ACCESSORY PANCREATIC TISSUE

REPORT OF TWO CASES *

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The occurrence of accessory pancreatic tissue in man is rather uncommon; a careful review of the literature by Warthin¹ in 1904 revealed only forty-seven cases, to which he added two. One case was reported in 1894 by Biggs,² which was not included in Warthin's survey, since which thirty-one additional cases have been reported (Table 1). Twelve of these thirty-two cases were found at operation, the remainder at necropsy.

In a series of 321 consecutive necropsies in the Mayo Clinic in which the entire length of the intestine was opened in 314 cases, I found accessory pancreases in two cases (0.6 per cent.). In one case the aberrant tissue was in the stomach; in the other, in the duodenum. These statistics conform to Opie's,³ who found ten cases of aberrant pancreatic tissue in 1,800 necropsies. In several instances, I have observed accessory pancreatic tissue in the jejunum at operation. In one instance, it was about 3 inches from the ligament of Treitz opposite the mesentery, and it was necessary to go below it in order to perform a gastro-enterostomy.

A macroscopic and microscopic study of the two specimens of accessory pancreatic tissue that I found at necropsy forms the basis of this investigation. I have, in addition, reviewed the embryology of the pancreas in an effort to ascertain the cause of abnormally situated masses of pancreatic tissue.

SPECIMENS OF ACCESSORY PANCREATIC TISSUE

CASE 1 (139972).—At necropsy on a woman, aged 64, a small tumor was found in the duodenum, 5.5 cm. below the pylorus and 3 cm. above the papilla of the common bile duct. The base of the tumor was 1.5 cm. by 1.5 cm., and it projected 1 cm. into the lumen of the bowel (Fig. 1). Microscopic examination disclosed it to be an aberrant mass of pancreatic tissue. All the histologic structures of the pancreas were present, namely, ducts, acini, islets and connective tissue. The growth was covered by the mucous membrane of the duodenum and appeared to be embedded in the submucosa.

*From the Section on Surgery, Mayo Clinic.

1. Warthin, A. S.: Two Cases of Accessory Pancreas (Omentum and Stomach), *Physician & Surg.* **26**:337-340, 1904.

2. Biggs, G. P.: Supernumerary Pancreas in the Pylorus, *Proc. New York Path. Soc.* 1894, pp. 55-56.

3. Opie, E. L.: *Disease of the Pancreas, Its Cause and Nature*, Ed. 2, Philadelphia, J. B. Lippincott Company, 1910.

CASE 2 (130601).—At necropsy on a woman, aged 21, on the posterior wall of the stomach near the greater curvature, in the prepyloric region, a hemispherical tumor mass was found, with its rounded surface covered by mucous membrane, projecting into the lumen of the stomach (Figs. 2 and 3). The base was 3 cm. by 2.5 cm., the thickness 1.2 cm. On section, the cut surface of the tumor was pinkish-white with many small lobules. A rich blood supply was manifested by several large blood vessels. The tumor had the appearance of pancreatic tissue. Microscopic study verified the macroscopic diagnosis by the finding of pancreatic acini, ducts, islets, and connective tissue in about the same relation as in the normal pancreas. Its bases rested on the submucosa and its rounded surface was covered over by the muscularis mucosae and mucous membrane.

HISTOLOGIC APPEARANCE OF THE SPECIMENS

In both specimens, all the histologic units of the pancreas were identified under the microscope, namely, ducts, acini, islets, and connective tissue (Figs. 4, 5, and 6). In Specimen 1, all the microscopic sections examined showed an increase in the interlobular, interacinar and periductal connective tissue. In Specimen 2, all the sections presented the well known microscopic picture of the normal adult pancreas.

Ducts.—Each specimen contained one large duct, which was patent, lined with high columnar epithelium, with an outer coat of dense fibrous tissue, and which I believed to be the main excretory duct. Into this outer coat the interlobular ducts passed obliquely as they do in the normal gland, an observation which I had made previously.⁴

Acini.—The arrangement of the cells forming the acini was the same as in the normal pancreas. These large secreting cells are pyramidal in shape and resemble the normal acini cells. The so-called centro-acinar cells were present.

Islets.—In Specimen 1, the islets were small and few in number, and there was a moderate fibrosis. In Specimen 2, the islets were numerous. They were normal in size and the cells resembled those of the normal islet.

In order to determine whether the acinic cells in the alveoli had been functioning, and if so to demonstrate their activity of function, sections were stained for zymogen. Sections from both specimens were found on microscopic examination to contain large zymogen granules in the cytoplasm of the apical portion of the acinic cells (Fig. 7).

The presence of zymogen granules in the acinic cells and a patent excretory duct are sufficient evidence to prove that these tissues were producing pancreatic juice; and by the presence of the islets, one is justified in concluding that they were producing a hormone, which was the same as the internal secretion from the islets in the pancreas. These observations make it reasonable to assume that aberrant masses of pancreatic tissue are capable of the same function as the normally placed gland and that they function independently of it.

EMBRYOLOGY

A careful study of the embryology of the pancreas in the minute human embryo⁵ has been possible only in a few instances, and most of

4. Horgan, E. J.: The Histogenesis of Carcinoma in the Islets of the Pancreas, *J. Lab. & Clin. M.* **5**:429-442 (April) 1920.

5. Lewis, F. T.: Development of the Pancreas, in Keibel, F., and Mall, F. P.: *Manual of Human Embryology*, Philadelphia, J. B. Lippincott Company, 1912 **2**:429-445.

Fig. 1 (A129972).—Accessory pancreas in the duodenum 5.5 cm. below the pylorus (Probe point may be seen projecting through ampulla of common bile duct).

the data are from the study of the development of the pancreas in the lower vertebrates. For this reason and because an accessory pancreas in the dog has been reported by Mann,⁶ I reviewed the comparative anatomy and embryology of the pancreas.

Comparative Anatomy and Embryology.—From the researches of Oppel⁷ and a complete survey of the literature which was compiled and reviewed by him, we have recorded data to prove the occurrence of the pancreas in the vertebrata from the cyclostomes, the lowest form of fish, through the orders of fishes, amphibians, reptiles, birds and mammals, to man. For a long time it was believed that the pancreas was missing in fishes and amphibians, but the organ has been found in many species

Fig. 2 (A130601).—Accessory pancreas in the posterior wall, near the greater curvature, in the prepyloric region of the stomach.

of these two orders. Oppel believes it could be found in every species of vertebrate if the investigator would make an earnest search for it.

It is of interest to know that even though Oppel made serial cross sections of the entire animal he could not demonstrate a pancreas in *Amphioxus lanceolatus*, the animal which is the only species representing the order of acranial vertebrates and spanning the gap between the vertebrates and the invertebrates. Other organs are missing in this animal and the pancreas may be. Oppel leaves it an open question.

6. Mann, F. C.: Accessory Pancreas in the Dog, *Anat. Record* **19**:263-268, 1920.

7. Oppel, A.: *Lehrbuch der vergleichenden mikroskopischen Anatomie der Wirbeltiere*. Jena, Fischer, 1900, **3**:742-870.

No doubt the extreme variation in the form of the pancreas in different species of animals has been the cause of its being overlooked by some investigators, for there is no regularity of form for each order of vertebrates. Oppel and others have found that the gland may exist in the form of (1) single or multiple masses of gland tissue embedded between the muscularis and serosa in the wall of the stomach or duodenum, or both, and having one or more short or long ducts from each mass; (2) one or several gland masses spread out between the layers of the mesentery and attached to the stomach, duodenum, or intestine and emptying through one main excretory duct from each mass; (3) numerous small or very small glands in fine cordons dispersed throughout the entire

Fig. 3 (A130601).—Cut surface of bisected accessory pancreas in the wall of the stomach showing lobules and blood vessels.

cavity between the layers of the mesentery, or, (4) numerous small or very small glands growing along the blood vessels, enveloping them like a sheath, and advancing with the blood vessels into the liver and spleen, interweaving the liver as it follows the vessels in their various directions, or into the spleen by entering at the hilum with the blood vessels, or spreading over the splenic capsule from the hilum.

In man, the fully developed gland is constantly found to lie in a transverse position, firmly fixed against the spine with the head engaged in the concavity of the first portion of the duodenum, while in many of the mammals, it is rather loosely placed between the layers of the mesentery of the small intestine and distributed over a large area.

Cells believed to be islet cells have been described as occurring in the gland tissue of all the various species in which the pancreas has been

studied. In the fishes, amphibians and reptiles, they occur in groups of a few cells only, and have a tubular structure; in birds and mammals, there is a greater differentiation of the cells and a well defined arrangement of the cells in the formation of the islets.

It has been well established that the pancreas is an organ which has developed from the duodenum, and in its embryologic development, the anlagen first appear as buds on the duodenum. The anlagen are multiple; in some animals as many as four have been found. They progress to a certain stage, independently of one another, between the folds of the primitive mesentery, to coalesce later and develop into the pancreas.

Embryology of the Pancreas in Man.—The pancreas in man develops from cells in the duodenum which differentiate and form two anlagen in

Fig. 4 (A129972).—Accessory pancreas, showing acini, ducts and islet, with increase in connective tissue.

the embryo of 3 or 4 mm. in length. The dorsal pancreatic anlage begins as an outpouching on the duodenum, the ventral pancreatic anlage as a grooved bud arising from the common bile duct at its juncture with the duodenum (Fig. 8). The growth of the dorsal pancreas is more rapid than that of the ventral. The anlagen grow separately until by their circumrotation and growth around the inner aspect of the duodenum they meet posteriorly, where they coalesce and continue development in one mass in the dorsal mesentery. The body and tail grow upward and to the left so that they lie in the dorsal mesogastrium, posterior to the stomach. As the stomach and dorsal mesogastrium change position, the pancreas moves within the dorsal mesogastrium until its position is

transverse, when it becomes firmly fixed to the parietal peritoneum of the posterior abdominal wall.

The primitive outpouchings are lined with columnar epithelium similar to that in the duodenum. As the buds grow, the epithelium develops branching ducts ramifying the connective tissue. The main duct of the dorsal pancreas opens into the duodenum, while the main duct of the ventral pancreas opens into the common bile duct at the ampulla. When the dorsal and ventral anlagen unite, the main duct of the ventral pancreas anastomoses laterally into the main duct of the dorsal pancreas. In this way, the main duct of the ventral pancreas with the distal half of the duct of the dorsal pancreas forms the duct of Wirsung, and the proximal half of the duct of the dorsal pancreas is the duct of San-

Fig. 5 (A130601).—Accessory pancreas, showing acini, small ducts and four islets.

torini. When the embryo is from 26 mm. to 33 mm. in length, and the tail of the pancreas extends well out into the dorsal mesogastrium, branching tubules can be seen throughout the gland. No acini or islets are to be seen at this stage, and there is no evidence of lobulations. The connective tissue forms the major portion of the organ. At the end of the branches of the main duct, the tubules have an enlarged bud. This bud branches and forms new tubules until the acini begin to form by several buds at the tip of each nodule. After the acini have begun to form throughout the gland, the islet cells appear in the connective tissue along the small ducts. Pearce⁸ found masses of cells which he identi-

8. Pearce, R. M.: The Development of the Islands of Langerhans in the Human Embryo. *Am. J. Anat.* **2**:445-455, 1902-1903.

fied as islet cells in an embryo of 54 mm. The connective tissue is derived from the mesodermal tissue of the dorsal mesentery.

In a general way, it may be said that each phase of the embryologic development of the pancreas in man, from the time the cells which form the anlagen begin their differentiation in the wall of the duodenum until the gland becomes fixed in its transverse position, represents a mature development in a lower vertebrate. But, in contradistinction to this, all the variations in form which occur in the lower vertebrates are not represented in man.

SURGICAL CONSIDERATIONS

The normal conditions prevailing in the area where a mass of accessory pancreatic tissue is engrafted may differ greatly from those under which the normal gland exists, and for this reason, it is logical to presuppose that in the abnormal location in which these masses of accessory pancreatic tissue are found, they are more prone to inflammatory processes and malignancy. Therefore, in addition to the surgical and pathologic conditions usually found in the normal pancreas, there may be others resulting from the abnormal situation of the accessory pancreatic tissue.

Opie⁸ has pointed out in the necropsy specimens studied by him the occurrence of chronic interstitial inflammation in accessory pancreatic tissue and Mayo-Robson⁹ has reported a case found at operation. Warthin¹ reported two cases in which there was increased connective tissue, and in one of these there were also areas of localized fat necrosis in the surrounding tissue. Gibson¹⁰ reported a case which he believed to be an acute pancreatitis.

The possibility that accessory pancreatic tissue may be the cause of carcinoma has been suggested by Eloesser¹¹ and others, but our only conclusive evidence is from Branham,¹² who reported a case of pyloric obstruction in which he performed a pylorectomy for a mass "2 inches long and 1 inch across. This was found, on microscopic examination by Professor Welch, to be a 'malignant adenoma' of the pylorus originating in misplaced pancreatic tissue."

It is possible that carcinoma of the duodenum, which is occasionally observed, originates in accessory pancreatic tissue. Such origin, how-

9. Mayo-Robson, A. W.: A Case of Chronic Pancreatitis Probably Starting in an Accessory Pancreas, *Lancet* **2**:1823-1825, 1905; *Anatomy of the Pancreas in Relation to Its Diseases*, Brit. M. J. **1**:1153-1161, 1908.

10. Gibson, C. L.: Accessory Pancreas in the Gastro-Intestinal Tract, *Med. Rec.* **82**:426-427, 1912.

11. Eloesser, L.: Die in den letzten 10 Jahren an der Heidelberger chirurgischen Klinik beobachteten Fälle von Pankreaserkrankungen Mitt. a. d. Grenzgeb. d. Med. u. Chir. **18**:195-294, 1908.

12. Branham, J. H.: Operative Treatment of Cancer of the Stomach, with Report of Six Partial Gastrectomies, *Maryland M. J.* **51**:144-148, 1908.

ever, cannot be established in any given case of carcinoma of the duodenum, as in all probability, the accessory pancreatic tissue if present will be unrecognizable. The histogenesis of carcinoma from these disconnected masses of tissue will be proved only by a careful study of a number of specimens in which all the pathologic changes can be demonstrated from the normal to a well defined carcinoma.

The tendency for intussusception in cases in which there is a tumor in the wall of the intestine has long been known. Benjamin¹³ reports a case of obstruction of the intestine in which abdominal exploration revealed an intussusception of the jejunum. The intussusception was

Fig. 6 (A130601).—Accessory pancreas, showing acini, ducts and two islets.

reduced and found to contain a tumor-like mass which proved to be an accessory pancreas. Several similar cases have been reported.

Diverticula of the intestinal wall with aberrant pancreatic tissue in the tip of the diverticulum have been reported by several observers who regarded the accessory pancreatic tissue as the cause of the diverticulum. In a few of these cases, the tip of the diverticulum, containing the inflammatory accessory pancreatic tissue, had become attached to the abdominal wall or to the intestine, and the band thus formed produced a loop-hole through which a coil of the small intestine passed, later to become obstructed and strangulated.

13. Benjamin, A. E.: Accessory Pancreas with Intussusception, *Ann. Surg.* **67**:293-298 (March) 1918.

DISCUSSION

Inasmuch as the collated studies of disconnected pancreatic tissue, recorded in the literature and supplemented by my own observation, have proved that these masses contain all the histologic units of the pancreas, that they have a blood supply, carry on a function independently of the pancreas, may become malignant, produce obstruction, intussusception and diverticula, the finding of this tissue is of more than academic interest.

Fig. 7 (A130601).—Oil immersion photomicrograph of acini, showing large zymogen granules in the cytoplasm of the apical portion of the acinic cells.

There does not appear to be an accepted theory as to the cause of accessory pancreatic tissue. Zenker¹⁴ believed it to be an anomaly occurring very early in embryonic life by the formation of an additional diverticulum which develops into a single gland mass independently of the normal pancreas and, as the intestine grows longer, may be carried away a great distance. Glinski¹⁵ attributes it to a failure of one or

14. Zenker, F. A.: *Nebenpankreas in der Darmwand*, Virchows Arch. f. path. Anat., **21**:369-376, 1861.

15. Glinski, L. K.: *Zur Kenntniss des Nebenpankreas und verwandter Zustände*, Virchows Arch. f. path. Anat. **164**:132-146, 1901.

more of the primitive anlagen to coalesce with the main pancreas, which he believed developed chiefly from the ventral anlage.

Warthin states, "It is more probable that accessory pancreatic tissue is formed from lateral budding of the rudimentary pancreatic ducts as they penetrate the intestinal wall, the mass of pancreatic tissue thus formed being snared off and carried by the longitudinal growth of the intestine either upward or downward."

Accessory pancreatic tissue cannot be looked on as an anlage which has failed to coalesce with its codeveloping companion. If it were due to failure to coalesce, the masses would be large and would be found always in the duodenum, whereas, in fact, all the aberrant masses are small and the accessory tissue has been found in the stomach, duodenum,

Fig. 8.—Reconstruction from a human embryo of 7.5 mm. (H.E.C. 256, Thyng, F. W.: *Am. J. Anat.* 7:489-503, 1908), $\times 55$; *D. chol.*, ductus choledochus; *D. cyst.*, ductus cysticus; *D. hep.*, ductus hepaticus; *Panc. d.*, pancreas dorsale; *Panc. v.*, pancreas ventrale; *St.*, stomach; *Ves. fel.*, vesica fellea.

jejunum and ileum, spleen, splenic capsule, mesentery, omentum and umbilicus. Nor can these masses of accessory pancreatic tissue be looked on as embryonic rests. They are adult tissues composed of differentiated cells having a function similar to the normal pancreas, and do not, in any way, conform to the theory of Cohnheim.

It is obvious that any hypothesis which may be advanced will of necessity be speculative, but after a review of studies of embryos recorded in the literature and the study I have made of sections of human embryos, I believe a reasonable explanation may be made, on developmental grounds, of the pancreas, stomach, intestines and mesentery. It is true that in the early stage of the development of the intestine and pancreas these structures resemble the intestine of the adult species of some of the lower orders of vertebrates, but we should be going far

afield to theorize on atavistic tendencies of the gland in explaining this abnormality. It should be borne in mind that this gland is changing its position and growing rapidly between the layers of the primitive mesentery from the time the anlagen appear until the gland becomes firmly fixed to the parietal peritoneum of the posterior abdominal wall, and, at the same time, the stomach is developing, the intestine is rapidly increasing in length and pulling with it the mesentery so that there is a movement of these tissues in directions opposed to that of the pancreas.

In man, the primitive anlage which develops into the pancreas appears when the embryo is from 3 mm. to 4 mm. in length. At this time the primitive intestine is an almost straight tube and the buds are

Fig. 9.—Taken from Toldt's Atlas of Anatomy 4:451, 1914.

comparatively large. The growth of the pancreas, like that of the liver, suprarenals and kidneys, is very rapid, and it attains a comparatively large size before the intestine is markedly increased in length (Fig. 9). The dorsal and ventral pancreatic anlagen conjoin when they meet posterior to the duodenum, and continue to grow upward and to the left.

During the partial circumrotation of the posterior and anterior pancreatic anlagen until they coalesce to form one body, and during the migration of the body upward, its branching buds come in contact with the wall of the stomach, intestine or mesentery and may become engrafted thereon. Later, as the gland pulls away in its growth and movement, the small bud which has become attached to the wall of the intestine is cut off and becomes incorporated in the wall of the intestine as a graft. As the intestine grows in length, the graft becomes further separated from the pancreas, unless the graft happens to be in the stomach or duodenum.

While the gland is growing and changing its position in the primitive mesentery, the mesentery is also growing and pulling in the opposite direction. In this manner, a bud may become attached to the mesentery and be pulled away from the gland. This may explain the case reported by Warthin in which he found an accessory pancreas in the fat of the great omentum.

TABLE 1.—ACCESSORY PANCREAS: THIRTY-TWO CASES REPORTED IN THE LITERATURE SINCE 1904

Year	Reported by	Location	Microscopic Structure
1894	Biggs ²	Pylorus	Pancreas
1901	Gandy and Grif- fon ¹⁶	Duodenum	Pancreatic acini, ducts and islets
1903	Reitmann ¹⁷	Ileum	Pancreatic acini, ducts and islets
1903	Reitmann ¹⁷	Jejunum	Pancreatic tissue
1904	Turner ¹⁸	Jejunum	Pancreatic acini and ducts
1904	Bize ¹⁹	Diverticulum of intestine	Pancreatic acini and ducts
		Diverticulum of intestine	Pancreatic acini and ducts
1904	Müller ²⁰	Stomach	Pancreatic acini and ducts
1904	Alburger ²¹	Jejunum	Pancreatic acini and ducts
1905	Lewis ²²	Small intestine	Pancreatic acini and ducts
1905	Mayo-Robson ⁹	Duodenum	Pancreatic acini
1906	Thelemann ²³	Stomach	Pancreatic acini, ducts and islets
1907	Basselt ²⁴	Diverticulum of duodenum	Isolated bits of pancreatic tissue
1907	Basselt ²⁴	Diverticulum of duodenum	Isolated bits of pancreatic tissue
1908	Branham ¹²	Stomach	Malignant adenoma of pancreatic tissue
1908	Clogg ²⁵	Diverticulum of intestine	Pancreatic tissue
1908	Thompson ²⁶	Diverticulum of intestine	Pancreatic tissue
1909	Reynier and Mas- son ²⁷	Pylorus	Pancreatic acini, ducts and islets
1909	Von Heinrich ²⁸	Jejunum	Pancreatic acini and ducts
1910	Weidman ²⁹	Splenic capsule	Pancreatic acini, ducts and islets
1911	Finkelstone ³⁰	Jejunum	Pancreatic acini and ducts
1912	Gibson ¹⁰	Stomach	Pancreatic acini and ducts
1913	Carwardine and Short ³¹	Jejunum	Pancreatic tissue
1913	Carwardine and Short ³¹	Jejunum	Pancreatic tissue
1913	Kremer ³²	Jejunum	Pancreatic acini, ducts and islets
1913	Kremer ³²	Jejunum	Pancreatic acini, ducts and islets
1913	Kremer ³²	Jejunum	Pancreatic acini and ducts
1913	Kremer ³²	Jejunum	Pancreatic acini, ducts and islets
1913	Kremer ³²	Jejunum	Pancreatic acini, ducts and islets
1913	Kremer ³²	Duodenum	Pancreatic acini, ducts and islets
1918	Benjamin ¹³	Jejunum	Pancreatic acini and ducts
1919	Nieuwenheijse ³³	Stomach	Pancreatic tissue

The buds from the primitive anlage contain the germinative cells from which all the histologic units of the gland can develop. So, in case the graft finds a suitable environment and lives, it will develop into a small accessory gland with all the function of the pancreas. The size to which the accessory pancreatic tissue grows is in proportion to the normal capabilities of development of the bud which becomes engrafted in the abnormal situation, and of the environment it finds therein.

16. Pancréas surnuméraire. Bull. et mém. Soc. anat. d. Paris **76**:451-453, 1901.

17. Zwei Fälle accessorischem Pankreas, Anat. Anz. **23**:155-157, 1903.

18. An Example of Accessory Pancreas, Lancet **2**:1566, 1904.

19. Etude anatomo-clinique des pancréas accessoires situés a l'extrémité d'un diverticule intestinal, Rev. d'orthop. **5**:149-159, 1904.

20. Accessory Pancreas in Posterior Wall of Stomach, Proc. Path. Soc., Philadelphia **7**:225, 1904.

21. Aberrant Pancreas in Wall of Jejunum, *Proc. Path. Soc., Philadelphia* **7**:227-229, 1904.
22. Note Upon an Accessory Pancreas in the Intestinal Wall, *Med. & Surg. Rep. City Hosp., Boston*, 1905, p. 172.
23. Ueber accessorisches Pankreas in der Magenwand, *Deutsch. Ztschr. f. Chir.* **85**:692-709, 1906.
24. Duodenal Diverticula, with Especial Reference to Diverticula Associated with Pancreatic and Biliary Ducts, *Tr. Chicago Path. Soc.* **7**:83-94, 1906-1909.
25. Acute Intestinal Obstruction, *Lancet* **1**:639-640, 1908.
26. Diverticula of the Intestinal Tract, *Lancet* **1**:860, 1908.
27. Sténose pylorique due à un lobule pancréatique aberrant, *Bull. de l'Acad. de méd.* **62**:100-106, 1909.
28. Ein Beitrag zur Histologie des sogen, akzessorischen Pankreas, *Virchows Arch. f. path. Anat.* **198**:392-401, 1909.
29. Aberrant Pancreas in the Splenic Capsule, *Proc. Path. Soc., Philadelphia* **13**:267, 1910.
30. Accessory or Aberrant Pancreas, with Report of a Case, *J. A. M. A.* **57**:1124-1125 (Sept. 30) 1911.
31. The Surgical Significance of the Accessory Pancreas, *Ann. Surg.* **57**:653-657, 1913.
32. De la fréquence des pancréas accessoires, *Arch. de méd. expér. et d'anat. path.* **25**:595-602, 1913.
33. Over het pancreas accessorium, *Nederlandsch Tijdschr. v. Geneesk.* **26**:2105-2113, 1919.