series of determinations we have found that more accurate results can be obtained by the refractometric method than can be obtained by drying weighed portions of the saps in a vacuum oven. The results are fully as accurate as are those obtained by drying in vacuo at room temperature over sulfuric acid.

The great advantage of the method lies in the fact that only 2 or 3 drops of sap are necessary and that the entire time of measurement need not exceed two minutes.

It appears probable that the method may be applied to other biological fluids. A more extended account of the method will appear in a botanical journal.