

guinal fossa, and consequently always lying on the inner side of the deep epigastric artery; (2) in not passing along the entire canal; (3) in external appearance, being smaller and more globular in form; (4) in being situated over the os pubis and not in the course of the inguinal canal. The most valuable differential point is

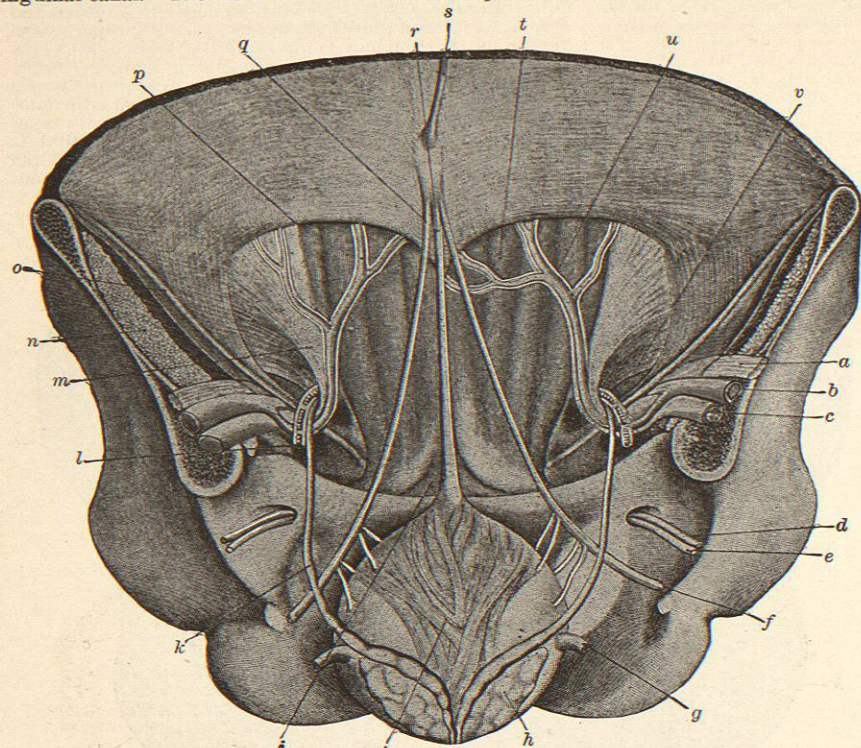


FIG. 4.—Rear View of Anterior Abdominal Wall, the Peritoneum having been Removed. (Joessel.) a, Anterior crural nerve; b, external iliac artery; c, external iliac vein; d, obturator artery; e, obturator nerve; f, umbilical artery; g, ureter; h, seminal vesicle; i, bladder; j, adnuculum lineae albae; k, vas deferens; l, spermatic vessels; m, transversalis fascia; n, iliacus; o, Poupart's ligament; p, semilunar fold of Douglas; q, obliterated umbilical artery; r, urachus; s, suspensory ligament of liver; t, rectus muscle; u, deep epigastric vessels; v, internal abdominal ring.

the position of the deep epigastric artery. The floor of the middle inguinal fossa is the rear wall of the inguinal canal. It is divisible into two parts: An inner part, the conjoined tendon of the internal oblique and transversalis; an outer part, the transversalis fascia. The conjoined tendon varies greatly in its development. In many cases it is slight and scarcely discernible, while in others it is strongly developed, especially in its deeper portion which is derived from the transversalis muscle, and which may bound the canal as far outward as the internal ring.

There are two forms of internal hernia which pass out through the middle fossa. The first and most common form protrudes in the inner part of the fossa, either separating or pushing before it the conjoined tendon. It traverses only the lower end of the canal, to emerge at the external ring. The coverings of this variety, from within outward, are the peritoneum and subperitoneal tissue, the fascia transversalis, and the conjoined tendon, except in those cases in which the sac passes between the fibres of the tendon, the intercolumnar fascia, the superficial fascia, and the skin. The spermatic cord, placed behind and on the outer side, is not in contact with the sac, the cremasteric and the infundibuliform fascia being interposed.

The second form of internal hernia passes into the in-

guinal canal through the outer portion of the rear wall, and lies between the conjoined tendon internally and the deep epigastric externally. It passes for a considerable distance along the canal, which gives it a certain degree of obliquity. The coverings of this of the first variety, with the exception of the conjoined tendon, which is replaced by a layer derived from the cremasteric fascia.

THE INGUINO-FEMORAL REGION.—Upon removing the skin of the inguino-femoral region the superficial fascia of the thigh is exposed, ascending as a continuous layer upon the abdomen, descending upon the thighs, and internally passing into the dartos of the scrotum and the superficial fascia of the perineum. A deep layer of superficial fascia, thin and membranous, can also be distinguished. It is this layer which is attached to the margins of the saphenous opening, closing it and receiving in this locality the special name of cribriform fascia. Between the two layers are the superficial blood-vessels and the lymphatics of the thigh.

The deep fascia of the thigh, the fascia lata, strong and aponeurotic, concerns us only in its anterior and upper regions, where it is described as consisting of two portions, the iliac and the pubic. The iliac portion, attached throughout to Poupart's ligament, lies in front of the femoral sheath, and, at the inner end of Poupart's ligament, terminates in a free edge, which, passing downward and outward and then inward, in the angle between the internal saphenous and femoral veins, becomes continuous with the pubic portion. The pubic portion, continued upward behind the femoral sheath to which it is attached, ends at the linea ilio-pectinea.

Thus is formed the saphenous opening through which the internal saphenous vein passes to join the femoral vein. Its upper extremity lies about an inch external to the pubic spine. Its vertical diameter is about an inch and a half or two inches. Only the outer side of the opening is well marked, where the free edge of the iliac portion of the fascia forms a distinct falciform border, ending above and below in superior and inferior cornua. On the inner side, the pubic portion does not form a well-marked edge, but, after covering the pectineus muscle, passes upward behind the femoral sheath to which it is connected, to the linea ilio-pectinea where it is continuous with the iliac fascia. The deep layer of the superficial fascia is attached to the margin of the opening which it closes, and, because it is perforated by the internal saphenous vein and numerous small arteries and veins, is known as the cribriform fascia.

Poupart's Ligament.—The defect in the anterior wall of the pelvis between the anterior superior spine of the ilium and the spine of the pubis is bridged over by

Poupart's ligament. The space between the ligament and the pelvic bones serves for the passage of certain structures from the abdomen into the thigh, and is divided into three compartments by the fasciae investing them.

The first or iliac compartment, situated externally, is formed anteriorly by Poupart's ligament and the iliac fascia, posteriorly by the ilium, and internally is separated from the second or pectineal compartment by an intermuscular septum. This compartment transmits the ilio-psoas muscle and anterior crural nerve.

The second or pectineal compartment, lodging the upper end of the pectineus muscle, does not communicate with the abdomen, but corresponds to the space between the pubic portion of the fascia lata and the pectineal surface of the os pubis.

The third or vascular compartment is the most important. It is situated in front of the other two, being bounded anteriorly by Poupart's ligament, and posteriorly by the continuous iliac and pectineal fasciae. It transmits into the thigh the external iliac vessels and the crural branch of the genito-crural nerve.

Femoral Sheath.—As the external iliac vessels become the femoral, they are enclosed within the femoral or crural sheath, which accompanies them into the thigh. The anterior wall of the sheath is derived from the transversalis fascia, the posterior wall from the iliac fascia. On the outer side of the artery the two layers are continuous and closely embrace it; but on the inner side, while they are continuous, a space is left between them and the vein. Furthermore, both the anterior and posterior walls are attached to the iliac and pubic portions of the fascia lata, respectively.

Within the sheath the artery lies external to the vein, and is separated from it by a thin septum stretched from the anterior to the posterior wall. A second septum completes, on the inner side, the compartment for the vein, and cuts off a third space, about one-half inch in length, between the vein and the inner wall of the sheath. This is the funnel-shaped crural canal, through which a femoral hernia descends. Thus each vessel has its separate compartment, and there remains a small internal compartment containing only areolar and lymphatic tissue.

The Femoral or Crural Canal.—The size of the femoral canal varies in different persons, being larger in the female than in the male. Like the external abdominal ring, the size of the femoral canal and the degree of tension of its orifices are markedly influenced by the position of the thigh. Extension, abduction, and external rotation contract the opening, while flexion, adduction, and internal rotation relax the femoral canal and its orifice; consequently this latter position should be used in the application of taxis to a femoral hernia.

The four walls of this canal will be understood from the above description. Below, it terminates beneath the saphenous opening, while above, it opens on the anterior abdominal wall by an aperture known as the femoral or crural ring. This aperture is oval, and is larger in the

female; its long diameter, directed transversely, is about one-half inch.

The ring, covered by the parietal peritoneum, shows a slight depression, which, if not visible, can easily be felt. Beneath the peritoneum is a thin layer of condensed pro-peritoneal tissue, the septum crurale, which closes the ring. The ring is bounded anteriorly by Poupart's ligament and the deep crural arch; posteriorly, by the os pubis, covered by the pectineus muscle and the pubic portion of the fascia lata; externally, by the external iliac vein. Internally to the ring are the sharp margins of Gimbernat's ligament, the conjoined tendon, and the deep femoral arch. With the exception of the external, the boundaries of the ring are formed by very unyielding structures.

Relations. The position of the external iliac vein has been noted. The deep epigastric vessels cross the superior and external angle. A small communicating branch between the deep epigastric and obturator arteries is usually found on the superior aspect of Gimbernat's ligament.

Obturator Artery.—In two out of every five subjects, the obturator arises from the deep epigastric on one or both sides. It then turns backward into the pelvis to reach the thyroid foramen. In doing so it may pursue one of two courses: First, it may turn backward close to the external iliac vein, and will then be on the outer side of the femoral ring; second, it may first run inward, then arch backward along the free edge of Gimbernat's ligament, and will then be on the inner side of the ring. This

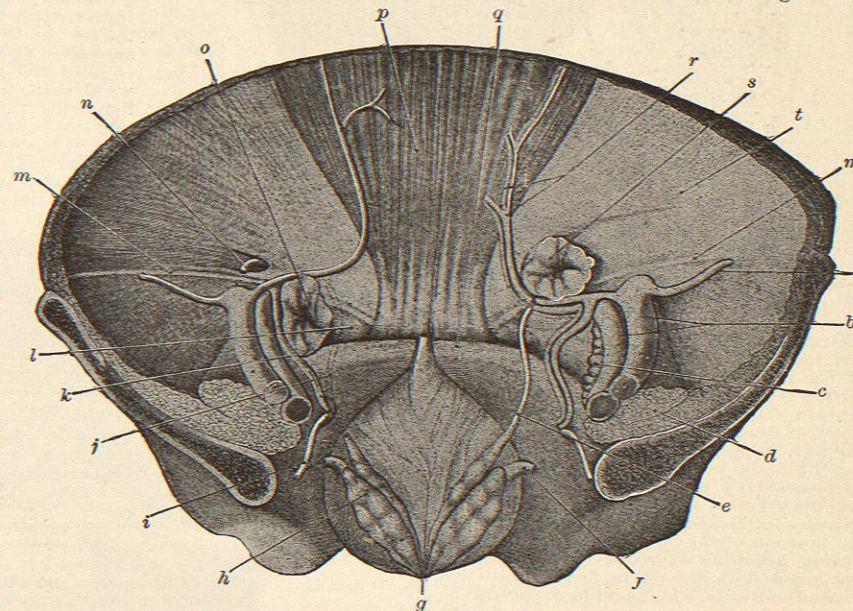


FIG. 5.—On the right side are shown the location and relations of an external inguinal hernia; on the left side, those of a femoral hernia. The obturator artery is shown arising from the deep epigastric. Its course along the free edge of Gimbernat's ligament is diagrammatically shown on the left side. (Joessel.) a, Deep circumflex iliac artery; b, external iliac artery and vein; c, lymphatic glands; d, ilio-psoas muscle; e, vas deferens; f, ureter; g, bladder; h, seminal vesicles; i, obturator nerve; j, abnormal obturator artery, internal to sac of femoral hernia; k, abnormal obturator artery, external to neck of femoral hernia; l, Gimbernat's ligament; m, Poupart's ligament; n, internal abdominal ring; o, sac of a femoral hernia; p, rectus muscle; q, upper border of pubis; r, deep epigastric vessels; s, sac of an external inguinal hernia; t, transversalis fascia.

inner position is more frequent in males than in females, though the epigastric origin on the whole is somewhat more common in females than in males.

These anomalies can be detected in a given case only by palpation of the artery through the femoral canal.

Femoral hernia is rare as compared with the inguinal variety. It occurs more frequently in females, and is al-

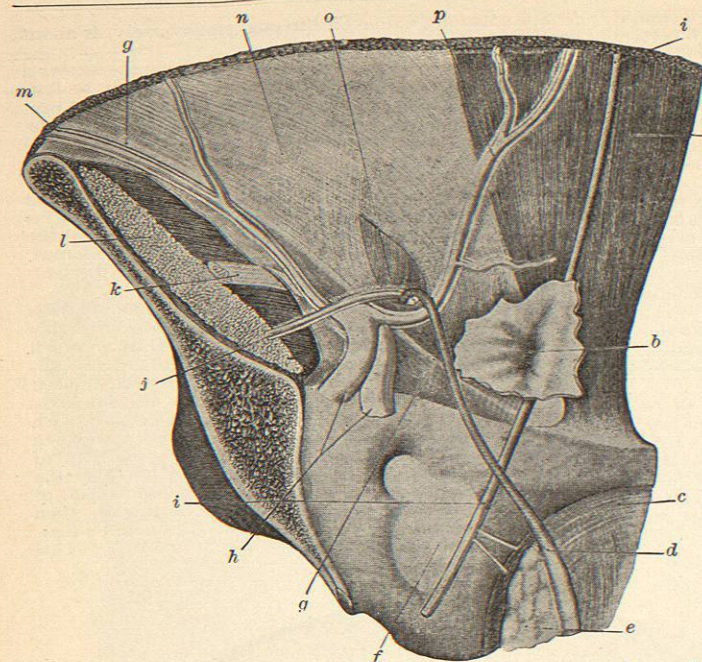


FIG. 6.—Rear View of Internal Inguinal Hernia. (Joessel.) *a*, Rectus; *b*, sac of internal inguinal hernia; *c*, bladder; *d*, vas deferens; *e*, seminal vesicle; *f*, obturator foramen; *g*, Poupart's ligament; *h*, external iliac artery and vein; *i*, obliterated umbilical artery; *j*, spermatic vessels; *k*, crural nerve; *l*, iliac muscle; *m*, deep circumflex iliac vessels; *n*, transversalis fascia; *o*, internal abdominal ring; *p*, deep epigastric vessels.

ways acquired. Entering through the femoral ring, it passes vertically downward along the femoral canal as far as the end, carrying before it a sac of peritoneum and the septum crurale. Having reached this point, the hernia turns forward through the saphenous opening, where it derives a covering from the cribriform fascia, and then ascends beneath the superficial fascia of the groin as far as, or above, Poupart's ligament. The fascia propria is composed of the septum crurale and the femoral sheath, but at times, instead of distending the sheath, it passes through an opening in it.

Within the canal the hernia is small, as it is surrounded by unyielding structures; but having passed the saphenous opening, it rapidly enlarges. The direction of a femoral hernia and the position of the body should be borne in mind during attempts at reduction by taxis. Thus the lower limb should be flexed, adducted, and rotated inward. The pressure should be first downward, then backward, and finally upward.

A femoral hernia may be strangulated at any part of the canal or at the saphenous opening, the most frequent point being the femoral ring. In all cases the stricture may be safely divided in an upward direction. At the femoral ring, the least damage will be done by dividing Gimbernat's ligament, except in cases of anomalous obturator artery.

The coverings of a femoral hernia, from without inward, are the skin, the superficial fascia, the cribriform fascia, the fascia propria, consisting of the femoral sheath and the septum crurale, and the peritoneum.

The Posterior Abdominal Wall. The posterior

abdominal wall is of simpler construction and of less extent than the antero-lateral. In its centre is the portion of the spinal column composed of the five lumbar vertebrae with their connecting ligaments and cartilages. On each side are arranged the muscles—ilio-psoas, quadratus lumborum, and erector spinae—enclosed within sheaths of fascia, that of the ilio-psoas muscle being of especial importance. This fascia is attached to the spinal column about the origin of the muscle; to the ligamentum arcuatum internum and to the anterior layer of the lumbar aponeurosis along the outer border of the muscle. Below, it firmly binds the iliac portion of the muscle into the false pelvis, being attached about its entire circumference, with the exception of the space where it passes beneath Poupart's ligament to form the posterior wall of the femoral sheath. It follows the tendon of the ilio-psoas to its insertion, and ends by blending with the fascia lata. Beneath this fascia collections of pus resulting from caries of the spine or of the ilium may be guided into the thigh, to appear just below the groin on the outer side of the femoral vessels. These collections of purulent fluid should be distinguished from those situated beneath the transversalis fascia or in the subperitoneal tissue. In the first instance, the pus can spread no farther backward than the outer edge of the psoas, and no farther downward than the iliac crest and Poupart's ligament; internally, it is arrested at the mid-line. In the second instance, an abscess is in close contact with the caecum or sigmoid flexure, and may open into one of them; or it may follow the iliac blood-vessels into the thigh. In any case the typi-

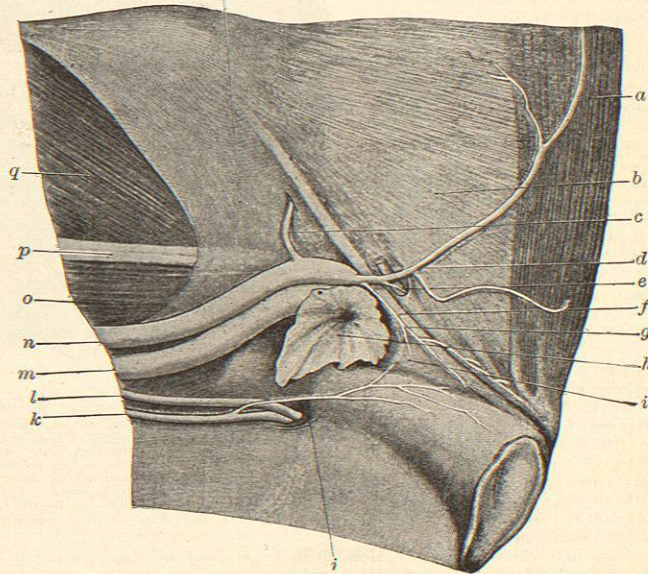


FIG. 7.—Rear View of Femoral Hernia, Showing Normal Obturator Artery. (Joessel.) *a*, Rectus muscle; *b*, transversalis fascia; *c*, deep circumflex iliac artery; *d*, deep epigastric artery; *e*, cremasteric artery; *f*, Poupart's ligament; *g*, pubic branch of deep epigastric; *h*, hernial sac; *i*, Gimbernat's ligament; *j*, pubic branch of obturator artery; *k*, normal obturator artery; *l*, obturator nerve; *m*, external iliac vein; *n*, external iliac artery; *o*, psoas muscle; *p*, anterior crural nerve; *q*, iliac muscle; *r*, iliac fascia.

cal picture may be lost should an abscess penetrate the layer of fascia beneath which it originally developed.

The incisions through the posterior abdominal wall are made to expose the kidney and colon. They are noted under the descriptions of these organs.

ABDOMINAL CAVITY AND CONTENTS.—The abdominal cavity is arbitrarily divided into nine regions by two horizontal and two vertical lines. The superior horizontal line extends between the cartilaginous ends of the tenth ribs, the inferior between the anterior superior iliac spines. These two lines divide the cavity into three zones, epigastric, mesogastric, and hypogastric, each of which is subdivided into three regions by vertical lines passing upward from the ilio-pectineal eminences to the higher horizontal line. The epigastric zone contains, in order, the right hypochondrium, epigastrium, and left hypochondrium. The mesogastric zone contains the right lumbar, umbilical, and left lumbar regions. The hypogastric zone contains the right iliac, hypogastric, and left iliac regions.

The viscera situated in each region are shown in the following table:

Right Hypochondrium.	Epigastrium.	Left Hypochondrium.
Liver. Right kidney. Hepatic flexure. Colon.	Liver. Stomach. Gall bladder. Duodenum. Pancreas.	Stomach. Spleen. Left kidney. Splenic flexure. Colon.
Right Lumbar.	Umbilical.	Left Lumbar.
Right kidney. Ascending colon. Ileum.	Transverse colon. Duodenum and small intestines. Great omentum.	Small part of left kidney. Descending colon. Small intestines.
Right Iliac.	Hypogastric.	Left Iliac.
Caecum. Appendix. Last coil of ileum.	Small intestines. Bladder in children. Distended bladder in adults. Pregnant uterus. Sigmoid colon.	Sigmoid colon. Small intestines.

Liver.—The liver occupies the right hypochondriac region and part of the epigastric, and extends into the left hypochondriac region as far as the mammillary line; at times it descends into the right lumbar region. With the exception of a small part of the right and left lobes, which come in contact with the anterior abdominal wall in the subcostal angle, it lies behind the ribs and costal cartilages.

Surface Outline. The outline of the liver may be indicated on the surface of the body as follows: Superiorly, a line beginning in the mammillary line in the fifth left intercostal space, extending toward the right, through the lower end of the sternum, gradually rising to the fourth right interspace just inside the nipple line, then sloping downward behind the fifth and sixth ribs, where the superior surface is continuous with the right surface. Inferiorly, beginning on the right side at the upper border of the third lumbar vertebra, the line runs directly to the costal arch, which it follows as far upward as the tip of the ninth costal cartilage. Here it crosses the subcostal angle to the eighth left cartilage, then gradually rises to terminate at the beginning of the superior line. The right surface, lying behind the seventh, eighth, ninth, and tenth ribs, is separated from them only by the thin edge of the lung, the diaphragm, and the pleura. It is thus apparent that the lower border is most accessible to examination, and especially that part of it which lies across the subcostal angle. Here it usually reaches a point midway between the end of the sternum and the umbilicus. When the lower border in the remainder of its extent is easily palpable, the liver is either displaced or enlarged. The superior extent can be determined only by percussion, but the line of absolute dulness does not

correspond to the line above given, for the reason that the anterior, right, and posterior surfaces are considerably overlapped by the lower edge of the lung. This line in the mid-line falls at the end of the sternum, in the right nipple line at the sixth rib, in the mid-axillary line at the eighth rib, and in the scapular line at the tenth rib. When the border of the liver can be palpated this method of determining its lower limit will be found more accurate than that by means of percussion.

Relations. The liver presents superior, anterior, posterior, inferior, and right surfaces. The superior surface is accurately moulded to the dia-

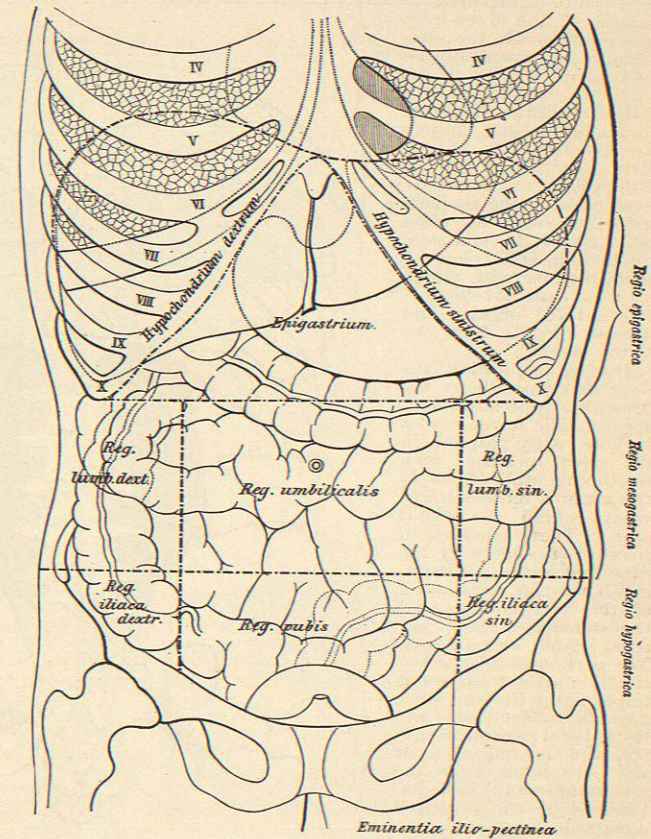


FIG. 8.—Regions of the Abdomen. Anterior view. (Joessel.)

phragm, which separates it from the pleurae, lungs, pericardium, and heart.

The anterior surface, also in contact with the diaphragm, with the exception of the small region coming in contact with the abdominal wall in the subcostal angle, lies behind the fifth to the ninth costal cartilages and adjacent portions of the ribs. In its upper part it is overlapped by the lower margin of the lung.

The posterior surface, also in contact with the diaphragm and overlapped by the lung, covers in turn the right suprarenal capsule, the vena cava, the thoracic duct, and the cesophagus.

The inferior surface is plainly impressed by the following organs: Beginning at the right, in front, the hepatic flexure of the colon; behind, the right kidney, immediately to the left of which is the impression of the duodenum, and to the left of both the impression of the

gall bladder. The succeeding part of the liver is the quadrate lobe, lying in front of the lesser omentum. Finally, the under surface of the left lobe overlaps the lesser curvature and upper part of the anterior surface of the stomach.

The right surface lies internal to the seventh, eighth, ninth, tenth, and eleventh ribs, being separated from them by the diaphragm, and being overlapped above by the lung. Many clinical facts of importance can be learned by a close study of these relations. In gunshot and stab wounds of the lower part of the thoracic wall, lung, pleura, diaphragm, peritoneum, and liver may all be involved. The end of a fractured rib may penetrate the liver. Abscesses of the liver may extend through the diaphragm and open into the pleural cavity, or, when this is obliterated by adhesions, into the lung, and a bronchus. Behind, an enlargement of the liver may retard the circulation in the aorta, the vena cava, or the thoracic duct. Below, the close relations of the stomach, duodenum, and colon explain the ease with which adhesions develop between these organs, and disease spreads from one to the others.

During inspiration, the liver descends about the breadth of one intercostal space. The lower border is more easily palpable in the erect posture than in the recumbent, as in the latter it recedes somewhat behind the costal arch. These changes in position, especially the first, may serve to distinguish a tumor or swelling of the liver from one of the stomach, kidney, adrenal gland, or pancreas. The peritoneal relations of the liver are extensive and important. For the most part its surface looks into the general peritoneal cavity, and the reflections of the peritoneum from the abdominal wall and diaphragm are the principal agents in supporting, or rather suspending, the organ. A small part of its posterior surface is not visible from the greater cavity, as it looks into the lesser. This corresponds in extent to the Spiegelian lobe. A second area of the posterior surface, between the layers of the right coronary ligaments, is not covered by peritoneum; it lies in contact with the diaphragm. This locality is the favorite seat of subphrenic abscesses, and here they most easily spread to the pleura and lung.

The artery of the liver is the hepatic branch of the coeliac axis. It reaches the organ between the layers of the lesser omentum, and entering at the transverse fissure its branches accompany those of the portal vein.

The portal vein, formed behind the head of the pancreas by the union of the superior mesenteric, splenic, inferior mesenteric, and the veins of the stomach, also ascends in the lesser omentum to the transverse fissure. In the substance of the liver its branches are situated within the portal spaces, *i.e.*, outside the lobules, before

entering the intralobular capillaries. They are distinguished by their relatively thick walls and collapsed state on cross section. An infective thrombo-phlebitis in a distant part of the abdomen or pelvis may be followed by a metastatic abscess or abscesses in the liver, a phenomenon explained by the anatomy of the portal circulation.

The hepatic veins are remarkable for their thin walls, which, closely connected with the surrounding liver substance, stand widely open on section. Consequently a rupture or incised wound of the liver bleeds with great freedom and the bleeding has little tendency to cease spontaneously. The hepatic veins emerge on the posterior surface of the liver, entering immediately the inferior vena cava within half an inch to an inch from its termination in the right auricle. They have no valves; consequently the circulation in them is easily impeded. In some forms of valvular heart lesions, — *e.g.*, tricuspid insufficiency, — the pulsation of the heart may be transmitted through them to the liver.

The excretory apparatus of the liver consists of the hepatic duct, the cystic duct and gall bladder, and the common duct. The gall bladder, three or four inches in length and with a capacity of from one to two ounces, is held in position on the under surface of the liver by the peritoneum. As a rule, it is closely applied to the liver substance, lying in a distinct fossa; but it may hang free, completely invested by peritoneum and suspended by a mesentery. Its fundus projects beyond the lower border of the liver opposite the ninth costal cartilage. It is directed downward, forward, and to the right, while the neck is in the opposite direction. Immediately below it are the transverse colon, duodenum, and sometimes the pylorus of the stomach. The relation to the colon is most constant and important. An artificial opening is sometimes formed between the two organs, and through it gall stones may be passed.

The ducts are all situated between the layers of the lesser omentum, and can be easily exposed by removal of its anterior layer. The portal vein, hepatic artery, and hepatic nerves are found in the same space, but the ducts are anterior to them, and occupy the right free edge of the omentum. In making a dissection, or in an operation, the foramen of Winslow should first be located, and with the fingers of the left hand in it for a guide an exposure can be easily accomplished. The cystic duct, arising at the neck of the gall bladder, is an inch and a half in length. It is directed downward, backward, and to the left, to join the hepatic duct at an acute angle. The hepatic duct, about two inches in length, is directed downward, backward, and to the right. It arises at the liver by two main branches. The common bile duct, formed by the union of these two, continues the direction

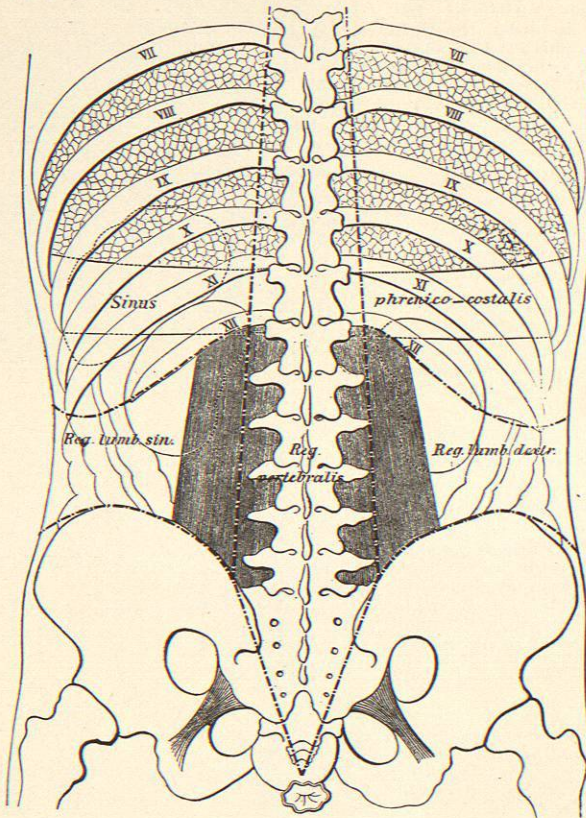
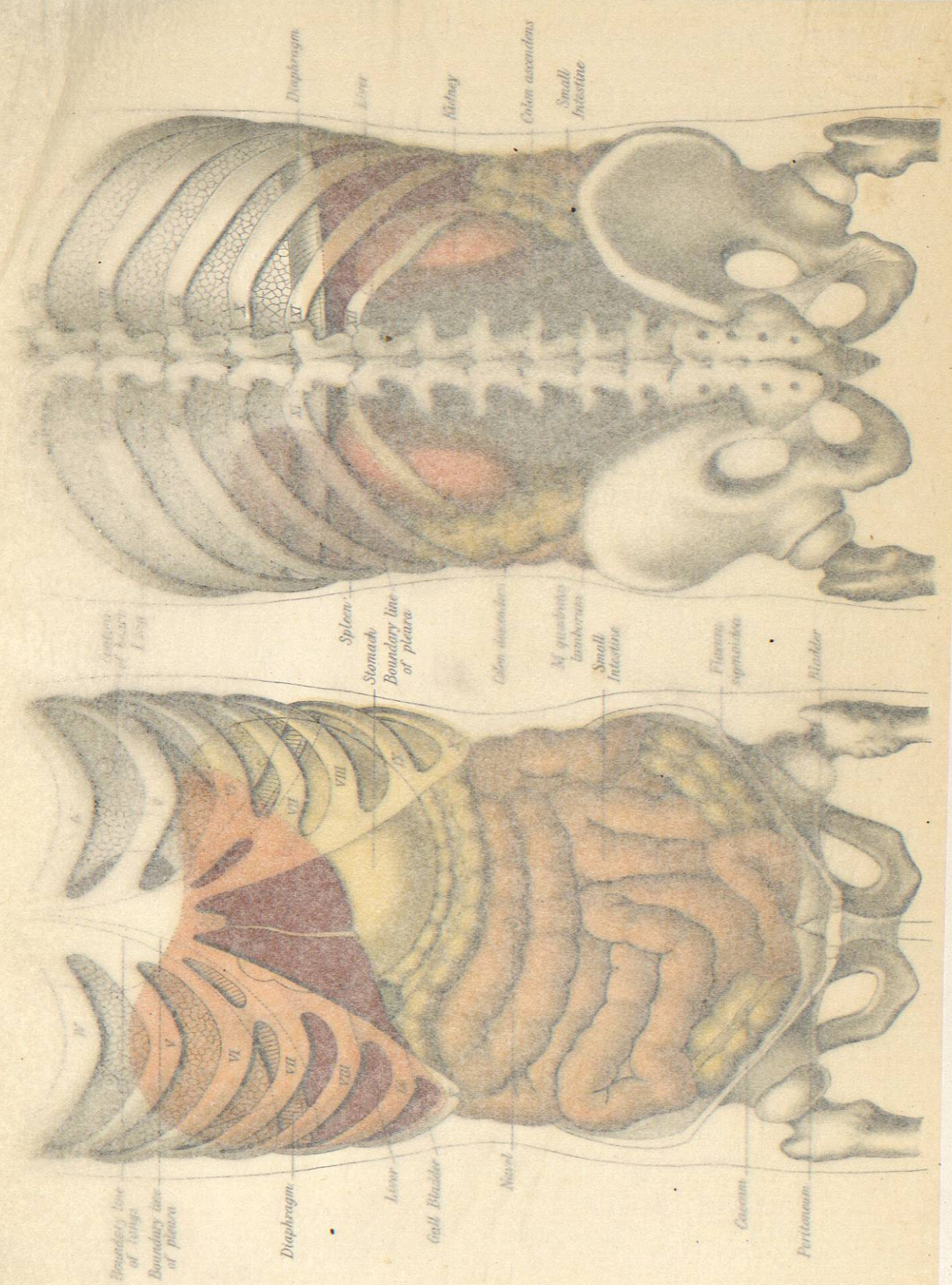


FIG. 9.—Regions of the Abdomen. Posterior view. (Joessel.)



Front and Rear Views (diagrammatic) of the Trunk of the Body, showing the Relations of the Abdominal