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A Comparison of the Buffer Value of Bile and Pancreatic Juice Secreted Simultaneously.

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It is well known that both bile and pancreatic juice play a rôle in neutralizing the acid chyme ejected into the duodenum and that pancreatic juice as a rule is more alkaline (pH 7.8—9.0)^{1, 2, 3} than hepatic bile (pH 7.4—8.5)^{4, 5, 6} and that gall bladder bile is acid (pH 5.4—6.9)^{4, 5} but the titration curves and buffer values of bile and pancreatic juice have not been determined and compared.

In doing this it was thought that more comparable results would be obtained by collecting bile and pancreatic juice from the same animal at the same time. So, under aseptic procedure the gall bladder bile was collected by ligating and removing the gall bladder. The common bile duct was then cannulated, the accessory pancreatic duct tied, and the principal pancreatic duct cannulated; both the cannulae in the common bile duct and the pancreatic duct were connected with sterile rubber balloons large enough to hold a 12-hour sample.⁶

The combined 24-hour collection of the secretions was measured and 10 cc. amounts titrated with N/10 HCl, and the corresponding pH determined with the quinhydrone electrode. This has been done in 5 dogs so far and a typical result is shown in the accompanying chart. In this chart the solid lines represent bile and the dotted lines represent pancreatic juice from the same dog. The lowest line is the gall bladder bile. The other solid lines are hepatic bile and the numbers on them refer to the days after operation that the secretions were obtained. The pancreatic duct cannula became occluded on the sixth day.

It is evident from these curves and our data that hepatic bile may be as alkaline or even more alkaline than pancreatic juice, and that the 2 act in a more or less compensatory manner, *i. e.*, when the

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¹ Auerbach and Pick, *Arch. a. d. Reichs-Gesund. am.*, 1912, **43**, 155.

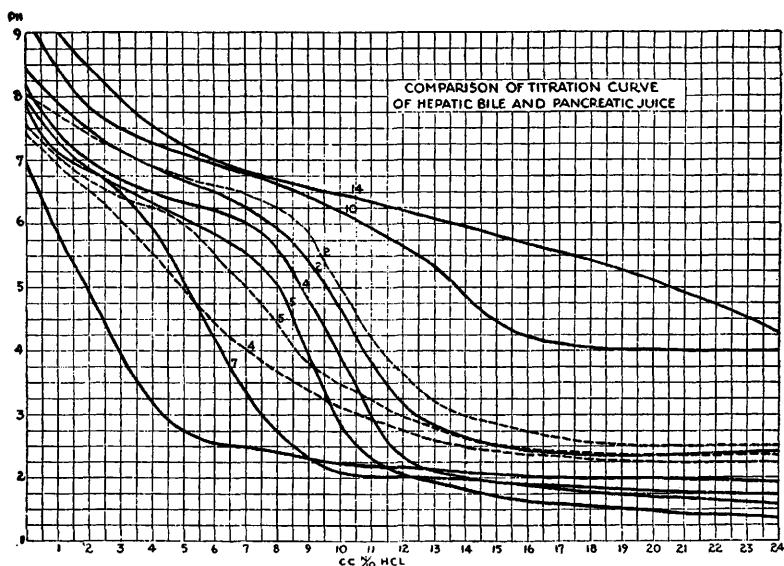
² Carnot and Guizewska, *Compt. rend. soc. de biol.*, 1925, **93**, 240.

³ Farrell and Ivy, *Am. J. Physiol.*, 1926, **78**, 325.

⁴ Okada, *J. Physiol.*, 1915, **50**, 114.

⁵ Neilson and Meyer, *J. Inf. Dis.*, 1921, **28**, 510.

⁶ Drury, McMaster and Rous, *J. Exp. Med.*, 1924, **39**, 403.



buffer action of one goes up, the other tends to go down. The slope of the curves shows a marked similarity and indicates that the buffer action is due to a substance common to both hepatic bile and the pancreatic juice, which substance is shown by other experiments to be sodium bicarbonate.

While the pancreatic juice is flowing, the hepatic bile is quite constant and in 10 instances lies very close to the curves for second and fourth day. This is shown in the chart. When, however, the pancreatic juice is blocked, the hepatic bile may vary quite widely in buffer action as indicated on the chart, usually increasing markedly in buffering action in an attempt to carry to the intestine the alkali previously carried by the pancreatic juice. The amount of pancreatic juice secreted is as a rule more than the amount of bile secreted, when both secretions are flowing freely, so that the total buffer secreted by the pancreas is always greater than the total buffer secreted by the liver under the conditions of our experiment.