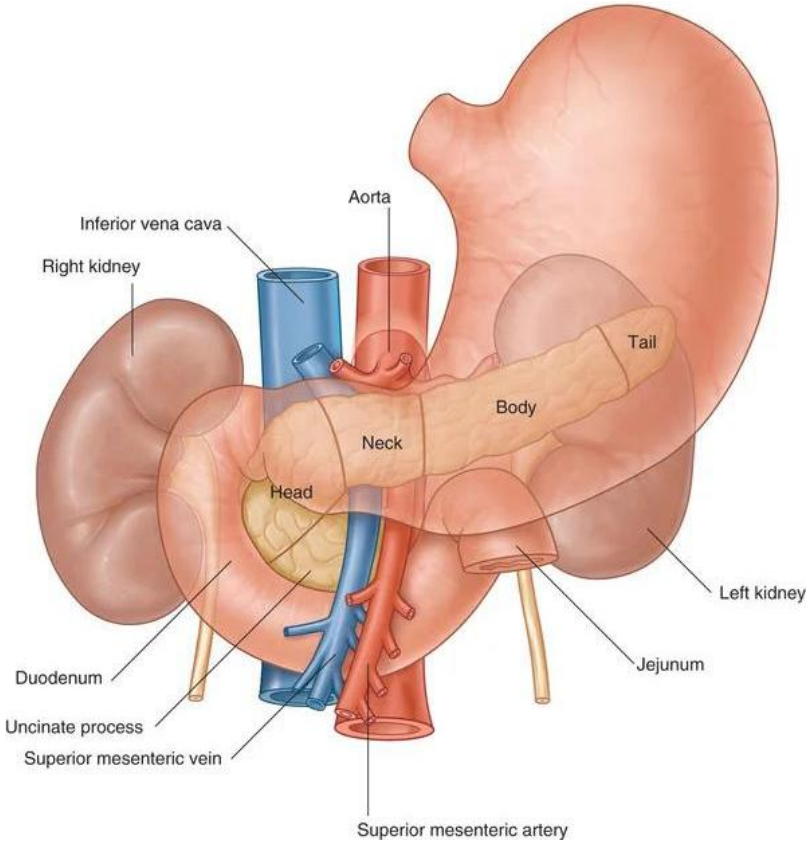
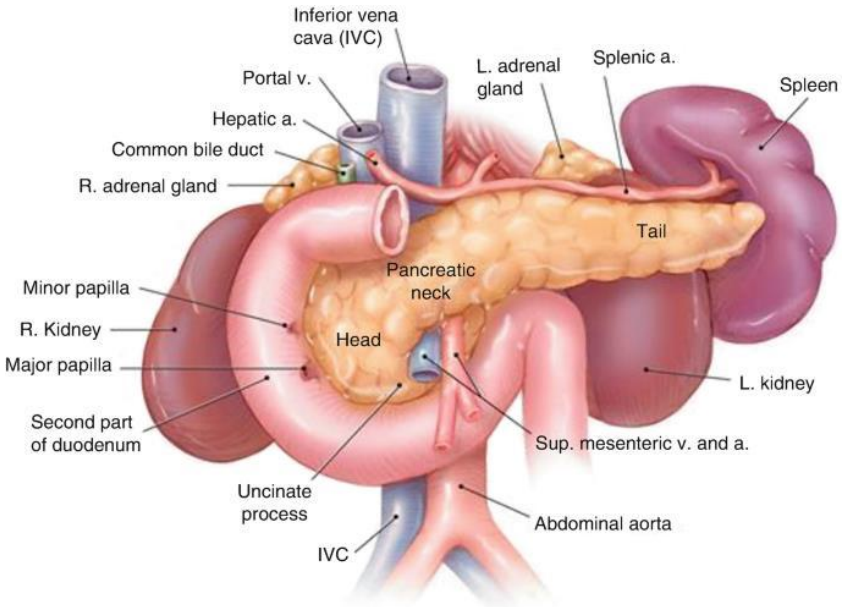
The Pancreas & Adrenal Gland

The Pancreas

a) Anatomy of the Pancreas

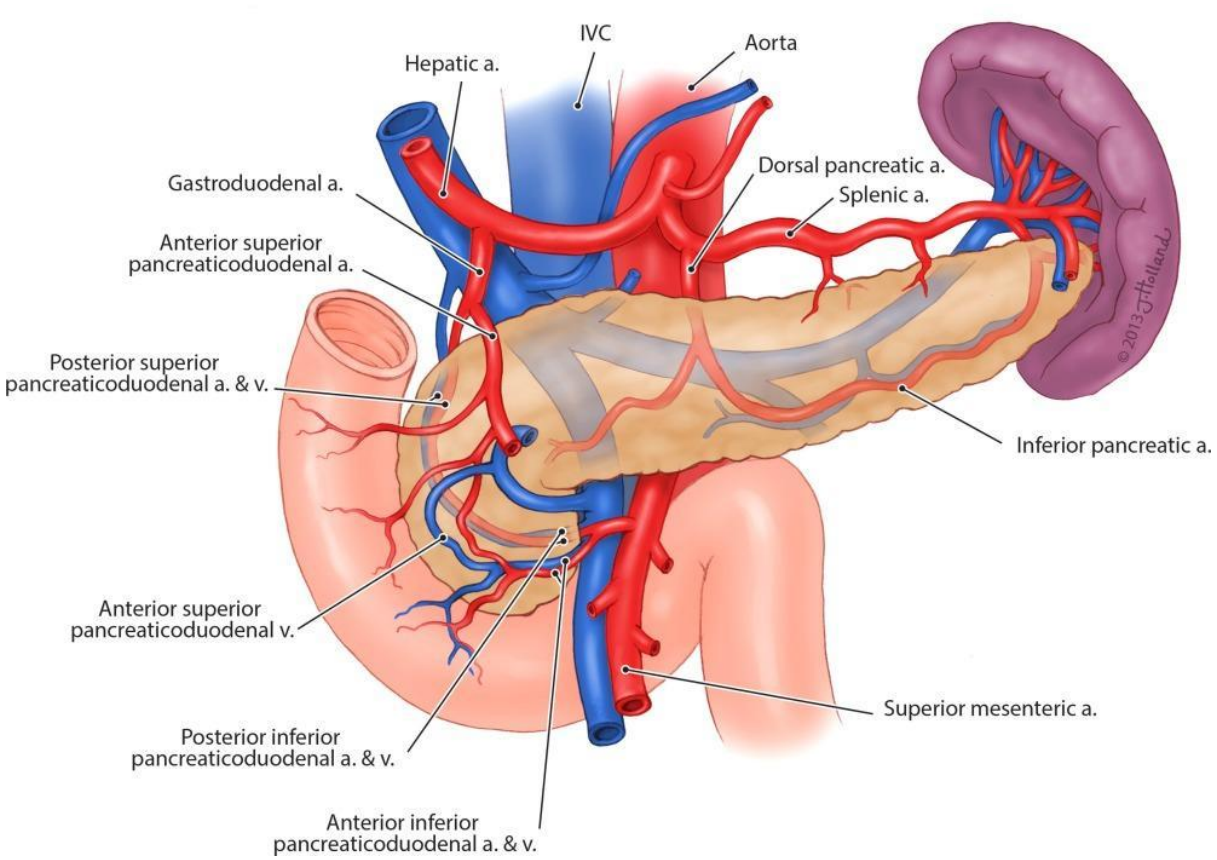
Site	Lies across the **upper part** of the posterior abdominal wall behind the peritoneum of the lesser sac (retroperitoneal).	
Course	It **crosses** from the concavity of the **duodenum** to the **hilum of the spleen**.	
Divisions	Head Body	Neck Tails



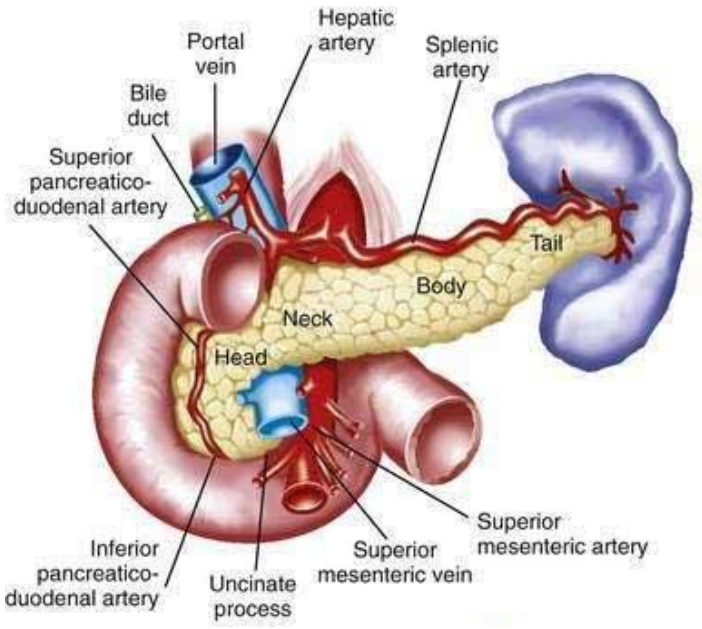


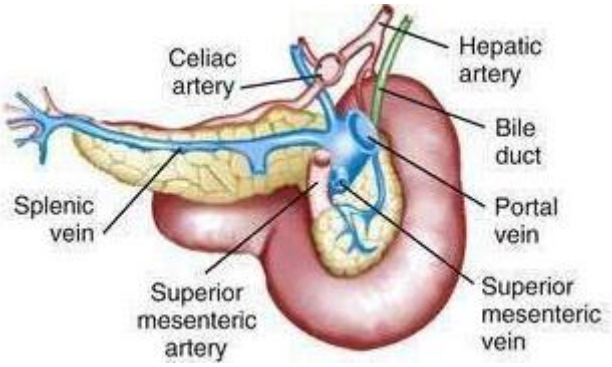
b) Parts & Relations of the Pancreas

a) Head of the Pancreas		
Site	Lies in the **concavity of the duodenum**, separated from it by groove containing the pancreaticoduodenal vessels.	
Uncinate Process	Projects upwards and to the left.	
Relations	Anteriorly	- The transverse colon - The coils of the jejunum - The superior mesenteric vessels: in front of the uncinate process
	Posteriorly	- The IVC - The common bile duct - The aorta: behind the uncinate process
b) Neck of the Pancreas		
Relations	Anteriorly	- The pylorus and the first part of the duodenum. - The peritoneum of the lesser sac.
	Posteriorly	It is related to the beginning of the portal vein and the termination of the superior mesenteric and splenic veins.



c) Body of the Pancreas		
Features	It extends to the left behind the lesser sac. It is triangular in cross section. It has three surfaces and three borders	
Three Surfaces		
Anterior Surface	Peritoneal Covering	Covered by the peritoneum of the lesser sac.
	Feature	Separated from the posterior surface of the stomach by the cavity of the lesser sac.
Inferior Surface	Peritoneal Covering	Covered by the peritoneum of the greater sac.
	Relation	The duodenojejunal flexure and left colic flexure.
Posterior Surface	Peritoneal Covering	Not covered by peritoneum
	Relation	- The abdominal aorta. - The splenic vein: above the superior mesenteric artery. - The left renal vein: below the superior mesenteric artery
Three Borders		
Upper Border	Related to the splenic artery	
Anterior Border	Gives attachment to transverse mesocolon	
Posterior Border	the same relations as posterior surface	

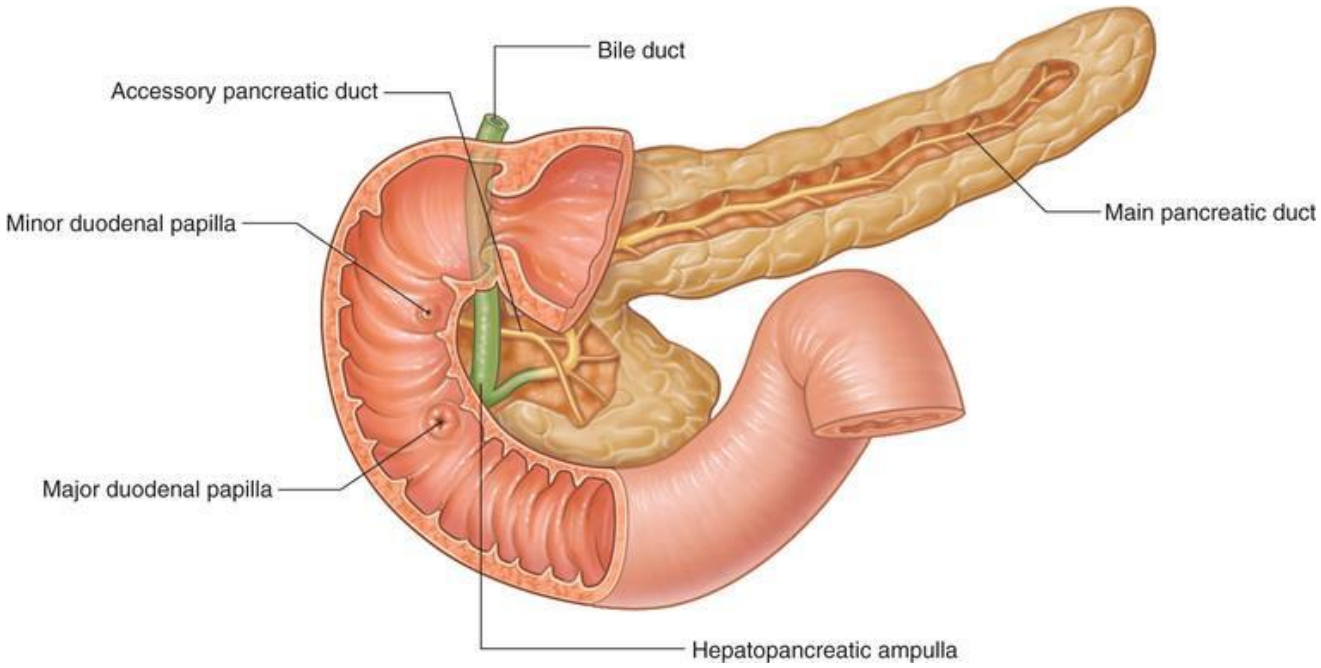


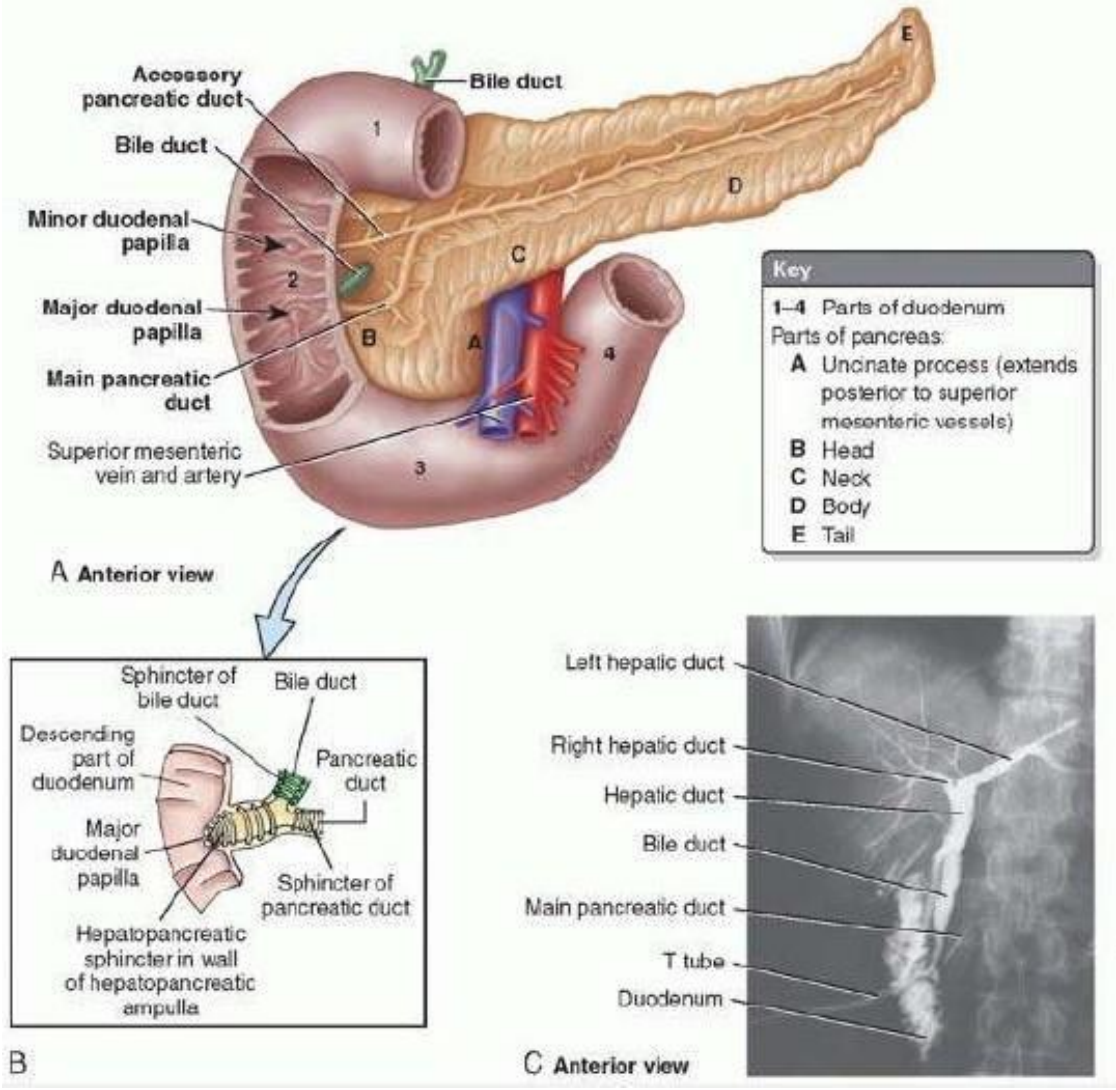


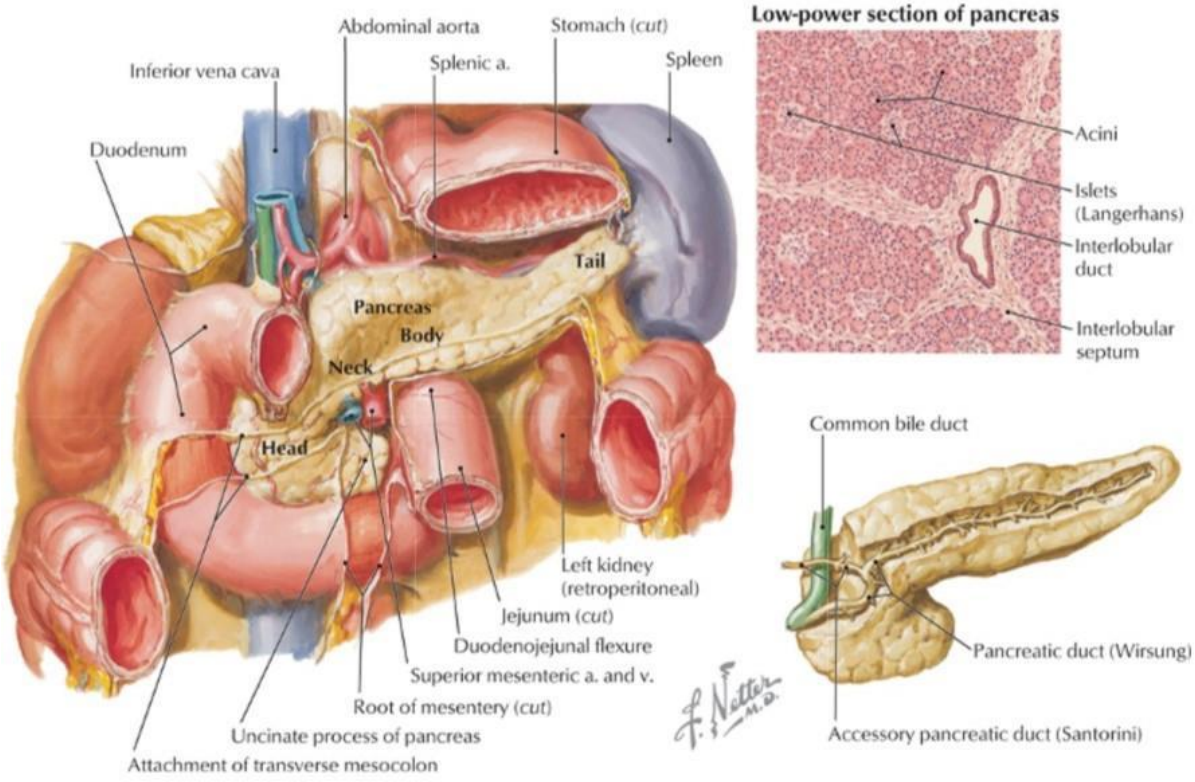
d) Tail of the Pancreas	
Features	- Is thick and blunt. - It lies between the two layers of the lienorenal ligament. - It is related to the terminal parts of the splenic vessels. - It comes into direct relation with visceral surface of spleen close to its hilum

c) Pancreatic Ducts

Main pancreatic duct	- It passes through tail, body and lower part of head. - In the lower part of the head of pancreas, the pancreatic duct joins the bile duct. - The joining of these two structures forms the hepatopancreatic ampulla (ampulla of Vater), which enters the 2nd part of the duodenum at the major duodenal papilla. - Surrounding the ampulla is the sphincter of ampulla (sphincter of Oddi), which is a collection of smooth muscle
Accessory pancreatic duct	- It is small duct, which begins in the upper part of the head. - It opens into the second part of the duodenum on the summit of the minor duodenal papilla, one inch above the major duodenal papilla.



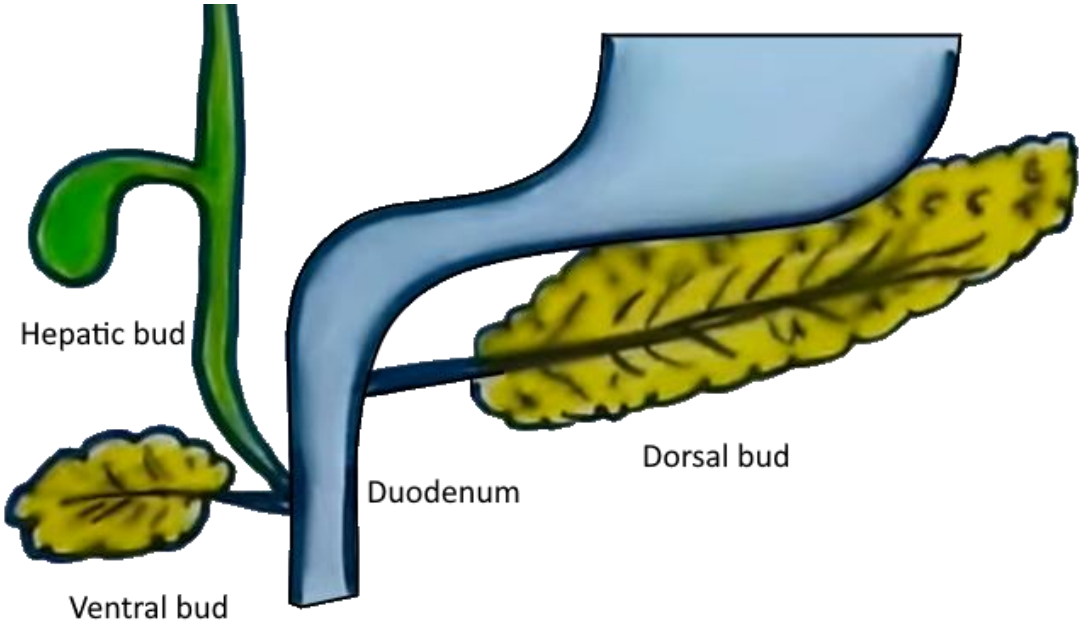

Accessory pancreatic duct
Bile duct
Minor duodenal papilla
Major duodenal papilla
Main pancreatic duct
Superior mesenteric vein and artery
Bile duct
1
2
3
4
A
B
C
D
E
Key
1–4 Parts of duodenum
Parts of pancreas:
A Uncinate process (extends posterior to superior mesenteric vessels)
B Head
C Neck
D Body
E Tail
A Anterior view
Sphincter of bile duct
Bile duct
Descending part of duodenum
Pancreatic duct
Major duodenal papilla
Sphincter of pancreatic duct
Hepatopancreatic sphincter in wall of hepatopancreatic ampulla
B
Left hepatic duct
Right hepatic duct
Hepatic duct
Bile duct
Main pancreatic duct
T tube
Duodenum
C Anterior view


Abdominal aorta
Stomach (cut)
Splenic a.
Spleen
Inferior vena cava
Duodenum
Tail
Pancreas
Body
Neck
Head
Left kidney (retroperitoneal)
Jejunum (cut)
Duodenojejunal flexure
Superior mesenteric a. and v.
Root of mesentery (cut)
Uncinate process of pancreas
Attachment of transverse mesocolon
Low-power section of pancreas
Acini
Islets (Langerhans)
Interlobular duct
Interlobular septum
Common bile duct
Pancreatic duct (Wirsung)
Accessory pancreatic duct (Santorini)

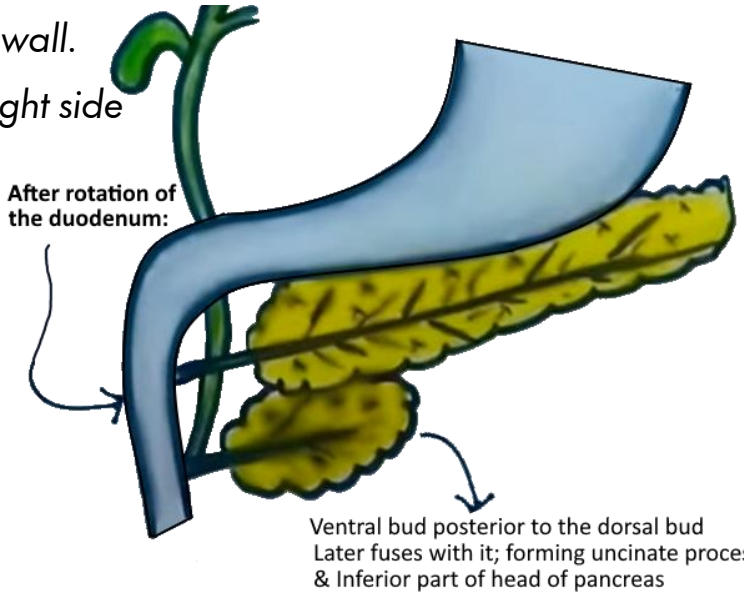
d) Development of the Pancreas

- The pancreas develops from the **duodenum** (between the layers of the **mesenteries**) by **2 buds** (arise from **caudal part of foregut**):

Dorsal Pancreatic Bud	Ventral Pancreatic Bud
Appears first	Arises from the ventral wall of the duodenum **in conjunction** with the hepatic bud
Arises from the dorsal wall of the duodenum slightly **above** the hepatic bud.	
It extends dorsally and upwards in the mesoduodenum.	It develops near the entry of the bile duct into the duodenum



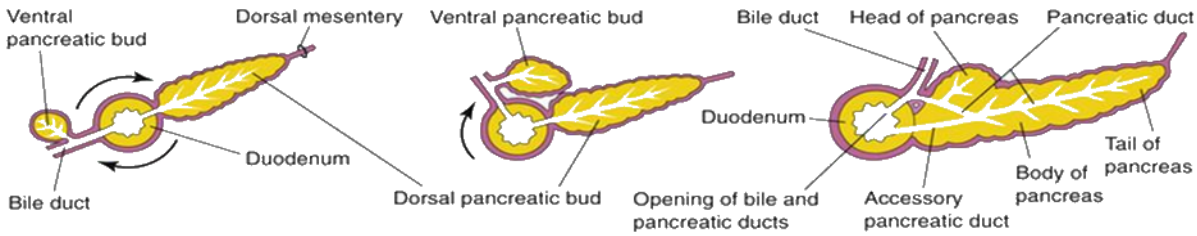
- **The ventral pancreas comes to lie below & behind the dorsal pancreas as a result of:**
  - Differential growth of the duodenal wall.
  - Axial rotation of the duodenum to right side



- *Later the parenchyma as well as the duct systems of the two buds fuse together so that:*

Ventral Bud	Forms **uncinate process** & the **inferior part of the head** of the pancreas
Dorsal Bud	Remaining parts of pancreas

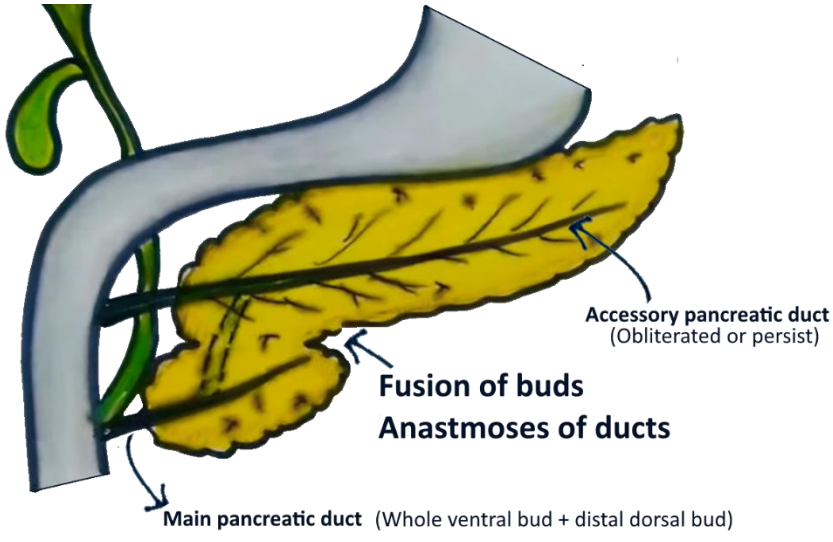
- *As the duodenum rotates to the right and becomes C-shaped, the ventral bud is carried dorsally with the bile duct.*



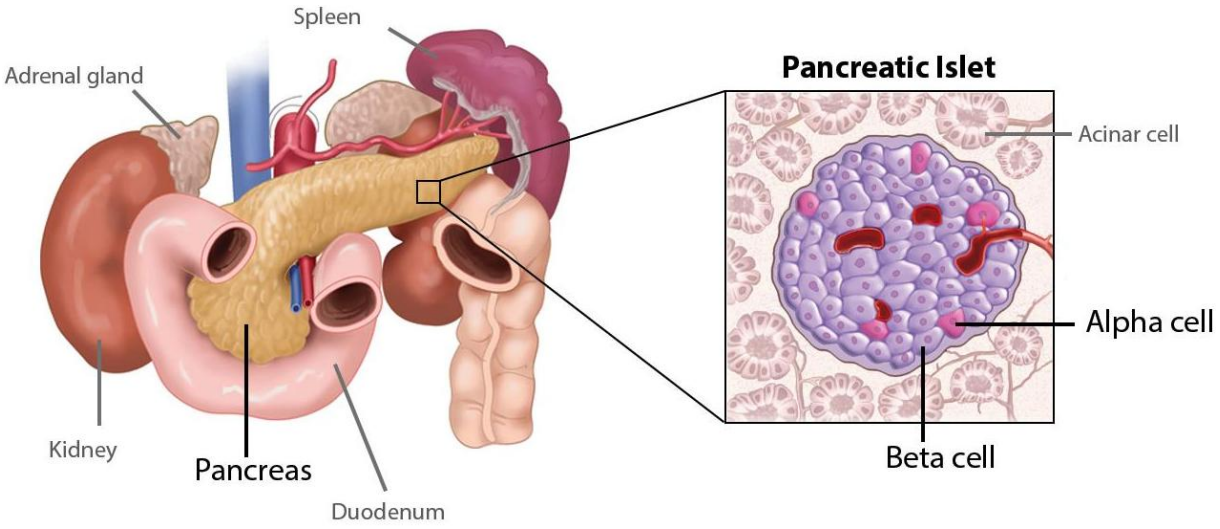
- *It soon lies posterior to the dorsal pancreatic bud and later fuses with it.*
- *As the pancreatic buds fuse, their ducts anastomose, forming:*

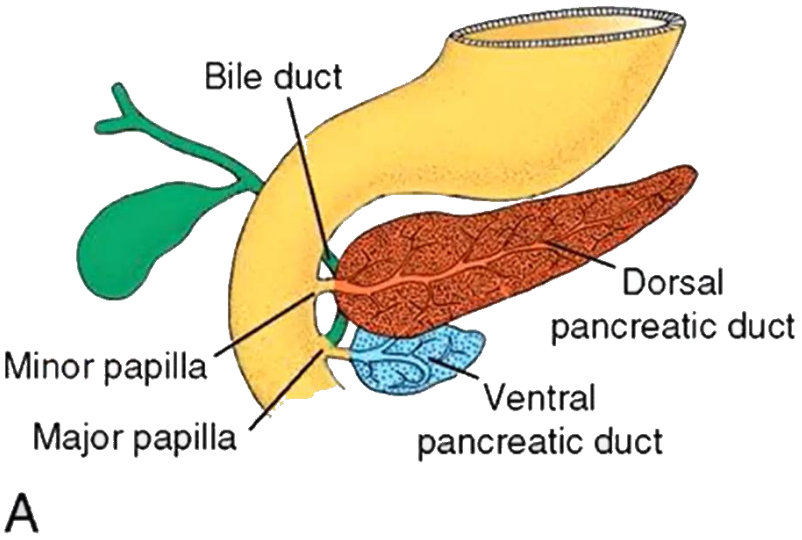
Main pancreatic duct	Formed by the **distal part of the dorsal pancreatic duct** & the **whole ventral pancreatic duct**.
Proximal pancreatic duct	It is either obliterated or persists as **accessory pancreatic duct**
Anomaly	In 10% of the cases the duct system fails to fuse (**Pancreatic divisum**)

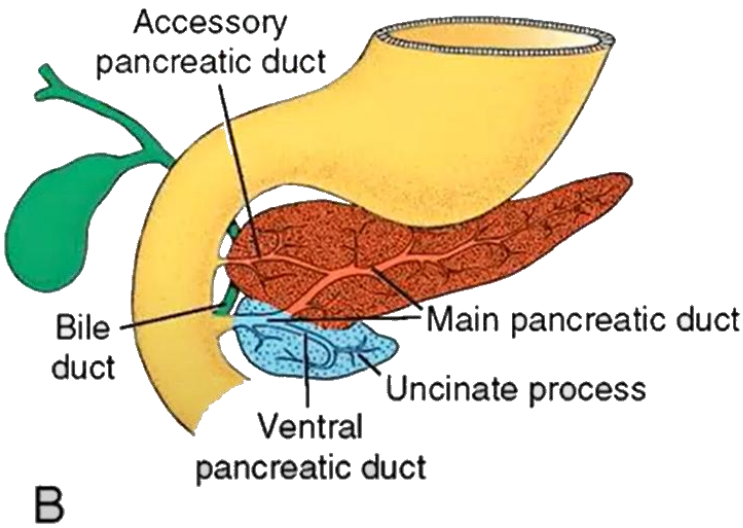
- *As the stomach, duodenum, and ventral mesentery rotate, the pancreas comes to lie along the dorsal abdominal wall (**becomes retroperitoneal**).*
- *The connective tissue sheath and interlobular septa → surrounding **splanchnic mesenchyme***

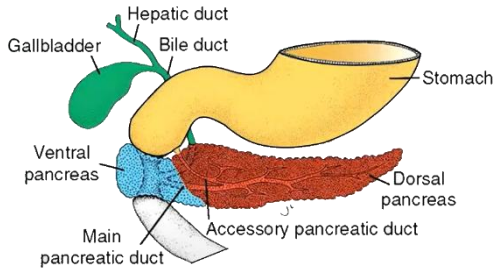


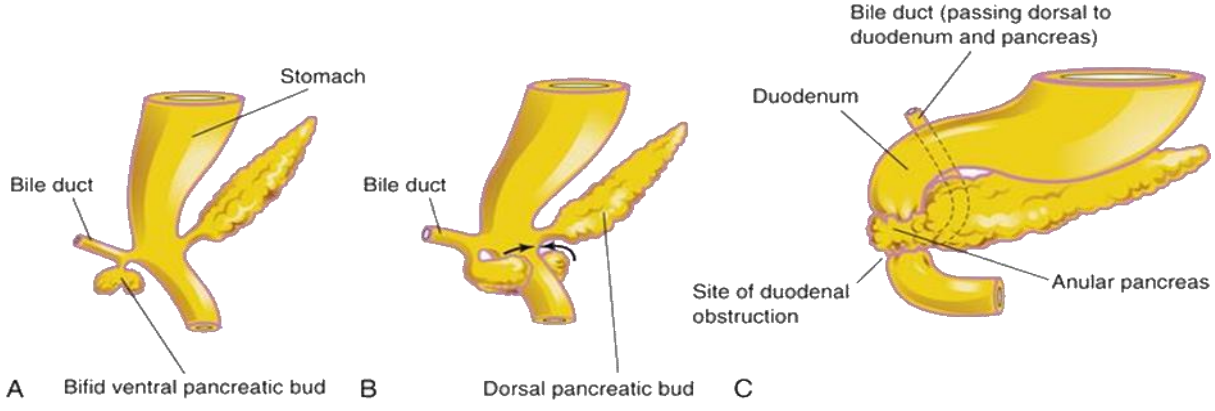
Development of the endocrine part of the pancreas	
Islet cells	Isolated clumps of endodermal cells bud from the tubules and accumulate within the mesoderm.
Glucagon & Somatostatin containing cells	They develop before differentiation of the insulin secreting cells.
With increasing fetal age	Total pancreatic insulin & glucagon content also increases
Islets of Langerhans	They develop from the parenchymatous tissue in the 3rd month, but they start secreting insulin during the 5th month.







Congenital anomalies of the Pancreas		
Annular pancreas	Incidence	It is an uncommon birth defect, but it warrants attention because it may cause **duodenal obstruction**.
	Cause	- This defect probably results from the **growth of a bifid ventral pancreatic bud around the duodenum**. - The parts of the bifid ventral bud then **fuse** with the dorsal bud, forming a **pancreatic ring**.
	Characters	- The ring-like, annular part of the pancreas consists of a **thin, flat band of pancreatic tissue** surrounding the **descending** or **second part** of the duodenum.  - An annular pancreas may cause **obstruction of the duodenum** shortly after birth, but many cases are not diagnosed until adulthood
	Manifestation	Newborns and infants are **intolerant of oral feeding** and often have **bilious vomiting** (green color).
Accessory pancreatic tissue		May be found in the **wall of the stomach** or the **duodenum**.
Hyperplasia of pancreatic islets		- occurs when fetal islets are exposed to **high blood glucose levels**, as frequently happens in **infants of diabetic mothers**. - Glucose freely **crosses the placenta** and **stimulates fetal islet hyperplasia and insulin secretion**, which causes **increased fat and glycogen deposition** in fetal tissues. - This results in **increased birth weight of infants** at term (i.e., macrosomia) and serious episodes of hypoglycemia in the postnatal period.

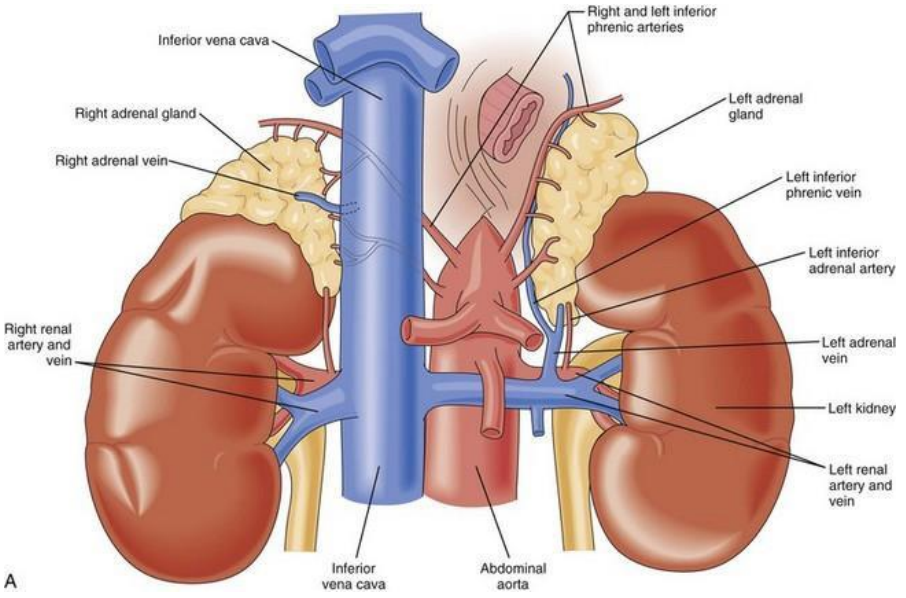


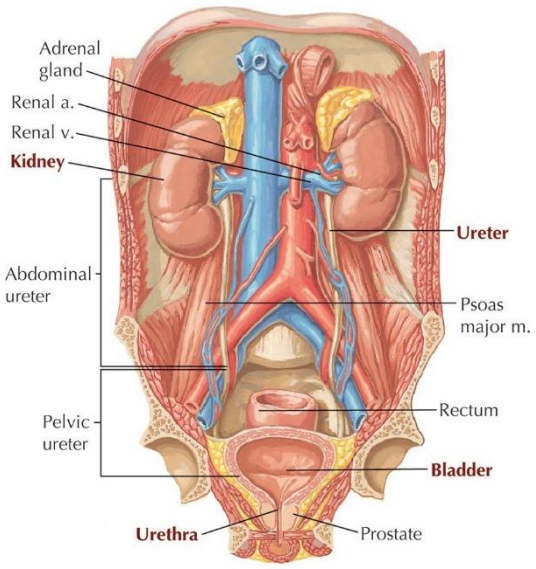
The Supra-renal gland

Structure	Consists of an outer cortex and an inner medulla	
Position	over the upper pole of the kidney one on each side of the midline.	
Coverings	With the Kidney	Renal fascia & Perirenal fat
	Separated from the Kidney	Septum of fibro-areolar tissue
Nerve supply	The Medulla	preganglionic sympathetic fibers (ends on the chromaffin cells)
	The cortex	Hormonal control of ACTH

Right & Left SRG

	Right SRG	Left SRG
Shape	Pyramidal	Semilunar
Ant. Relation	- IVC - Bare area of the liver	- Lesser sac (stomach bed) - Stomach
Post. Relations	- Right crus of the diaphragm - Right kidney	- Left crus of the diaphragm - Left kidney
Hilum	Directed upwards	Directed downwards
Arteries	1) Superior suprarenal → from Inferior Phrenic 2) Middle suprarenal → from Abdominal aorta 3) Inferior suprarenal → from Renal artery	
Veins	Ends in the IVC	Ends in the Left renal vein





- *Quiz:*

1) Which of the following related to pancreas?

A. lies across the lower part of the posterior abdominal wall behind the peritoneum of the greater sac.

B. The neck related posteriorly to pylorus and the first part of the duodenum and peritoneum of the lesser sac.

C. The neck related anteriorly to pylorus and the first part of the duodenum and peritoneum of the lesser sac

D. The uncinate process of its head projects downwards and to the left

E. The cross sections of its body has 3 borders and 2 surfaces

Answer: C

2) Which of the following related to adrenal glands?

A. It consists of an outer medulla and an inner cortex

Answer: E

B. The left suprarenal vein ends in the inferior vena cava.

C. The right adrenal gland related anteriorly Left crus of diaphragm Left kidney.

D. The left adrenal gland related anteriorly to IVC and Bare area of the liver.

E. The right adrenal gland related anteriorly to IVC and Bare area of the liver.