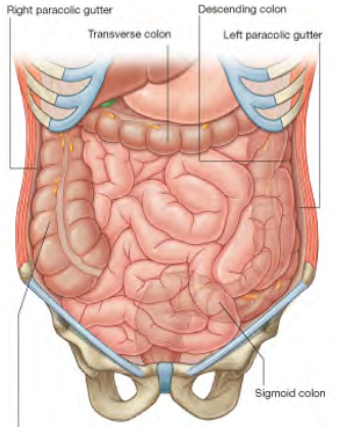
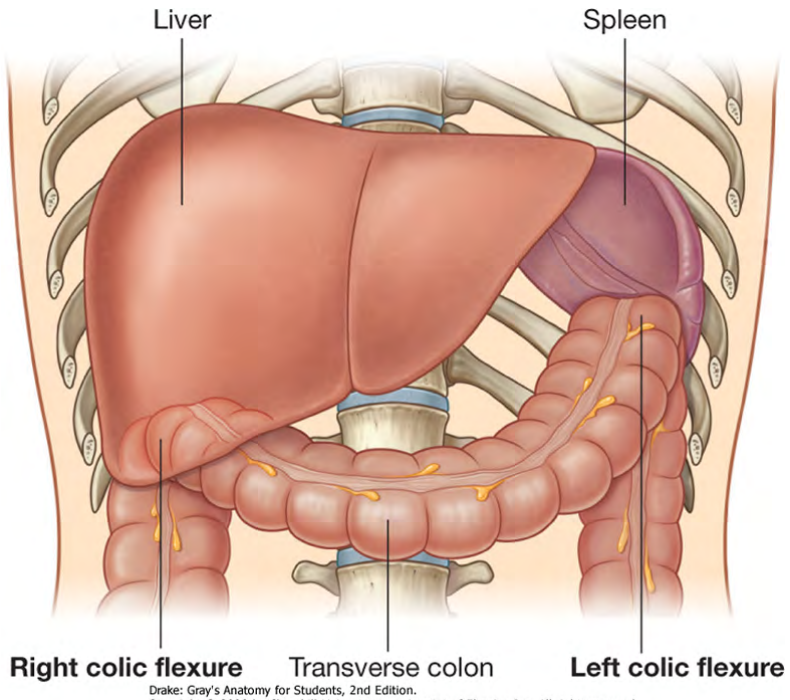
Digestive System



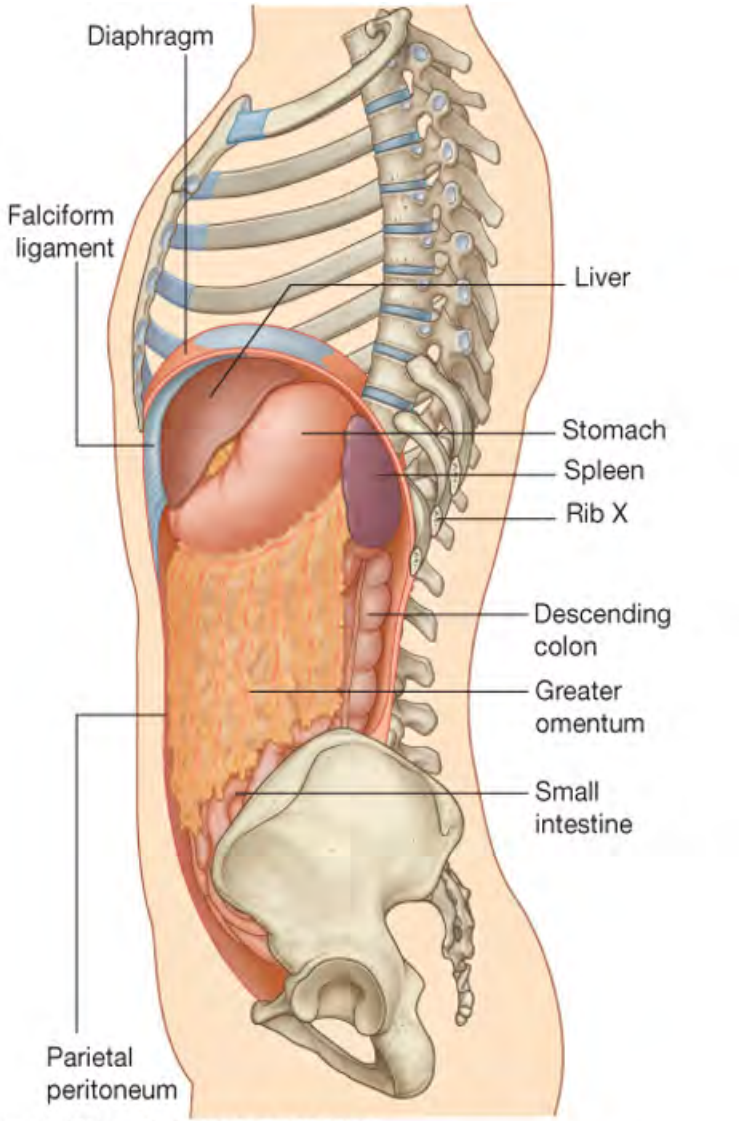
University of Pavia

The Liver

- It's the largest abdominal viscera, occupying the Right Hypocondrium and Epigastrium and frequently extends into the left Hypocondrium.
- It's overall wedge shaped and reddish brown in colour and it constitutes the 5% of the body weight.
- It's the organ responsible for the mantainance of homeostasis, nutrition and immune defense.



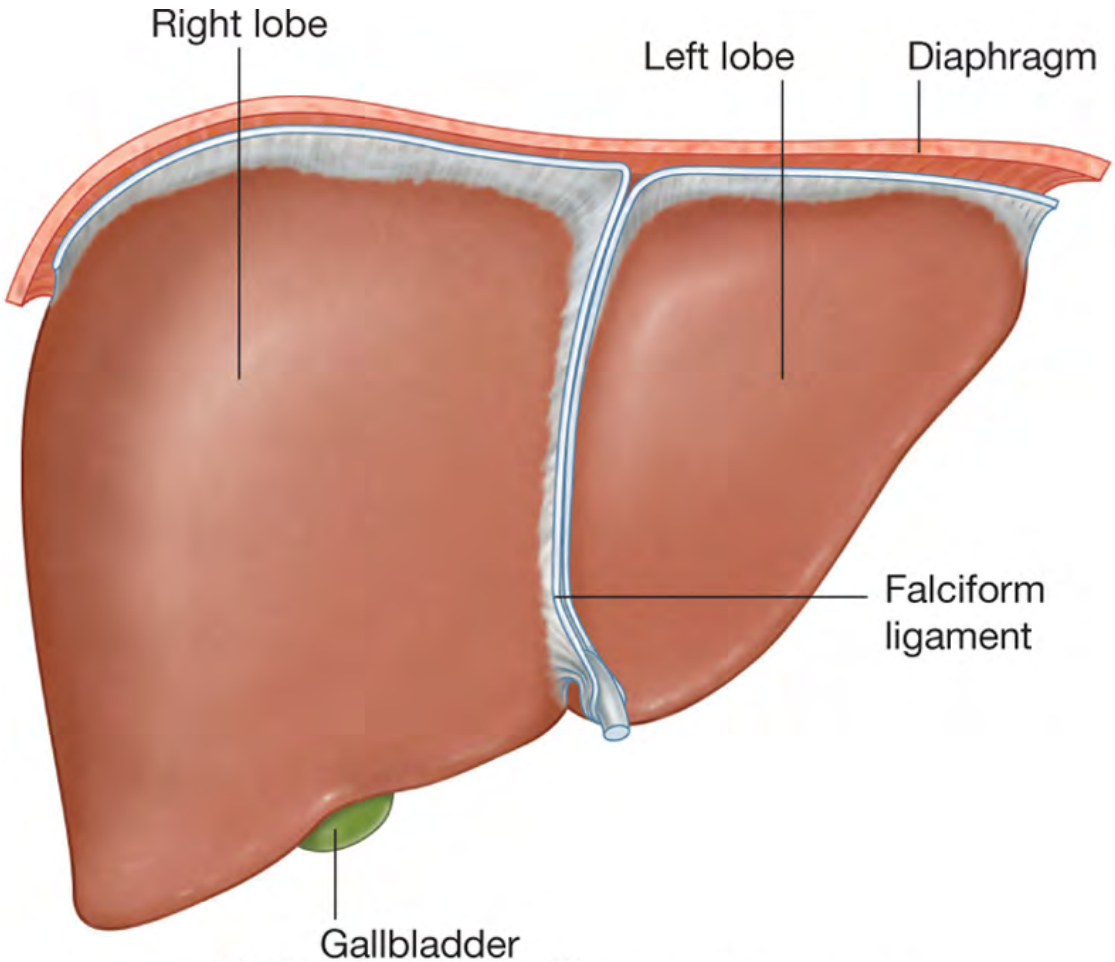
Drake: Gray's Anatomy for Students, 2nd Edition.



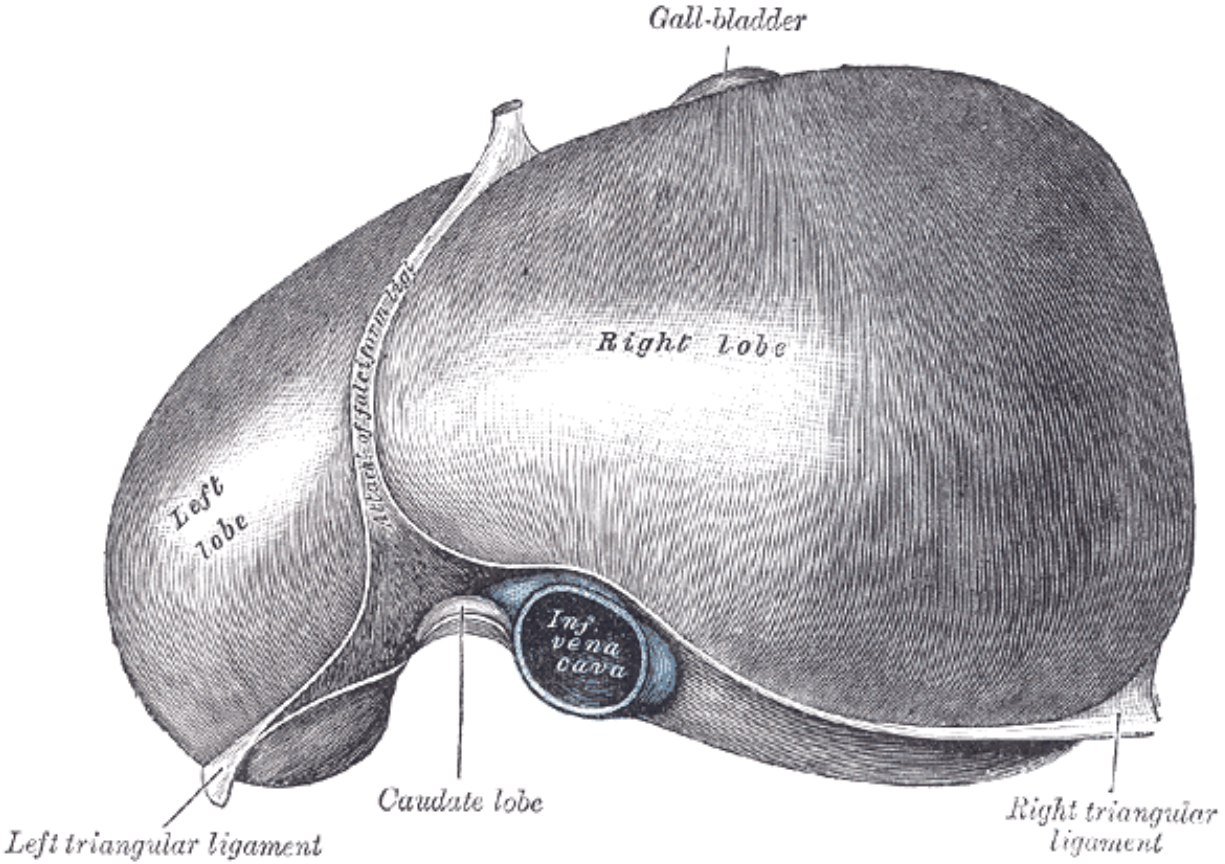
Just to visualize where we are

But in order to understand the liver, we need it to describe first its surfaces…

The Liver is usually described as having a superior, anterior, right, posterior and inferior surfaces.



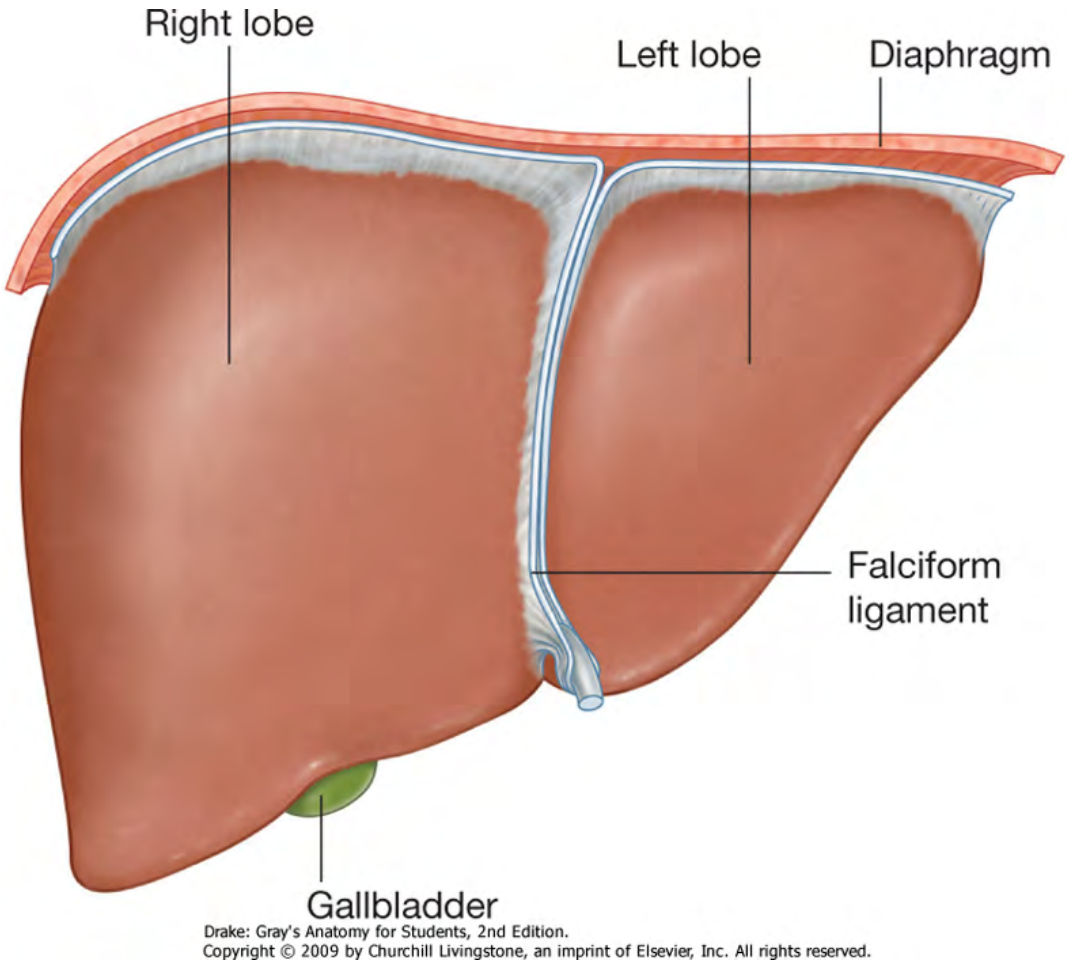
Superior surface of the Liver



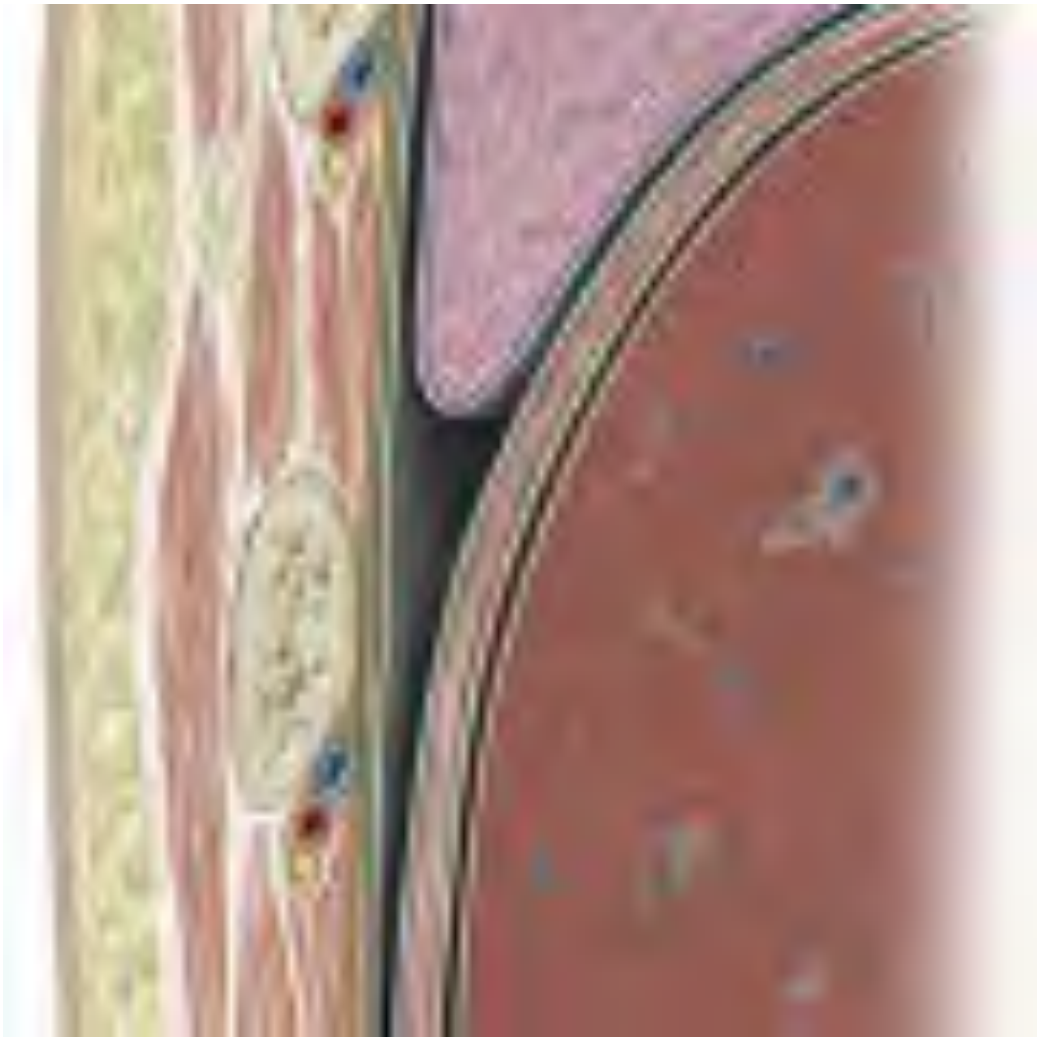
It's the largest surface and lies immediately below the diaphragm, separated from it by the peritoneum, except for a small triangular area where the two layers of the Falciform Ligament diverge. It lies beneath the Right dome and a shallow cardiac impression is appreciable. The Left side of the Superior surface lies beneath the left dome of the Diaphragm

Anterior Surface

It's approximately triangular and convex and is covered by peritoneum except for the attachemtn of the Falciform ligament. Much of it is in contact with the peritoneal covering of the Anterior Abdominal wall.

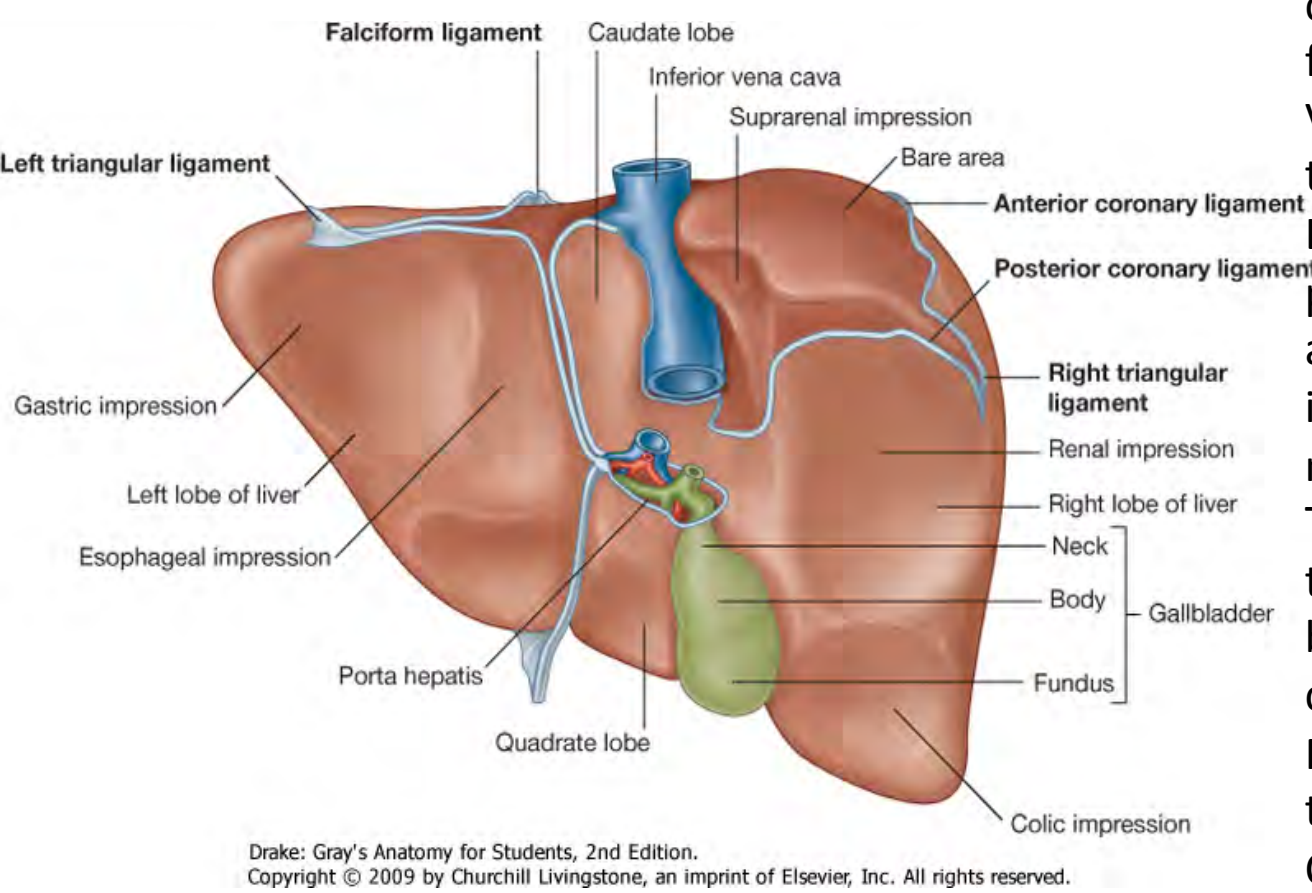


Right Surface of the Liver



It’s covered by peritoneum and lies adjacent to the Right dome of the Diaphragm which separates it from the Pleura and the Right Lung and the 7th to 11th Intercostal ribs. The Diaphragm, the Costodiaphragmatic recess lined by pleura lie lateral to the middle third of this surface.

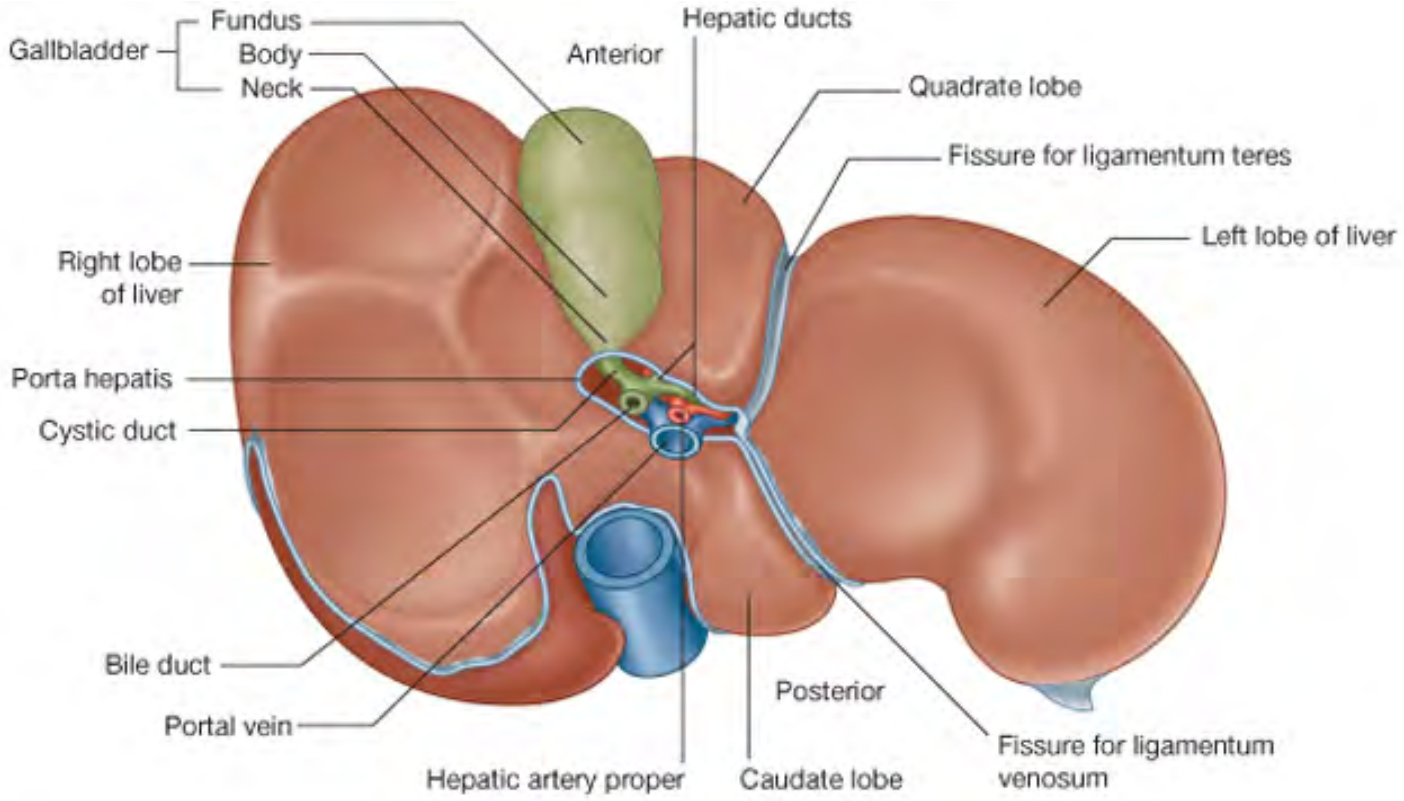
Posterior Surface



It's convex and wide on the Right. A deep median concavity corresponds to the forward convexity of the Vertebral Coloumn, close to the attachment of the Ligamentum Venosum. It's present the so called 'bare area' and the Inferior Cava lies in a groove or tunnel in the medial end of the Bare area. To the left of the Caval groove the posterior surface is formed by the Caudate Lobe, and covered by a layer of Peritoneum continuos with that of the inferior layer of the Coronary Ligament and the Layer of the Lesser Omentum.

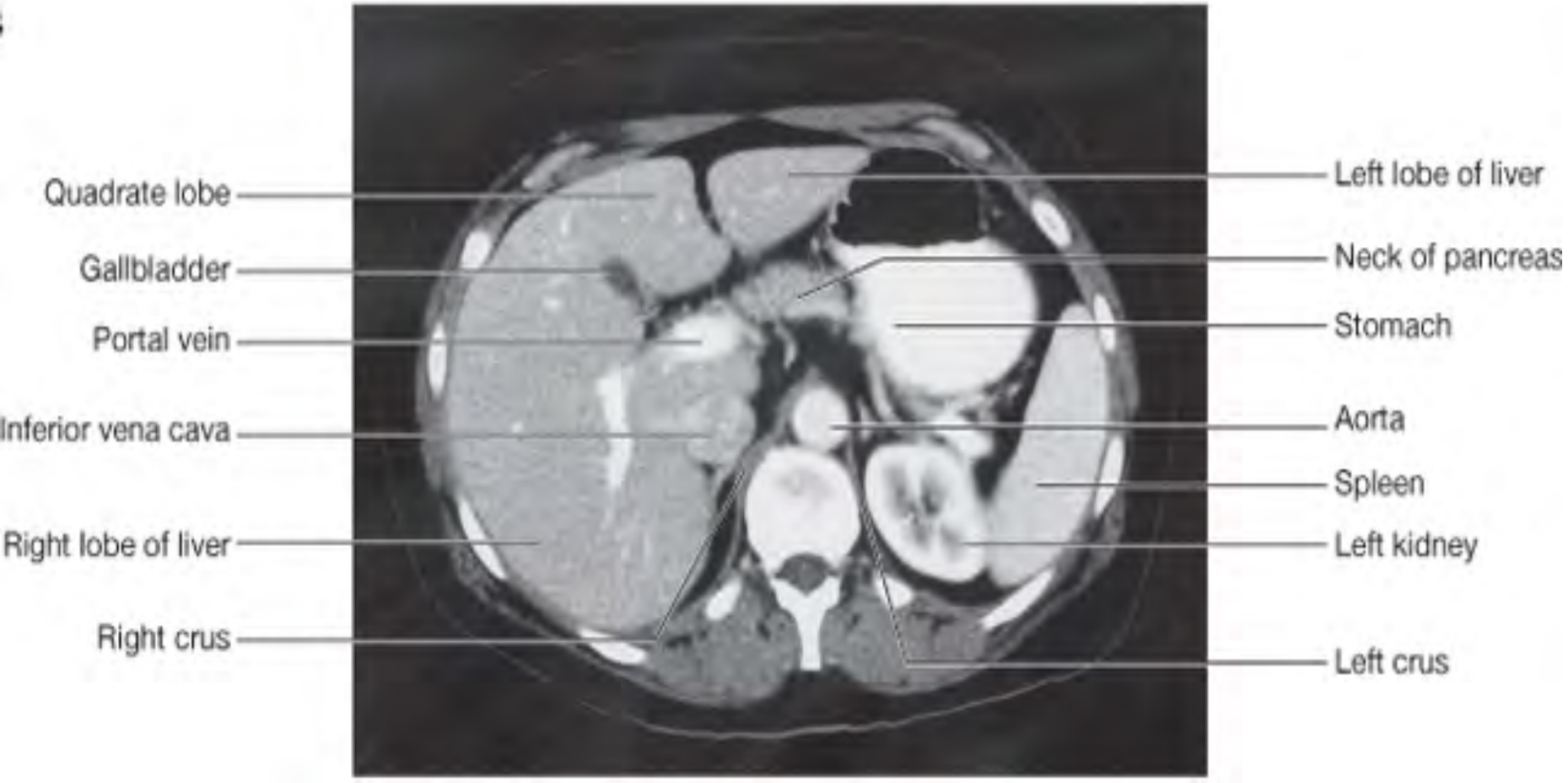
The fissure of the Ligamentum Venosum, which cuts deeply in front of the Caudate Lobe and contains the two layer of the Lesser Omentum, separates the Posterior aspect of this lobe from the Left one. Regarding the left posterior portion, it presents a Gastric and Oesophageal Impression.

Inferior surface

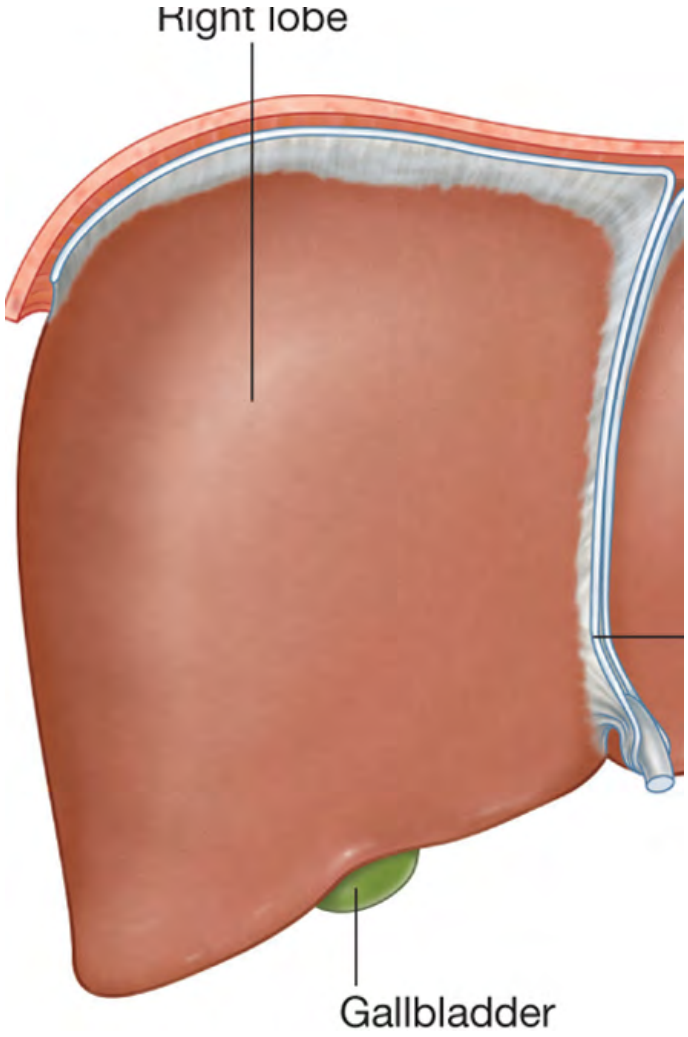


It blends with the posterior with the posterior surface in the region of the origin of the Lesser Omentum, the Porta Hepatis and the Lower Layer of the Coronary Ligament, marked near the midline by a sharp fissure which contains the Ligamentus Teres (the Obliterated fetal left Umbilical Vein). The gallbladder usually lies in a shallow fossa.

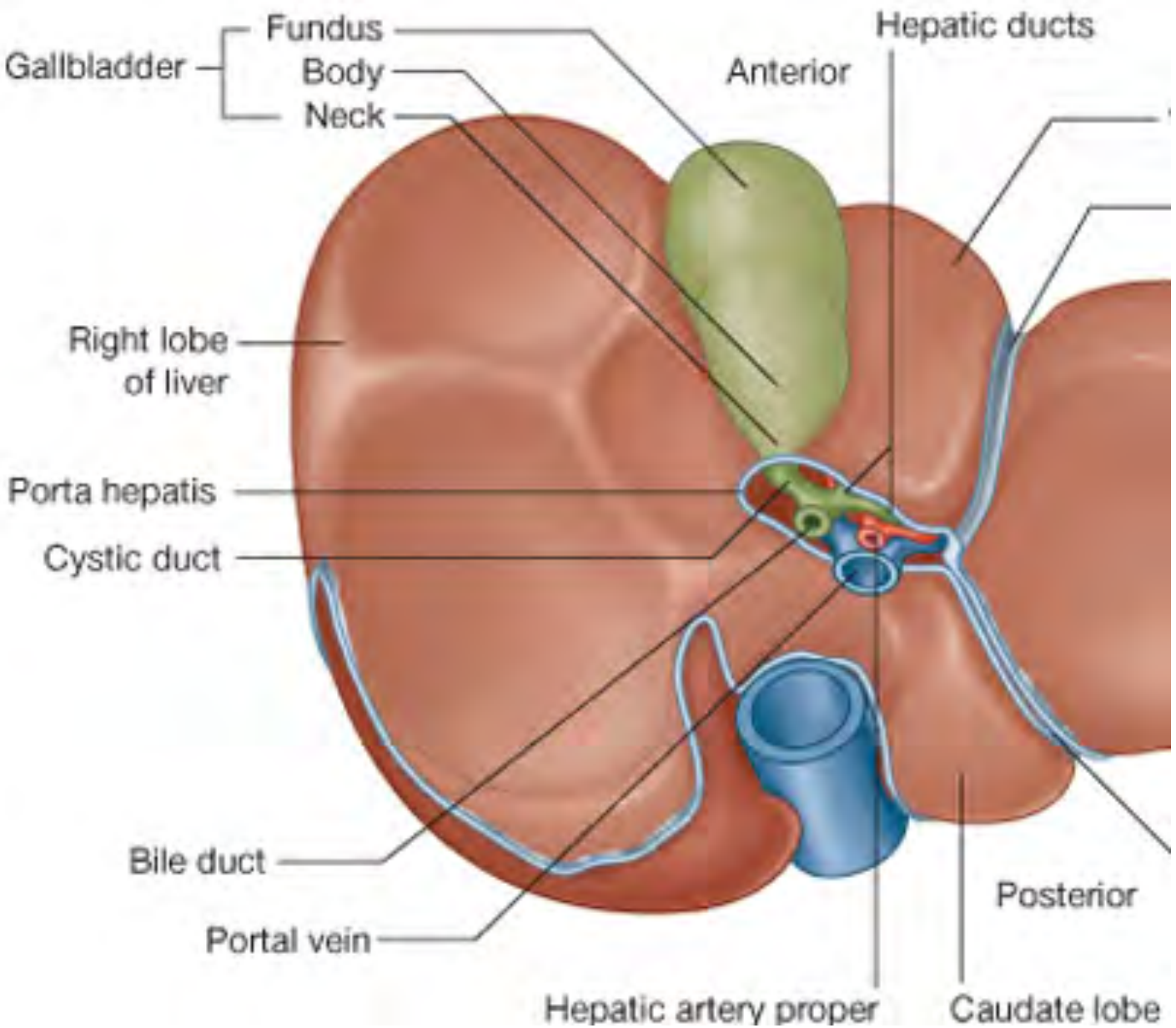
The Quadrate lobe lies between the Fissures for Ligamentum Teres and Gallbladder. The Inf surf of the Left Lobe is related inferiorly to the Funfus of the Stomach and the Upper and Lesser Omentum. The Quadrate lobe lies adjacent to the Pylorus, first part of Duodenum and the Lower part of Lesser Omentum.



But anatomically the liver is also divided into Lobes…



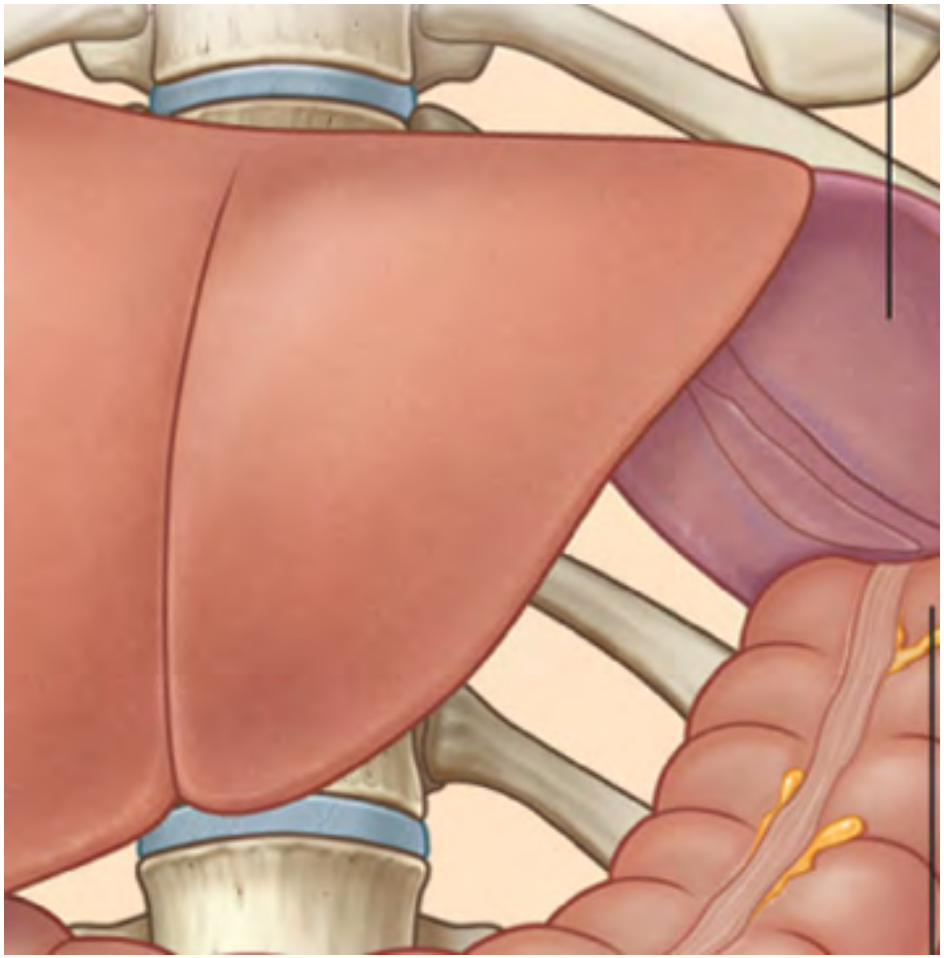
It's divided from the Left Lobe by the Falciform ligament superiorly and the Ligamentum Venosum inferiorly. On the inferior surface, to the right of the groove formed by the Ligamentum Venosum there are two prominences, separated by the Porta Hepatis: the Caudate Lobe lies posteriorly and the Quadrate Lobe anteriorly. The Gallbladder lies in a shallow fossa to the right of the quadrate lobe



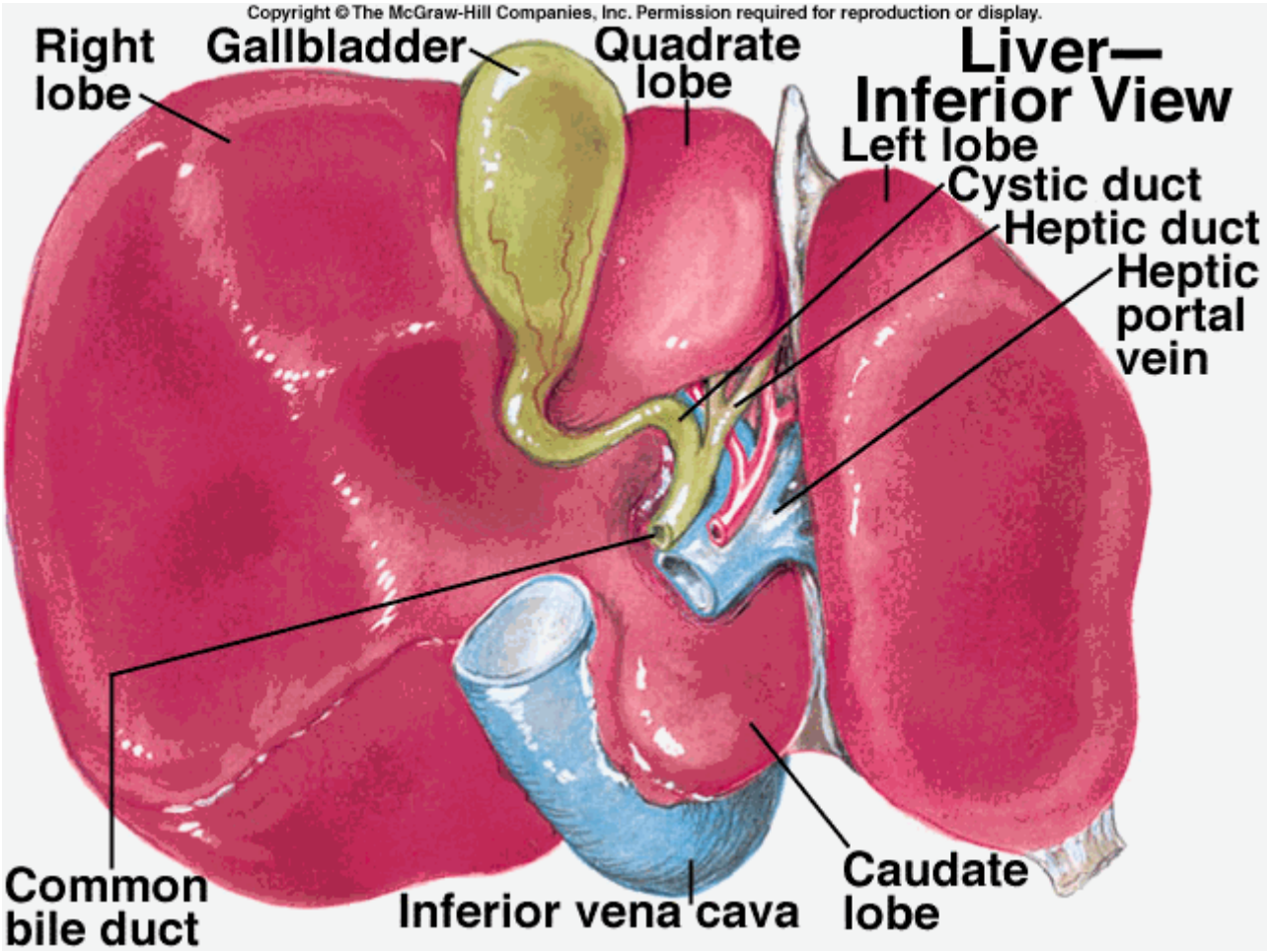
Right lobe of the liver, inferior wiew

Left lobe of the Liver

It’s the smallest of the lobes and lies to the left of the Falciform Ligament with no subdivisions and it’s sustantialy thinner than the Right lobe, having a thin apex that point s into the Left Upper quadrant.

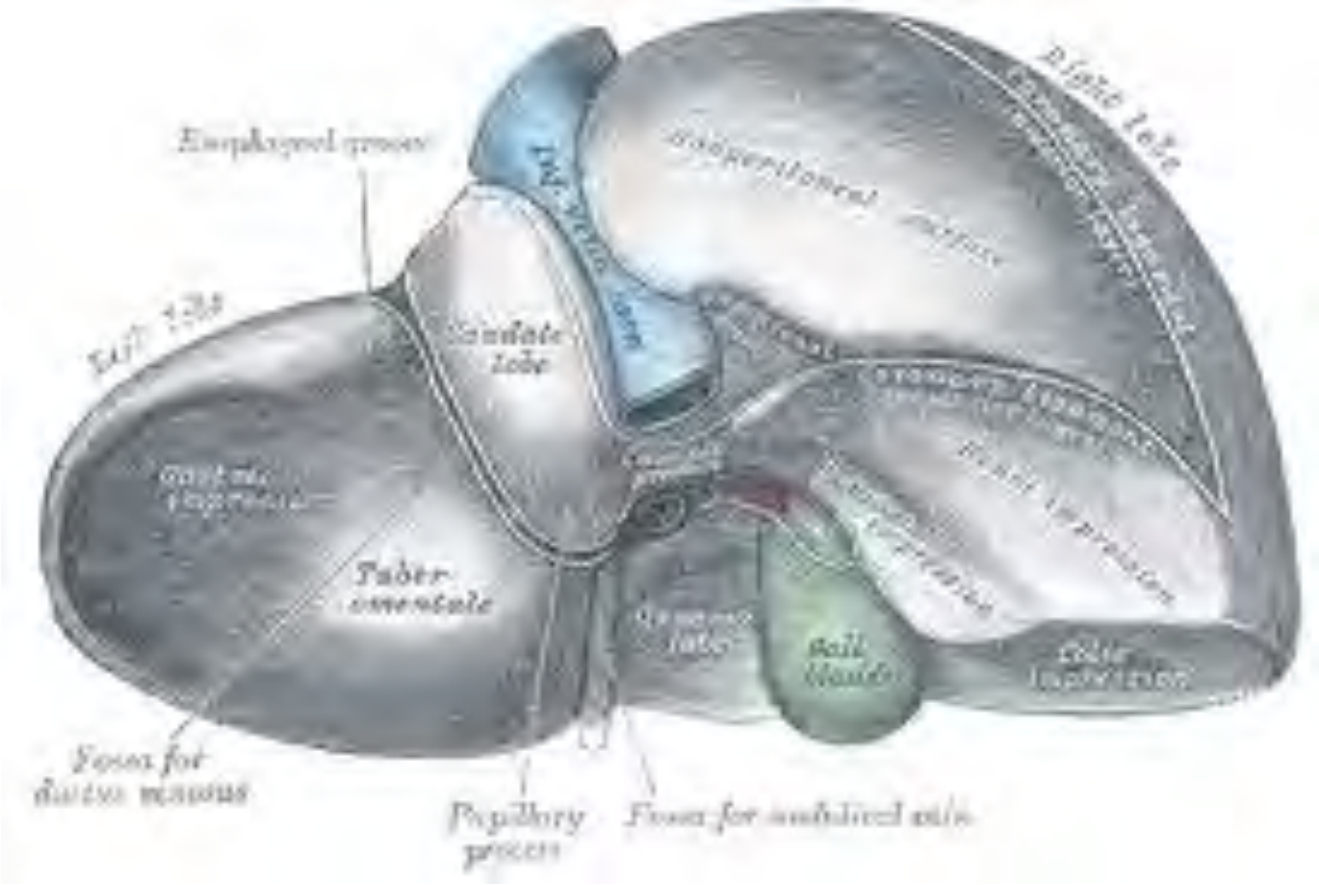


Qaudrate Lobe



It's visible as a prominence on the Inferior surface of the liver, to the right of the groove formed by the Ligamentum Venosum. It lies anteriorly to the Porta Hepatis and is bounded by the Gallbladder fossa to the right, a short portion of the Inferior border anteriorly, the Fissure for the Ligamentum Teres to the left and the Porta Hepatis posteriorly.

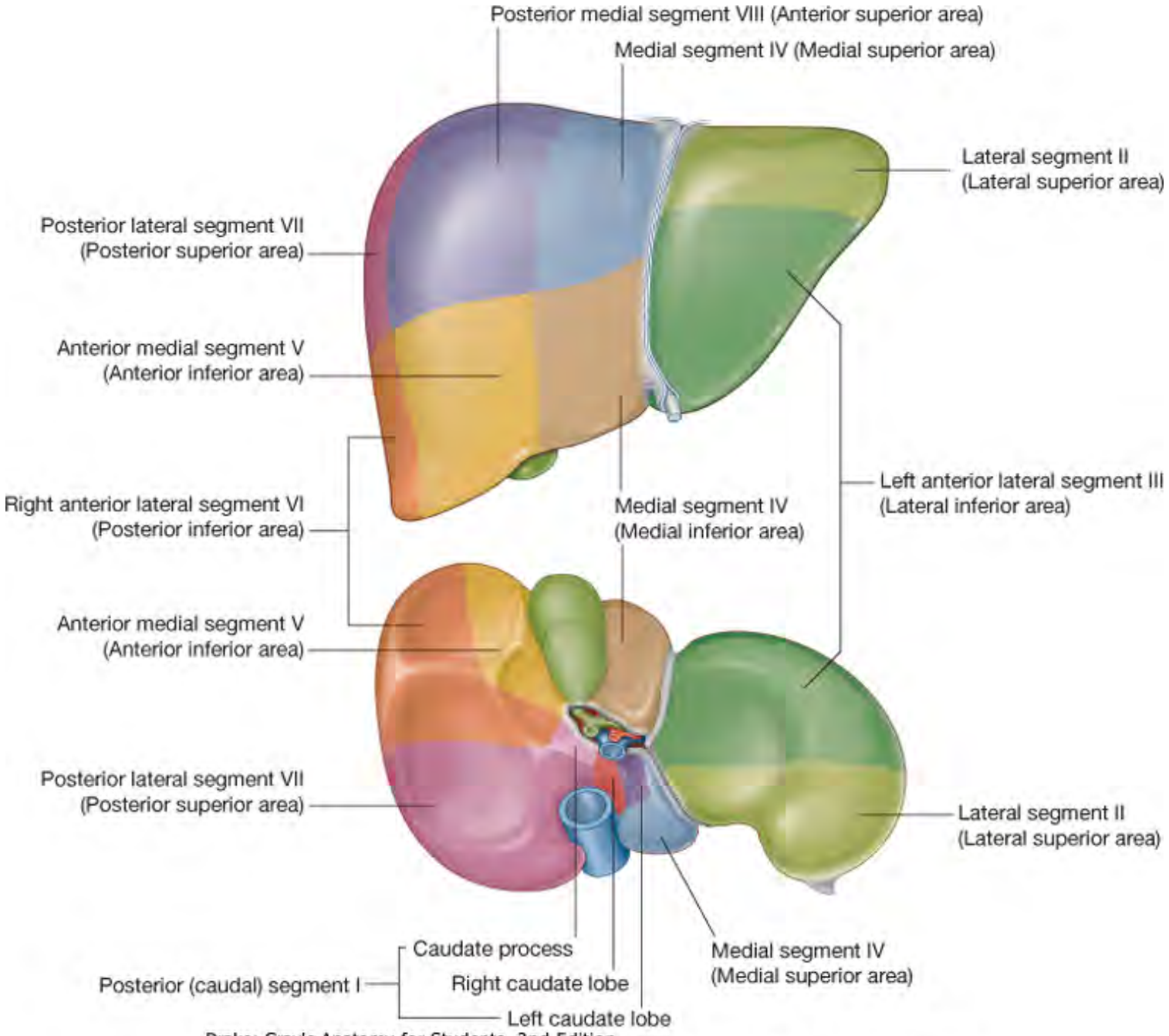
Caudate or Spigelian Lobe



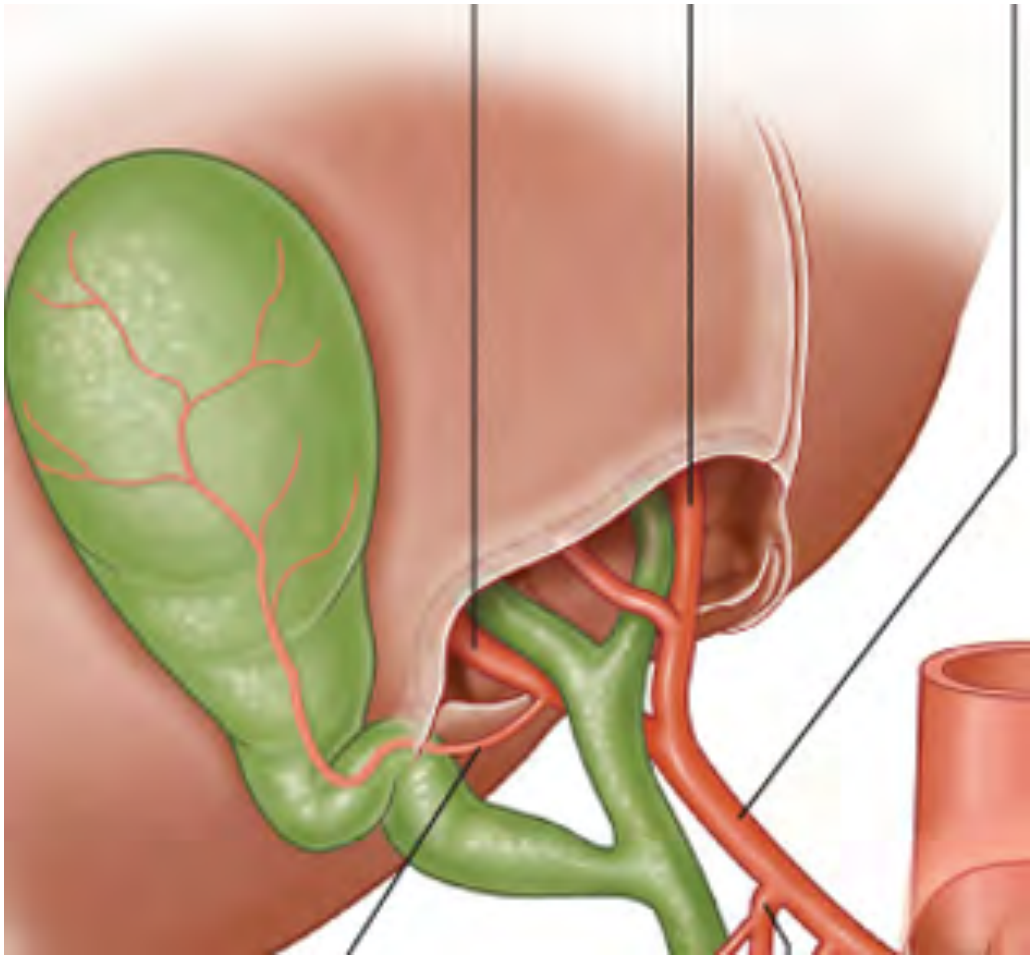
It's visible as a prominence on the Inferior and Posterior surfaces to the right of the groove formed by the Ligamentum Venosum. It lies posteriorly to the Porta Hepatis. To its rightis present the groove for the Inferior Cava. Above it continues into the Superio surface on the Right of the upper end of the fissure of Ligamentum Venosum.

But we must be aware that:

- Current understanding of the Functional anatomy of the Liver is based on Coinaud's division into 8 functional segments made in 1957.
- It's also divided into 4 portal sectors by the 4 main branches of the Portal vein.
- The 3 main hepatic veins lie between these sectors and are known as Inersectorial Veins.
- The Intercostal planes are also known as '*scissures*'



The Porta Hepatis



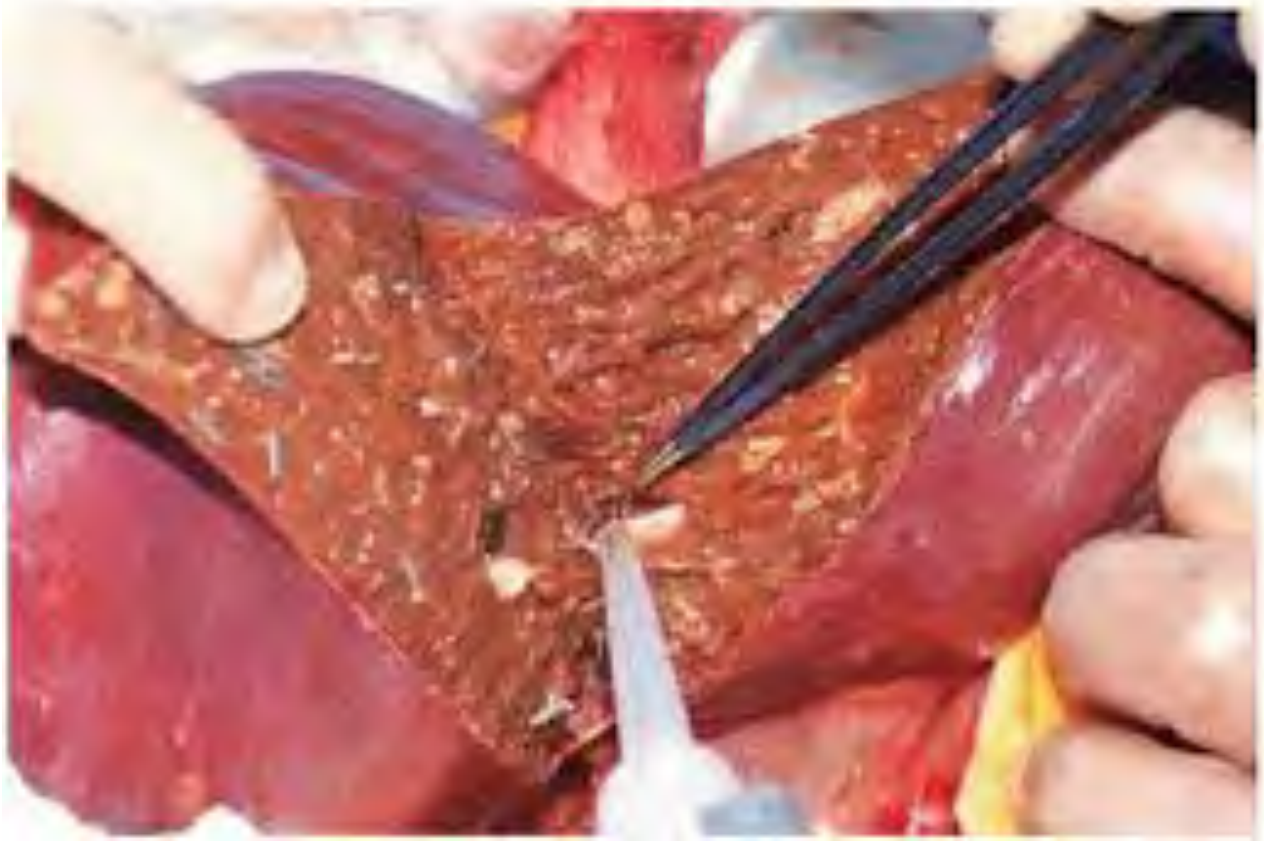
It's a deep fissure on the Inferior surface of the Liver. It's situated between the Quadrate Lobe in front and the Caudate process behind. It contains the Portal Vein, Hepatic Artery, Left and Right Bile ducts. The Hepatics ducts lie anteriorly to the Portal Vein and Hepatic Artery. All these structures are enveloped in a perivascular fibrous capsule, the *Hepatobiliary Capsule of Glisson,* a sheat of loose connective tissue, which also is extended as far as the vessels reach the individual segment of the Liver.

So, since most of you would be physician would come sooner or later in contact with a liver ecography…

This is exactly how a window on the liver looks like, with the well identificable darker ('empty') spaces of the Hepatic Veins.

And may be also with Hepatic Surgery…

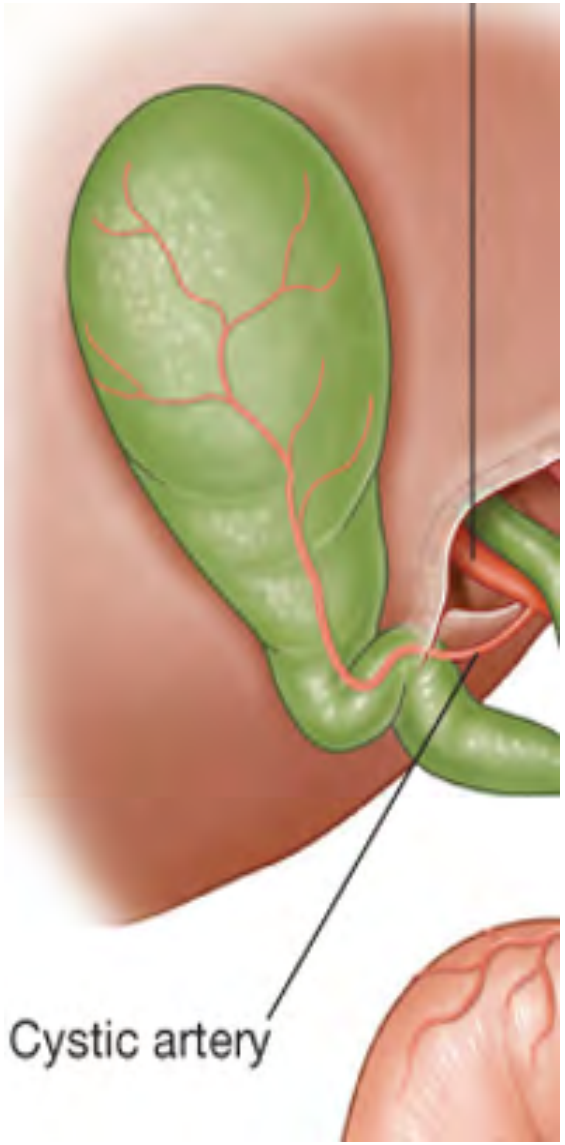
CT scan of colorectal liver metastases initially deemed unresectable before (a) and after chemotherapy (b), by which time these tumours are easily resectable.



Actually, liver surgery is pretty ‘new’ as a kind of surgery, due to the technical (surgical) problems in managing this organ. Infact, just in the last 40 years, thanks to the Bipolar cautery, a high frequency electrical current passed through tissue from one electrode to another, is possible to control the massive bleeding of this enormously vascularized gland.

Gallbladder

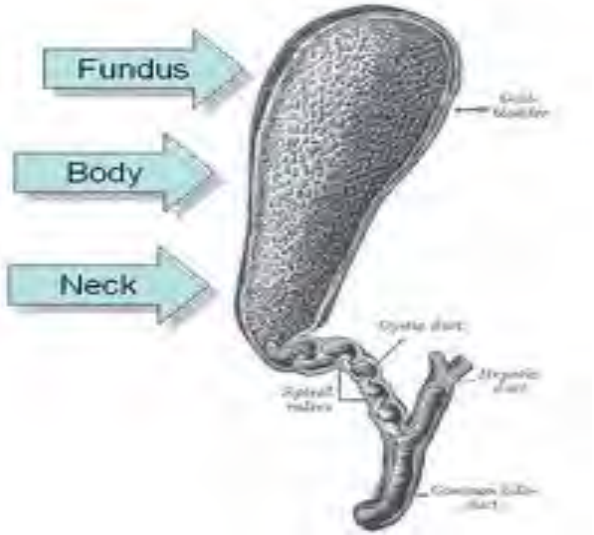
It's a flask shaped, blind ending diverticulum attached to the Common Bile Duct by the Cystic Duct. It's usually grey-blue in colour and usually lies attached to the Inferior surface of the Right Lobe by connective tissue. It's between 7 and 10 cm long with a capacity up to 50ml. It usually lies in a shallow fossa in the liver parenchima, covered by peritoneum continued from the Liver surface.



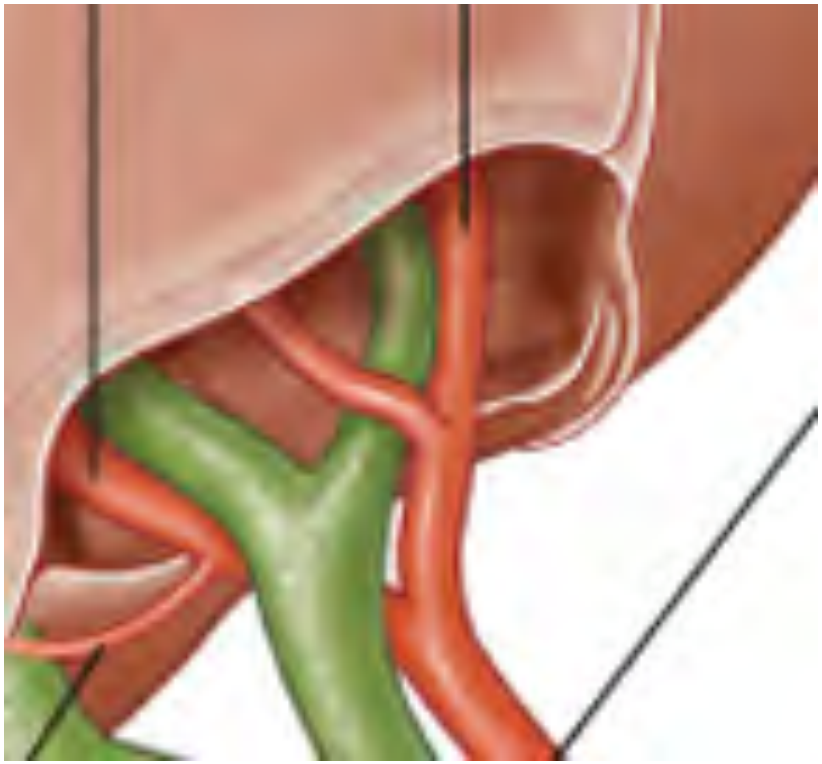
- It's usually described as having a *fundus*, a *body* and a *neck*.

The *neck* lies at the medial end close to the Port Hepatis and has a short peritoneal covered attachment to the Liver mesentery (which usually contains the Cystic Artery). The mucosa at the medial end is obliquely ridged, forming a spiral groove continuos with the Spiral Wave of the Cystic duct. At its lateral end the neck widens out to form the Body of the Gallbladder and this widening is often referred as Hartamann's pouch. The neck lies anteriorly to the Second Part of the Duodenum.

The *body* lies in contact with the Liver surface. It lies anterior to the Second part of the Duodenum at the right end of Transverse Colon. It often lies in contact with the anterior abdominal wall behind the 9th costal cartilage.

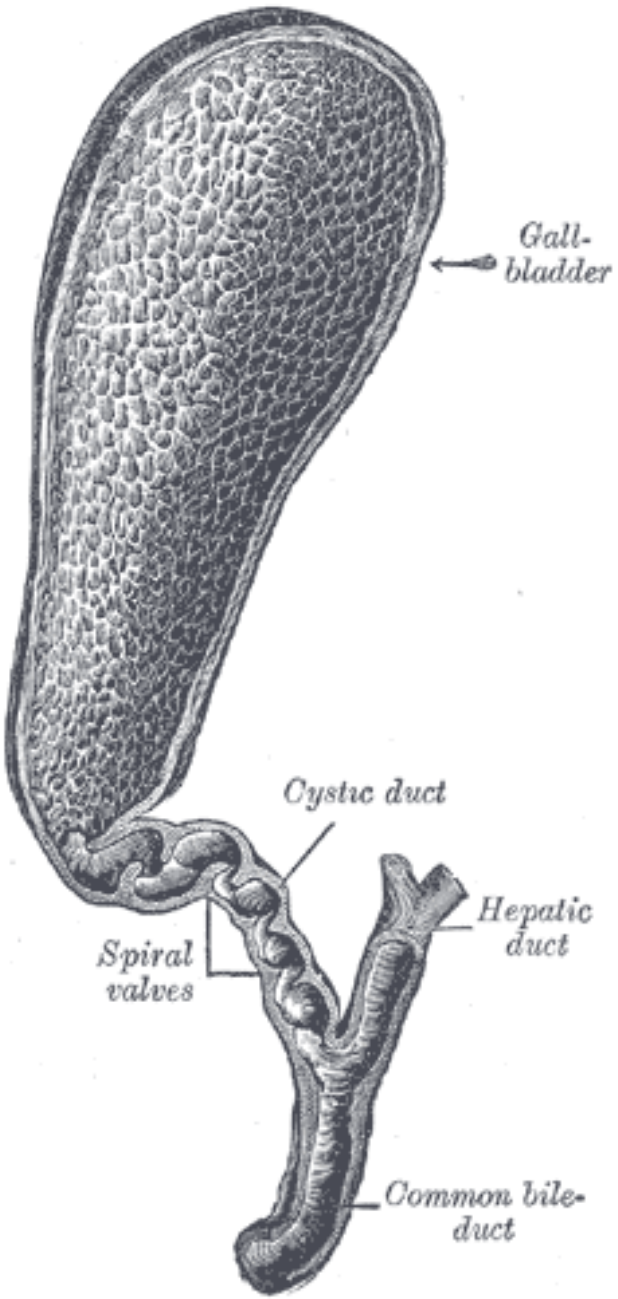


Intrahepatic Biliary tree

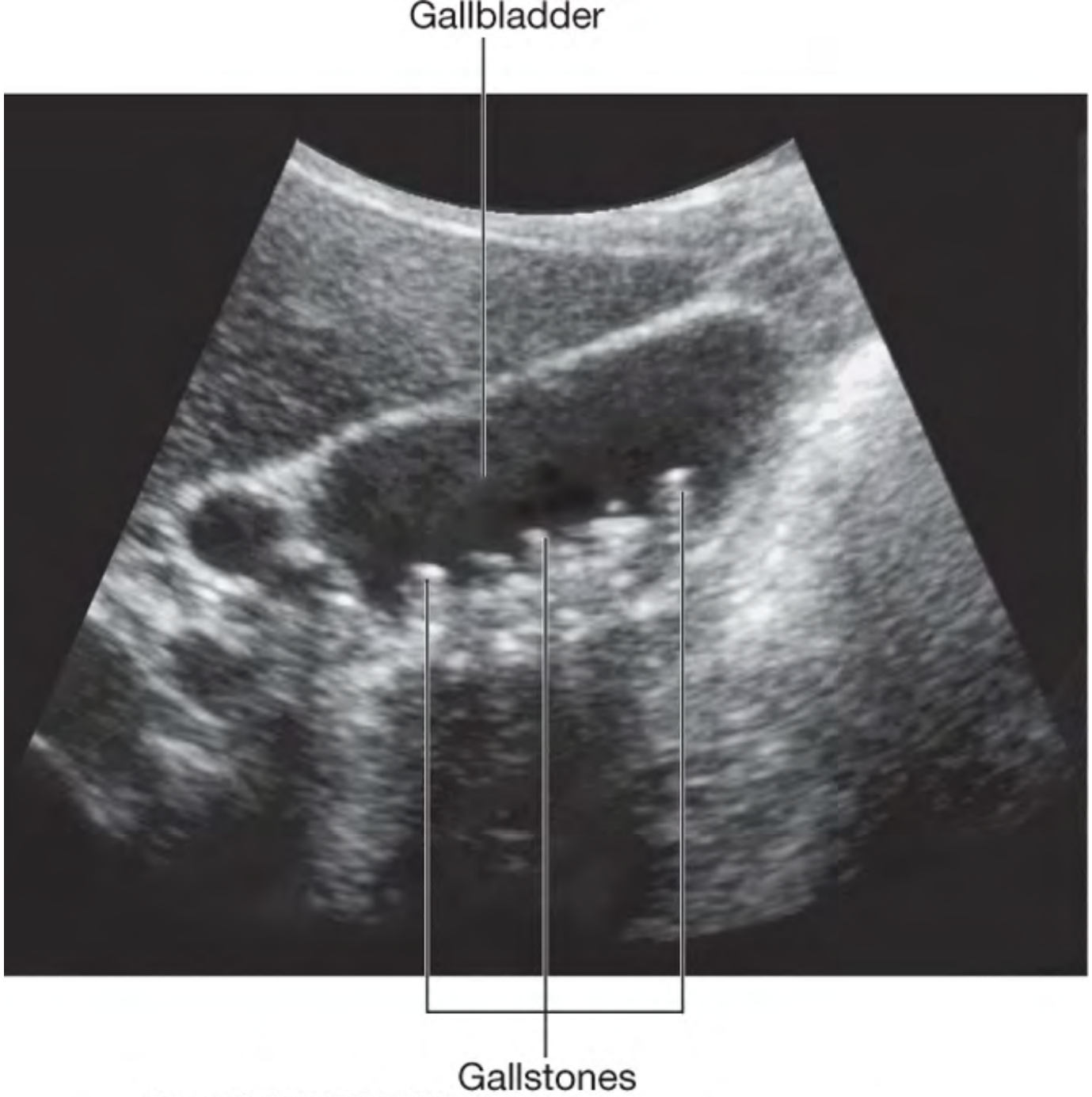


The Left Hepatic Duct is formed by the union of segment II and segment III behind the Umbilical portion of the Left Portal Vein. The Right Hepatic duct is formed by the union of the right medial (ant) and lateral (post) sectorial ducts. The join themselves in the Common Hepatic Duct, just outside the Porta Hepatis.

Cystic Duct



It drains the gallbladder into the Common Bile Duct. It's between 3 to 4cm long, passes posteriorly to the left from the neck of the gallbladder and joins the Common Hepatic Duct to form the Common Bile Duct. It almost runs parallel to it and is adherent to the Common Hepatic Duct for a short distance before joining it. The junction usually occours near the Porta Hepatis. It bears 5-12 crescentic folds, contiuos with that of the Gallbladder. Gallstones usually forms in the gallbladder. As it empties they move toward the Cystic Duct. When some of this stones enter the Cystic Duct they may provoke an irritation of the coluomnar mucosa of this duct, which in turns leads to spasm of the Cystic Duct walls.

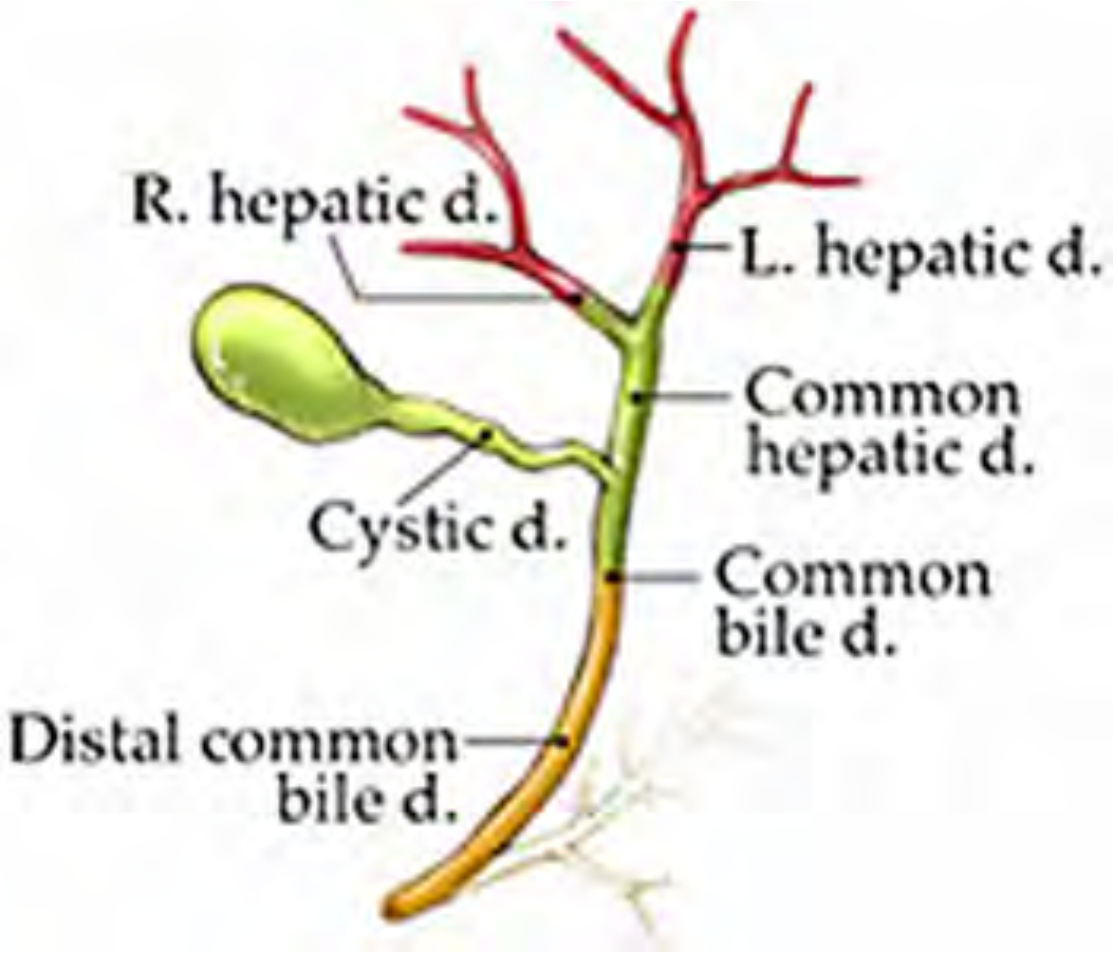


Hepatic Bile Duct

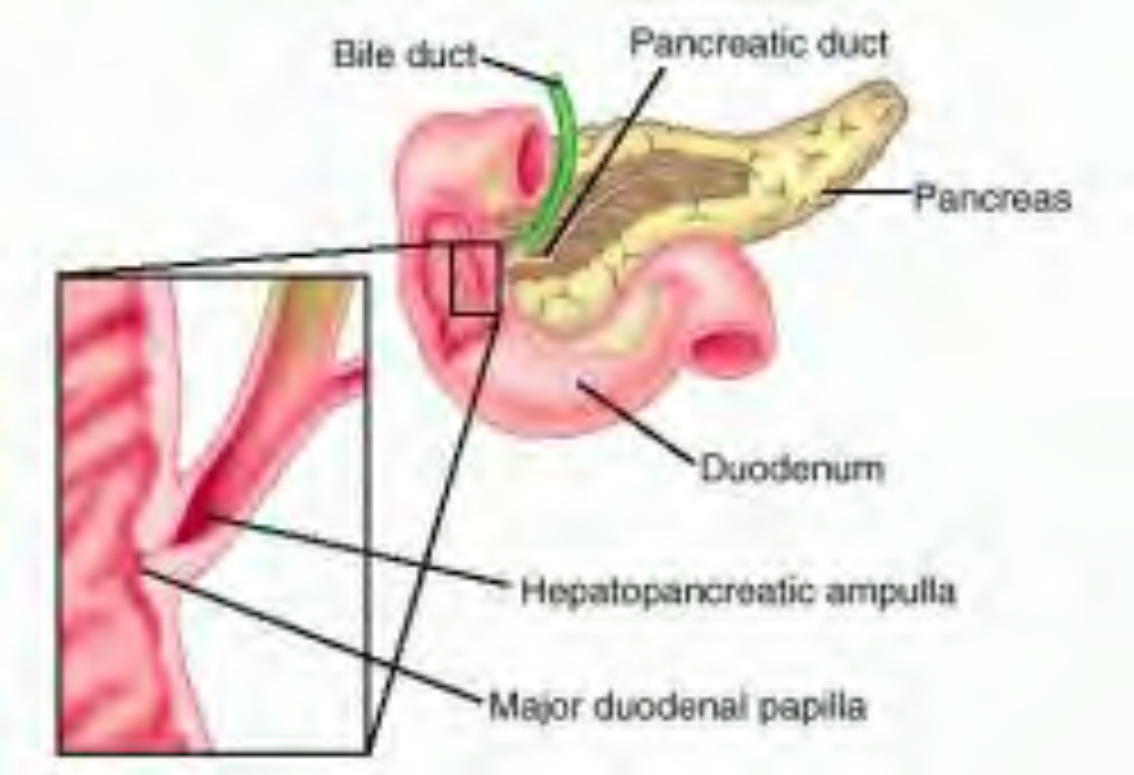
It begins at the Right end of Porta hepatis. It descends apprxim 3 cm before being joined on its right at an acute angle by the Cystic Duct to form the Common Bile Duct. It lies to the right of the Hepatic Artery and anteriorly to the Portal Vein in the free edge of the Lesser Omentum.

Common Bile Duct

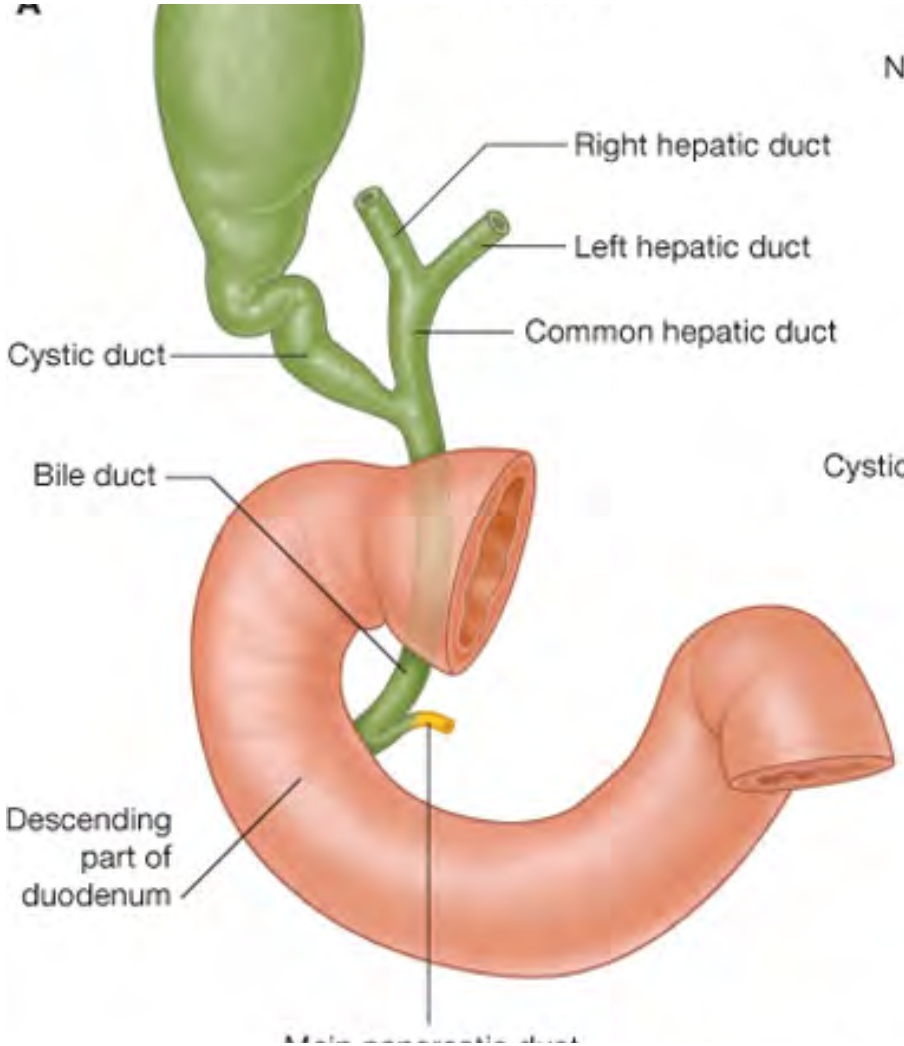
It's usually 6 to 8 cm long with a diameter of 6mm. It descends posteriorly and slightly to the left, anterior to the Epiploic Foramen in the right border of the Lesser Omentum, where it lies anteriorly and to the right of the Portal Vein and Hepatic Artery. It than runs in a groove on the superolateral part of the posterior surface of the head of the Pancreas. The duct lies anterior to the Inferior Cava and is embedeed in the pancreatic tissue

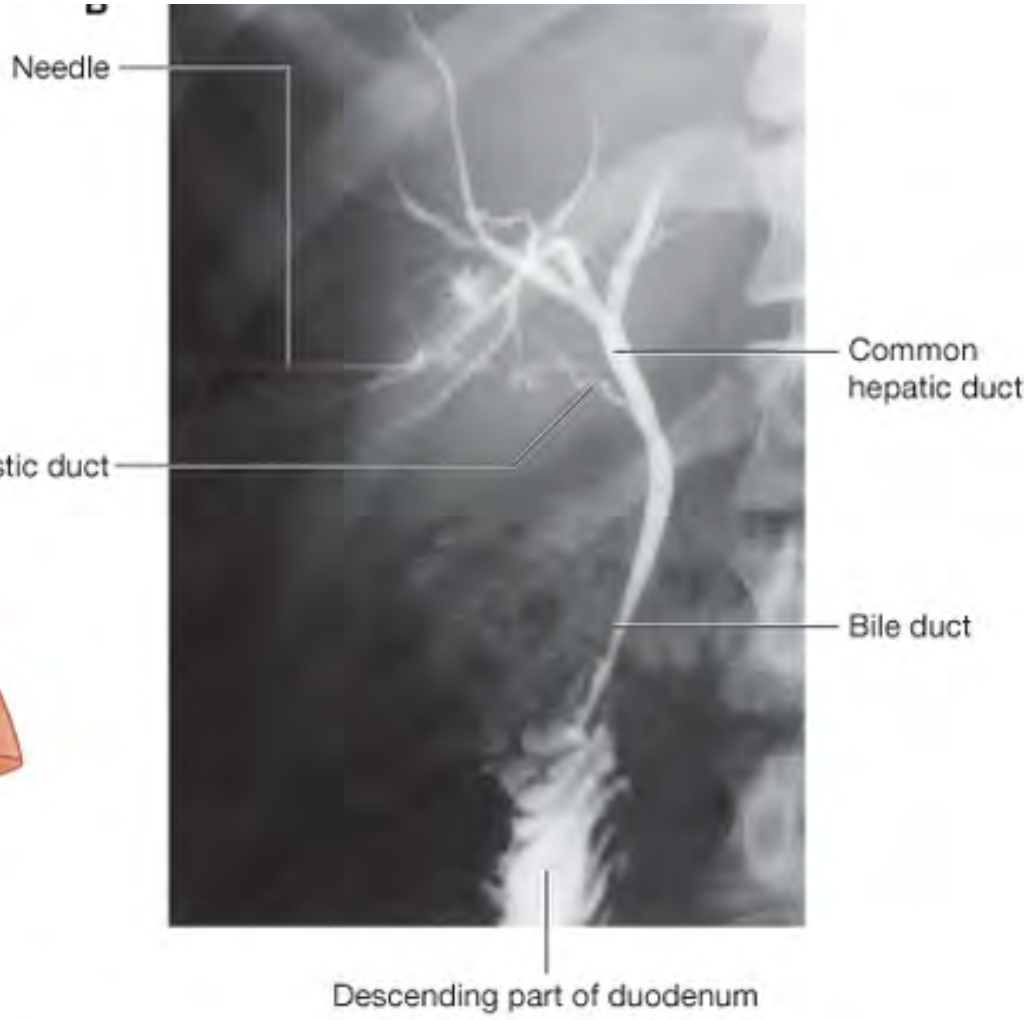


Hepatopancreatic Ampulla (of Vater)

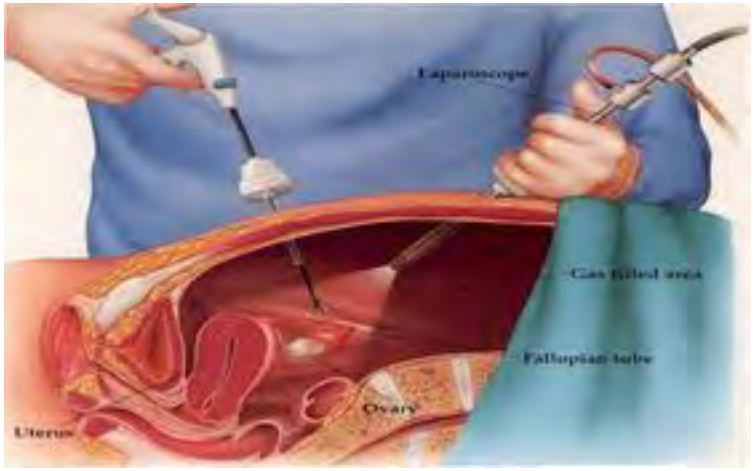


As it lies medial to the Second part of the Duodenum, the Common Bile Duct approaches the Right end of the Main Pancreatic duct. These ducts enter the Duodenal wall togheter and usually unite to form the *Hepatopancreatic Ampulla of Vater*. It's basically a circular muscle that surround the lower part of the Common Bile Duct and also sorrounds the terminal part of the Pnacreatic duct. When the Pressure exceeds 100mm of water, the Sphincter of Oddi relaxes and the content enters in the Duodenum.

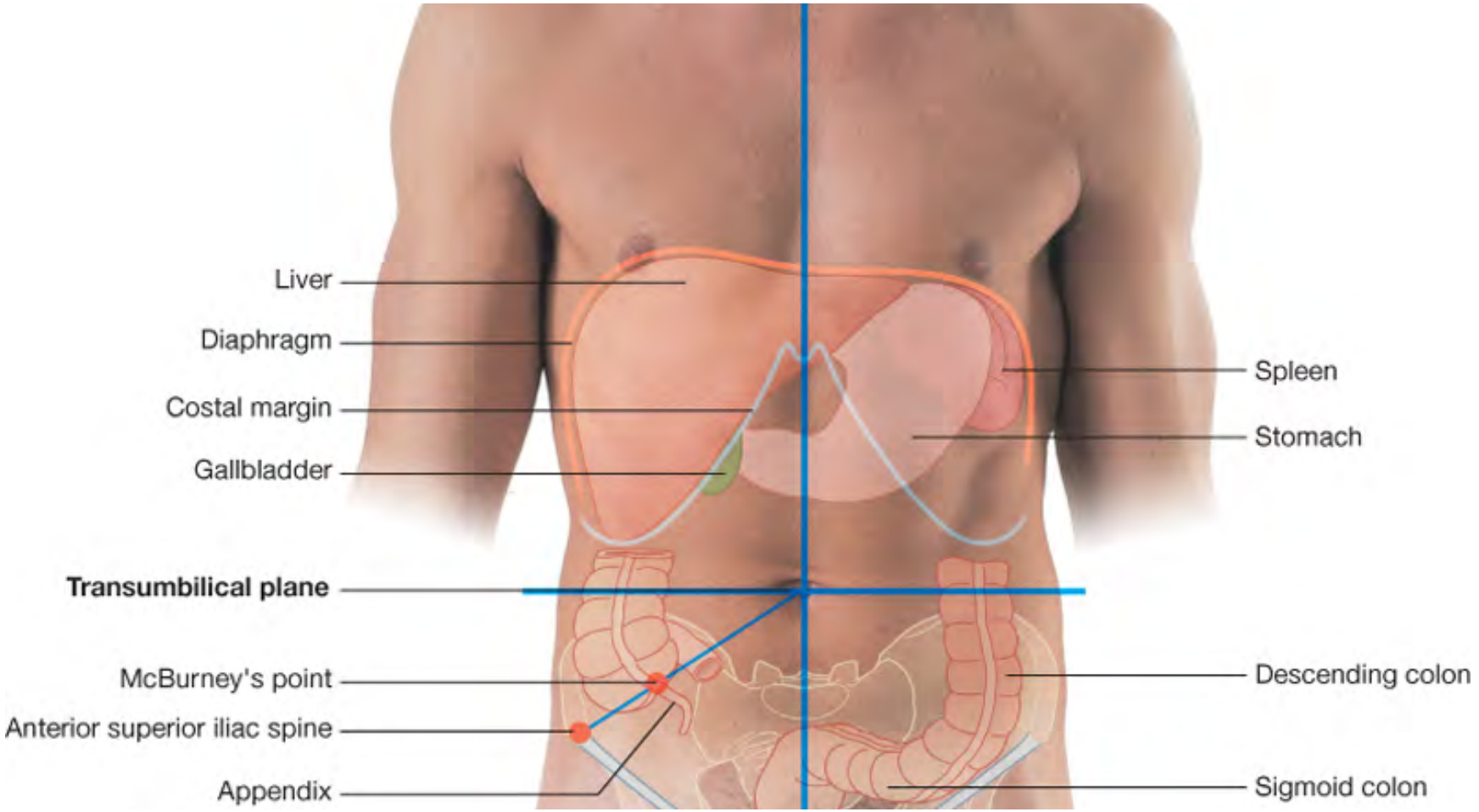

Right hepatic duct
Left hepatic duct
Common hepatic duct
Cystic duct
Bile duct
Descending part of duodenum


Needle
Common hepatic duct
Cystic duct
Bile duct
Descending part of duodenum

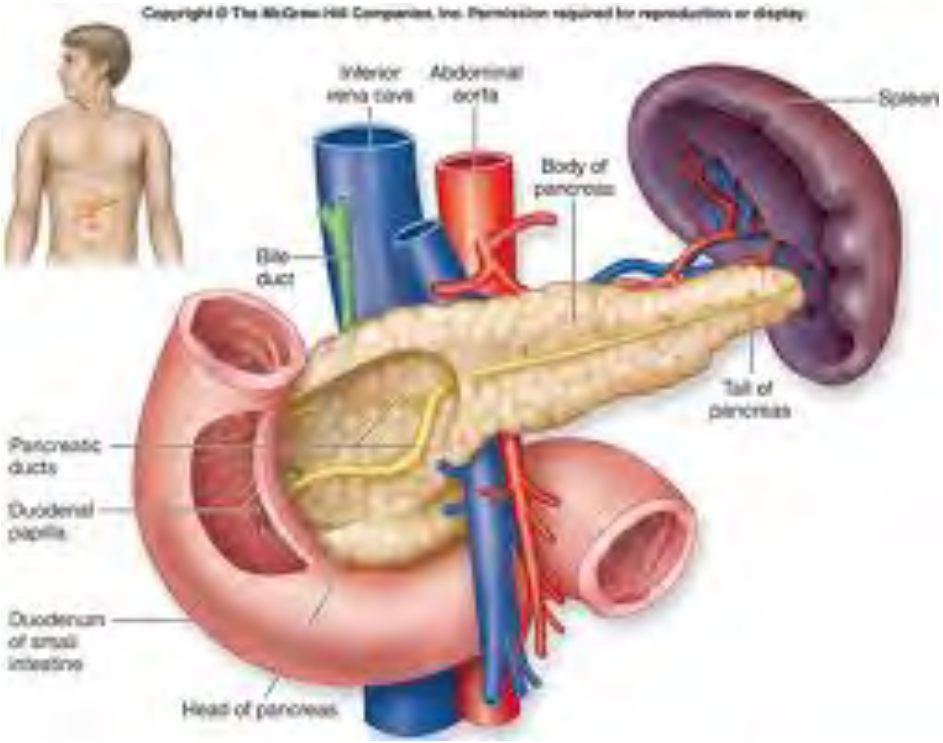
Colecistectomy (gallbladder removal), nowdays, is a very common procedure and most of the time is performed under a laparoscopic approach!



So, to get oriented….

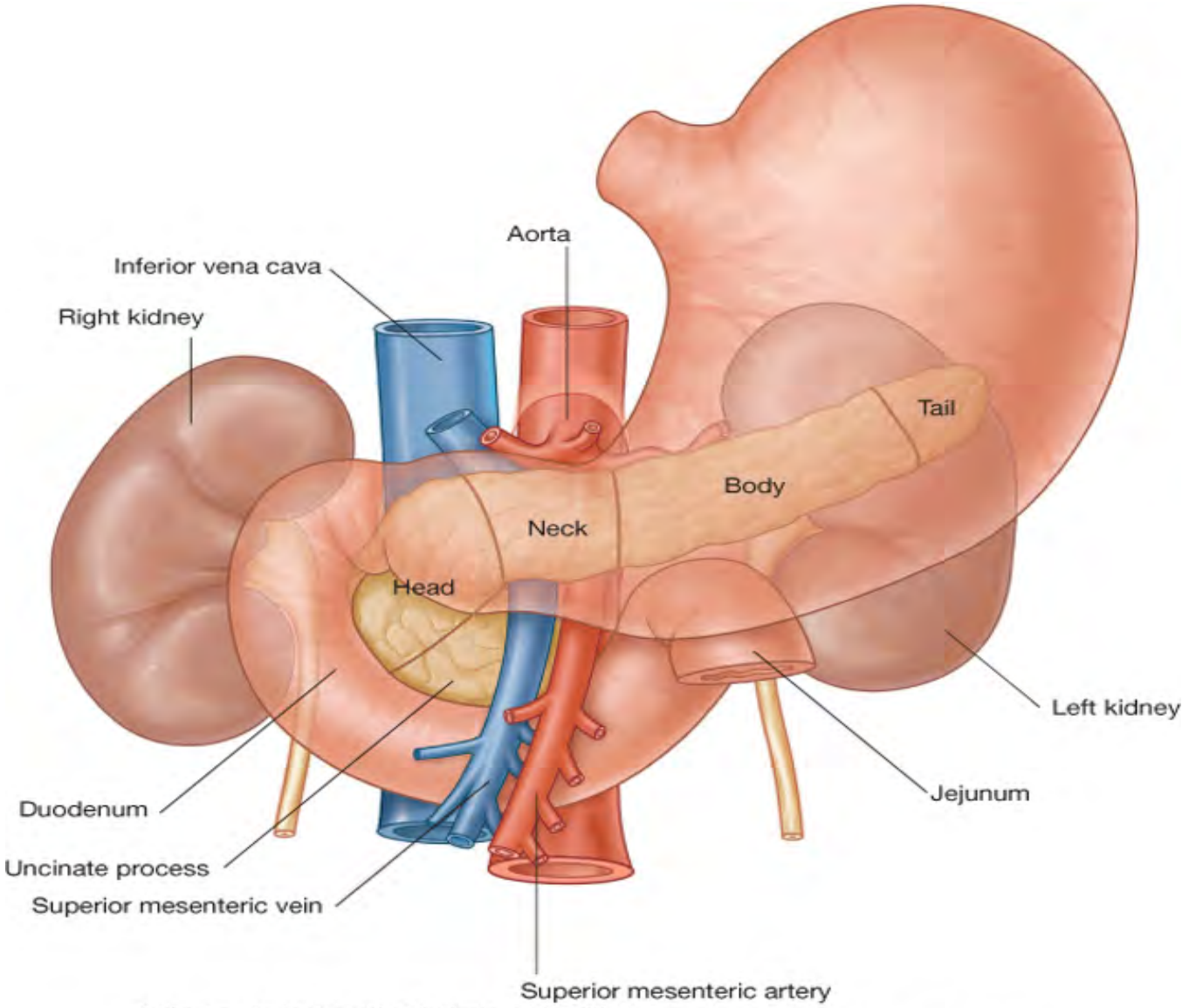


The Pancreas

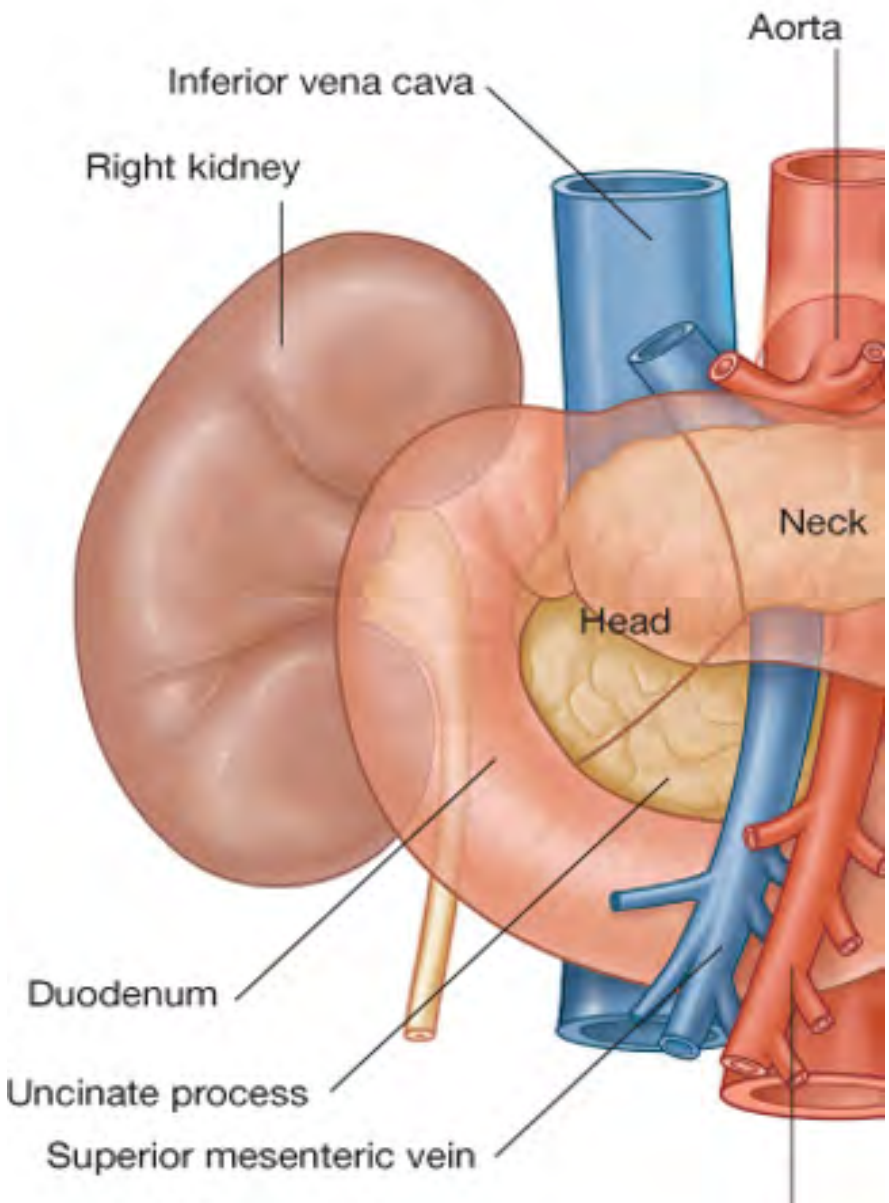


It's the largest of the digestive glands and performs a range of both exocrine and endocrine functions. It's salmon pink in colour, with a lobulated and smooth appearance. In adults it measures from 12 to 15cm long and it's shaped as a flattened tongue of tissue. It lies between the curve of the first, second and third part of the duodenum, and extends transversally and slighltly upward across the posterior abdominal wall (being totally a retroperitoneal organ) till to the hilum of the Spleen, behind the Stomach

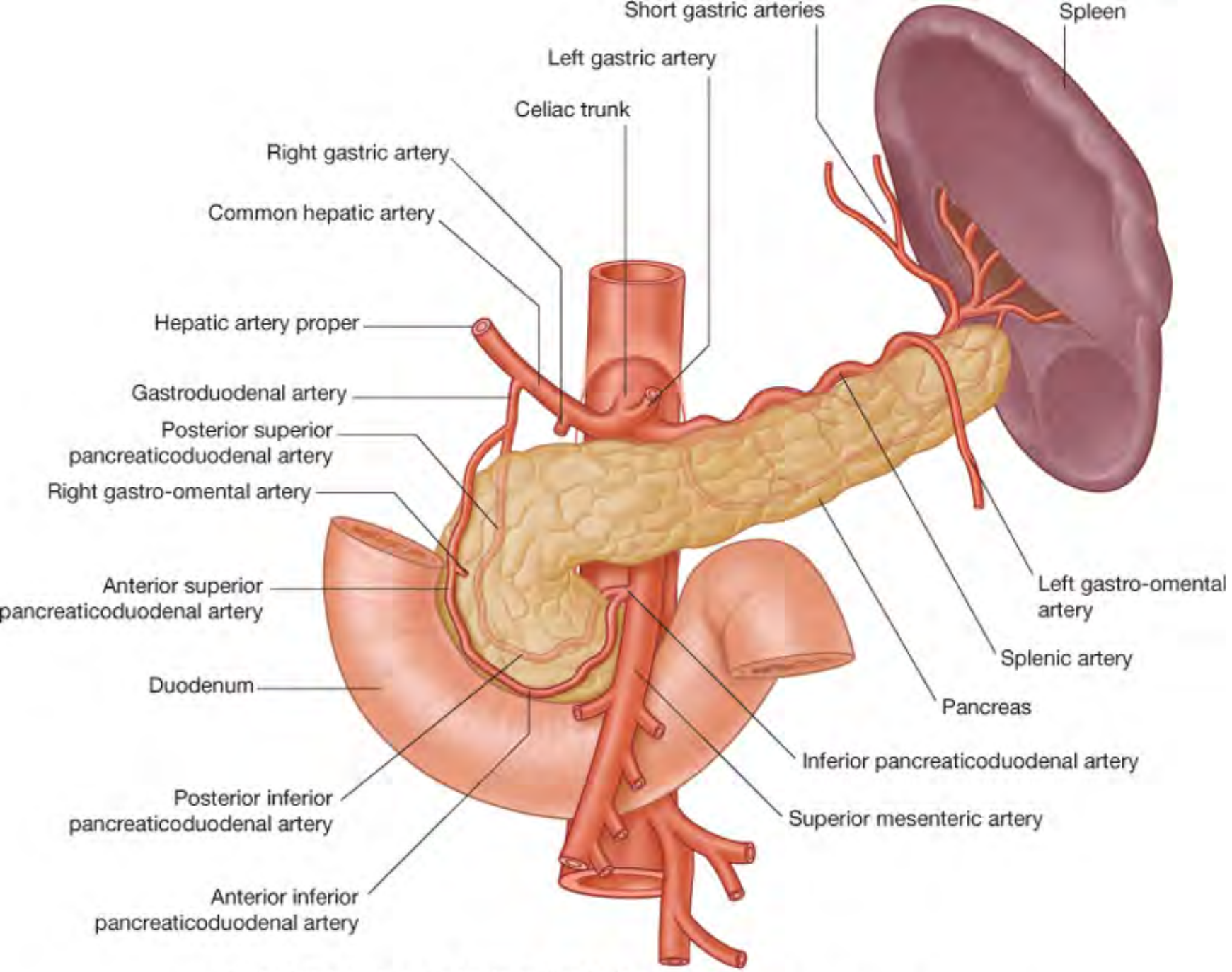
For descriptive purpouses, it's divided into…



The Head

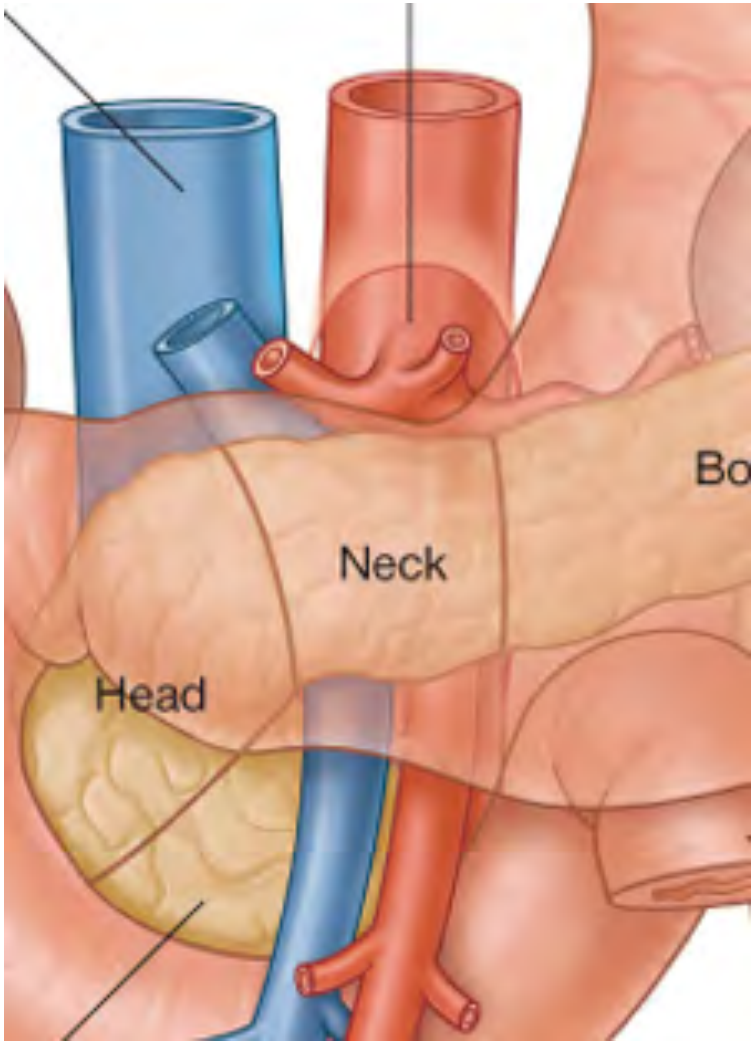


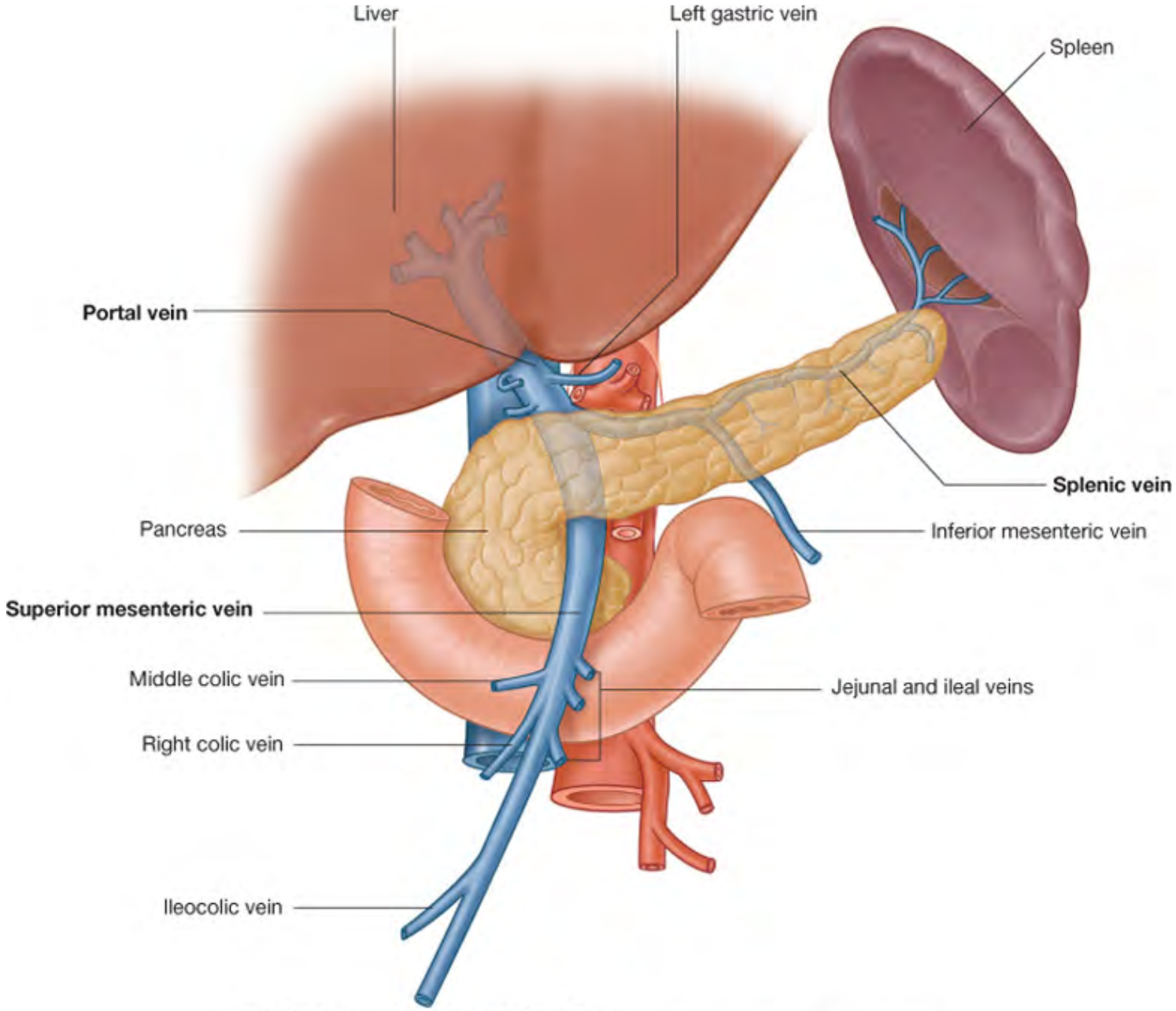
It lies to the right medial side of the vertebral coloumn, within the curve of the Duodenum. It's the thickest and broadest part of the Pancreas. The Sup. And Inf. Pancreaticoduodenal Artery lie between the head and the duodenum in this area. The boundary with the neck is often marked anteroposteriorly by a groove of the Gastroduodenal Art. The Anterior surf is covered by peritoneum and lies adjacent to the Right Ureter. The Posterior one is related with the Inferior Vena Cava and Right Renal Vein.



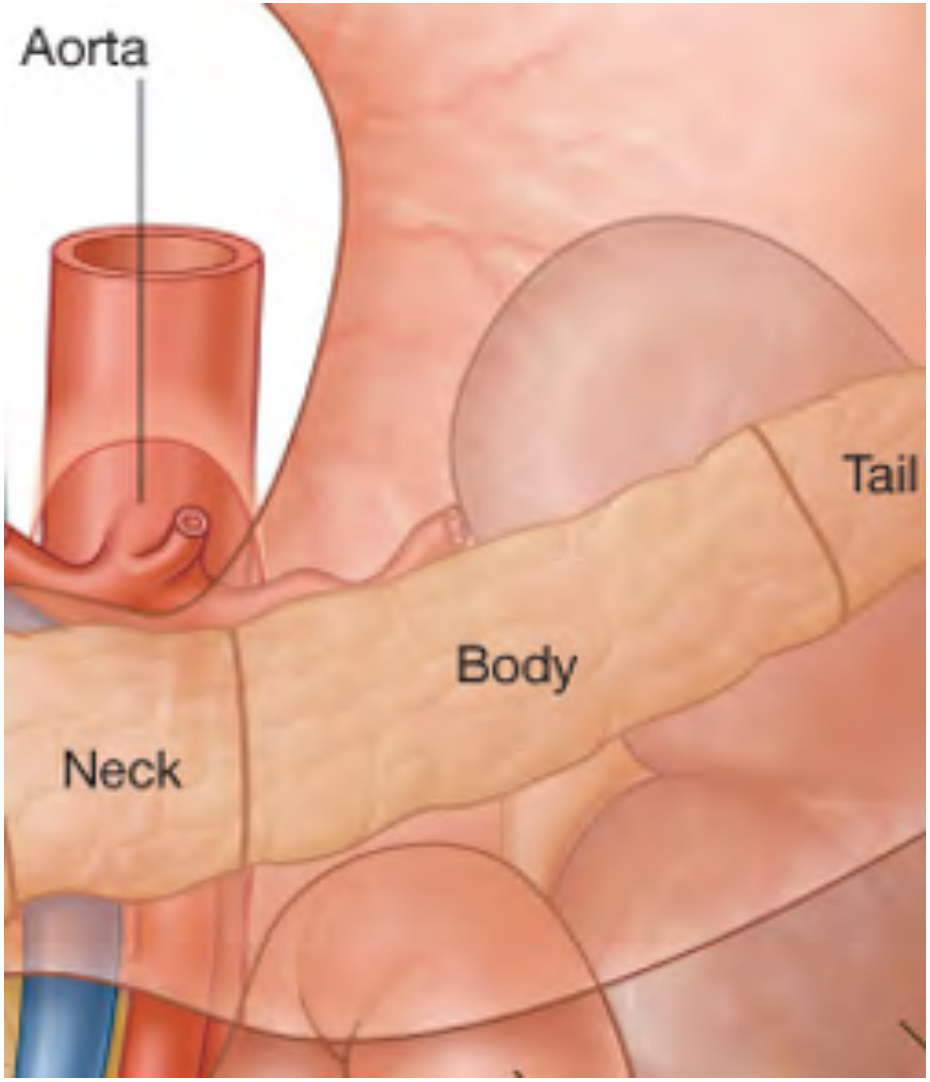
The Neck

It links the head to the body. It's often the most anterior portion and lies anteriorly to the Portal Vein. The lower part lies anterior to the Superior Mesenteric Vein. The Anterior Surface of the neck is covered by peritoneum and is adjacent to the Pylorus, just inferior to the Epiploic Foramen. The Gastroduodenal, Ant and Sup Pancreaticoduodenal Arteries descends in front of it.

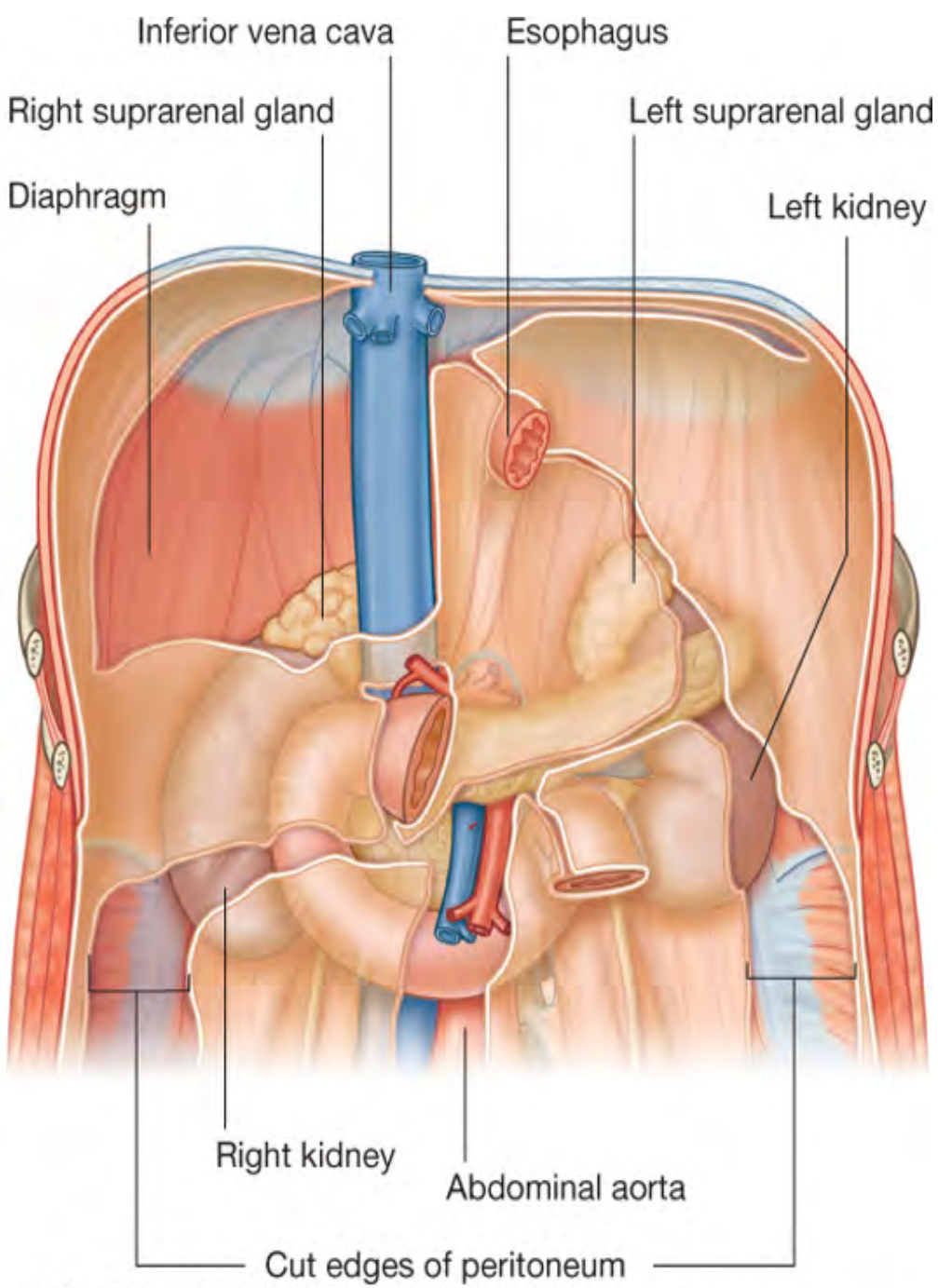




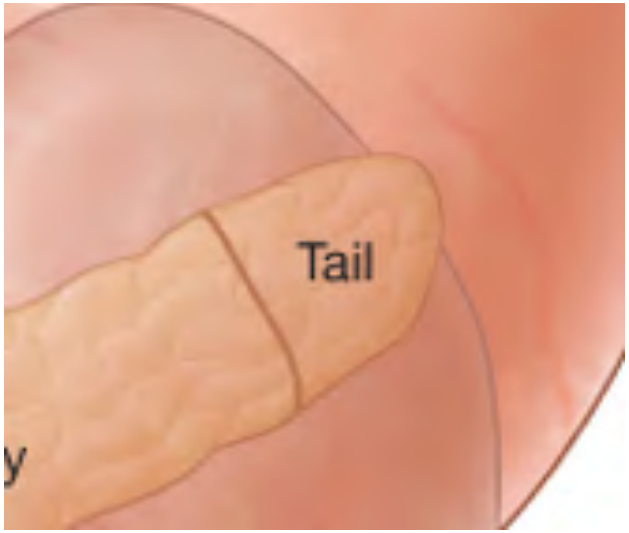
Body



It's the longest portion of the gland and runs from the neck to the tail. It's slightly triangular in cross section, becoming thinner and less broad toward the tail. The *Anterosuperior* surface is peritoneum covered and the Superior leaf of Transverse Mesocolon is reflected here. The *Posterior* Surface is devoid of Peritoneum and lies anteriorly to the Aorta, Left Crus of the Diaphragm, Left Suprarenal Gland, Left Kidney and Left Renal Vein. It's also closely related to the Splenic vein. The *Anteroinferior* surface is peritoneum covered (continuos with that of the Posteroinferior layer of Transverse Mesocolon. Inferiorly is adjacent to the 4th part of Duodenum, Duodenojejunal flexure and the Ligament of Treitz presents its anterior relation.

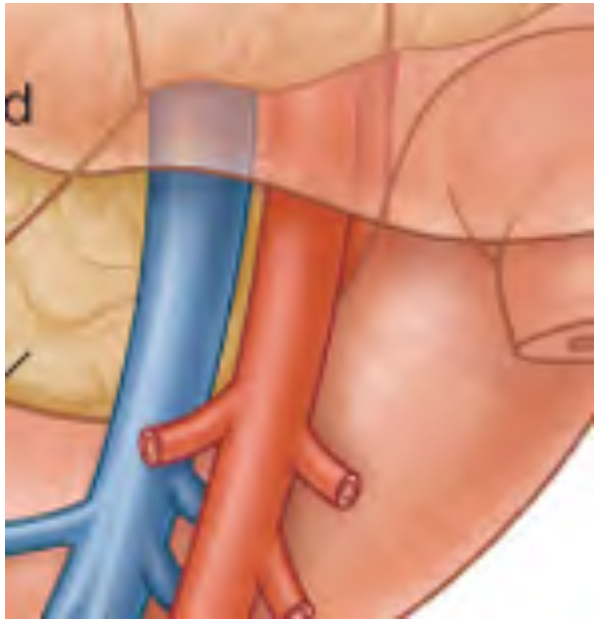


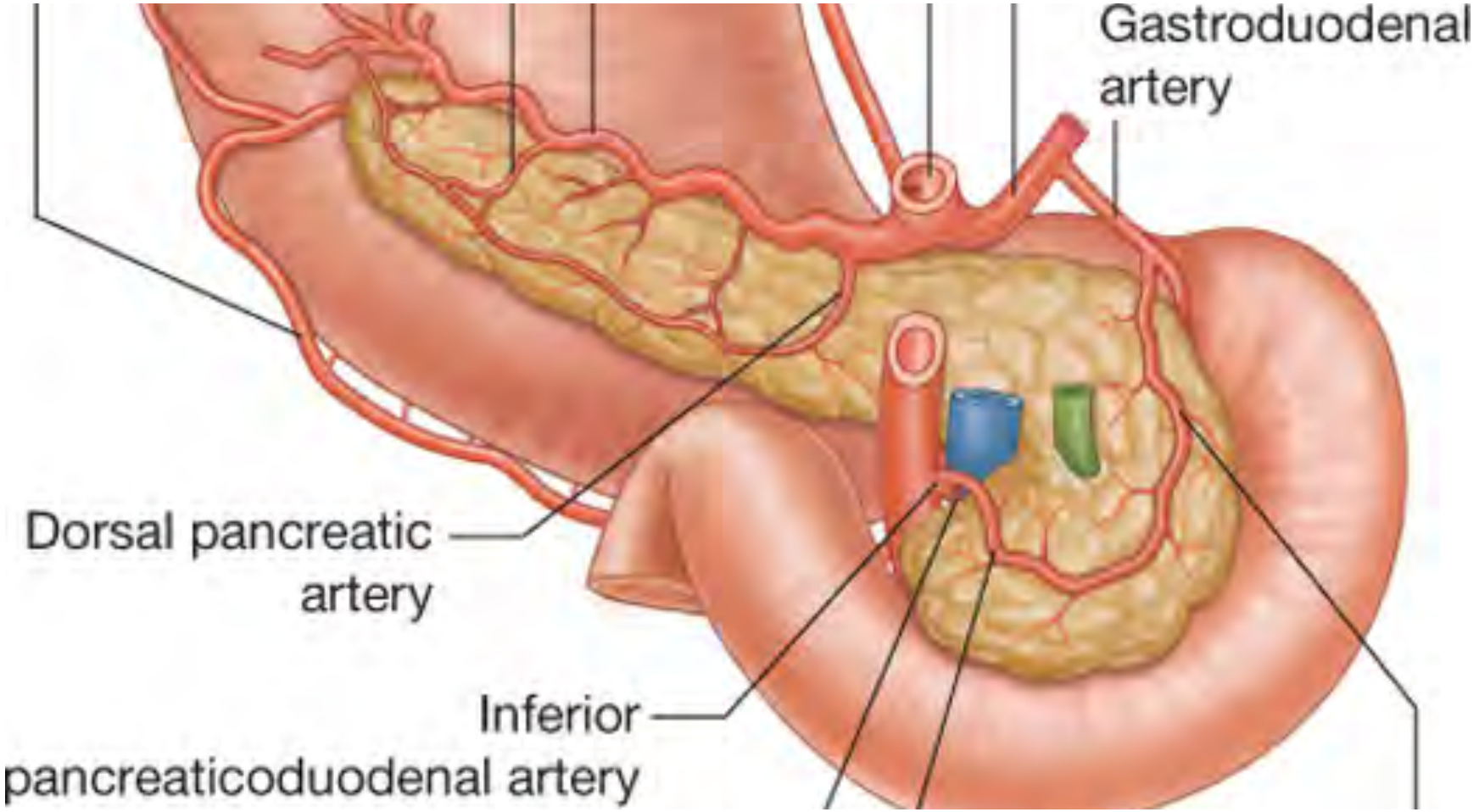
Tail and Uncinate Process



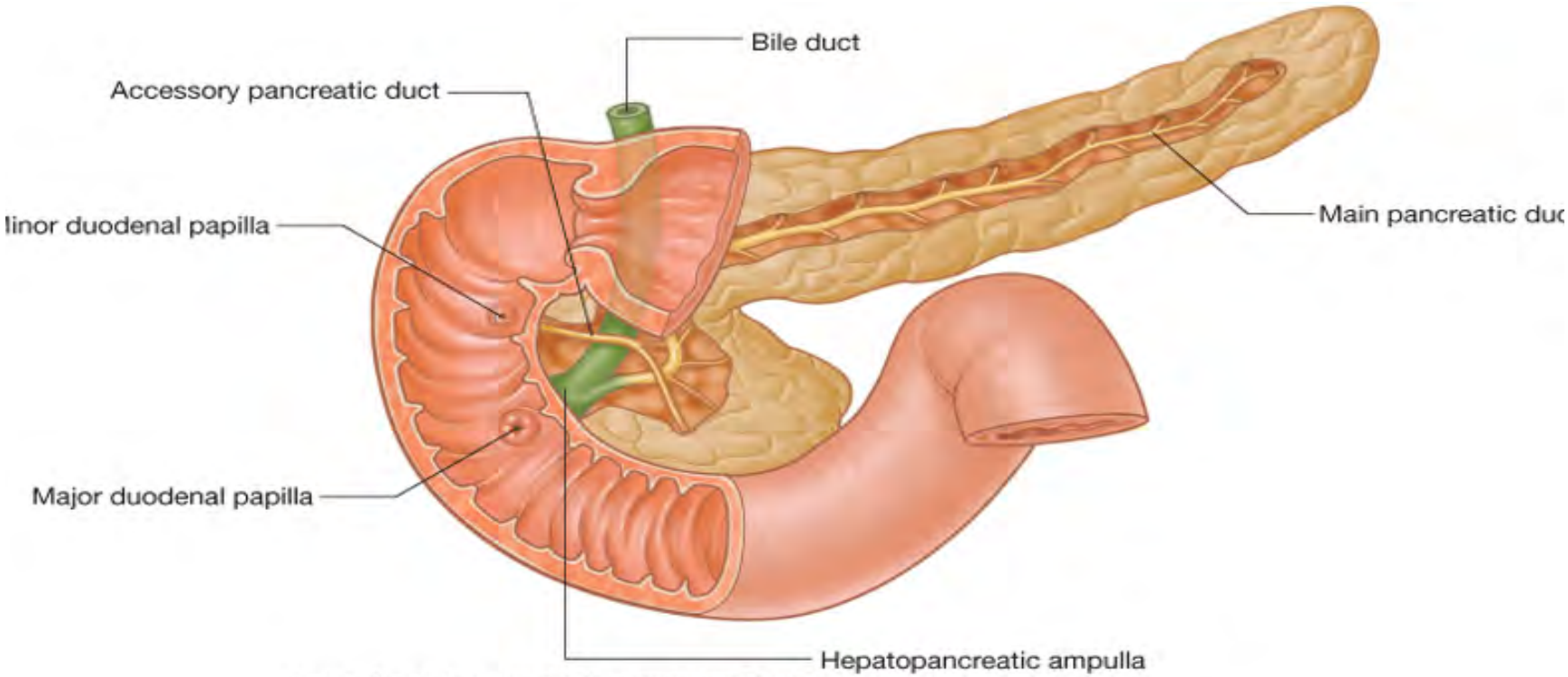
It's the narrowest portion of the Gland and lies between the layers of the Splenorenal Ligament. The tip of the tail may lie in contact with the Splenic Hilum.

It extends from the Inferior lateral end of the Head of the Gland. It's embriologically separated to the rest of the gland and lies posteriorly to the Superior Mesenteric Vein. Posterioly presents the Aorta and inferorly the Upper surface of the third part of the Duodenum.




Gastroduodenal artery
Dorsal pancreatic artery
Inferior pancreaticoduodenal artery

Pancreatic Ducts



Drake: Gray's Anatomy for Students, 2nd Edition.

Exocrine part of the gland drains into a multiple system of duct. The main Duct is derived from the distal part of the Dorsal Duct but fuses with the more posteriorly placed ventral duct. The *Main Pancreatic Duct of Wirsung* usually runs within the substance of the gland from left to right. The *Accessory Pancreatic Duct of Santorini* usually drains the Upper part of the anterior portion of the head of the pancreas. The Accessory Duct usually opens onto a small rounded Minor Duodenal Papilla, which lies 2cm anterosuperior to the Major Duodenal Papilla (opening of the Duct of Wirsung).

So, to get still oriented…