LITTEN'S SIGN. See *Chest, Physical Examination of.*

LITTON SELTZER SPRINGS.—Sonoma County, California.

POST-OFFICE.—Healdsburg. Hotel and cottages.

These excellent seltzer and soda springs are located about four miles north of Healdsburg, on the line of the San Francisco and Northern Pacific Railroad. The springs and adjoining property—about 1,000 acres—have been incorporated, and extensive buildings, in the way of hotels, cottages, bath-houses, etc., are contemplated. Some of the waters are used commercially. The water is slightly acid when first drawn, but by exposure it loses its carbonic anhydride and becomes alkaline. The following analysis was made some years ago by Dr. Winslow Anderson:

ONE UNITED STATES GALLON CONTAINS:

Solids.	Grains.
Sodium chloride	79.34
Sodium bicarbonate	6.26
Sodium carbonate	72.73
Potassium carbonate	3.60
Magnesium bicarbonate	13.90
Magnesium sulphate	6.75
Calcium bicarbonate	14.05
Calcium sulphate	5.03
Ferrous carbonate	2.14
Alumina	6.81
Borates	4.43
Lithia	Trace.
Ammonia	.33
Silica	8.09
Organic matter	Trace.
Total solids	223.46
Free carbonic-acid gas	375.60
Temperature, 62° F.	

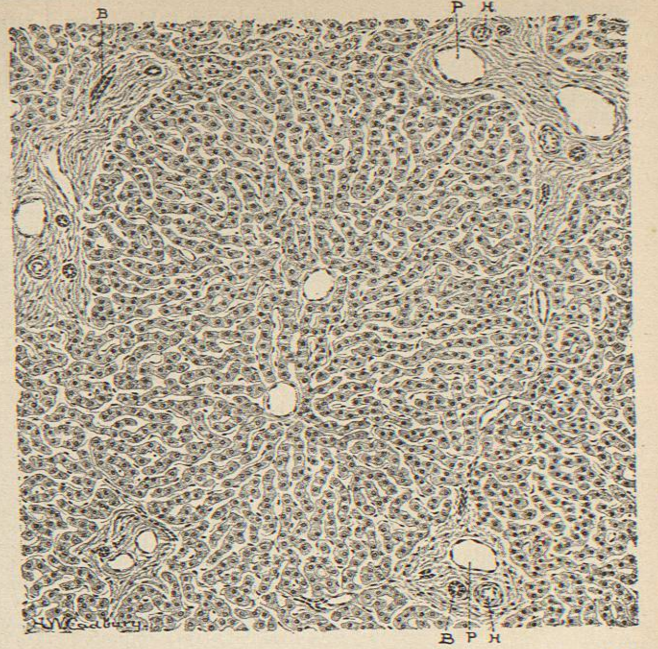

FIG. 3211.—Section of Liver. × 80. *P*, Portal vein; *H*, hepatic artery; *B*, bile duct. (Hendrickson.)

A previous analysis by Professor Hanks showed 228.69 grains in solids and 383.75 grains in carbonic anhydride to the United States gallon. The temperature of the water is 62° F. It is much used as an antacid in dyspepsia, and in uric-acid states. The water has aperient and diuretic properties.

James K. Crook.

LIVER, ANATOMY OF THE.—The liver is the most bulky of the abdominal viscera and the largest gland in the body. Its size and its connection with the portal system render it at once remarkable. In the abdominal cavity it occupies the greater portion of the right hypochondriac, a large portion of the epigastric, and a small part of the left hypochondriac regions. Although the shape of the liver is somewhat variable because of pressure of neighboring organs, still it has in general a wedge-like form with the base to the right.

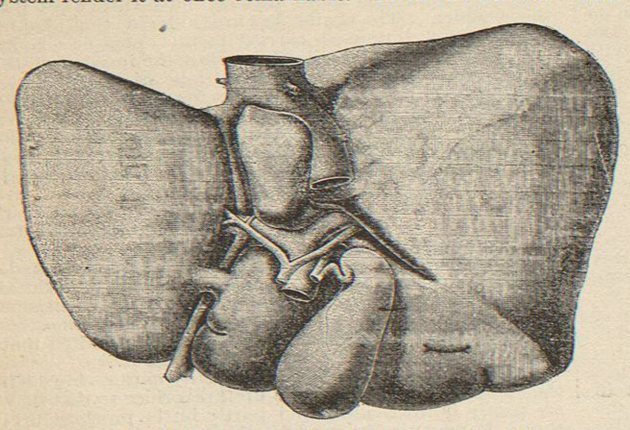

FIG. 3210.—Inferior Surface of the Liver. (Sappey.)

Because of the irregularity of the liver's contour some difference has existed in the descriptions of the surfaces. We may, however, regard it as possessing five: anterior, posterior, superior, inferior, and right surfaces.

The anterior surface, the largest of all the surfaces, is smooth and triangular and composed of the right and left lobes; the line of demarcation between these lobes being formed by the umbilical notch and the attachment of the falciform ligament.

The posterior surface is also roughly triangular in shape and very uneven, being rounded and broad behind the right lobe but narrow on the left. It is composed of a portion of the left lobe, the Spigelian lobe, and caudate lobe, and a small strip of the right lobe.

The superior surface is convex and includes the upper surface of the right and left lobes.

The inferior surface is uneven and concave and embraces the lower surface of the left and right lobes and that portion lying between the umbilical fissure and the gall bladder, known as the quadrate lobe.

The right surface is convex from before backward and often convex from above downward. It is made up entirely of the right lobe.

The fissures may be divided thus:—The transverse or portal, which is the hilus through which the great vessels and nerves enter and the hepatic duct passes out, and which lies between the quadrate lobe in front and the Spigelian and caudate lobes behind. The longitudinal fissure lies between the right and left lobes. This is subdivided anteriorly into the umbilical fissure lying between the quadrate and left lobes of the liver, and posteriorly into the fissure of the *ductus venosus*, which lies between the lobe of Spigelius and the left lobe.

The fissure of the vena cava lies between the Spigelian lobe and the right lobe. In this fissure lies the vena cava, and it is often converted into a canal by liver substance bridging over around the vena cava.

With one exception the ligaments are peritoneal folds. The coronary ligament connects the posterior surface of the liver to the diaphragm. The suspensory or falciform ligament is a part of the old anterior mesentery of the stomach and duodenum. It is a thin membrane which passes between the anterior abdominal wall and diaphragm and the upper surface of the liver. It contains, between its two layers, the obliterated umbilical vein, the round ligament. Others are the gastro-hepatic, the hepato-duodenal, hepato-colic, hepato-renal, cystico-duodenal, and right and left lateral ligaments; the names indicating in each case their situation.

The blood supply of the liver is derived from two vessels, the hepatic artery and the portal vein. These blood-vessels together with the bile duct ascend to the liver in the gastro-hepatic omentum and enter through the transverse fissure; after this all three divide into right and left branches for the respective main lobes of the organ. The liver is peculiar in its blood supply in that the main source is that of the portal vein which receives blood from the digestive tract, pancreas, and spleen.

The hepatic artery and portal vein, in company with the bile duct, penetrate throughout the liver and are surrounded for some distance by an areolar investment, the so-called capsule of Glisson.

The hepatic veins which convey the blood away from the liver pursue through the substance an entirely different course from the other vessels and pass out at its posterior surface, where they empty by two or three main branches and several smaller ones into the inferior vena cava.

The lymph vessels of the liver are divided into a superficial and a deep system. These will be described in detail subsequently.

The pneumogastric nerves, especially the left, and branches from the cœliac plexus, constitute the nerve supply of the organ. These enter the liver along with the great vessels and may be traced throughout the portal canals.

The excretory system of the organ is made up of the hepatic ducts which extend throughout the portal canals and which gradually converge toward the hilus to form one duct, the hepatic duct. The hepatic duct descends in the gastro-hepatic omentum for a variable distance, usually from 3 to 4 cm., and there meets with the cystic duct descending from the gall bladder, and the two ducts uniting at an acute angle form the common bile duct.

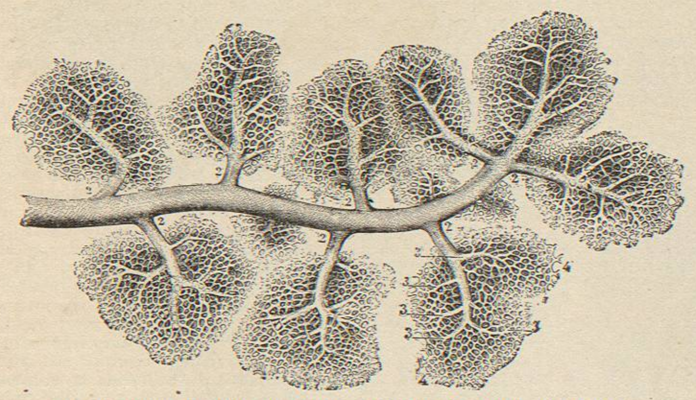

FIG. 3212.—Showing the Origin of the Hepatic Veins. (Sappey.)

The gall bladder is a pear-shaped sac measuring from 7 to 8 cm. long and from 2.5 to 3 cm. broad at the fundus. It is fastened to the liver by connective tissue, blood-vessels, and in part by peritoneum. The fundus extends beyond the anterior margin of the liver in the region of the incisura vesicalis, while the neck of the bladder usually extends in the posterior and upper part of the vesical fossa close to the transverse fissure. It is continued in a spiral curve into the cystic duct. The curved groove on the surface corresponds to a more or less pronounced spiral fold which traverses the interior of the duct and is known as the Heisterian valve.

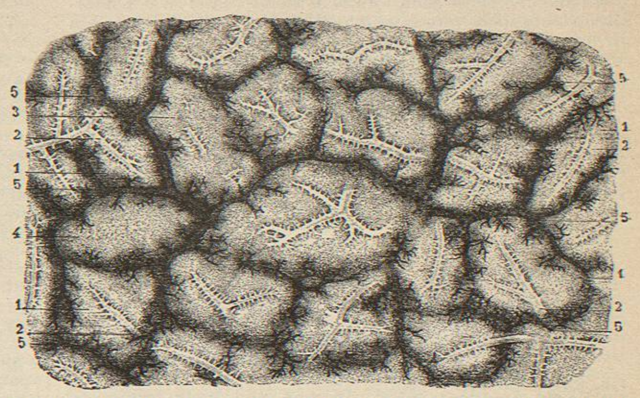

FIG. 3213.—The Vascular Arrangement of the Liver Lobule. 5, Interlobular blood-vessels; 2, intralobular or central veins. (Sappey.)

The common bile duct results from the union of the hepatic and cystic ducts, and it is through this channel that bile is conducted to the duodenum. The duct is from 4.5 to 5 cm. long and about 0.25 cm. in diameter and lies in the gastro-hepatic omentum to the right of the hepatic artery.

The liver surface is covered in part by two coats: the peritoneum and a connective-tissue investment. The former does not extend over the entire surface; the latter, however, is present everywhere and connects the serous coat to the glandular substance. Its inner surface is in direct contact with the liver cells and extends in between the lobules to form the interlobular connective tissue. At the transverse fissure, this areolar tissue is present in greater amount and is found to penetrate into and throughout the liver substance. It surrounds the branches of the portal vein, hepatic artery, and bile ducts, and, forming a coarse framework lying between the lobules, ultimately becomes continuous with the connective-tissue investment covering the surface of the organ. The connective-tissue stroma which penetrates throughout the liver and envelops the portal veins, hepatic arteries, and bile ducts is known as the capsule of Glisson.

A slight coat of fibrous tissue is also discovered about the branches of the hepatic vein. This is never very marked and is continuous from the surface of the organ where the larger hepatic veins empty into the vena cava.

The liver may be described as a tubular gland which has a more or less net-like arrangement. If studied with the naked eye it is found to be made up of small portions which are more or less spherical in general contour. This is especially well marked in some animals, such as the pig. These small portions are known as the liver lobules, and they are separated from one another by connective tissue, the capsule of Glisson, in which the larger blood-vessels, bile ducts, nerves, and larger lymphatics lie. Slight magnification shows the lobule to have a radial arrangement, which is produced by the irregular-shaped columns of liver cells and intervening intralobular blood capillaries.

In the centre of each lobule a blood-vessel of considerable size is discovered, which is known as the central vein or intralobular vein, and which is found to empty into the sublobular vein at the base of each lobule. The latter in turn is found to empty into branches of the hepatic veins which eventually empty into the inferior vena cava.

Radiating from the centre of the lobule to the periphery are discovered numerous branching and anastomosing columns of liver cells which form the parenchyma of the organ, and lying between these are to be seen in part fine blood channels (the intralobular blood capillaries) and in part the intralobular connective tissue.

FIG. 3214.—The Bile Capillaries and Interlobular Bile Duct from an Adult Pig. Golgi method. (Hendrickson.)

The blood capillaries, therefore, constitute a network throughout the lobule and are formed from branches of the portal vein and hepatic artery which lie in the capsule of Glisson at the periphery of the lobule.

In man the liver lobule is not always a discrete unit as in some of the lower animals, but very often is found to contain two or more central veins, while the distribution of the portal canals is not always regular.

The liver cells are of a polyhedral or rhomboid form having a mean diameter of from 0.017 mm. to 0.22 mm. They possess no cell membrane. They are colorless, but contain a variable number of yellow or brownish pigment granules in their protoplasm, and the cytoplasm has a finely granular appearance. It often happens that a cell may have two nuclei, while frequently two nucleoli may be discovered in a single nucleus. The nuclei are round and clear and of the vesicular type.

The hepatic cells are often found to contain, under normal conditions, but especially after the ingestion of fatty food, a considerable number of fat droplets; these are most numerous in those cells which are nearest the periphery of the lobule. Also under certain conditions irregular amorphous masses or globules of glycogen may be present in the cells. When present in considerable amount the protoplasm of the cells is converted into an open network. By means of various methods—the silver chromate impregnation employed by Golgi, the injection of sulphoindigotate of soda, into the blood-vessels of living animals, and the injection of colored aqueous masses into the hepatic ducts—the demonstration of the finer biliary passages within the lobule has been rendered comparatively easy. These methods show a close network of very fine channels between and around the individual cells, much finer and closer than the blood capillary network from the branches of which they run apart. These fine passages are the commencement of the biliary ducts into which at the circumference of the lobule they open. It is uncertain whether they have a definite wall or whether they are merely channels grooved out between the hepatic cells. In all animals the bile canaliculi are separated by at least a portion of a liver cell from the nearest blood capillaries. The natural injection method as well as impregnations with silver chromate would seem to show an even closer relation between these intercellular bile capillaries and the hepatic cells; for, with little effort, we can readily demonstrate very small vacuoles in the liver cells which are seen to communicate by a fine hair-like canal with the intercellular bile capillary. Several of these vacuoles can be demonstrated in the same plane of a liver cell. It has been thought by some observers, however, that these terminal structures within the liver cells are formed only at the moment of secretion and are not, therefore, permanent structures.

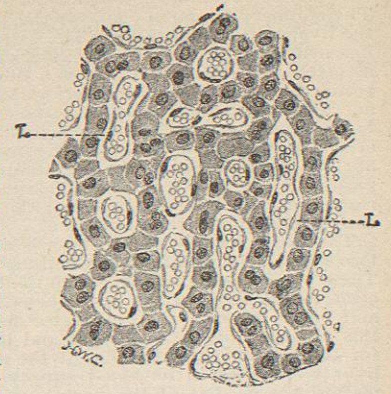

FIG. 3215.—Showing Finer Structure of Hepatic Cells and Intralobular Lymphatic Channels, *L*. (Hendrickson.)

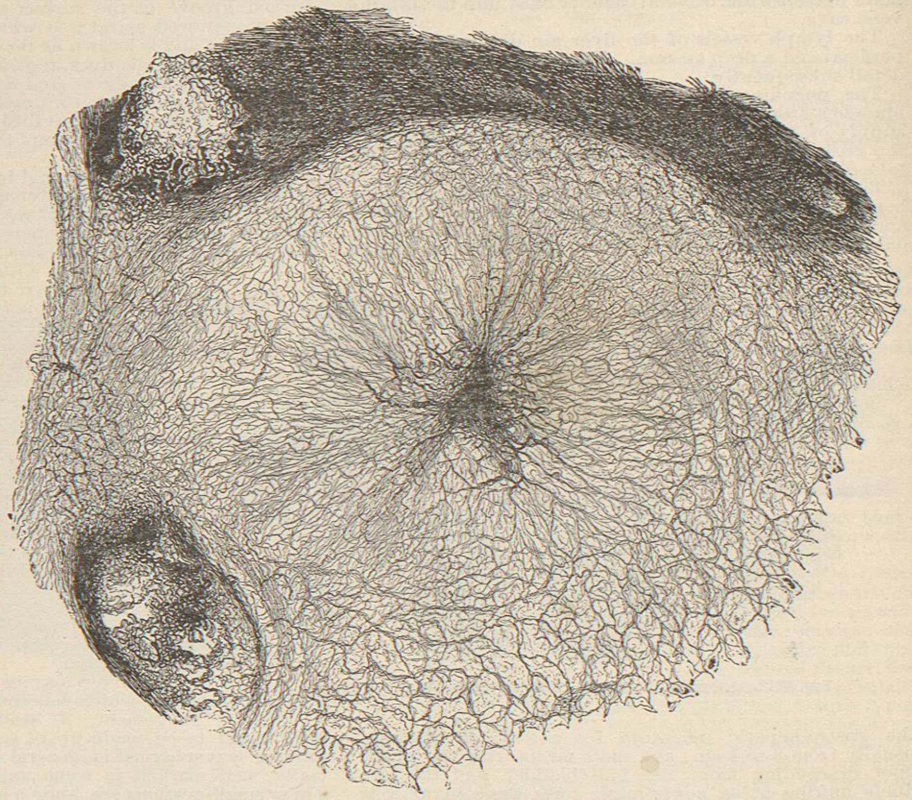

FIG. 3216.—Showing the Reticulated Tissue of the Liver Lobule. (Mall.)

At the periphery of the lobule the bile capillaries open into the larger interlobular bile ducts which lie within the portal canal. These small interlobular canals have walls composed of connective tissue and a basement membrane which lies just outside the layer of short columnar epithelial cells which lines the fine lumen. Lying within the connective-tissue coat are found smooth muscle cells which are distributed in a longitudinal, a transverse, and a diagonal direction with reference to the long axis of the bile duct.

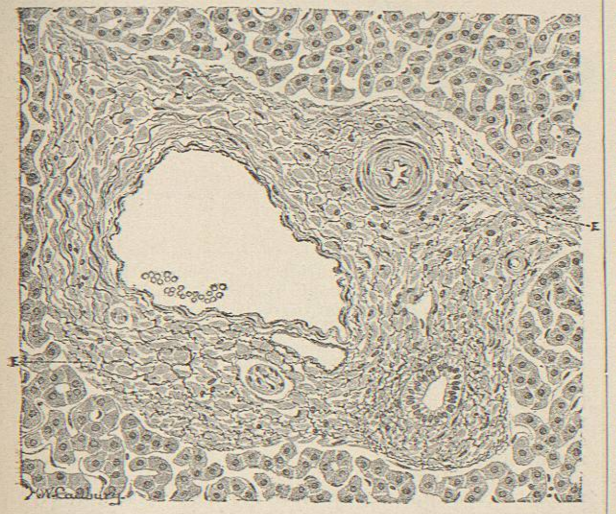

FIG. 3217.—The Elastic Tissue of a Portal Space, *E*. (Hendrickson.)

As these ducts approach the lobules, the lining epithelial cells become gradually flatter and flatter and at the point where they reach the liver cells at the periphery all lining cells apparently disappear. The basement membrane gradually disappears with the epithelial cells. Throughout the portal canals down to the large hepatic ducts the interlobular ducts preserve the same structure as described above. The epithelial cells, however, lining the ducts gradually become higher as the larger ducts are approached, while the connective tissue and smooth muscle forming the walls also become much more prominent.

The lymphatics of the liver are divided into a superficial and a deep set. The former are found as a subperitoneal plexus over the entire surface of the liver. Those over the anterior and superior surfaces gradually unite and communicate through the hepatic ligaments with the thoracic lymphatics. The plexus on the under surface of the liver, on the other hand, drains into the lymphatics of Glisson's capsule.

The deep lymphatics are found distributed throughout the liver in the portal canals, about the hepatic veins, and within the lobule. Surrounding each column of liver cells within the lobule is found an incomplete small lymphatic space which in section is demonstrated as a narrow channel separating the blood capillary on both sides from the liver cells. These small channels are the ultimate lymphatic radicles, and it is from this intralobular lymphatic plexus that the larger lymph vessels of the portal canals convey the lymph to the transverse fissure through the capsule of Glisson. The lymph radicles about the hepatic veins also receive lymph from this intralobular plexus.

The connective-tissue stroma of the liver is found in largest amount between the lobules, in the capsule of Glisson. This, as has been described, is found to penetrate throughout the liver and ultimately becomes continuous with the subperitoneal connective-tissue coat which covers the entire surface of the organ. Not all the connective tissue, however, is limited to the periphery of the lobules, for close observation shows not only some fibrous tissue about the hepatic veins but also a fine network throughout the lobule.

By special stains and a variety of digestion methods it has been possible more carefully to analyze the different forms of tissue which make up this stroma.

It has been demonstrated that throughout Glisson's capsule white fibrous tissue is present in large amount, and this is readily recognized not only by the general form and coarseness of the fibres, but has been proved by definite chemical tests. In addition to this, however, the so-called reticulated tissue or reticulum is also present in considerable quantity, and this is of special interest inasmuch as it has been found that the intralobular connective tissue is entirely of this variety. Elastic tissue is present in small amount, except in the coat of the large blood-vessels where it is present in considerable quantity.

The entire excretory apparatus of the liver, including the hepatic duct, cystic duct, gall bladder, and common bile duct, are found microscopically to possess the same architecture.

They are lined throughout by a mucous membrane with columnar epithelial cells. Next to this the wall consists of a connective-tissue and muscular coat, and finally, in the case of the gall bladder, beyond this there is a peritoneal investment.

Because of the special clinical interest in the musculature of the biliary passages, and especially that portion which is known as the duodenal papilla, a somewhat fuller treatment than is usual will be given.

By special maceration methods the musculature of the bile passages has been re-examined by the author. Other confirmatory methods, such as sectioning, show a similarity of results in all cases.

In the gall bladder, as has been previously mentioned, the arrangement of the smooth muscle fibres is plexiform. Those, however, which run transversely * to the long axis of the bladder are most numerous. The muscle bundles are not arranged in definite and regular coats; the transverse, longitudinal, and diagonal bundles mingle without conformity to any rule. The muscle bundles are more or less separated from one another by a certain amount

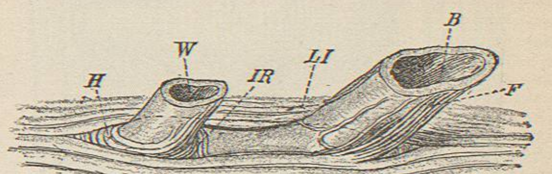

FIG. 3218.—Macerated Duodenal Portion of the Common Bile Duct of Man. Showing the entrance of common bile duct and pancreatic duct into the intestine. × 5. (Hendrickson.)

of connective tissue, but since the individual muscle bundles overlap, there are few if any places in this coat where muscle is entirely absent.

In the cystic duct the smooth muscle is also found to

* The terms transverse, longitudinal, and diagonal are used with reference to the long axis of the gall bladder and its ducts.

have a plexiform arrangement, so that the smooth muscle bundles are seen to run in three directions, viz., transverse, longitudinal, and diagonal. The transverse bundles however, are about equal in number.

In that portion of the cystic duct which is nearest the gall bladder the amount of muscle is considerable, but this gradually diminishes in amount as the common bile duct is approached. At the junction of the cystic, hepatic, and common bile ducts the quantity of muscle present is very small.

Muscle fibres are also present in those folds of the cystic duct which are known as the valves of Heister, and these are found to have the following distribution:

The transverse muscle bundles of the cystic duct are not limited to the wall proper, but at the level of the valves of Heister also run around in the valve in a circular direction. Most of the longitudinal bundles of the cystic duct continue down the duct without entering the valve, but still there are some of these bundles which (having reached the level of the valve) bend around at almost a right angle and run out into the fold. We have no evidence that the diagonal fibres take any part in the musculature of the valves of Heister. Those valves which are nearest the common bile duct are quite small and either contain very little muscle or none at all.

The hepatic duct contains a small amount of smooth muscle, and that which is present is found to follow three directions, longitudinal, transverse, and diagonal.

The longitudinal fibres are most numerous.

Although the amount of muscle in the common bile duct is small, it is found to be distributed in a manner similar to that found in the hepatic duct.

Preliminary to the description of the duodenal portion of the common bile duct, it will be well to state that many individual variations in structure occur, but that these variations do not alter the general anatomical bearing of the region. Fig. 3218 shows the entrance of the common bile duct, *B*, and the duct of Wirsung, *W*, into the intestinal wall. We see a simple separation of the fibres of the outer longitudinal muscular coat of the intestine, *LI*. The common bile duct and the duct of Wirsung pass through this separation. At *F* we find muscle fibres arising from the outer longitudinal muscular coat.

These fibres run up on the common bile duct and, becoming gradually less and less marked, finally disappear.

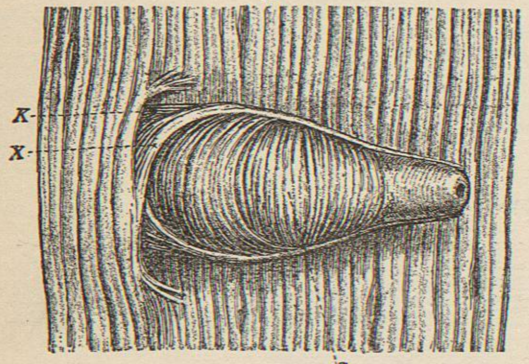

FIG. 3219.—Macerated Duodenal Portion of the Common Bile Duct of Man. The mucous membrane, muscularis mucosæ, and submucosa of the intestine have been removed. ×5. (Hendrickson.)

This arrangement is bilateral. The fibres marked *IR* represent some bundles of muscle which (shown in Fig. 3220, *IR*) form an independent ring of muscle around the common bile duct, between it and the duct of Wirsung.

At *H* are seen muscle fibres which run almost entirely around the duct of Wirsung; but as these fibres approach that side of the pancreatic duct which is nearest the common bile duct, they turn abruptly and run up on the duct of Wirsung in a longitudinal direction. They gradually diminish in volume as they ascend the duct. This structure is bilateral. See also Fig. 3220, *H*.

Fig. 3219 represents the structures seen upon removal of the mucous membrane from the intestinal wall in the region of the duodenal papilla. The inner circular muscular coat of the intestine is represented by *CI*. The first point to demand attention is the penetration of the inner circular muscular coat by the common bile duct. At the spot of penetration there is a simple separation of the muscle bundles of the inner circular muscle coat.

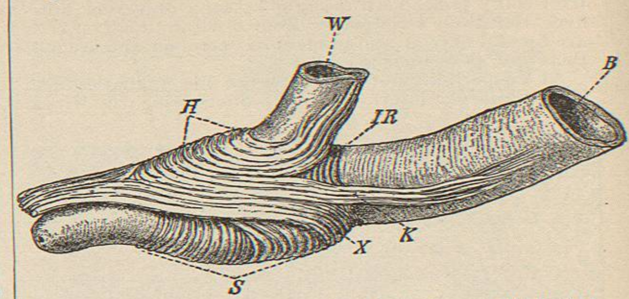

FIG. 3220.—Macerated Duodenal Portion of the Common Bile Duct of Man. All of the intestinal coats have been removed. ×5. (Hendrickson.)

At *S* are bundles of muscle running around the common bile duct (see also Fig. 3220, *S*). These are independent rings of muscle which embrace the duct. Now, if we look farther back on the common bile duct, near the point at which it penetrates the inner circular muscular coat, we observe muscle bundles, *X*, which do not run entirely around the duct. These muscle bundles are very intimately mixed with the independent muscle rings which completely embrace the duct. The former, however, upon reaching the level of the inner circular muscle coat, turn abruptly forward and under the bile duct, and after running for some distance toward the duodenal papilla finally end in the connective tissue of the submucosa of the intestine (see also Fig. 3220, *X*). This arrangement is bilateral. The drawing shows that this arrangement of muscle about the common bile duct begins at a point before the duct penetrates the inner circular muscular coat. In this particular specimen, a muscle bundle of the inner circular muscular coat curves around and becomes continuous with the fibres marked *X*.

Finally in Fig. 3220, a bundle of muscle fibres, *K*, can be seen on each side of the common bile-duct running parallel with it. These bundles arise on the surface of the common bile duct (Fig. 3219, *K*) and are covered by the fibres, *F*, of Fig. 3218. In this case they run forward from under the inner circular muscular coat (Fig. 3219, *K*) and bend around beneath the common bile duct, becoming continuous with each other, thus forming a loop around the duct of Wirsung (Fig. 3220, *K*).

William F. Hendrickson.

LIVER, DISEASES OF: ABSCESS.—DEFINITION.—An affection characterized by the production of one or more areas of necrosis and puriform softening in the liver, due to the action of micro-organisms, and associated with more or less marked degeneration of the intervening parenchyma.

DISTRIBUTION.—Suppurative hepatitis (hepatitis apostematosa), as a primary disease, occurs in the temperate zones with the greatest rarity, but is more frequent in tropical and subtropical climes. As we meet it in the temperate regions, apart from cases due to trauma and wound infection, it is practically always metastatic or due to extension of inflammation from neighboring organs.

ETIOLOGY AND PATHOGENESIS.—It may be taken as

practically certain that all forms of suppurative hepatitis are due to the activity of micro-organisms, either bacterial or protozoan. The forms which have been found, and consequently regarded as etiological factors, include the streptococcus, the staphylococcus albus and aureus, the bacillus coli, the diplococcus pneumoniæ, the bacillus pyocyaneus, the ray fungus, and the amœba coli.

Bacterial agents may reach the liver in several ways, namely, by the hepatic artery, the portal vein, and the bile ducts; or, again, by direct extension from contiguous parts. Rarely, infection occurs by retrograde metastasis from the vena cava or hepatic vein.

Some idea of the frequency of the various forms may be gathered from the following figures: In 1,474 autopsies of which I have notes, occurring at the Royal Victoria and the Montreal General Hospitals, 22 cases of liver-abscess were found. Of these, 3 cases were due to dysentery, 13 were from portal infection, 3 were biliary, 1 was arterial, 1 occurred by extension, and 1 case was apparently primary.

Apart from metastatic cases some occur which are attributable to trauma. Here, in a previously healthy organ, a severe blow or crush results in a necrosis of an area of liver substance, and this subsequently undergoes liquefaction. This event is best explained on the hypothesis that the liver normally contains bacteria. I have satisfied myself by culture and other experiments that the healthy organs contain bacteria, and these results have been amply corroborated by the work of Dr. W. W. Ford[1] at McGill University. In suitable preparations also bacteria can be traced from the surface of the intestine through the mesenteric lymphatics and glands to the liver, so that it is evident that there is what may be called a "vital absorption" of micro-organisms, apparently through the agency of phagocytes, and partly by the tissue fluids, from the alimentary tract to the liver. Normally, the liver has sufficient power to resist the action of these germs, which indeed may be of low virulence from the start or may become attenuated in their passage to the organ, so that disease usually does not result. Should, however, from any cause, the resisting power of the liver be diminished, as, for instance, by trauma or toxic agents, infection and degeneration may result. Except upon this theory it is almost impossible to explain certain forms of so-called "idiopathic" abscess of the liver which occur apparently spontaneously, quite apart from dysentery or other ulcerative lesions of the intestinal tract. Birch-Hirschfeld[2] indeed recognized the probability of "idiopathic" liver abscess being cryptogenic, a term which may at last have some more positive meaning in the light of the above researches.

In discussing the subject of liver-abscess it is perhaps most convenient to treat of the disease as falling into two main groups: (1) *Primary suppurative hepatitis*, where the pathological lesion is primarily induced in the liver; and (2) *secondary suppurative hepatitis*, in which the liver is affected by infective agents derived from some diseased tissue external to it.

The first class may again be divided into, (*a*) *Intrinsic*, where the infective agents are originally present in the liver. It is to this form, inasmuch as it occurs apparently spontaneously without any association with dysentery or any other obvious cause, that the unsatisfactory term "idiopathic" has been applied. Most cases of traumatic origin may also be placed in this class. (*b*) *Extrinsic*, where the agents are introduced from without. An example of the latter is seen in "wound infection" of the liver.

By far the most common event is for the inflammatory process to be secondary to disease of some other organ.

Inasmuch as the tropical form of the disease is of the greatest practical importance and presents many features peculiar to itself, it has been thought advisable to treat of it under a separate heading (see p. 532) and to discuss first those forms of abscess which are liable to be met with in temperate regions.

ABSCESS OF THE LIVER FROM ARTERIAL INFECTION.—In this form, which is really but one manifestation of general septicopyæmia, the infective agents reach the liver through the hepatic artery. In the vast majority of cases, if not in all, the micro-organisms are not sufficiently numerous to cause blocking of the vessels immediately, but become entangled in the endothelium of the finer capillaries where they proliferate, leading to thrombocapillaritis and complete obstruction. True embolism is by no means common; when this occurs it is generally due to ulcerative endocarditis.

The etiology of this form is that of septicopyæmia in general. The primary foci whence the infective agents gain entrance to the general circulation are very various. The disease may complicate all forms of wound infection—osteitis, osteomyelitis, gangrene of the lung, putrid bronchitis, bronchiectasis, suppurative lesions about the bladder, prostate, and urethra, from the uterus after delivery, and ulcerative endocarditis and aortitis. It has also been known to follow such simple affections as carbuncle and whitlow, and is occasionally met with as a complication of the acute infective fevers. The organisms usually at work are the streptococcus pyogenes and the staphylococcus albus and aureus. Some writers note that injuries to the head occasionally result in abscess of the liver, but according to K. Bärensprung, who has made an investigation into this point, liver abscess is not more specially related to injuries of the head than to those of the peripheral parts generally. Most of these cases are examples of septicopyæmia, but some are possibly due to retrograde embolism.

SUPPURATIVE HEPATITIS OF PORTAL ORIGIN.—This is by far the most frequent form. In this case we have practically a septicopyæmia confined to the liver, for it is upon this organ that the brunt of the disease is concentrated. Infective agents may come from any part of the portal tract. They do not necessarily cause disease of the larger venous trunks, but may reach the finer capillaries, where they proliferate and lead to inflammation and obstruction of the vessels. Often the lesion is an acute thrombophlebitis of the portal vein, or a purulent infiltration of the vessel wall and the adjacent parts (suppurative portal pylephlebitis). An example of this is seen in the case of infection of the umbilical vessels in new-born children. It is fairly common in appendicitis and perityphlitis, which form the most important cause. Here there is likely to be thrombophlebitis of the superior mesenteric vein extending directly from the appendicular region into the portal vein. In 517 cases of appendicitis collected by Dr. George E. Armstrong,[3] of Montreal, from the clinics of the Royal Victoria, Montreal General, and Western hospitals, in 67 that died thrombophlebitis of the mesenteric vessels and abscess of the liver occurred five times. Again, combining the statistics of Einhorn, Langheld, and R. H. Fitz, we find that in 479 post-mortems upon appendicitis cases, pylephlebitis and abscess of the liver were found in 23 cases, or 4.8 per cent. Septic emboli occasionally arise from the small intestine, stomach, spleen, and pancreas, and also occur in dysentery, pelvic abscess, and rectal disease. Exceptionally, in cases of cholecystitis and pericholecystitis, extension of the process to the portal vein may take place, and thus an embolic infection of the liver result.

In the septic embolic and metastatic forms one sees a number of abscesses of varying size. These are usually irregular, pointing to their development from the confluence of isolated foci. Occasionally the union is not complete, so that the abscess presents a more or less lobular arrangement. In the periphery of the larger abscesses, and separated by relatively healthy tissue, minuter areas of suppuration can often be seen. The suppurative process tends to spread along the portal sheaths, but the hepatic veins do not always escape, for thrombi may be found in them extending even into the larger trunks. The cavities are filled with viscid, yellowish-green pus, of foul odor, often mixed with blood, in which sequestra of liver substance may often be found. Round about the abscesses is a narrow zone of yellowish-white color, or, in gangrenous inflammation, of a dirty green appearance.

Microscopically, a study of the most recent lesions