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### A New Type of Pancreatic Fistula\*

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Several types of pancreatic fistulae have been devised for the study of the external secretion of the pancreas since DeGraaf first tied a cannula in the sectioned pancreatic duct of the dog and led it through the skin. This method and in particular the modification introduced by Elman and McCaughan<sup>1</sup> serves very well for acute experiments. The cannula however usually loosens and comes out after 10 to 15 days and the fistula closes or the animal dies. The method of Heidenhain<sup>2</sup> and Pawlow,<sup>3</sup> whereby the piece of duodenal wall containing the entrance of the lower pancreatic duct in the case of the dog is transplanted into the skin of the abdominal wall is more useful for chronic experiments. This has, however, the limitation in that relatively small amounts of secretion are obtained (200 to 300 cc. per day), the excoriation of the skin is very troublesome, the secretion is contaminated by contact with the abdominal wall, and lastly an ascending infection of the pancreas often results via the ducts and the secretion stops almost completely. In an attempt to obviate some of these difficulties the following type of pancreatic fistula was devised.

The duodenum was cut across 2 cm. distal to the pylorus and again about 8 cm. lower down, just below the entrance of the lower pancreatic duct. The pyloric antrum was resected and the lower

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<sup>1</sup> Elman, R., and McCaughan, J. M., *J. Exp. Med.*, 1927, **45**, 561.

<sup>2</sup> Heidenhain, R., *Die Bauchspeicheldrüse. L. Hermanns Handb. d. Physiol.*, 1883, **5**, 173.

<sup>3</sup> Pawlow, J. P., *Die Arbeit der Verdauungsdrüsen.* Wiesbaden 1898.

duodenum anastomosed to the open end of the stomach by the end to side suture. The common bile duct was sectioned near its entrance into the duodenum and implanted either into the stomach or upper jejunum. The upper short section of duodenum containing the entrance of the pancreatic ducts (usually 2 or more in the dog) was converted into a closed sac by inversion and closure of both ends. An external fistula of this duodenal-pancreatic sac was then established by means of a special gold plated cannula, described in a previous publication.<sup>4</sup> This cannula was carefully wrapped with omentum before it was brought through a stab wound in the abdominal wall. Pancreatic juice was collected in rubber bags attached to the cannula. The juice was of course activated by the admixture of the small amount of *succus entericus* secreted by the duodenal sac. Animals have been kept in good condition in the laboratory, by special treatment to be detailed later, for as long as 6 months with no excoriation or digestion of the abdominal wall.

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**Fatal Effect of the Total Loss of Pancreatic Juice.\***

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While certain of the earlier physiologists, notably Pawlow, had noted various deleterious effects from chronic pancreatic fistula in animals, these were commonly ascribed to the disturbance in digestion resulting from the absence of an important digestive juice in the alimentary tract. Elman and McCaughan<sup>1</sup> were the first to clearly demonstrate that these adverse symptoms were due to the removal of some necessary substance from the body and its excretion in the pancreatic juice. By an improved type of fistula which permitted greater quantities of pancreatic juice to escape than had been obtained by former workers, they found that death resulted in the dog in from 7 to 8 days when pancreatic juice in amounts of from 150 to 400 cc. was lost per day. Confirming these findings

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<sup>4</sup> Dragstedt, L. R., and Ellis, James C., *Am. J. Physiol.*, 1930, **93**, 407.

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<sup>1</sup> Elman, R., and McCaughan, J. M., *J. Exp. Med.*, 1927, **45**, 561.