

The use of this pancreatic enzyme is difficult to understand, since any milk taken by the mouth would be coagulated in the stomach by the rennin there present. A similar difficulty exists regarding the purpose of rennin in the gastric secretion of fishes and other animals from whose food milk is absent, as also regarding the presence of milk-curdling ferments in the juices of certain plants. A possible explanation is that such ferments may have a less obvious action upon other forms of proteid, a fact which yet remains to be discovered. *Benjamin Moore.*

PANCREAS, DISEASES OF THE.—The great importance of diseases of the pancreas was not generally recognized by the medical profession until within comparatively recent times, but that pathological alterations of the organ not uncommonly exist was known to all of the older pathologists. That changes in the pancreas sometimes occur in individuals who have diabetes mellitus was first recognized by Cowley in 1788, but prominence was not given to the matter until 1877 when Lancereaux's work was published, and the relation between the two conditions has been recently definitely proven by the experimental work of von Mering and Minkowski. Spiess in 1866 recognized hemorrhage into the pancreas as being a frequent cause of sudden death, and Zenker some years later accentuated this relation; but its great importance was first fully recognized by Draper, who particularly directed attention to it in 1886. In 1889 Draper's fellow-townsmen, Fitz, in a most admirable paper, opened up a new field to the clinician in bringing together a great mass of isolated facts concerning pancreatitis, and coordinating them in such a masterly manner that since this time inflammations of the organ have been brought within the list of those diseases which may be diagnosed. Several years before the appearance of the article by Fitz, Senn, of Chicago, very thoroughly reviewed the subject of pancreatic cysts. In the article that follows the writer wishes particularly to express his indebtedness to the various papers upon this subject written by Fitz, to the chapter on these diseases in Osler's "Practice of Medicine," and to the recent monograph upon the subject by Koerte.

FATTY AND HYALINE CHANGES IN THE PANCREAS, AND AMYLOID INFILTRATION.

FATTY CHANGES.—The fatty alterations that occur in the pancreas may be divided into (a) fatty degeneration, and (b) fatty infiltration.

(a) In many acute diseases, especially in those accompanied by high temperature, *fatty degeneration* occurs in the pancreatic cells. Happily, the condition is one that passes away with its cause, and is not generally supposed to give rise to serious or permanent change in the organ. There is no symptomatology of the condition.

(b) *Fatty Infiltration.*—This condition is frequently observed in obese individuals, and is not generally believed to produce any serious interference with the functions of the organ, though cases of diabetes have been reported in which this lesion was present in the pancreatic tissues to a marked degree. In these instances it is likely, as in a case recently observed by the writer, that the fatty changes were secondary to interstitial pancreatitis and that they were not responsible for the diabetic condition.

HYALINE DEGENERATION.—In a very interesting paper Opie has recently called attention to the fact that diabetes sometimes occurs in which the only alteration found post mortem is hyaline degeneration of the islands of Langerhans in the pancreas. Whether or not there is any connection between the two conditions cannot as yet be stated with certainty.

AMYLOID INFILTRATION.—Amyloid infiltration of the coats of the blood-vessels of the pancreas occurs in those conditions in which this material is being produced in the body. So far as is known it does not give rise to any serious alterations of the pancreatic functions.

PANCREATIC HEMORRHAGE.

Pancreatic hemorrhage is a condition that occurs to a slight degree in quite a number of different affections, but the term is here limited to those sudden and profuse extravasations of blood into the organ that are commonly known as pancreatic apoplexy.

Etiology.—In the vast majority of instances those suffering from severe pancreatic hemorrhage have passed middle life, and the disease appears particularly to affect corpulent individuals. In many instances those who have had the disease have been addicted to the continuous use of alcohol. It commonly occurs also in those who have previously suffered more or less with "indigestion," and in many cases there appear to have been previous mild attacks. It is more common in males than in females. In some instances it has followed injury. As to the exact nature of the condition of the blood-vessels that predisposes to this disease we are still in great ignorance, careful microscopic studies being much needed to elucidate this rather obscure morbid state. It has been assumed by some that syphilitic disease of the blood-vessels is the most common cause of the malady, but adequate proof of this has not as yet been brought forward. That minute hemorrhages occasionally occur in the pancreas as the result of chronic induration of the organ there can be no question, and extravasations of a similar kind are occasionally found in connection with obstructive diseases of the circulation—such as are produced by organic heart lesions, emphysema, and tumors pressing upon the inferior vena cava. Recently Chiari has shown that minute hemorrhages are sometimes produced in the pancreas by what appears to be post-mortem digestion of portions of the organ.

Morbid Anatomy.—In cases of severe hemorrhage into the pancreas the entire organ may be blood-stained, and be either of an almost black, dark purple, or brownish-red hue. In by no means all instances, however, does the gland as a whole present this appearance, as all degrees of hemorrhage are met with from the complete infiltration of the organ to single, minute ecchymotic spots situated in some part of the substance of the gland. In the affected region the pancreas is usually distinctly increased in size, though in some instances it appears to be normal in bulk. The organ may be of normal consistency, distinctly softened, or quite friable. It is of interest to note that in no instance has any one succeeded in finding the blood-vessel from which the hemorrhage came. Under the microscope the tissues of the pancreas may present a practically normal appearance, though, especially in obese individuals, more or less fatty infiltration is generally present. Blood in various stages of disintegration is found both within the interstitial tissues of the organ, and within its parenchyma in the diseased regions. In some instances the tissues of the pancreas present evidences of extensive necrotic change, as was observed by the writer in one instance in which the nuclei of all of the cells in the affected areas entirely failed to take basic stains. It not uncommonly happens that the hemorrhage does not remain confined to the pancreas, but extends into the surrounding retroperitoneal tissues, even so far as the left kidney, and it occasionally forces its way into the fat of the omentum and mesocolon.

Symptoms.—The disease comes on in almost all instances with extraordinary suddenness, the individual having usually been in perfect health previously, though in rare cases the condition is preceded by slight prodromal pains in the upper part of the abdomen. In most instances the pains are confined to the region of the pancreas, but in some cases they may be diffused throughout the abdomen, and have been sometimes mistaken for colic in the beginning. Following the pain there are usually nausea and vomiting of a most persistent kind, and occasionally there is an urgent desire to defecate. Along with these symptoms a profound depression of the vital powers invariably occurs; the pulse is small, feeble, and exceedingly rapid. There is pronounced and oftentimes urgent dyspnea, the patient tosses from one side of the bed to

the other, is bathed in cold perspiration, the countenance exhibits great anxiety, and there is every symptom of impending dissolution. In a comparatively short time the abdomen not uncommonly becomes swollen, and tenderness develops in the epigastric region. The temperature is either normal or subnormal. Constipation is quite frequent. If the hemorrhage is at all extensive the patient rapidly grows worse, and death usually occurs within a few hours. There can be no question that recovery sometimes follows the milder forms of the disease.

Diagnosis.—Pancreatic apoplexy is distinguished by the sudden onset, with excruciating pains in the epigastric region, nausea and vomiting, and rapid collapse. It is differentiated from intestinal obstruction by the sudden onset, and by the extreme urgency of the symptoms. In biliary colic the history, the absence of excessive vomiting, and symptoms of collapse serve to distinguish between the two conditions. In gastric and duodenal ulcer perforation is preceded by frequent attacks of severe pain in the epigastric region, tenderness over the site of the ulcer, and the vomiting of blood. Moreover, ulcer generally occurs in anemic young women.

Prognosis.—In all cases of severe hemorrhage death follows in a very short time, the patient not, as a rule, surviving longer than two or three hours. On the other hand, when the amount of blood effused is small, recovery may occur, though in these cases the condition very quickly becomes one of pancreatitis. Patients have survived even very severe hemorrhages, as is conclusively shown by the fact that recovery has occurred in several instances in which the diagnosis was made by an exploratory incision.

Treatment.—The nature of the lesions in this disease makes it, of course, impossible for drugs in any way to influence the local condition, and the treatment is therefore necessarily entirely of a symptomatic kind. Morphine should be given to relieve the pain, and the collapse should be treated in the usual way by the application of warmth, and by the hypodermatic injection of strychnine and atropine. For the reason that death in this condition cannot be produced merely by the loss of blood, but is brought about by the pressure exerted upon the surrounding nerve structures, it has been suggested that free incisions around the pancreas might relieve this condition, and thus be the means of saving the patient's life.

ACUTE PANCREATITIS.

There are at least three more or less separate and distinct varieties of acute inflammation of the pancreas: (a) the acute hemorrhagic, (b) the acute suppurative, and (c) gangrenous pancreatitis, each of which demands separate consideration.

(a) **ACUTE HEMORRHAGIC PANCREATITIS.**—By the term acute hemorrhagic pancreatitis is meant that condition of the pancreas in which the hemorrhagic lesion is accompanied by evidences of so-called inflammation. This condition cannot be clearly separated from that of simple pancreatic hemorrhage, the latter merging insensibly into the former.

Etiology.—This disease is much more commonly observed in persons past middle life than in the young, but instances have been reported in which the malady occurred in children, the sufferer in one instance being only nine months old. It is more common in males than in females, though the number of recorded instances of the disease is not as yet sufficiently great to determine its relative frequency in the two sexes with certainty. It occurs more commonly in obese individuals than in those who are lean. In quite a large percentage of the recorded cases the subjects have been alcoholics. Like pancreatic apoplexy this condition has been frequently observed to occur in individuals who had previously suffered for a greater or less length of time with derangements of the digestion, and in some cases there has been a clear history of previous attacks of the malady. It is also noteworthy that many of those who have had the disease had pre-

viously suffered for a period of years with unmistakable symptoms of gall-stones and inflammatory states of the gall-bladder. In view of the fact that in conditions of this kind bacteria are always present in the gall-bladder and ducts, the investigations of Hlava, Williams, and Flexner, who produced experimental inflammations of the pancreas by the injection of various bacteria, seem to be of special significance.

Morbid Anatomy.—In acute hemorrhagic pancreatitis the pancreas presents much the same macroscopic appearances that it exhibits in pancreatic apoplexy. The organ, wholly or in part, is almost black, of a purple hue, or of a dark red color, and in the affected regions is considerably swollen. The tissues of the gland are in some instances softened and quite friable. The amount of hemorrhage varies in different instances. It may be confined to the head, body, or tail of the organ, or may be diffused throughout its entire extent. Not uncommonly the hemorrhage extends into the retroperitoneal tissues, and is frequently found present in the omentum, mesentery, and mesocolon. The spleen may be enlarged. Within the pancreas itself there are not uncommonly found small areas of a dull whitish opaque appearance that are made up of fat which has undergone a peculiar chemical alteration. This change in the fat is known as *fat necrosis*, and is dependent upon the fat-splitting ferments elaborated in the gland. Williams describes the appearance as follows: "Frozen sections of the white necrotic nodules showed them to be made up of coarse granules and masses, globules and crystals, and a small amount of masses of brown pigment. Many of the opaque masses were about the size and shape of fat cells, and evidently represented altered fat cells. The surrounding tissues were mildly congested; a few small extravasations were noted; the fat cells appeared normal. Sections of the same embedded in colloidin, and stained with hæmatoxylin or carmine, give similar results." It is noteworthy that tetroxide of osmium is not reduced by the structures composing these necrotic tissues. It has been shown by Langerhans that the areas of fat necrosis are made up of a substance that results from the combination of lime with certain fatty acids. Osler speaks of a case in which death was the result of Bright's disease, and in which the lobules of the pancreas were entirely isolated by areas of fat necrosis with extensive deposition of lime salts. In hemorrhagic pancreatitis it very frequently happens that areas of fat necrosis are found in the fatty tissues of the omentum, mesentery and mesocolon, and in the adipose tissues situated behind the gland. It should be remarked, however, that minute areas of fat necrosis are sometimes found in the living human being where there is no disease of the organ, and Chiari has shown that post mortem there are often found in the pancreatic tissues minute alterations that appear to be the result of auto-digestion—alterations which bear a close relation to the necrosis that occurs in the fatty structures. Balsler, who first accurately described the condition in man, has also shown that it not uncommonly occurs in the fatty tissues around the pancreas in healthy swine. This observation has been recently confirmed in this country by Williams, who has also shown that it occasionally occurs in the abdominal adipose tissues of the cat. It is very interesting to note that experimental fat necrosis in connection with hemorrhage into the pancreas has been produced artificially by a large number of investigators, among whom are to be especially mentioned Hlava, Langerhans, Hilderbrand, Dettmer, Williams, Flexner, Rosenbach, and Opie. These investigators have shown that the condition may be induced in dogs and other animals by the injection, into the pancreas or its ducts, of bacteria, acids or alkalis, by ligation of the organ, by simply injuring it or by injuring it and at the same time infecting it with bacteria, and by the introduction of sections of fresh pancreas into adipose tissue.

Symptoms.—The initial symptoms that usher in an attack of acute hemorrhagic pancreatitis are those of pancreatic hemorrhage. There is a sudden onset with ex-

cruciating pain in the upper part of the abdomen, vomiting, and all indications of collapse. However, in some instances the disease does not begin with such violent symptoms, there being a period of days or even weeks during which there are slight, oftentimes colicky pains in the abdomen, combined with a certain amount of tenderness: constipation is, as a rule, present. The temperature, which in the beginning may be normal or subnormal, becomes somewhat elevated as the so-called inflammatory phenomena develop in the diseased organ; but, as a rule, the fever does not go above 103° F. About the time that the fever begins, chilly sensations are not uncommonly complained of, and even pronounced chills are occasionally encountered. The pulse is always rapid, and as a fatal termination is approached, it becomes weaker and weaker, and finally uncountable. The respiration is almost in all instances shallow and decidedly hurried. In most cases after the disease has existed for a short time the abdomen becomes distinctly swollen, and is exceedingly tender in the epigastric region. In some instances it has been possible to feel the swollen pancreas through the abdominal walls, though this cannot, as a rule, be accomplished.

Diagnosis.—Although this disease was always overlooked until a comparatively short time ago, the diagnosis, thanks to the brilliant work of Fitz, has been recently made in a large number of cases. Where a previously healthy person is suddenly seized with intense pain in the upper part of the abdomen, with nausea and vomiting, and with pronounced symptoms of collapse, this disease should be always suspected. Of all the conditions simulating acute hemorrhagic pancreatitis, acute intestinal obstruction is perhaps the one that may be most readily mistaken for it; but the former malady may be distinguished by the suddenness of the seizure, by the pronounced symptoms of collapse, and by the absence of distention of the intestine in the early stages. The further fact is of importance that obstruction of the small intestine in the region of the pancreas is very infrequent, and the patency of the large intestine can be always readily determined by inflation. Biliary colic may also be mistaken for pancreatitis, but may be generally distinguished from it by the history of previous attacks, by the situation of the pain, and by the absence of pronounced symptoms of collapse. It should, however, be remembered that several instances of pancreatitis have been recorded in which the patient had previously suffered from biliary colic. In the later stages of acute hemorrhagic pancreatitis inflammatory exudates collect in the lesser omentum to such an extent that the condition somewhat resembles that of pancreatic cyst, but the history of the case and the pronounced septicæmic state that often occurs in connection with it will serve to make the diagnosis clear. In case of doubt the physician may resort to aspiration, which will determine the true nature of the condition with certainty. The symptoms that occur in connection with perforation of the stomach or duodenum, resulting from ulcer, somewhat resemble those which are found in this disease; but generally the two may easily be distinguished by the history of severe pain following the taking of food, the vomiting of blood, and the increased secretion of hydrochloric acid that are so characteristic of the former conditions. Irritant poisons might give rise to some of the symptoms usually observed in pancreatitis, but the history of the case and the absence of the evidences of corrosive action in the mouth and throat and the character of the vomit, will generally serve to make clear the true nature of the condition.

Prognosis.—Although acute pancreatitis is a very fatal disease, there are numerous instances on record in which recovery occurred even from the severer forms of the malady. If the patient survive the first few days of the disease there is always hope for ultimate recovery, though even in these cases a death from septicæmia and exhaustion generally occurs in from two months to a year. In the latter stages abscesses in and around the pancreas not uncommonly occur, and inflammatory exudates often collect in the lesser omentum to a considerable extent.

In these instances laparotomy and the establishment of proper drainage are absolutely essential to the preservation of the patient's life, and as we learn to make the diagnosis with more certainty there can be no doubt that fatal terminations will become less and less frequent. Cases have been recorded in which diabetes followed the disease.

(b) **ACUTE SUPPURATIVE PANCREATITIS.**—Acute suppurative pancreatitis is a condition that fortunately is rarely observed, it being much less frequent than the hemorrhagic form. Pus may be diffused throughout the organ, or it may be localized. Not uncommonly the neighboring viscera are secondarily affected, and the abscess may perforate into the stomach, into the small intestine, or into the peritoneal cavity. Secondary abscesses in the lesser omentum have in a number of instances been produced, and thrombosis of the portal vein has been noted. The spleen is often enlarged. This disease has in some instances followed injury; but in quite a number of cases, further than that the patient had previously suffered with disturbances of the digestion, the origin of the affection was not apparent. It should also be remembered that this condition may be encountered as a sequel to the acute hemorrhagic form of the malady.

The **symptoms** of this disease are by no means so characteristic as those that are encountered in the hemorrhagic form of the affection; although there is always more or less pain localized in the region of the organ, it is never so intense, and does not come on with such suddenness as in the hemorrhagic form; and vomiting, although quite common, is not so persistent. Intense pain in the sciatic nerves may occur. Patients suffering with this disease very quickly develop the symptoms of septicæmia or septicæmia, usually having irregular rises and falls in temperature, profuse sweats, and chills, and they present the profound depression of the general system that is so characteristic of blood poisoning. In a number of cases it has been possible by palpation to discover, in the region of the pancreas, the presence of a tumor; and this discovery, whenever it can be made, is of the utmost importance from a diagnostic standpoint. Jaundice and sugar in the urine have been noted in some instances.

(c) **GANGRENOUS PANCREATITIS.**—Gangrenous pancreatitis usually follows the acute hemorrhagic form of the disease, and may be partial or complete; it has been known also to follow the suppurative variety of the affection, and has in some instances resulted from injury.

Under these circumstances the pancreas becomes totally or in part necrotic, and the diseased parts are soft, have a foul odor, and present a dark, slaty appearance. In many instances the diseased tissues have completely sloughed away from the remains of the organ; they then commonly lie along with masses of pus and broken-down tissue in the cavity of the omentum. Notwithstanding the extremely dangerous situation in which a patient must, under these circumstances, be placed, instances of recovery after operation are not wanting; and Trafoyer and Chiari have reported cases in which sloughs of the pancreas made their way into the cavity of the intestines, and were discharged from the bowels.

As this condition is usually secondary to acute hemorrhagic pancreatitis, its early **symptoms** are those of this disease. After the necrosis in the tissues occurs there follow septicæmic symptoms, in combination with tenderness in the upper part of the abdomen and evidences of a tumor-like mass in the same situation.

Treatment.—The treatment of acute hemorrhagic pancreatitis in the beginning is that of pancreatic apoplexy. The agonizing pain requires the exhibition of full doses of morphine hypodermically, and the symptoms of collapse should be treated by the subcutaneous injection of strychnine, atropine, and whiskey, and by the application of external warmth to the body. Following this the treatment should be entirely symptomatic. The diet should be relatively free from fat. The administration of portions of raw pancreas, with the food, has been recommended by some, as the food is in this way brought

more or less in contact with the pancreatic juices which are so necessary for proper digestion. Diastases are also useful if they be administered immediately after food is taken, as they take the place of the pancreatic juices in a measure. In the suppurative and gangrenous forms of the affection laparotomy offers the best hope for the ultimate recovery of the sufferer. In the latter stages of all forms of the disease the patient requires a supporting, nourishing diet, with the administration of stimulants and tonics.

CHRONIC PANCREATITIS.

By the term chronic pancreatitis is meant the gradual increase of the fibrous and elastic tissues that are normally found in the pancreas, this change resulting in the compression and ultimate destruction of a greater or less amount of the glandular structure of the organ. Such a chronic inflammation is a matter of very great importance, inasmuch as it is very commonly associated with diabetes mellitus.

Etiology.—Birch-Hirschfeld showed, a number of years ago, that chronic fibroid thickening of the pancreas not uncommonly results from congenital syphilis, and his conclusions have been recently confirmed in a most admirable article by Schlesinger. It has been also assumed by some that acquired syphilis is likewise capable of inducing chronic induration of the organ, but its causal relation to the present disease has not as yet been conclusively shown. Quite a number of cases have occurred in those who have been addicted to alcohol, and the inference therefore seems justifiable that this habit may in some way predispose to this morbid state. There seems good reason to believe that catarrhal conditions of the duodenum, leading to changes of a similar kind in the common and pancreatic ducts, give rise in some instances to this affection, and we have abundant proof that closure of either of these ducts by means of gall-stones, pancreatic calculi, or in other ways, results in chronic indurative change in the organ. Experiments on animals have also shown that ligation of the duct of Wirsung is followed by an increase in the fibrous structures of the gland. "Fibrous thickening of the pancreas is even associated with ulcer of the stomach or duodenum, tumors of the stomach or suprarenal capsule, aneurism of the aorta or celiac axis, or with disease of the spine" (Fitz). Dilatation and obstruction of the pancreatic duct is not uncommonly the result of chronic induration of the organ. The writer has recently recorded a case in which diabetes quickly followed mumps, and the theory was suggested that an acute pancreatitis was in this case produced by the poison of this disease, and that subsequently chronic changes occurred, giving rise to glycosuria.

Morbid Anatomy.—Fibroid thickening of the pancreas is most frequent in the head of the gland, but the disease may be limited to other parts of the organ, or may involve it throughout. Opie has recently written a number of interesting articles upon the subject of chronic induration of the pancreas, and he recognizes two different varieties of the disease: (1) Interlobular pancreatitis, characterized by the proliferation of fibrous tissue between the lobules which are invaded from the periphery; and (2) interacinar pancreatitis, where the newly formed fibrous tissue is more diffusely distributed between the lobules and individual acini. This writer asserts that the interlobular form of the disease is that variety which follows occlusions of the pancreatic duct, and, although the parenchyma of the gland is in a large measure replaced by fibrous tissue, the islands of Langerhans are for the most part unaffected, and diabetes is but rarely observed. In the interacinar form of the malady the areas of Langerhans are on the other hand quickly destroyed, and in these instances diabetes always occurs. It was suggested many years ago by Laguesse, and later by Schaefer and Diamare, that Langerhans' bodies exert the important function of controlling carbohydrate metabolism, and Ssobolew has recently brought forward as experimental proof of this fact that after feeding animals with carbohydrates in considerable quantities

the cells of the islands became more granular than usual. There is therefore some experimental evidence that Langerhans' islands are in some way associated with the assimilation of carbohydrates. There is even stronger pathological proof of this relation in the human being. The experiments of von Mering and Minkowski, by which the close relation of diabetes mellitus to alterations of the pancreas was so clearly shown, are so well known, and have been so frequently cited, that it does not appear necessary to consider the matter at length in this article. In all cases in which the fibrous change has advanced to any great extent the pancreas is found distinctly diminished in size, and its surface is more or less roughened and nodular; on the other hand, where the changes are not so pronounced the organ may be but little smaller than normal, and its surface may be comparatively smooth. On section its consistence is found to be considerably increased, and its tissues are, as a rule, even paler than normal. The subperitoneal tissues surrounding the pancreas are in some instances likewise thickened. Fatty changes are oftentimes extreme, and, as in a case recently observed by the writer, the entire organ may present the macroscopic appearance of a mass of ordinary fat, though on microscopic examination the fibrous tissues are found to be greatly increased. In some instances these fatty alterations are not so extreme, there being merely small yellowish spots scattered throughout the organ. In some cases hamatoidin crystals, crystals of fatty acids, and calcareous granules are found scattered throughout the substance of the gland.

The fibrous changes not uncommonly result in constriction of the pancreatic ducts at various points, causing them to appear dilated and tortuous, though this does not always occur.

Symptoms.—Progressive loss of flesh and strength and the various indications of alteration in the digestion are the symptoms that are most commonly observed in chronic pancreatitis. There are usually loss of appetite, belching, pyrosis, nausea, and a sense of weight and fullness in the epigastrium, and occasional vomiting. Diarrhoea very commonly exists, and the feces are frequently fatty, and may be colorless even when no jaundice exists. The sclerotic changes have in some instances compressed the common duct, in which case jaundice, of course, supervened. In connection with the influence of the pancreatic secretion on the chemical changes occurring in the fatty foods ingested the observations of Mueller are very interesting. He has shown in three cases of pancreatic disease that the fat contained in the feces was by no means decomposed to such an extent as is the case in health. He found that normally 84.3 per cent. of the fat contained in the stools is split up, forming free fatty acids and soaps; and in a number of instances this percentage was practically that found in the discharges of individuals suffering from other diseases than those of the pancreas. On the other hand, in instances in which the pancreatic secretion does not reach the intestine he found that on an average only 39.8 per cent. of the fat occurred as fatty acids and soaps. It is, of course, obvious that such a pronounced variation from the normal must occur only in those instances in which there is suppression of the greater part, or all, of the pancreatic secretion, and that in cases in which the stenosis of the pancreatic duct is only partial, the proportion of altered fat in the feces will be considerably greater. It is therefore clear we cannot assume that the greater part of the fat will appear as such in the stools in all cases of pancreatic disease. Notwithstanding this, an analysis of the discharges will probably be found of value in obscure cases. The examination is conducted as follows: The feces are heated at a temperature of 100° C. until thoroughly dried, and then finally are pulverized. This powder is then treated with alcohol, acidulated with hydrochloric acid, and boiled. This causes the soaps to become again free fatty acids, the neutral fats remaining unaltered. The mass is then thoroughly dried, and is treated with ether for three days in a Soxhlet apparatus. The ethereal extract is then filtered and evaporated, dissolved in abso-

lute ether, again filtered, dried, and weighed. This determines the amount of neutral fat, and both the free fatty acids and those that were in combination forming soaps. A weighed portion of this mass is then dissolved in warm alcohol containing a small amount of ether, and a few drops of an alcohol solution of phenolphthalein are then added, and the solution is titrated with caustic potash in alcohol. From the results of this titration we estimate the amount of free fatty acids present in the entire residue, and this, subtracted from the total weight of the mass, gives the amount of neutral fat.

Since the time of Cowley it has been known that diabetes mellitus is not uncommonly associated with alterations in the pancreas, and a large number of observations made within recent times show beyond question that the relation is not an accidental one, and that diabetes is in many cases the result of disease of this organ, interstitial pancreatitis being the lesion most commonly found. The brilliant investigations of von Mering and Minkowski have shown experimentally that diabetes may be produced in the dog and other animals by the extirpation of the pancreas, and instances are not wanting where the removal of the organ in man has resulted in severe glycosuria. The theory has been suggested by Minkowski that the pancreas elaborates "a glycolytic ferment" by means of which the sugars are chemically changed in the body, and that when the pancreas is removed or destroyed, this ferment being no longer present, glycosuria results. It has been thought by others that this experimental diabetes is the result of disturbed tissue-metamorphosis produced by the absence from the intestine of the pancreatic juices—a view supported by the fact that diabetes may follow ligation of the duct of Wirsung. Despite the fact that diabetes frequently follows organic alterations in the pancreas, it is but proper to state that this condition by no means always results; and, further, that there are on record many instances of diabetes in which no changes could be found in this organ. It is of interest to note that Picenti and Gerhardt have claimed that the percentage of indican in the urine is much lowered in diseases of the pancreas.

Diagnosis.—The diagnosis of this disease is exceedingly difficult, for it never gives rise to symptoms that are in any way characteristic. The condition may, however, be suspected when the patient is found to suffer from long-continued derangements of the digestion, loss of strength and flesh, in combination with the presence, in the feces, of an increased amount of fat, which, according to Mueller, exists in a state of free neutral fat, and not broken up into fatty acids. In conjunction with these glycosuria, when present, is of course of great importance in deciding the true nature of the disease, though it should never be forgotten that this condition may occur when the pancreas is in no way affected. For the reason that salol is not decomposed in the intestine in the absence of the pancreatic juice, the failure of carbolic acid to appear in the urine after the administration of full doses of this drug would be strong presumptive evidence of either the total destruction of the secreting structure of the organ or of the occlusion of its duct.

Prognosis.—As regards recovery the prognosis is, of course, hopeless, for we are acquainted with no means by which the process in the pancreas may be cured or even stayed. However, on account of the fact that the disease progresses very slowly, and that great destruction of the parenchyma of the organ is necessary before pronounced symptoms are produced, those suffering with the affection generally survive for a considerable period of time.

Treatment.—The treatment of chronic pancreatitis necessarily resolves itself into seeing that the patient lives under proper hygienic conditions, takes a sufficient amount of outdoor exercise, and gives the necessary attention to the diet. Inasmuch as fats and starches are digested by the secretion from this organ, it is of much importance that these articles be eliminated in a large measure from the diet of the sufferer, and the necessity for a precaution of this kind is often accentuated by the

coexistence of glycosuria. It is practically impossible entirely to withdraw carbohydrates from the dietary. The administration of some diastatic ferment to the food is of decided value, or small pieces of raw pancreas may be substituted, inasmuch as it has been shown that the digestion of foods and starches is greatly promoted by its use under these circumstances. Other symptoms have to be treated as they arise.

PANCREATIC CALCULI.

Calculi are occasionally formed in the pancreatic ducts where they may remain, or from which they may be discharged through the duct of Wirsung and common duct into the duodenum.

Etiology.—Pancreatic calculi are occasionally encountered post mortem, and there are several instances in which the passage of the stones through the ducts into the duodenum has been diagnosticated in life. The condition, however, is one which is rarely encountered, being much less frequent than cholelithiasis. Concerning the causation of this affection it is generally assumed that catarrhal changes in the ducts most frequently give rise to it, but in all probability it may be also associated with the lithæmic diathesis.

Morbid Anatomy.—The calculi are usually quite small, being, as a rule, not larger than a grain of sand, though instances have been recorded in which stones of this kind were more than an inch in diameter. There may be only a single calculus or there may be large numbers, more than one hundred having been found in a single instance. They are usually rounded or oblong, but they may be quite irregular in form. In many instances their surfaces are smooth, though they may be decidedly roughened. They are usually of a light color, and consist generally of carbonate of lime, though they may be composed of phosphate of lime, or a stone may consist of a combination of the two. In some instances they consist of organic material.

In cases in which the calculi become impacted either in the duct of Wirsung or in the common duct, great dilatation of these canals results, and these distentions may be so increased in size that they present the appearance of being cysts. As a result of the stoppage of the pancreatic duct chronic interlobular pancreatitis is sooner or later produced, and in rare instances suppuration of the organ occurs. Fistulous openings have sometimes resulted, the dilated ducts communicating with the stomach, duodenum, or peritoneal cavity. The irritation produced by these stones is supposed by some to lead to the development of cancer.

Symptoms.—In the few instances in which the passage of pancreatic calculi has been diagnosticated during life, the symptoms came on somewhat suddenly with severe pain in the epigastric region, somewhat to the inner side of the left mammary line. From this point the pain generally extended around the border of the ribs on the left side to the spine, and later radiated into the left shoulder. During the height of the attacks vomiting has been noted, and in the case of Cipriani there were salivation, polydipsia, glycosuria, fatty diarrhœa, fever, and great weakness. Following the attacks thirst and hunger have generally been pronounced. In the case just referred to, there were repeated attacks, and the diagnosis was confirmed by the finding of a stone in the feces. In the case reported by Poliakoff the patient complained of severe pain in the abdomen for two and a half months, the pain being sometimes accompanied by vomiting. The sufferer developed hunger and thirst, and sugar was found in the urine. The symptoms are not, however, in all instances so characteristic, for in the case recorded by Minnich the patient could not distinguish between attacks of pancreatic and those of biliary colic, he having previously repeatedly suffered from the latter affection.

In those instances in which the calculi lodged in the duct of Wirsung, causing retention of the pancreatic secretion and secondary changes in the organ, the symptoms

that followed resembled those which occur in chronic pancreatitis. There are similar digestive disturbances, accompanied by loss of flesh and weight, and diabetes occasionally develops. The fat in the feces is generally increased, and is not split up into fatty acids to the same extent as in health. Microscopic examination of the feces will frequently show the presence of much undigested food, unaltered muscle fibres being especially numerous. In those instances in which the ducts become greatly dilated a tumor may be occasionally felt in the region of the pancreas, and when this can be done the presence of such a tumor may be considered of the utmost diagnostic importance.

Diagnosis.—The diagnosis of pancreatic colic is made by noting that the patient is suddenly seized with severe pain in the left epigastric region, the pain radiating around the lower border of the ribs to the spine on the left side, and oftentimes passing up into the left shoulder. Vomiting and glycosuria in some instances have accompanied the passage of the stone. After about two hours the pain usually ceases suddenly, and the patient develops marked hunger and thirst. From biliary colic the condition may be usually distinguished by the facts that in the former condition there is tenderness in the region of the gall-bladder, and that the pain is not confined in such a pronounced way to the left side of the body. It cannot be questioned, however, that a diagnosis between the two cannot always be made with certainty. From acute pancreatitis it is distinguished by the facts that the vomiting is not so severe, that the symptoms of collapse are not so pronounced, and that the pain ceases in the course of a comparatively short time.

In those instances in which the excretory duct of the pancreas is occluded, the symptoms will resemble those of chronic interstitial pancreatitis, though the relation of a calculus to the condition may be inferred when there is a previous history of possible pancreatic colic.

Prognosis.—In pancreatic colic the prognosis is good, as under proper exercise and diet the condition that lies at the bottom of the attacks may usually be entirely relieved.

In those instances in which the concretions have lodged in the excretory duct of the organ, the prognosis is much more unfavorable, as sooner or later chronic interstitial pancreatitis develops. In some cases, however, recovery has followed as a result of the establishment of fistulous communications with the neighboring viscera and the consequent discharge of the stone.

Treatment.—For the relief of the intense pain that accompanies the passage of a calculus, morphine should be freely administered subcutaneously; and, if necessary, ether or chloroform may be given. The application of heat to the abdominal wall may be also of considerable service. In the case of Cipriani the patient recovered under the internal administration of hydrochloric acid, a vegetable diet, baths, and gymnastics. It has also been asserted that the hypodermic injection of 1 c.c. of a one-per-cent. solution of pilocarpine three times a week has resulted in the disappearance of attacks of pancreatic colic. After the stone has lodged in the excretory duct of the organ medical treatment is, of course, no longer of avail; but it seems highly probable that recovery in these instances would frequently follow intelligent surgical intervention.

The treatment of chronic interstitial pancreatitis resulting from the stoppage of the excretory duct of the gland is entirely symptomatic, and is in every way similar to that already recommended for a pancreas which is chronically indurated as a result of any cause whatever.

PANCREATIC CYSTS.

By the term pancreatic cysts is meant the presence in the organ of collections of fluids due to a variety of different causes. Fitz thinks that many reported cysts of the pancreas were circumscribed collections of fluid wholly outside of the organ.

Etiology.—Pancreatic cysts occur with about equal fre-

quency in the two sexes, as of 121 cases of the disease operated upon by surgeons, Koerte found that 61 were males, 56 females, and in 5 the sex was not mentioned. The affection is rather more common after middle life than before, though instances have been reported in which the disease occurred in an infant six months old. As several cases have been reported in very young children, it is highly probable that pancreatic cysts are occasionally congenital, though the more frequent cause is beyond doubt the obstruction of the excretory duct of the gland. Trauma is also recognized as a frequent etiological factor in the production of cysts of the pancreas, as out of 121 cases collected by Koerte, in 33 instances the lesions had followed blows or injuries. Retention cysts which have developed from the smaller ducts of the gland—through their becoming occluded either by a constriction or by the pressure exerted by a calculus or by a tumor of some kind—are sometimes encountered. In a remarkable case reported by Durante a cyst resulted from the obstruction of the duct of Wirsung by a round worm. Parasitic cysts are sometimes likewise found. It is highly probable that in many of those instances in which pancreatic cysts are supposed to have followed injury the condition is really one of inflammation of the tissues surrounding the organ, with the accumulation of inflammatory products.

Morbid Anatomy.—Cysts may occur in any part of the pancreatic tissues, though they are most commonly encountered in the body and tail of the organ. They vary in size from those that are merely microscopic to enormous collections of liquid, an instance having been recorded in which the tumor contained fourteen quarts of fluid. The cysts may be single or multiple. Their walls are, as a rule, smooth, but in some instances papillary new formations spring from them. The inner walls of the cysts are lined by cylindrical epithelium. The fluid is usually of a clear grayish hue, and is slightly opaque, though not uncommonly it is clear and of a straw color; in a few cases, however, and particularly in those of a traumatic nature, it may be blood-stained. The reaction of the liquid is alkaline, the specific gravity varying from 1.010 to 1.024. In many instances the fluid will emulsify fat, convert starch into glucose, and digest albuminous substances, though not uncommonly, especially in older cysts, these properties are entirely wanting. Under the microscope the fluid is found to contain leucocytes, epithelial cells, cholesterol, and small drops of fat.

In many cases the tumors gradually increase in size at the expense of the parenchyma of the pancreatic structures, and this is sometimes so extreme that the gland may be practically destroyed. As the cyst enlarges it usually pushes the stomach upward and the transverse colon downward, though the latter viscus may lie directly in front of it. In rare instances the cyst lies above the lesser curvature of the stomach and pushes the organ downward; and in other cases it develops below both the stomach and the transverse colon. In some instances the walls of the cysts are firmly attached by adhesion to neighboring viscera. The cysts may rupture into the peritoneal cavity, into the stomach, or into the intestines.

Symptoms.—In quite a number of instances the first evidence of the existence of a pancreatic cyst has been the detection of a tumor-like mass in the abdominal cavity, although, as a rule, before these cysts reach a noticeable size other symptoms manifest themselves and first direct attention to them. In the traumatic cases there are usually in the beginning inflammatory symptoms, consisting of pain, vomiting, and more or less pronounced collapse. In all varieties of these cysts usually the most pronounced symptom is pain, which may occur in attacks lasting only a short time, or may be persistent and continued for weeks, months, or even years. The pains are present in the region of the pancreas, and, as in other affections of this organ, they have a tendency to radiate toward the left side, and into the left shoulder. Not uncommonly these painful paroxysms are accompanied by symptoms of deranged digestion, and

as the disease progresses the patient loses in weight and strength. As the cysts enlarge they appear as localized prominences in the upper portion of the abdomen, usually in the left hypochondriac region, though they may be present below the navel. The tumors are globular in shape, smooth, and offer considerable resistance. In most instances they are but slightly movable, and are not, as a rule, affected to any great extent by the respiratory act, but instances have been recorded in which they were pedunculated and could be moved into almost all parts of the abdominal cavity. The cysts are, of course, dull on percussion when not covered by the stomach or intestine. The pulsation of the abdominal aorta is not uncommonly transmitted, though the cysts are never expansile. On auscultation a systolic souffle may be distinctly heard in some instances. The tumor by its pressure may seriously interfere with the functions of neighboring organs in addition to its destructive action on the pancreas itself. The pressure in some instances has been so extreme that symptoms of intestinal obstruction have occurred, and jaundice in some cases has been produced. Sometimes the cyst diminishes in size, as in a case reported by Halsted, in which the girth of the abdomen decreased to the extent of twelve inches in ten days. If the entire gland be destroyed, or if its duct be so compressed that the pancreatic juices cannot be discharged, the feces may contain considerable quantities of fat, glycosuria may be present, and the amount of indican in the urine may be decreased. Salivation, as in other diseases of the pancreas, is sometimes noted.

Diagnosis.—Cysts of the pancreas should be suspected in all cases in which successive attacks of severe pain occur in the epigastric region, especially if they be accompanied by pronounced symptoms of collapse. The diagnosis, however, must always remain problematical until a tumor is discovered in the affected region, in which case, conjoined with the symptoms just referred to, the probability of pancreatic cyst should always be considered. Should doubt exist, aspiration may be resorted to, and the fluid obtained tested for pancreatic ferments; but it should always be remembered that in quite a proportion of cases the fluids that occur in these possess no digestive properties, and on the other hand that other liquids sometimes do. From aneurism the cysts may be differentiated by the fact that even when they show pulsation it is non-expansile, and that in the knee-elbow position it entirely disappears. Collections of fluids in the pancreas may be mistaken for ovarian cysts, but may be generally diagnosed by the facts that in the latter condition the increase in the abdomen is from below upward, and that on aspiration the contents of the tumors are rarely blood-stained, do not emulsify fat, and contain no digestive ferments. Cysts of the gall-bladder differ in that they are continuous with the liver, and that on puncture the fluid found corresponds to bile rather than to the juices elaborated by the pancreas. Solid tumors may be distinguished by the fact that they contain no liquids. Cysts of the lesser peritoneum, or mesentery, are differentiated with great difficulty from like collections of fluid occurring in the pancreas, but the absence of digestive properties in the liquids removed from these situations, and the lack of symptoms indicating interference with the proper performance of the functions of the pancreas may serve to make the diagnosis clear.

Prognosis.—Cysts of the pancreas not uncommonly exist for long periods of time without producing any serious results, but they may cause marked disturbances by pressing upon the neighboring organs. Diabetes is sometimes produced by them, though this is comparatively rare. The particular danger is rupture of the cyst into the neighboring cavities.

Treatment.—Of one hundred and one cases collected by Koerte, which were opened and drained, four deaths followed as a direct result of the operation, and one case ultimately ended fatally from infection of a fistulous tract resulting. In fourteen cases the cysts were extirpated, with twelve recoveries.

NEW GROWTHS OF PANCREAS.

Tumors of the pancreas are exceedingly rare, but the neoplasms that occur in the organ are in most instances malignant. Of the tumors that develop in the gland carcinoma is the most common, but sarcoma, adenoma, lymphoma, gumma, and tubercle are occasionally encountered. For the reason that most of the tumors that occur in the organ belong to the group of carcinomata, and inasmuch as the symptoms of other tumors of moment are practically identical with those occurring in this form of the disease, cancer will be alone considered.

CARCINOMA OF THE PANCREAS.—Notwithstanding the great amount of work that has been recently done upon the subject of the etiology of cancer, there is as yet no satisfactory explanation of its causation, and we shall therefore have to be contented with pointing out that carcinoma of the pancreas usually occurs between the ages of thirty and fifty, and that it appears to be rather more frequent in men than in women. The rarity of the condition is evident by the fact that in 36,541 post-mortems the disease was found in only 174 instances.

Morbid Anatomy.—Carcinoma of the pancreas may occur in any part of the organ, but its most frequent site is in the head of the gland. The tumor may be very soft, or, when containing much fibrous tissue, of almost cartilaginous consistency. In some instances the neoplasm is circumscribed and remains confined to one part of the organ; but in other cases it is diffused throughout the entire substance of the gland. It may be very small or quite large, sometimes attaining the size of a cocoanut. The disease does not remain confined to the pancreas, but is prone to extend into the surrounding tissues, notably into the walls of the duodenum. The lymph nodes in the vicinity are sooner or later involved, and secondary nodules may occur in the spleen or liver.

Symptoms.—Until the tumor reaches such a size that it can be palpated, the diagnosis of cancer of the pancreas is exceedingly difficult, and is indeed generally impossible, as the symptomatology of the disease in its incipency is apt to be vague and misleading. In most cases the first manifestations of the affection are disorders of the digestive functions, which in the course of weeks or months are followed by paroxysms of epigastric pain, not uncommonly accompanied by nausea and vomiting. As the tumor increases in size the common duct is in most instances compressed, with the result that jaundice of an intense and persistent kind is induced, and on account of the retention of the bile the gall-bladder is generally greatly dilated. Jaundice sometimes develops slowly, and in other instances with suddenness. On account of the absence of the pancreatic and biliary secretions the feces are apt to be white, and in rare instances to contain an increased amount of fat. The feces when examined microscopically are apt to exhibit many undigested muscle fibres, even in instances in which constipation exists. In some cases the urine is found to contain sugar, and indican is said by some to be considerably diminished in amount. As the tumor increases in size it sometimes causes obstruction of the duodenum, with the result that the stomach and upper part of this viscus become considerably dilated. If it be very large it may impede the portal circulation with the production of ascites, or by pressure upon the inferior vena cava dropsy in the lower extremities may be developed. In rare cases hydronephrosis has been produced in the left kidney as a result of the compression of the left ureter. After the tumor becomes quite large it may be felt, especially if perfect relaxation of the abdominal muscles be brought about by the means of general anaesthesia. It should, however, be remembered that the tumor must be quite large in order that this may be accomplished, for it has not been palpated in more than ten per cent. of all cases in which the disease was undoubtedly present. If carcinoma exist the tumor is deeply seated, and is but slightly movable. It may or may not be tender. In some instances the neoplasm causes hemorrhage into the peritoneal cavity or into the intestine, and this may be so profuse as to

cause death. In the beginning the appetite and general health may be but little changed, and, indeed, increased hunger and thirst may occur, especially if diabetes exist. As the disease progresses the patient, as is usual in all forms of carcinoma, becomes anemic and loses flesh, which condition may be extreme in the latter stages of the affection. The temperature is apt to be somewhat below the normal.

Diagnosis.—Carcinoma of the pancreas is most likely to be mistaken for carcinoma of one of the neighboring viscera—the liver, the transverse colon, the pyloric end of the stomach, or the duodenum. From carcinoma of the liver it is distinguished by the facts that in the former condition the disease is in almost all instances secondary to cancer of some of the other abdominal viscera, that it is often associated with enlargement of the liver, and that an ascites frequently exists. The tumor in cancer of the liver is situated somewhat higher up than are those of the pancreas, and it is, as a rule, more easily movable. In both diseases jaundice occurs, but is much more common in cancer of the pancreas. In cancer of the transverse colon obstinate constipation as a result of the obstruction usually exists, and this is generally associated with the production of a large amount of indican, quantities of which appear in the urine. In these cases the tumor is more superficial, and is more frequently movable, and the disease is not accompanied by jaundice. In cancer of the pyloric end of the stomach there is commonly a history of intense pain developing an hour or so after taking food, and examination usually reveals the fact that the stomach is greatly dilated, contains much lactic acid, and but little hydrochloric acid. Not uncommonly it will be found that the patient suffering with this malady has vomited blood freely, and jaundice is not so apt to be present. From cancer of the duodenum it is practically impossible to distinguish carcinoma of the pancreas, as the two conditions commonly give rise to symptoms in every way similar. Cancer arising in either of these situations is, moreover, very apt to extend to the other. The symptoms of cancer of the pancreas that are of greatest diagnostic importance are the presence of a deeply seated but slightly movable tumor in the situation normally occupied by the head of the gland, the existence of intense and persistent jaundice, pain in the affected region, rapid emaciation and loss of strength, diminished excretion of indican in the urine, and especially the presence of sugar in this excretion. The absence of the pancreatic juice in the intestine, according to Mueller, results in the diminished splitting up of the fats ingested, and this, if true, in all probability will prove of much value in enabling us to make the diagnosis in obscure cases. For the reason that salol, when taken by the stomach, is decomposed only in the presence of the pancreatic secretion, the absence of carbohc acid in the urine after the administration of full doses of this drug points to obstructive lesions of the excretory ducts—a condition which is usually present in carcinoma of the organ.

Prognosis.—When surgical interference is not invoked, death in practically all instances results from carcinoma of the pancreas, but the practicability of removing tumors from this organ has been recently clearly shown; and in cases in which the diagnosis can be made early enough, the operation would offer some hope for the life of the patient.

Treatment.—As we have no drugs that act specifically on carcinomatous processes, treatment is to be entirely of a symptomatic kind. Diastases and small pieces of raw pancreas may be administered with the food with advantage, but the only effect that can follow this is an improvement in the digestive functions. In the early stages an operation may be the means of saving the patient's life, as, according to Koerte, recovery has followed in several cases of this kind after the removal of the tumor.

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PANCREAS. (SURGICAL.)—ANATOMICAL CONSIDERATIONS.—The pancreas lies transversely across the upper part of the abdominal cavity, behind the stomach, on a level with the first and second lumbar vertebrae, and three inches above the umbilicus. The head is contained in the loop of the duodenum, the body lies on the crura of the diaphragm. To the left the posterior surface is in contact with the left kidney and suprarenal capsule. The tail touches the lower part of the inner surface of the spleen. Its average length is from five to six inches, and it weighs from two and a half to three and a half ounces.

The blood supply is from the splenic artery and from the inferior mesenteric and hepatic by the inferior and superior pancreatico-duodenal arteries. The blood is returned into the portal vein by means of the splenic and superior mesenteric veins.

The lymphatics terminate in two glands which lie on the superior mesenteric artery. The nerves are branches of the solar plexus which accompany the arteries entering the gland.

The pancreas is a compound racemose gland, soft in texture, and of a pinkish-cream color (Morris').

The secretion of the pancreas is carried by short canals or ducts to the main duct, the duct of Wirsung, which they join at nearly right angles. The duct of Wirsung turns down through the head of the pancreas and opens into the second portion of the duodenum, together with the common bile duct. The lesser duct, or duct of Santorini, collects the secretion from a portion of the neck and head of the pancreas, and opens into the duodenum 2.5 to 3.5 cm. nearer the stomach. Brewer² states that the older anatomists were wrong in teaching that the duct of Santorini, or smaller duct, usually atrophied; according to him it is practically always present in the human subject.

The pancreas is developed between the two layers of the posterior mesentery from two offshoots from the intestinal tube just below the gastric dilatation. Brewer² calls especial attention to the fact that the pancreas is at this time completely invested by peritoneum, "and only becomes a retroperitoneal organ by the absorption and conversion, into areolar tissue and fat, of the several layers of the posterior mesentery." He then draws attention to the fact that the areolar tissue surrounding the pancreas is continuous with that surrounding the left kidney and the areolar tissue lying behind the colon on the left side.

ACCESSORY PANCREAS.—Tieken states that fourteen cases of accessory pancreas have been reported. This results from lack of fusion of the separate diverticula. These accessory glands may be found in the walls of the stomach or duodenum, or in the mesentery. It has been suggested that these accessory glands may cause diverticulums of the intestine. They have