

change in the secretion toward an excess of its earthy constituents, or an obstruction leading to retention of the secretion. The pancreas is also liable to amyloid and fatty degeneration, and is sometimes the seat of secondary tubercular deposits.

DISEASES OF THE LIVER.

TOPOGRAPHY OF THE LIVER.

THE liver, with its annexed apparatus, occupies the right hypochondrium, and extends in part across the epigastrium (Fig. 13). On percussion the area of the hepatic dullness is determined by the position of neighboring organs, as well as by those variations in the size of the liver due to disease and to its own normal elasticity. Under variations of the blood-pressure—as, for example, in mitral obstruction or regurgitation, and in portal stenosis—the size of the liver increases or lessens. Distention of the intestines with air, and emphysema of the lungs by increasing sonority at the borders of the liver, narrow the boundary of the dullness. When the patient is recumbent, the liver gravitates upward and backward; when the patient is upright, it glides downward and forward—hence the area of dullness shifts correspondingly. Besides the variations in the area of dullness due to these several factors, the vertical line of dullness differs at different points: in the axillary line it is four to five inches, and in the mammary line three to four inches. There is a difference between the deep and the superficial dullness. On strong percussion the deeper parts are thrown into vibration, and hence the wider the area of dullness; whereas on slight percussion the shelving margin of the lung vibrates alone, thus lessening the dullness.

In health the inferior border of the liver extends to the margin of the ribs. If on palpation it can be felt beyond, there is probably enlargement of the organ, unless effusion into the thorax or a tumor, etc., depress it downward. In the axillary line the dullness extends to the upper border of the eleventh rib (Fig. 13, XI). Besides the various conditions external to the organ which may affect its position, it should not be forgotten that—as has been stated—the liver has a considerable

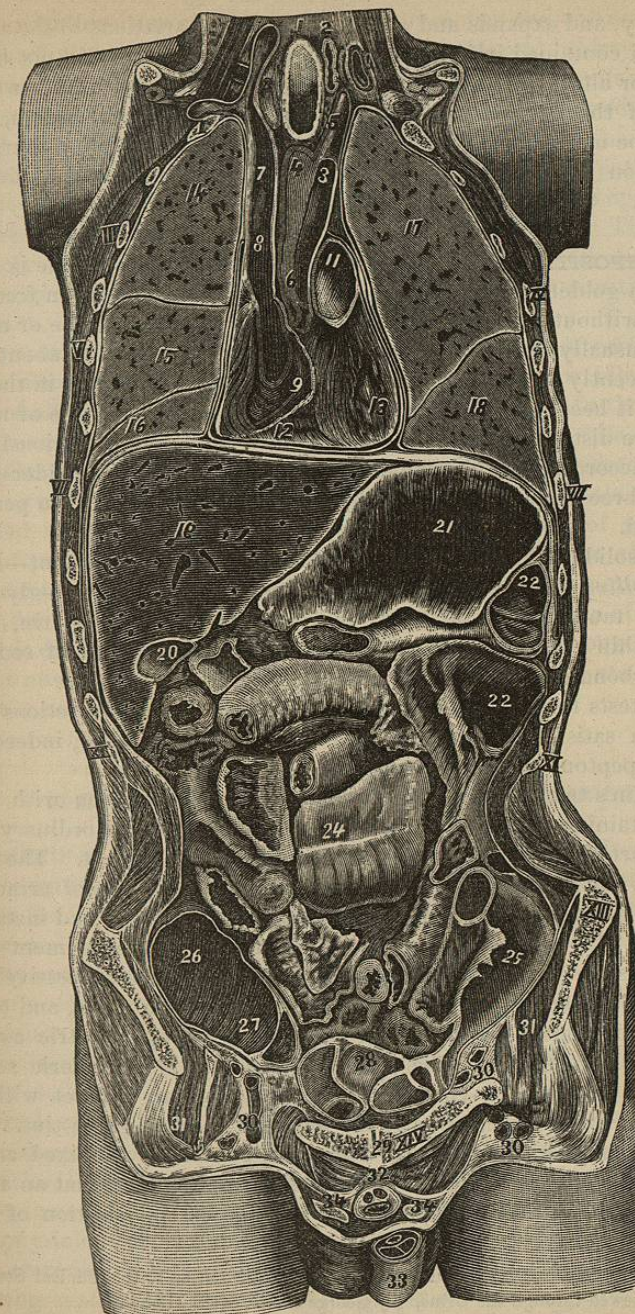


FIG. 13.—HORIZONTAL SECTION OF THORAX, ABDOMEN, AND PELVIS, FROZEN.—1, Section of Trachea; 11, Left Atricle; 13, Left Ventricle; 9, Right Ventricle; 19, Liver; 20, Gall-bladder; 21, Stomach; 26, Cæcum; 27, Entrance to Appendix; 25, Descending Colon. After Rüdinger.

elasticity, and expands and contracts with the variations in the amount of blood contained in it. Mere change of position should not be mistaken for alteration in size. It is a good plan, in exploring the topography of the liver, to fix first the upper border of the organ, which should be marked with ink, and then ascertain the inferior margin by percussion from below upward until the line of hepatic dullness is reached.

COMPOSITION OF AND TESTS FOR BILE.—The bile is a fluid having a golden, reddish-brown, or greenish color, and when free from mucus, without viscosity. In reaction it is faintly alkaline or neutral—most usually the latter—and it has a specific gravity of about 1010, when recently secreted; but if it is retained for some time in the gall-bladder it becomes darker in color, viscid from the presence of mucus, and more distinctly alkaline. The quantity of solids is variously estimated, according to the time it has remained in the gall-bladder—from two to three per cent. when fresh, and rising to ten to fifteen per cent. when old.

The solids of bile consist of a coloring-matter or pigment—*bilirubin* or *biliverdin*; of peculiar acids, combined with soda—glycocholate and taurocholate of soda; of fatty matters—cholesterin, soaps, and lecithin; and of salts—chloride of sodium, phosphate of soda and lime, carbonate of sodium, etc.

The tests for bile when mixed with other animal secretions have not been satisfactory hitherto, nor are they now unless, indeed, Dr. Oliver's peptone test prove sufficient.

Gmelin's test for bile-pigment consists in the reaction with nitric acid containing some nitrous, which is the case with the ordinary commercial article. There are several modes of applying it. The most distinctive is to place on a porcelain plate a thin stratum of urine, and bring in contact with it some nitric acid. At the point and instant of contact, a play of colors due to the oxidation of the pigment takes place—first, a green, then blue, violet, and red zones successively appear. Rosenbach suggests the plan of filtering the urine, and touching the pigment adherent to the paper with a drop of nitric acid—a green circle forming at the point of contact. Hydrochloric acid is preferred to nitric by Harley. This, brought into contact with the urine on a white plate, gives to the pigment an olive-green tint.

The most promising test for bile when contained in mixed animal secretions is that of Oliver.* It is based on the fact that an acidulated peptone is precipitated from its solution on the addition of bile.

* London "Lancet," April and May, 1885, "A Contribution to the Clinical Study of the Liver viewed through the Urine," by George Oliver, M. D., London.

The test solution, as recommended by Oliver, has the composition as follows: "Pulverized peptone (Savory and Moore), thirty grains; salicylic acid, four grains; acetic acid (B. P.), thirty minims; distilled water, eight ounces. Perfect transparency is obtained after repeated filtration." The reaction is described by Oliver as follows: "When twenty minims of urine, containing bile salts in pathological quantity, are run into sixty minims of the test solution, an opalescence appears proportionate to the amount of bile derivative." This test is not only exceedingly delicate, but there do not appear to be any sources of fallacy in respect, at least, to the ordinary constituents of the urine.

Pettenkofer's test can not be used with any degree of certainty for bile in complex animal solutions, such as urine, but for bile alone it satisfies all the requirements. It is applied as follows: In the solution of bile some strong sulphuric acid is put, and when the bile acids are precipitated more sulphuric acid is added, until they are dissolved. A little sirup is now dropped into the liquid, and the whole is gently warmed, when a fine purple color like that of a solution of permanganate of potassium is developed. Strassburg's modification of this test is sometimes convenient. To the mixture suspected to contain bile—urine, for example—a little cane-sugar is added, and a strip of filtering-paper is dipped into it and then dried. A drop of strong sulphuric acid is now let fall on the paper, when, in less than a minute, a ring of violet appears around the drop.

SPECIAL DISEASES: JAUNDICE, OR ICTERUS.

Definition.—The term *jaundice*, derived from the French word *jaune*, signifying yellow, means a yellowish discoloration of the skin due to the deposition of bile-pigment. The Greek word *icterus*, sometimes used to designate this state, has the same meaning. Jaundice is a symptom, common to many affections of the liver. To give it separate consideration, as if it were a disease, is not, therefore, a logical position, but it is the usual practice of systematic writers, and the author is, therefore, constrained to follow it, that his work may not appear deficient.

Etiology.—There are three conditions under which jaundice may be produced. Hæmatogenous is that due to the disorganization of the blood and the separation of hæmatoidin. At one time bilirubin—a bile-pigment—and hæmatoidin—blood-pigment—were supposed by the physiological chemists to be identical. It would hence follow that, were any substance to enter the blood capable of setting free the coloring matter, the appearance of jaundice would result. The bile

acids were supposed to effect this change, setting free hæmatoidin, and thus causing hæmatogenous jaundice. But the identity of the two pigments is no longer admitted, and the production of artificial jaundice has not been accomplished by injecting bile acids into the blood. The theory of hæmatogenous jaundice is, therefore, no longer tenable, with the data at present in our possession.

The existence of a jaundice by suppression was entertained for several centuries, and has been supported by eminent authorities of the present generation—by Watson,* Bamberger,† Budd,‡ Trousseau,|| Moxon,§ and others—but is now generally abandoned except by Harley, who in the last edition of his work [1885] reaffirms and vigorously maintains his original position. To establish this theory, it is necessary to show that the bile exists preformed in the blood, and that the liver merely acts as a strainer, to separate it. Notwithstanding the detection of the bile acids is comparatively easy, neither acids nor pigments can be found in the blood—not even in the blood of the portal vein. Hence it follows that jaundice by suppression does not exist.

The third theory, which is universally admitted to be true, if it may be by some regarded as limited in application, ascribes jaundice to the reabsorption into the blood of bile already formed by the liver. There are two conditions under which this is known to occur, and a third, which is supposititious. The usual condition consists in an obstruction of the ducts. Heidenhain has proved experimentally that a very slight obstacle suffices. It has been observed clinically that jaundice occurred when there was such a slight catarrhal swelling of the intestinal extremity of the common duct as left no trace after death, except the staining which marked the limit of the bile-flow.

Again, bile will flow into the vessels instead of into the ducts, when the pressure in the former is lower than it is in the latter. This, Frerichs maintains, is the chief cause of jaundice, and Heidenhain has also proved it by direct experiment. The occurrence of jaundice by mental emotion can only be rationally explained by this theory. It has been maintained that jaundice may be produced by the absorption of bile that the intestines fail to dispose of. A species of circulation of the bile is, by Schiff, maintained to exist. That which is cast into the duodenum from the common duct is taken up by the radicles of the portal vein, undergoing changes not well understood, but probably

* "Lectures on the Practice of Medicine," Lecture lxxv.

† "Krankheiten des chylopoietischen Systems," p. 517.

‡ "On Diseases of the Liver," p. 373.

|| "Clinique Médicale," tome iii, p. 274.

§ "Transactions of the Pathological Society."

due to an action of the pancreatic juice, as is the present notion, and is again excreted by the liver. A failure to destroy this portion of the bile, or the presence of, or an excess of, may result in the absorption of sufficient to produce jaundice. There is little probability in this theory.

Pathological Anatomy.—The liver being most concerned should be carefully examined. Obstruction of the ducts by hyperæmia and catarrhal swelling may disappear after death. In that case, the presence or absence of bile-staining will indicate the seat of the obstruction. Very often the *ante-mortem* state is shown to have been an obstruction at the duodenal orifice of the common duct, by the absence of bile-staining here and in the neighboring part of the intestine, while above in the ducts the staining is well marked. A plug of mucus in the common duct, not stained with bile, will show that no bile has passed since the formation of the plug. Masses of epithelium and mucus may form obstructions high up in the smaller ducts. The hepatic or common duct may be obstructed by a calculus. Tumors, enlarged lymphatics, an aneurism, cancer of the pancreas, etc., may occlude by exterior pressure. When the obstruction, of what nature soever it may be, is persistent, important changes occur in the liver. The ducts and gall-bladder become enormously dilated—in a uniform or sacculated manner. The walls of the duct thicken, due to a hyperplasia of the connective-tissue elements, and the follicles dilate. The coloring matter of the bile present in the ducts is finally absorbed, and only a colorless fluid remains. The substance of the liver changes, has a mottled appearance due to the tinting of the center of the lobule with a deep yellow, while the peripheral portion has a lighter yellow shade—changes due to the deposit of pigment. The bile when the ducts are obstructed passes out of the liver by the lymphatics into the thoracic duct, and thence into the blood (Fleischl).* The obstruction continuing, the depth of color in the lobules increases, changing to a dark green finally; the substance of the liver becomes firmer and granular, enlarges a little, and then begins to shrink. If the jaundice has persisted for a long time, a considerable overgrowth of connective tissue takes place, the hepatic cells shrink, become angular, and their contents have a shining, rather vitreous appearance, and in some cases are destroyed.

The kidneys also undergo important changes in jaundice, as Frerichs was the first to show. When the jaundice has been of long standing, the kidneys have a deep-olive tint, the tubules are stained green or brown, and the epithelium is fatty, colored greenish, brownish, or black, and is largely detached. In extreme cases, the deposits of pigment fill the tubules with a black mass.

* Legg, "On the Bile, Jaundice, and Bilious Diseases," New York, D. Appleton & Co., 1880, p. 351.

Symptoms.—Jaundice first appears in the conjunctiva, and immediately the bile-pigments may be detected in the urine by Gmelin's test. Then the skin of the face appears sallow or fawn-color, quickly changing into yellow, and thence the yellowness extends to the chest and arms, to the abdomen and lower limbs, and finally the whole body is uniformly yellow. In slight cases, the face and thorax only may be tinged. The mucous membrane of the mouth is stained; but it does not show in the lips, because of their redness, and is visible in the roof of the mouth and the soft palate. Very rarely does the saliva exhibit a yellow tinge, and present the reaction for bile-pigment; but the milk of the nursing mother, jaundiced, contains bile, and jaundice is said to be communicated to infants in this way. In a very short time, within forty-eight hours probably, bile-pigments appear in the blood; but doubts may be expressed in regard to the presence of bile acids, although they have been discovered in the blood of dogs whose common duct had been tied. Becquerel and Rodier, and afterward Frerichs, found that there was a large increase of fatty matters and cholesterin. The blood is also changed, as respects the red globules, which are diminished in number. The urine early undergoes a change, and becomes intensely colored with bile-pigment, which it imparts to linen and white paper dipped into it. The color varies from a simple increase in the depth of the normal color up to the darkness of black coffee. The usual tint is that of dark sherry or brandy. The urine is usually turbid on cooling, from the presence of a great quantity of urates; is acid in reaction, and the specific gravity is well up toward normal. Albumen, at least in traces, is rarely absent from the urine in jaundice. The best test for the presence of bile in the urine is the nitric-acid or Gmelin's test. It is best performed by pouring into a test-tube about an inch of nitric acid; then let drop from a pipette some suspected urine on the side of the tube. As the urine comes in contact with the acid, if free from bile, it forms a red line on the margin of the acid; but if it contain bile there will be an alternation of colors—green, blue, violet, and red—the green being uppermost. Although the bile acids have not been found in the urine, nitrogenous derivatives from them were discovered by Hoppe-Seyler, Kühne, and Bischoff. Recently minute traces of the bile acids have been detected in the urine in health. It is supposed that absorption of these takes place in the intestine. If jaundice has long continued, the bile acids cease to be produced, and hence are not to be found in the urine. The amount of urea present in jaundice may be normal, or above or below normal, so that at present no conclusions can be drawn from this fact. Casts are sometimes present in the urine, especially hyaline, sometimes epithelial.

The stools in jaundice are grayish or slate-colored, sometimes quite white. In other cases, portions of the stools are stained with bile, some parts not containing any, giving them a parti-colored appearance.

They are often very fetid, from the decomposition of some articles of food, and the wind passed is equally foul. Again, they may be entirely without odor. As a rule, the bowels are rather constipated, although diarrhœa may occur.

Jaundice is usually unaccompanied by pain. It is true, those cases due to the passage of gall-stones are preceded by the most severe suffering; but the jaundice itself is comparatively painless. Headache is a common symptom; but it is rarely considerable—often only a tense feeling in the frontal region. Drowsiness, hebetude of mind, and despondency are commonly experienced. The appetite is generally poor, but is sometimes inordinate or canine. Nausea, a persistent and harassing hiccup, and a heavily furred tongue, are present in some cases; in others, the digestion is good and the tongue clean. Languor, muscular soreness, inability for any considerable exertion, and decline in the bodily vigor generally, are experienced in most cases. As that important material, glycogen, ceases to be formed when the bile-ducts are obstructed, an adequate explanation is thus afforded of the decline in strength. Although various disturbing causes may alter the conditions, in jaundice the temperature is barely normal, or is below normal. It has been shown experimentally that the injection of the bile acids into the blood lowers the temperature. In those diseases—as pneumonia, for example—in which high temperature is the rule, the fever-heat does not attain the usual altitude when jaundice occurs. It sometimes happens that the temperature rises quite high—104°, 105°, or 106°—at or near the termination of chronic jaundice; but this is indicative of a fatal termination, and is due to or accompanied by a considerable disturbance of the nervous system.

In many cases of jaundice the pulse is slow. Frerichs has met with a case in which it was twenty-one to the minute, but it rarely descends below fifty. Exercise and the occurrence of inflammatory action increase the pulse-rate when it is abnormally slow. The cause of the slow beat has been variously interpreted: it has been ascribed to increase of inhibition; to the action of the bile acids on the cardiac muscle and on the cardiac ganglia. A murmur has also been discovered in the mitral area in the cases of slow beat of the heart, due, it is supposed, to diminished power in the papillary muscle, and whence imperfect action of the mitral-valve segment.

More or less itching of the skin, sometimes an intolerable itching, is observed in many cases—probably in three fourths of the cases. It is sometimes preceded by nettle-rash; and the itching may precede the jaundice by several days, even weeks. Sometimes the itching ceases when the jaundice appears; but it comes on in most cases with the jaundice, and gradually declines. The itching is usually worse at night, and is most annoying where the clothes have pressed. The taste in jaundice is often bitter, and sapid articles are not rightly ap-

preciated. Rarely is the vision yellow, all objects being seen through a yellow medium.

In the more ancient cases of jaundice, yellow, leathery patches, round or oval in shape, appear on the skin, especially on the eyelids and hands: they are entitled *xanthelasma*, and two forms are recognized—the flat and the tuberos. The change consists in a fatty infiltration of the affected area. It is not necessary to the appearance of this affection, that the jaundice be intense, but it must be long continued. It very rarely arises earlier than four months, and usually not earlier than a year, after the appearance of the jaundice. Why it should develop in some cases of jaundice and not in others is unknown. The conditions exciting it are equally obscure. It may slowly disappear without leaving any changes, but remedies do not affect it.

Course, Duration, and Termination.—The behavior of jaundice is so largely dependent on its cause, that no course can be laid down applicable to all cases. The jaundice of acute yellow atrophy and of phosphorus-poisoning is of short duration and fatal, while that due to a permanent obstruction is most protracted. The jaundice arising from catarrh of the ducts depends on local conditions, which vary in extent and importance. The reader will find under the several maladies of the liver the manner in which the course, duration, and termination are thus influenced.

Diagnosis.—A simple inspection suffices to make the diagnosis of jaundice, but to determine its cause is most difficult. If the jaundice comes on in the course of a gastro-duodenal catarrh, and there is no apparent change in the liver, nor disease of other organs, it is probably a case of simple catarrhal jaundice. If it occur in the course of a malarial fever, it is probably of this form. If the jaundice is preceded by sudden violent pain in the right hypochondrium, it is due to the passage of gall-stones. If the jaundice be intermittent, but irregularly so, and if the attacks occur frequently, the jaundice from one attack not disappearing before another comes on, the cause is probably gall-stones. If the attacks are regularly intermittent, and accompanied by fever of high grade, preceded by a chill and succeeded by a sweat, the cause is malarial. If the jaundice be persistent—lasting many months—and intense, and follow an attack of pain which has not been repeated since, the liver remaining unchanged in size, it is probably due to a permanent occlusion by a gall-stone. An intense, persistent jaundice, with uniform and painless enlargement of the liver, without other indication of disease, may signify obstruction by hydatids. A faint jaundice, a mere fawn-color, lasting many months unchanged, with evidence of contraction after a period of enlargement of the organ, is produced by sclerosis or cirrhosis, or nutmeg-liver, and this diagnosis becomes more certain if there be present ascites and enlargement of the superficial veins of the abdomen. Jaundice, with persistent pain or soreness in

the right hypochondrium and considerable enlargement of the liver, indicates cancer.

Treatment.—The several conditions of which jaundice may be a symptom require treatment according to their nature, and the reader is referred to the special articles for the necessary guidance. Irrespective of the cause the treatment of jaundice is concerned with the removal of this symptom. As most cases are due to some kind of obstruction, it is improper to stimulate the organ when it is unable to discharge into the intestine that which it has already produced. Laxatives and diuretics are the obvious remedies to secure the elimination of the biliary matters circulating in the general system. Grain-doses (one grain) of calomel, rubbed up in sugar of milk, and given at night, is the best laxative in these cases, but this remedy must not be given frequently, lest ptyalism result. Calomel allays the irritability of the gastro-duodenal mucous membrane, lessens the activity of the liver, which is shown by the diminution in the amount of bile excreted, and stimulates to increased effort the glands of the lower ileum and cæcum. This combination of actions renders calomel peculiarly serviceable in the obstructive forms of jaundice. Saline laxatives, which have a diuretic action, are very useful: they promote elimination by the two most important channels. In two instances of persistent jaundice from catarrhal obstruction, I have seen very sudden relief afforded by the compound jalap powder.

Some of the newer antiseptics have proved useful in the treatment of jaundice. Of these, the benzoates and salicylates of sodium and the salicylate of cinchonidine have exerted the most distinctly curative action. Salol, which is a salicylate of phenol, has been highly commended recently for its therapeutical utility in affections of the intestinal mucous membrane characterized by fermentation of the contents of the canal in process of digestion.

In malarial jaundice there can be no question regarding the utility of quinine. The swollen liver, and, also, the swollen spleen, yield rapidly to the action of sufficient doses—from 10 to 30 grains each day.

In gouty jaundice the salts of manganese and permanganate of potassium, sodium phosphate, and salicylate of cinchonidine are useful in a high degree.

CONGESTION OF THE LIVER.

Definition.—By congestion of the liver is meant an increase in the amount of blood in the organ. Owing to the mechanical arrangement of its vessels, the circulation in the liver is influenced by the condition of the heart and lungs, by the state of digestion, and by the action of the diaphragm and abdominal muscles. It is peculiarly liable to suffer from changes in its blood-supply. It may be active (malaria, excesses in eating), or passive (mechanical stasis from obstruction at the heart or lungs).

Causes.—The increased fullness of the portal vein and hepatic artery during the process of digestion is a physiological state, which