MED437
KING SAUD UNIVERSITY

ANATOMY
Team 437

Pancreas and Biliary System

Lecture (3)

- Important
- Doctors Notes
- Notes/Extra explanation

Please check our Editing File

هذا العمل مبني بشكل أساسي على عمل دفعة ٤٣٦ مع المراجعة والتدقيق وإضافة الملاحظات ولا يغني عن المصدر الأساسي للمذاكرة

{وَمَنْ يَتَوَكَّلْ عَلَى اللَّهِ فَهُوَ حَسْبُهُ}

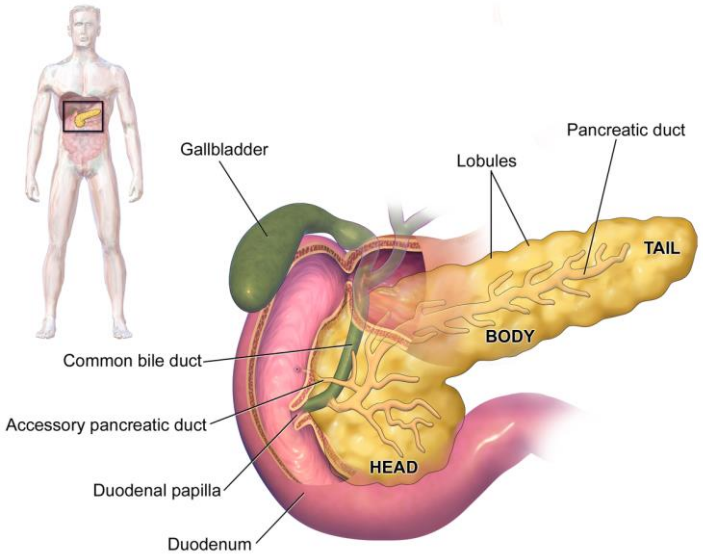
Objectives

At the end of the lecture, students should be able to:

- ✓ **Location**, **surface anatomy**, **parts**, **relations** & **peritoneal reflection** of the **pancreas** and **gall bladder**.
- ✓ **Blood supply**, **nerve supply** and **lymphatic drainage** of **pancreas** and **gall bladder**.
- ✓ Course of each of **common hepatic**, **cystic** and **common bile duct** and **pancreatic ducts**

Pancreas
Location

- Located in Epigastrium* & Left upper quadrant of abdomen.
- Pancreas is a **soft**, **lobulated elongated gland** with both **exocrine** (secretes pancreatic juice) and **endocrine** (secretes insulin) functions.
- 6-10 inch in length & 60-100 gram in weight.
- Retro-peritoneal** in position.
- Lies across the posterior abdominal wall in an oblique directions at the transpyloric plane **(L1 vertebra)** but the tail is at T12.
- Epigastrium* : upper central region of the abdomen.
- Retro-peritoneal** : behind the peritoneum (only covers anterior surface), more fixed (less movement).
- **3** Surfaces: **Superior**, **inferior** & **anterior**
- **3** Borders: **Anterolateral**, **anteroinferior** (with peritoneum) & **posterior** (without peritoneum)



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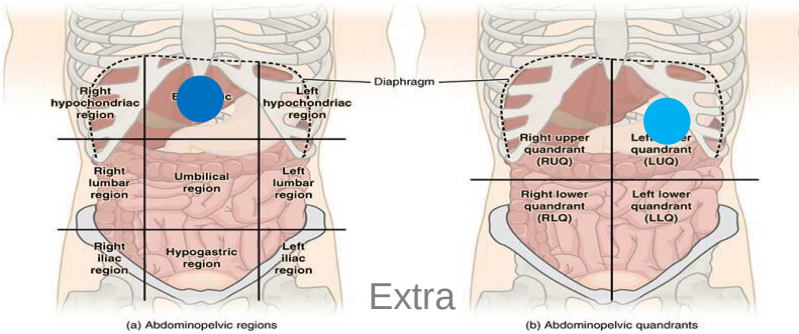
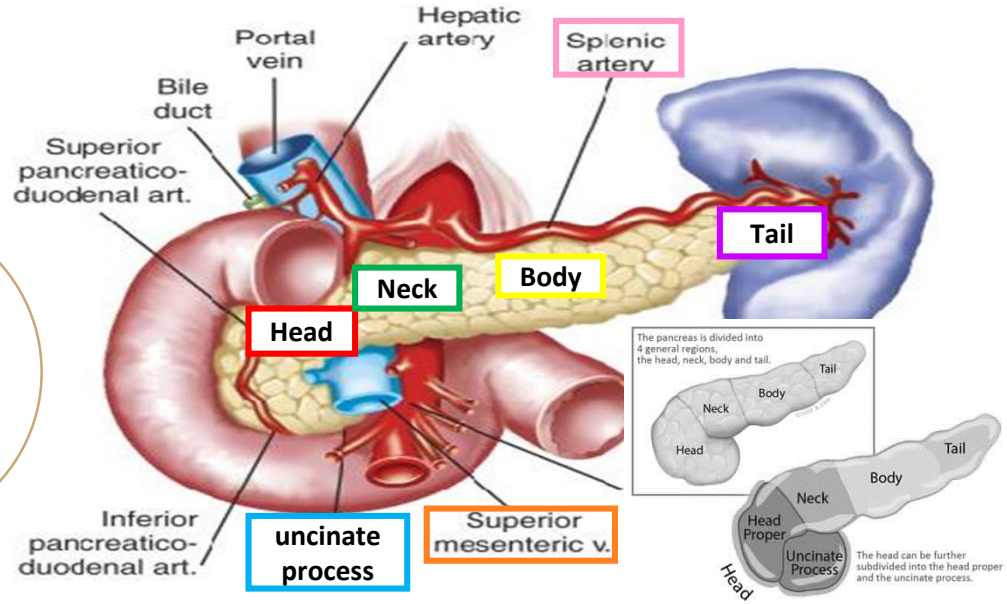


Pancreas

PARTS:

It is divided into:

Head | Neck | Body | Tail



Head

- **Disc shaped**, lies **within the concavity** of the **duodenum**.
- Related to the 2nd and 3rd parts of the duodenum on the **right.**
- Continues with the neck on the **left**.
- Includes uncinate process (part extending to the left behind the **superior mesenteric** vessels.

Neck

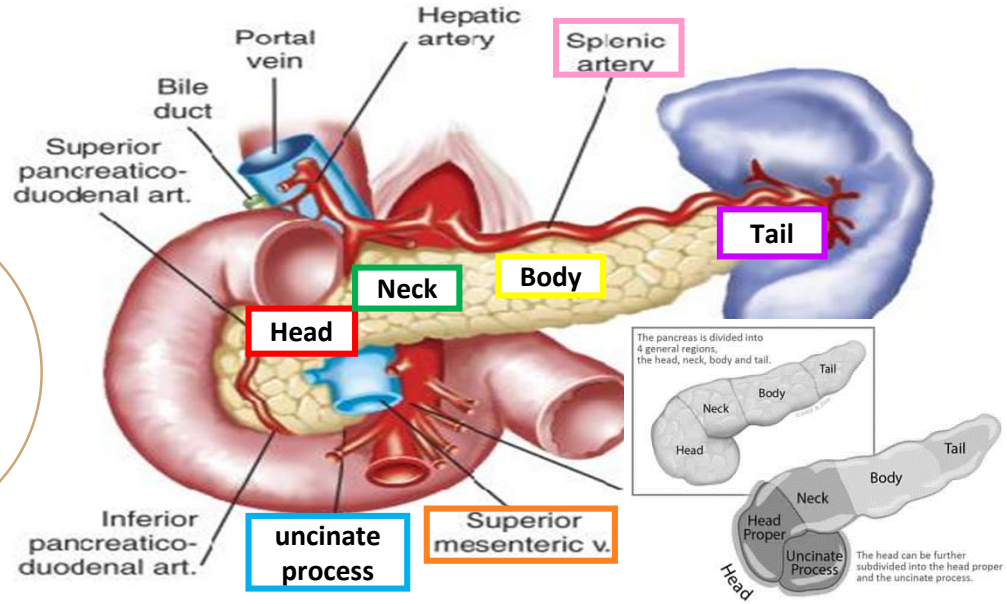
- The **constricted portion connecting** the head & body of pancreas.
- Lies in **front** of origin of **superior mesenteric artery** of **abdominal Aorta** and the beginning/confluence (origin) of the portal vein at level L1.
- Its anterosuperior surface supports (يكون تحتها) the pylorus of the stomach .
- The **superior mesenteric vessels** emerge from its **inferior border**.

Pancreas

PARTS:

It is divided into:

Head | Neck | Body | Tail



Body

- It runs **upward** and to the **left**.
- It is **triangular in cross section**.
- The **splenic vein** is embedded in its **posterior surface** While **splenic artery*** runs along it **upper border.**

*One of the **torches (ملتوية/متعرجة) arteries** in the human body (**facial** & **uterine** arteries are the other torches arteries)

Tail

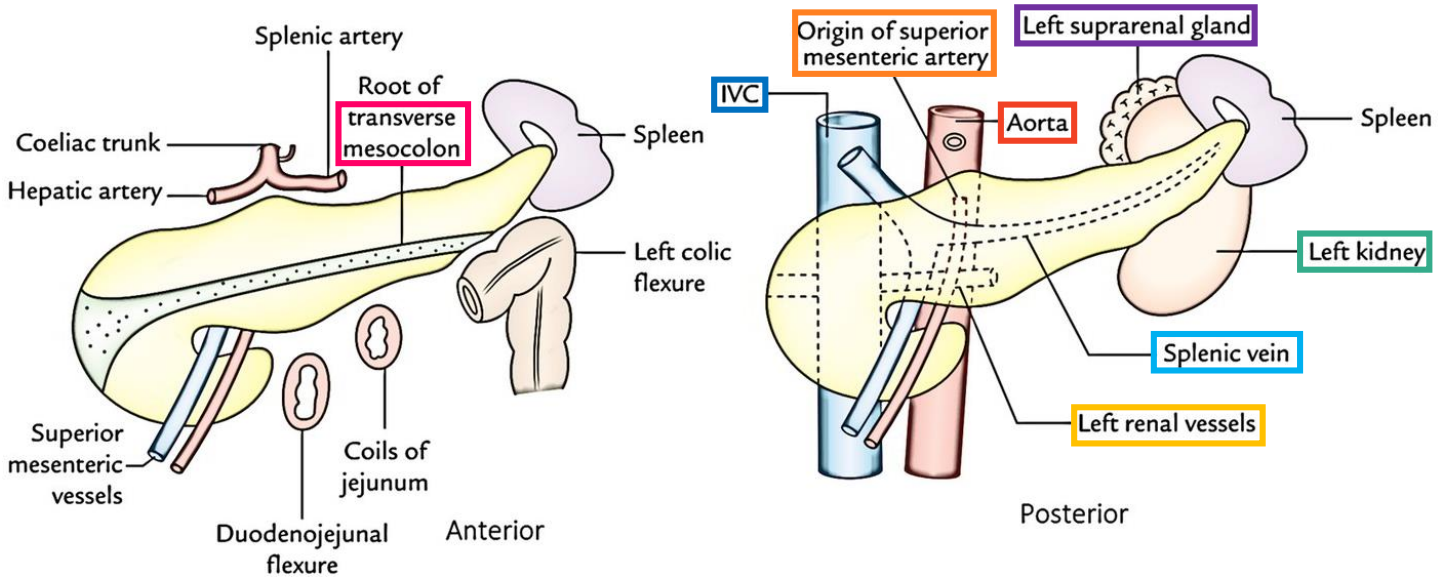
- **Narrow**, **short segment**, ending at the **splenic hilum** & **highest** part
- Lies in the **splenorenal ligament (or lienorenal ligament)**** (may get **injured** during **splenectomy**), at the level of the **T12 vertebra**
- Anteriorly related to **splenic flexure** of **colon**.

**This ligament is attached to the helium of the spleen & front of the left kidney, its fold of peritoneum. It contain (splenic vessels “arteries” & tail of pancreas)

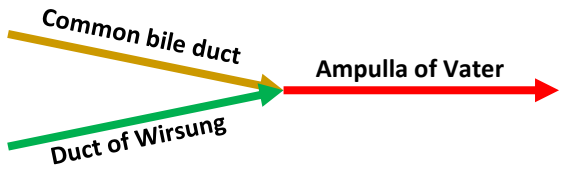
Pancreas Relations

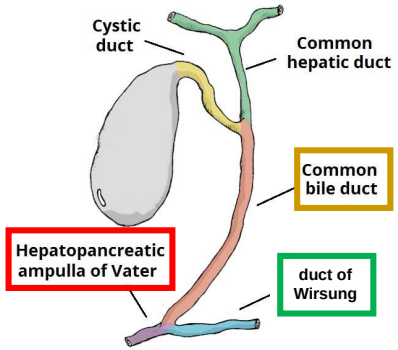
(All relation of posterior abdominal wall)

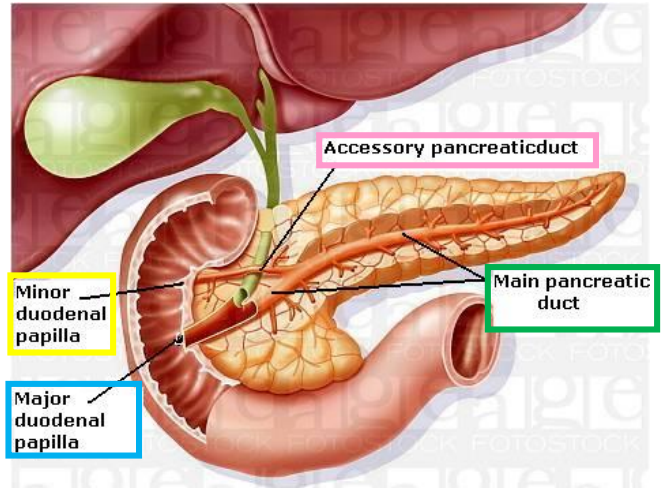
Anterior	Posterior (IMPORTANT)
• Stomach separated by **lesser sac** • Transverse colon • Transverse mesocolon (derivative of **dorsal mesentery**)	• Common bile duct • Portal & Splenic Veins, Inferior Vena Cava • Aorta & Origin Of Superior Mesenteric Artery • **Left** psoas muscle, • **Left** Supra renal (Adrenal) Gland, Left Renal Vessels & upper 1/3rd of **Left** Kidney • Hilum of the spleen



Pancreas
Pancreatic Duct







Main/Major duct (duct of Wirsung):

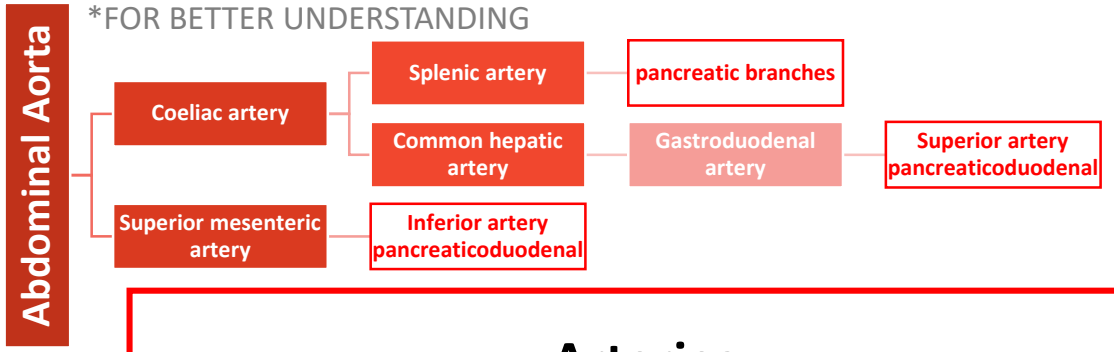
- **Runs** the **entire** length of pancreas beginning **from** the **tail**.
- It **receives** many **tributaries** from **tail**, **body**, **neck**, inferior portion of head (NOT superior portion) & **uncinate process**.
- **Joins** with **common bile duct** & together they **open into** a **small hepatopancreatic ampulla (Ampulla of Vater)** in the duodenal wall 2nd part.
- The ampulla opens into the lumen of the duodenum by means of a **small** Papilla (Major duodenal papilla).

Accessory duct (of Santorini)

- Drains superior portion of the head
- It empties separately into 2nd part of duodenum at (minor duodenal papilla)
- One inch above the major papilla

Pancreas
Blood Supply

*FOR BETTER UNDERSTANDING

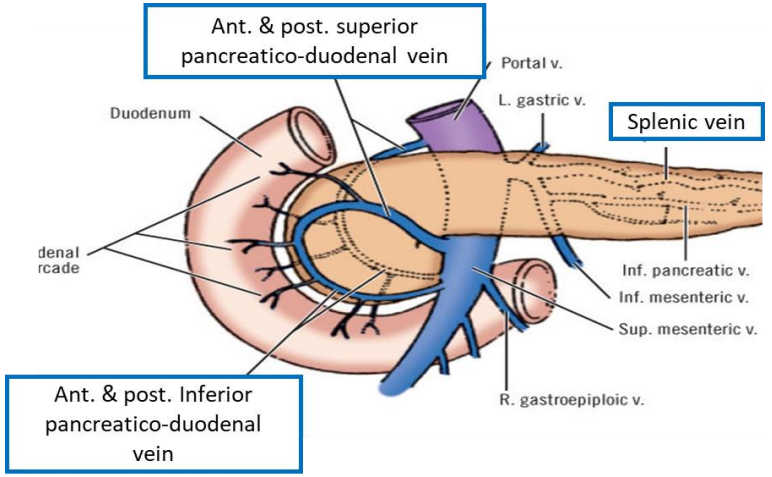


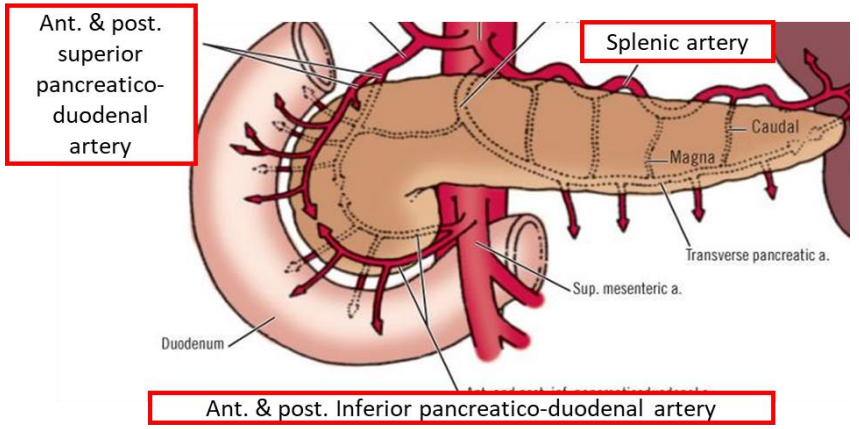
Veins

- Head & neck: Drained by anterior and posterior venous arcades that form the superior & inferior pancreaticoduodenal veins which follow the corresponding arteries.
- Body & tail: Drained by **splenic vein**, which is a tributary of **portal vein**

Arteries

- Head & neck: Supplied by branches from:
  - **Celiac trunk** through Superior artery pancreaticoduodenal
  - **Superior mesenteric artery** through Inferior artery pancreaticoduodenal
- Body & tail: Supplied by **Splenic artery** through 8-10 pancreatic branches.





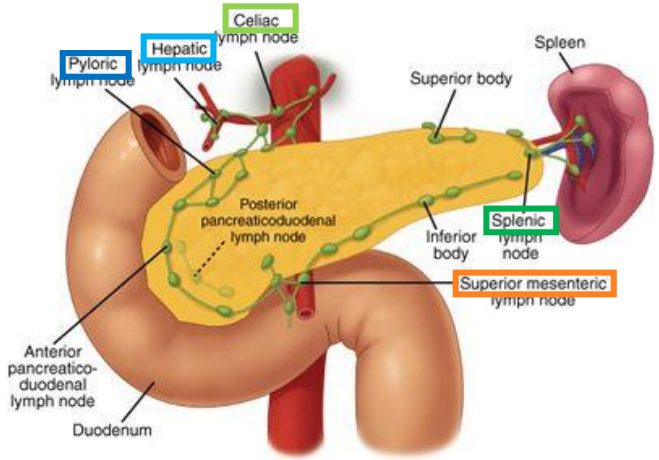
Pancreas
lymphatic drainage & nerve Supply

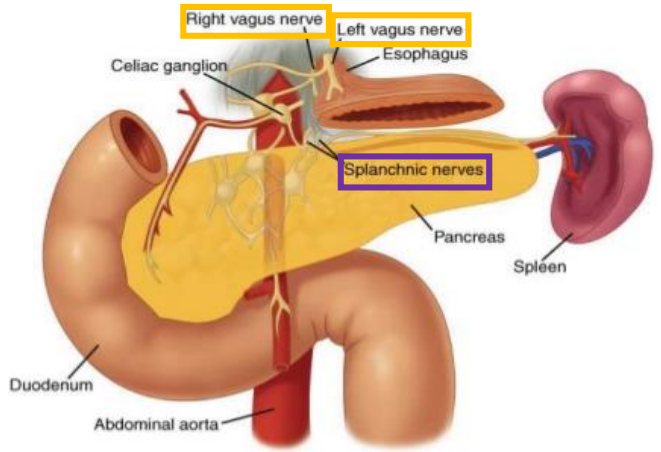
Lymphatic Drainage

- **Rich network** that drains into **pyloric**, **hepatic** & **splenic** nodes
- Ultimately the **efferent vessels** drain into the **celiac** (body & tail) & **superior mesenteric** (head) **lymph nodes**.

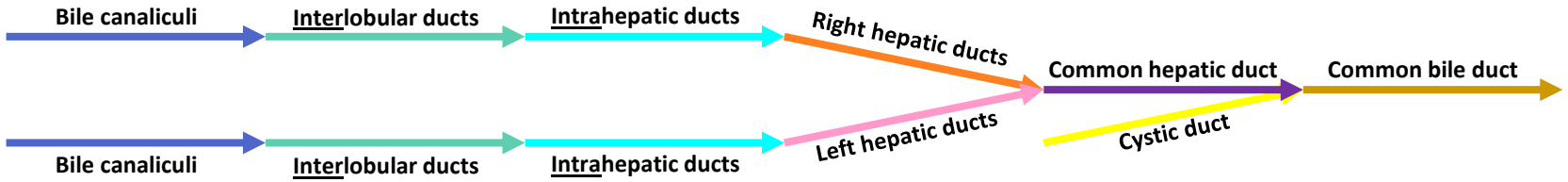
Nerve Supply

- **Sympathetic** fibers from the **thoracic splanchnic nerves**. (Sympathetic fibers have a predominantly **inhibitory** effect)
- **Parasympathetic fibers** from the vagus. (**Parasympathetic** fibers **stimulate** both **exocrine** and **endocrine secretions**)

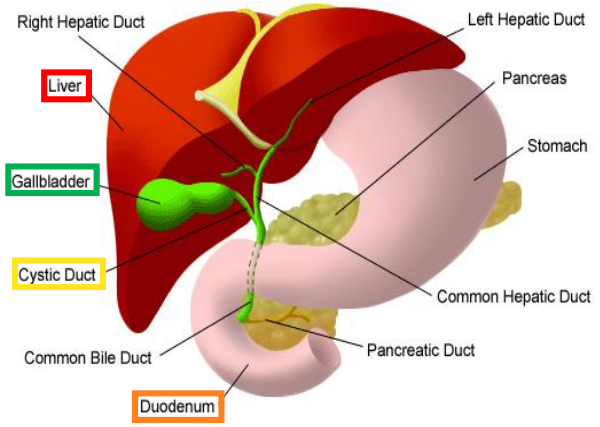




Biliary system



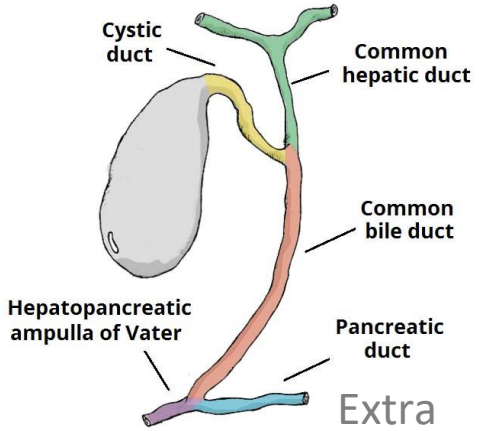
- The biliary system consists of the ducts and organs (**liver**, **gallbladder** & **bile ducts**) that are involved in the **production**, **storage** & **transportation of bile** respectively.
- **Bile** is **secreted by** the **liver cells** at a constant rate of about **40 ml/hour**. When digestion is not taking place, the bile is **stored** and **concentrated** in the gallbladder, later it is delivered to the duodenum.



The bile ducts consist of

- Bile canaliculi (between the liver sacs)
- Inter**lobular** ducts
- Intra**hepatic** ducts (within lobes)
- Right and left hepatic ducts*
- Common hepatic duct
- Cystic duct (From Gallbladder)
- **Common bile duct** (Bile duct)

Join and form larger ducts



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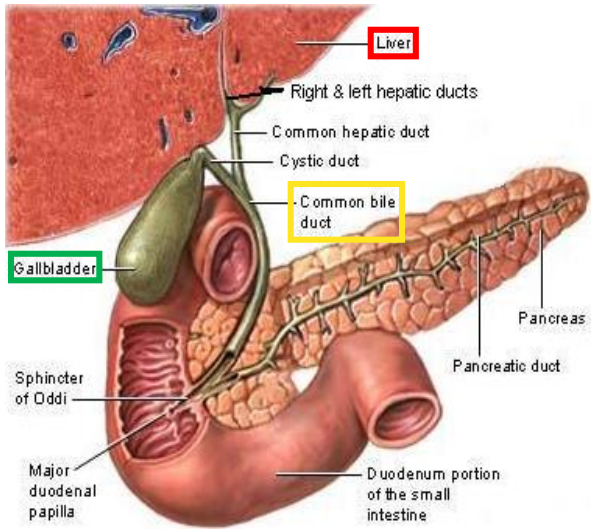
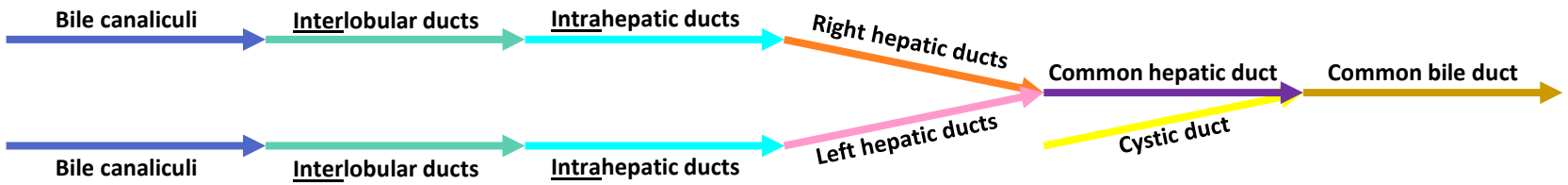


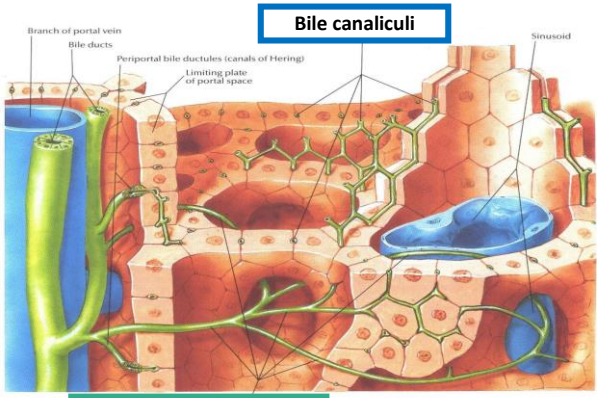
*It comes from **porta hepatis** (helium: deep fissure in the inferior surface of the liver)

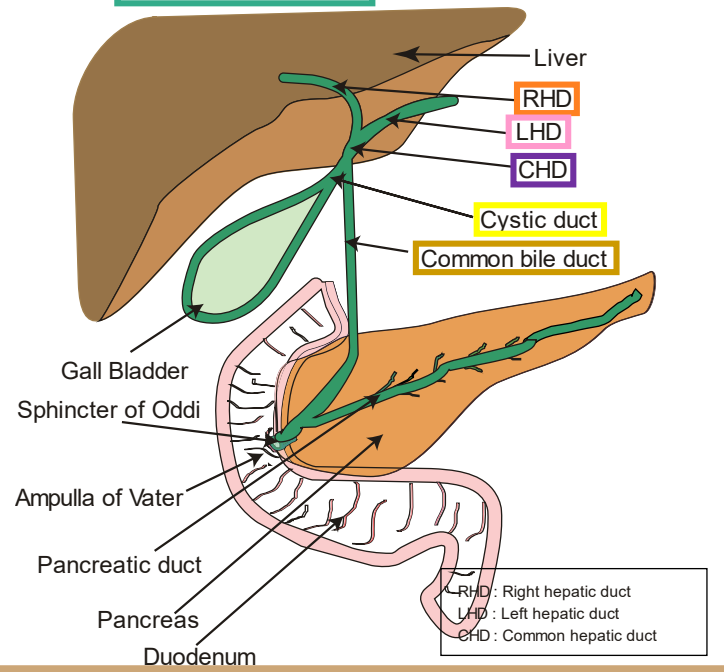
Biliary system
Bile ducts



- The **smallest Interlobular tributaries** of the bile ducts are situated in the portal canals of the liver; they receive the **Bile canaliculi**.
- The interlobular ducts join one another to form progressively larger ducts and, eventually, at the porta hepatis, form the right and **Right hepatic ducts**.
- The **Left hepatic duct** drains the right lobe of the liver and the **left duct** drains the left lobe, the **caudate lobe & quadrate lobe***.
- After a **short course**, the **hepatic ducts unite** to form the **Common hepatic duct**.
- The common hepatic duct is about **1.5 inches (4 cm)** long and **descends** within the free margin of the lesser omentum (fold of peritoneum between stomach "lesser curvature" liver "porta hepatis")
- It is joined on the right side by the **Cystic duct** from the gallbladder to form the **Common bile duct**.

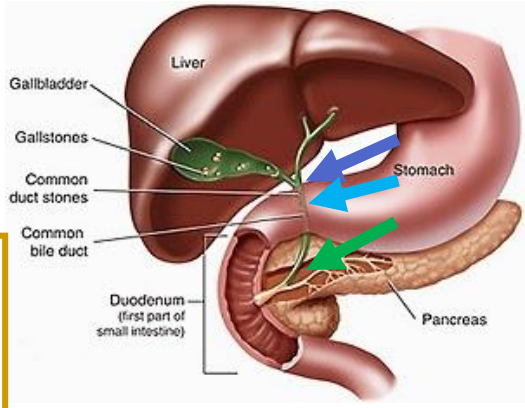
*Anatomically (position) related to right lobe of liver,
Physiologically (function) related to left lobe of liver



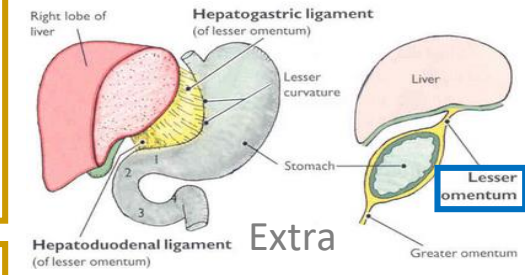


Biliary system
Common Bile Duct

*REMEMBER portal vein & hepatic artery & bile duct also lies in it



- The common bile duct is about 3 inches (8 cm: 4 → cystic and 4 → common hepatic) long.
- **Course**:
  - First it lies in the right free margin (border) of the **lesser omentum***
  - Then it runs (descend) behind the **first part of the duodenum**.
  - Lastly it lies in a groove on the **posterior surface of the head of the pancreas**.
  - Here, the bile duct comes into contact with the main pancreatic duct. (cancer of the HEAD "last stage" of the pancreas will lead to obstructive jaundice due to obstruction of the bile duct)



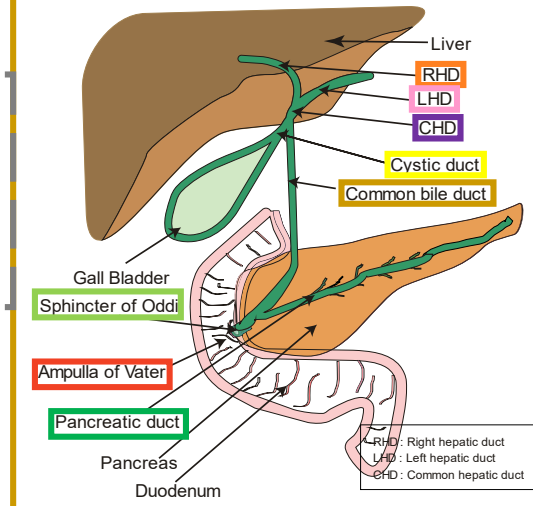
Common Bile Duct

- The bile duct **ends below** by piercing the **medial wall of the second part of the duodenum** about halfway down its length.

[repeated slide 7]

- **Joins** with main pancreatic duct (**duct of Wirsung**) together they **open into** a **small hepatopancreatic ampulla (Ampulla of Vater)** in the duodenal wall 2nd part.
- The ampulla opens into the lumen of the duodenum by means of a **small** Papilla (Major duodenal papilla).

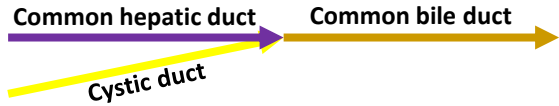
- The terminal parts of both ducts and the ampulla are surrounded by circular muscle, known as the sphincter of the hepatopancreatic ampulla **(sphincter of Oddi).** (this sphincter is constricted when we're not eating. so the bile goes back to the gallbladder)
- Occasionally, the bile and pancreatic ducts open separately into the duodenum.

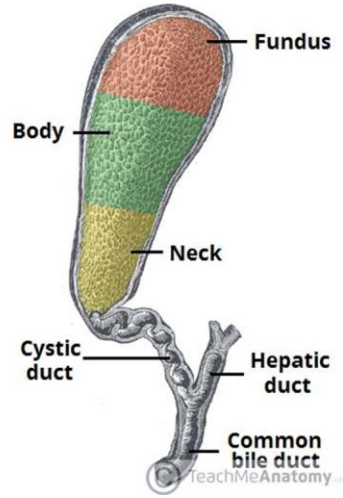


Gallbladder

REMEMBER
Bile **secreted** by liver cells | Bile **stores** by Gallbladder

- A **pear shaped sac** lying on the **undersurface of the liver**.
- It has a capacity of 30 to 50 ml , it **stores bile**, which is concentrated by absorbing water.
- The gallbladder is divided into: the **neck**, **body** & **fundus**:
  - The **neck** becomes continuous with the **cystic duct**, which turns into the **lesser omentum**, joins the **common hepatic duct**, to form the **common bile duct**.
  - The **body** lies in contact with the visceral surface of the liver and is directed upward, backward, and to the left.
  - The **fundus** is rounded and projects below the inferior margin of the liver, the **peritoneum completely surrounds it** and **binds** the body & neck to the **visceral surface** of the liver, where it comes in contact with the anterior abdominal wall at the level of the **tip** of the right **ninth** right costal cartilage.



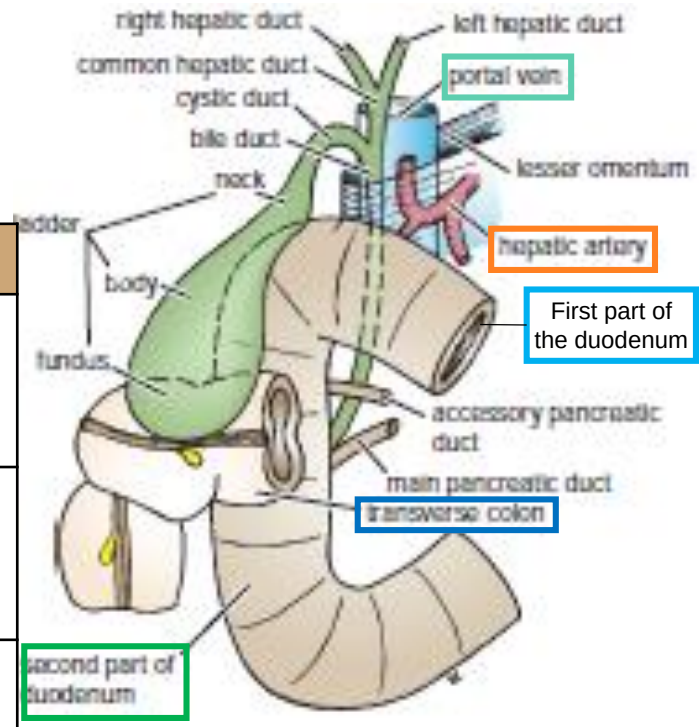


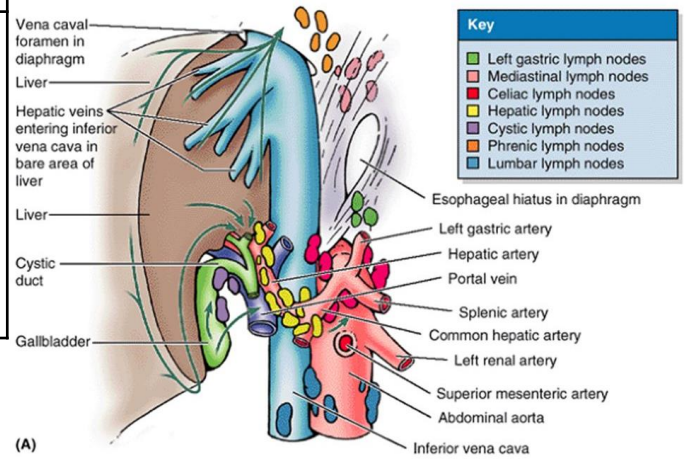
Function of the Gallbladder

- When digestion is not taking place, the sphincter of Oddi remains closed and bile accumulates in the gallbladder.
- The gallbladder concentrates & stores **bile**
- **Selectively** Absorbs bile salts & Keeps the **bile** acid, Excretes cholesterol & Secretes mucus
- To aid in these functions, the mucous membrane (mucosa) is thrown into permanent folds that unite with each other, giving the surface a **honeycombed** appearance.

Gallbladder
Relation & Supply

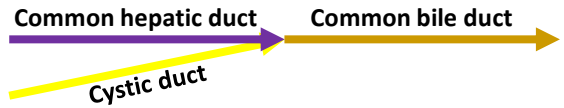
	Anterior	Posterior
Relation	• The anterior **abdominal wall** • The inferior surface of the **liver**	• The **transverse colon** • **1st** part of the **duodenum** • **2nd** part of the **duodenum**
Blood supply	• The **cystic artery**, a branch of the **right hepatic artery**. • The **cystic vein** drains **directly** into the **portal vein**. • Several very small **arteries** and **veins** also run between the **liver** & **gallbladder**.	
Lymph drainage	The lymph drains into a **cystic lymph node situated near the neck of the gallbladder**, From here, the lymph vessels pass to the **hepatic nodes** along the course of the hepatic artery and then to the **celiac nodes (lastly)**	
Nerve supply	Sympathetic and parasympathetic **vagal** fibers form the **celiac plexus**. The gallbladder contracts in response to the hormone **cholecystokinin**, which is produced by the mucous membrane of the duodenum on the arrival of fatty food from the stomach *Gallbladder **NOT affected** nerves, its **affect** by **cholecystokinin hormone** (secrete with fatty meal & stimulate by transportation of bile)	

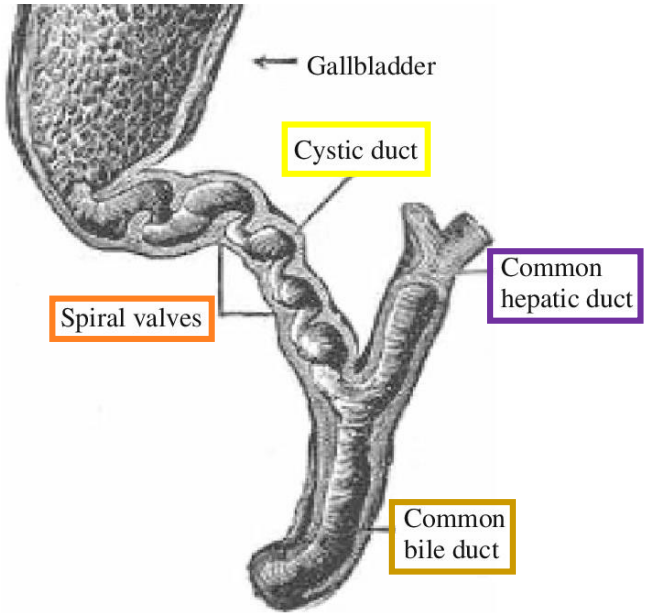




Cystic Duct

- The cystic duct is about 1.5 inches (3.8-4 cm) **long** and **connects** the **neck** of the **gallbladder** to the **common hepatic duct** to form the **common bile duct**
- It is usually **somewhat S shaped** and **descends** for a variable distance in the right free margin of the **lesser omentum**.
- The mucous membrane of the cystic duct is raised to form a spiral fold (inside) that is continuous with a similar fold in the neck of the gallbladder.
- The fold is commonly known as the "spiral valve" (to keep the lumen constantly open)





SUMMARY

		Pancreas	Gallbladder
Parts		Head, neck, body → L1 Tail → T12	Fundus, body, and neck
Relations	**Anteriorly**	• Stomach separated by lesser sac • Transverse colon & transverse mesocolon	• Anterior abdominal wall • Inferior surface of the liver
	Posteriorly	• Bile duct, portal & splenic veins, inferior vena cava, aorta & origin of superior mesenteric artery • Left psoas muscle, left adrenal gland, left renal vessels & upper 1/3rd of left kidney • Hilum of the spleen.	• Transverse colon • First and second part of duodenum
Duct		**Main Duct** (of Wirsung): Joins common bile duct & together they open into a small hepatopancreatic ampulla (Ampulla of Vater) **Accessory Duct** (of Santorini) drains superior portion of the head	**Cystic duct** connects the neck of the gallbladder to the common hepatic duct to form the **bile duct**
Arterial supply		Head and neck: superior pancreatico)duodenal artery (celiac) and inferior pancreatico)duodenal artery (superior mesenteric) Body and tail: splenic artery (celiac)	Cystic artery (right hepatic artery)
Venous drainage		Head and neck: superior and inferior pancreatico)duodenal veins Body and tail: splenic vein → portal vein	Cystic vein → portal vein
Lymphatic drainage		Pyloric, hepatic and splenic nodes → celiac and superior mesenteric nodes	Cystic lymph node → hepatic nodes → celiac nodes
Nerve supply		Sympathetic: thoracic splanchnic nerves (inhibitory) Parasympathetic: vagus nerve (excitatory)	Sympathetic and parasympathetic vagal fibers form celiac plexus

MCQs

(1) Which of the following is part of the Bile Ducts?

A) Interhepatic duct
B) Intralobular duct
C) Interlobular duct
D) Non of the them

(2) The Bile Secretion Rate is:

A) 20 ml/hour
B) 40 ml/hour
C) 60 ml/hour
D) 80 ml/hour

(3) Which of the following is responsible for STORAGE of bile?

A) Bile Ducts
B) Liver
C) Gallbladder
D) Pancreas

(4) Which part of the pancreas includes the uncinate process?

A) Head
B) Neck
C) Body
D) Tail

(5) The pancreas is related to the posterior abdominal wall at:

A) 9th right costal cartilage
B) Transpyloric plane L1
C) 8th right costal cartilage
D) Transpyloric plane C6

(6) The gallbladder contracts in response to which hormone?

A) Secretin
B) Gastrin
C) Cholecystokinin
D) insulin

(7) Cystic duct connects the neck of the gallbladder to the common hepatic duct to form?

A) Pancreatic duct
B) Right hepatic duct
C) Left hepatic duct
D) Common bile duct

(8) The right and left hepatic ducts are formed at:

A) Porta hepatis
B) Splenic flexure
C) Second part of duodenum
D) Fundus of gallbladder

(9) The fundus of the gallbladder comes in contact with the anterior abdominal wall at the level of:

A) 9th right rib
B) 8th right rib
C) Tip of the 9th right costal cartilage
D) Tip of the 8th right costal cartilage

(10) Cystic duct usually somewhat?

A) Round shape
B) Pear shape
C) Disc shape
D) S shape

Answers

(1) C
(2) B
(3) C
(4) A
(5) B
(6) C
(7) D
(8) A
(9) C
(10) D

Good luck
Special thank for team436 ❤

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- References:
  1. Girls' & Boys' Slides
  2. Greys Anatomy for Students
  3. TeachMeAnatomy.com

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