

# **ANATOMY OF PANCREAS- REVISIT**

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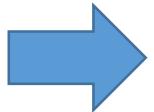
Faculty of Medicine

Ragama



# Clinical case

- 67 year old male patient was admitted to the NCTH Ragama C/O LOA ,LOW generalized body itching He further had dark urine ,and pale colour stool.
- On Examination - Anaemic and Yellow discoloration of sclera.

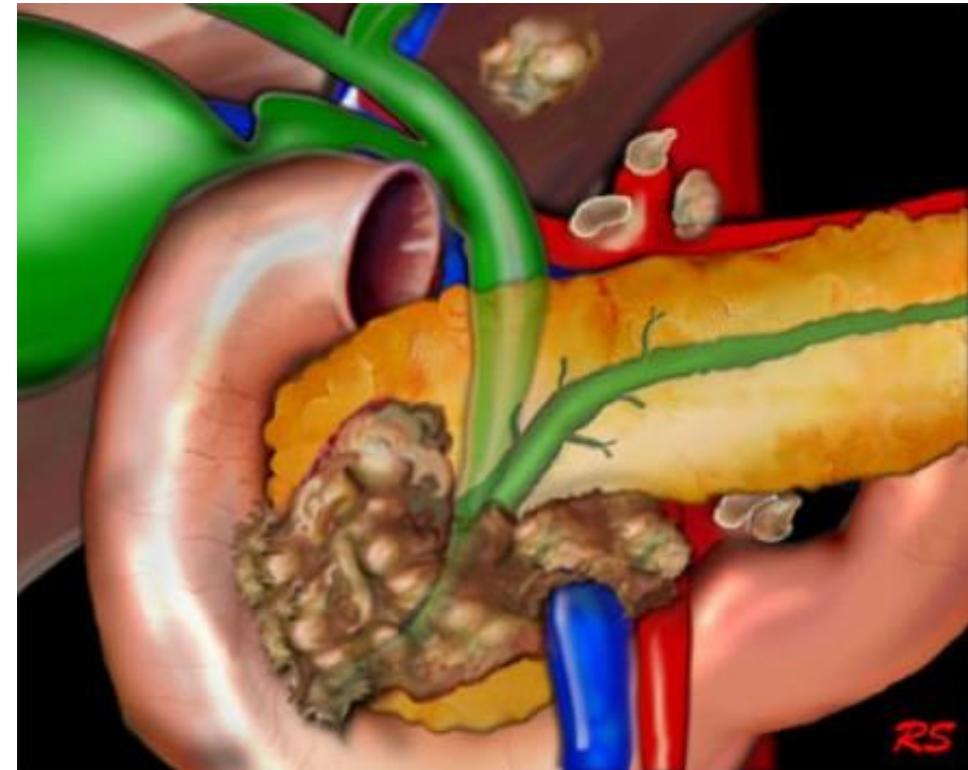


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# Investigations

- High urine bilirubin.
- Elevated serum direct bilirubin fraction.
- Elevated serum ALT and Gamma GT
- USS abdomen and CT showed
  - Mass lesion at head pancreas
  - Dilated intra and extra hepatic bile ducts

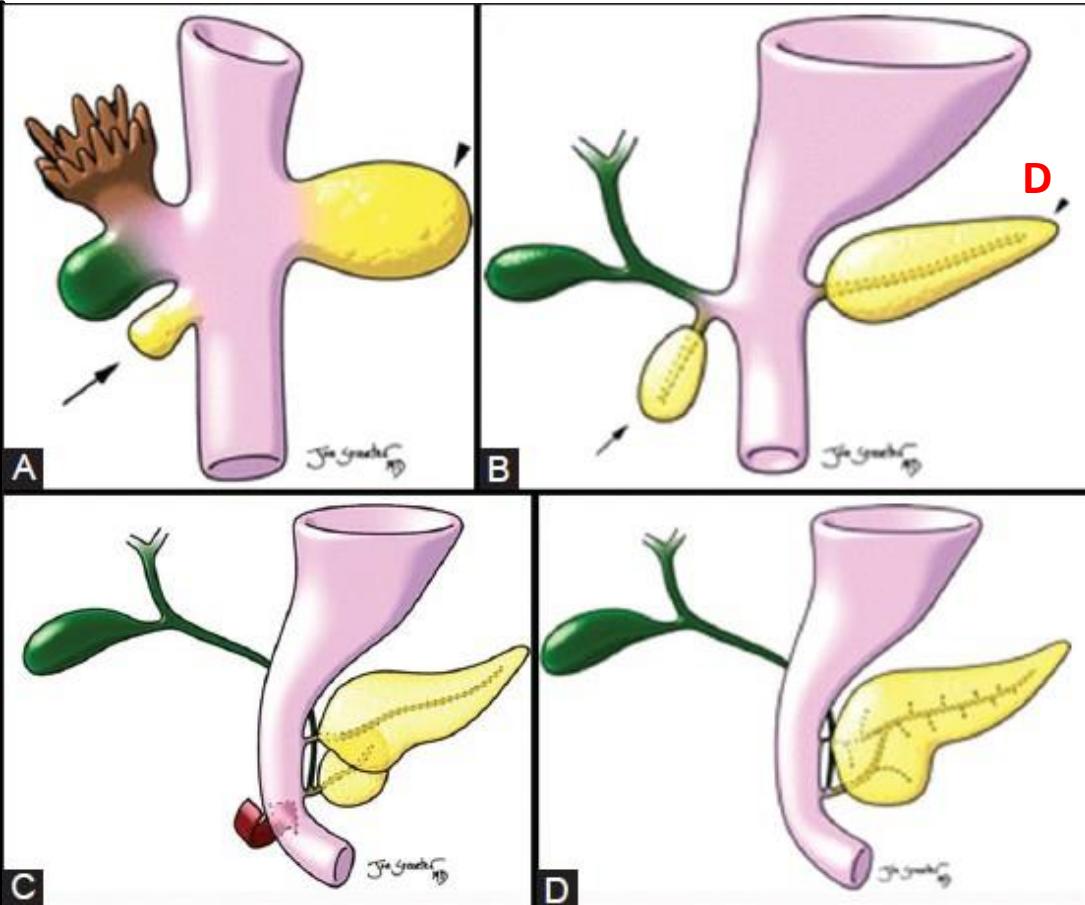


Diagnosis – Carcinoma of head of pancreas



# Development of pancreas

- Forms from the embryonic foregut and is therefore of endodermal origin
- Formation of a ventral and a dorsal pancreatic bud.
- Dorsal bud (larger, first), ventral bud (smaller, later)
- Dorsal pancreatic bud forms the head, body and tail
- Ventral pancreatic bud forms the uncinate process



# Introduction

- Gland with both exocrine and endocrine functions
- J shape
- 15-25 cm long
- 2.5 cm – 3.8 cm broad
- 60-100 g
- Location: Retro-peritoneum, 2<sup>nd</sup> lumbar vertebral level
- Extends in an oblique, transverse position



# Parts of pancreas

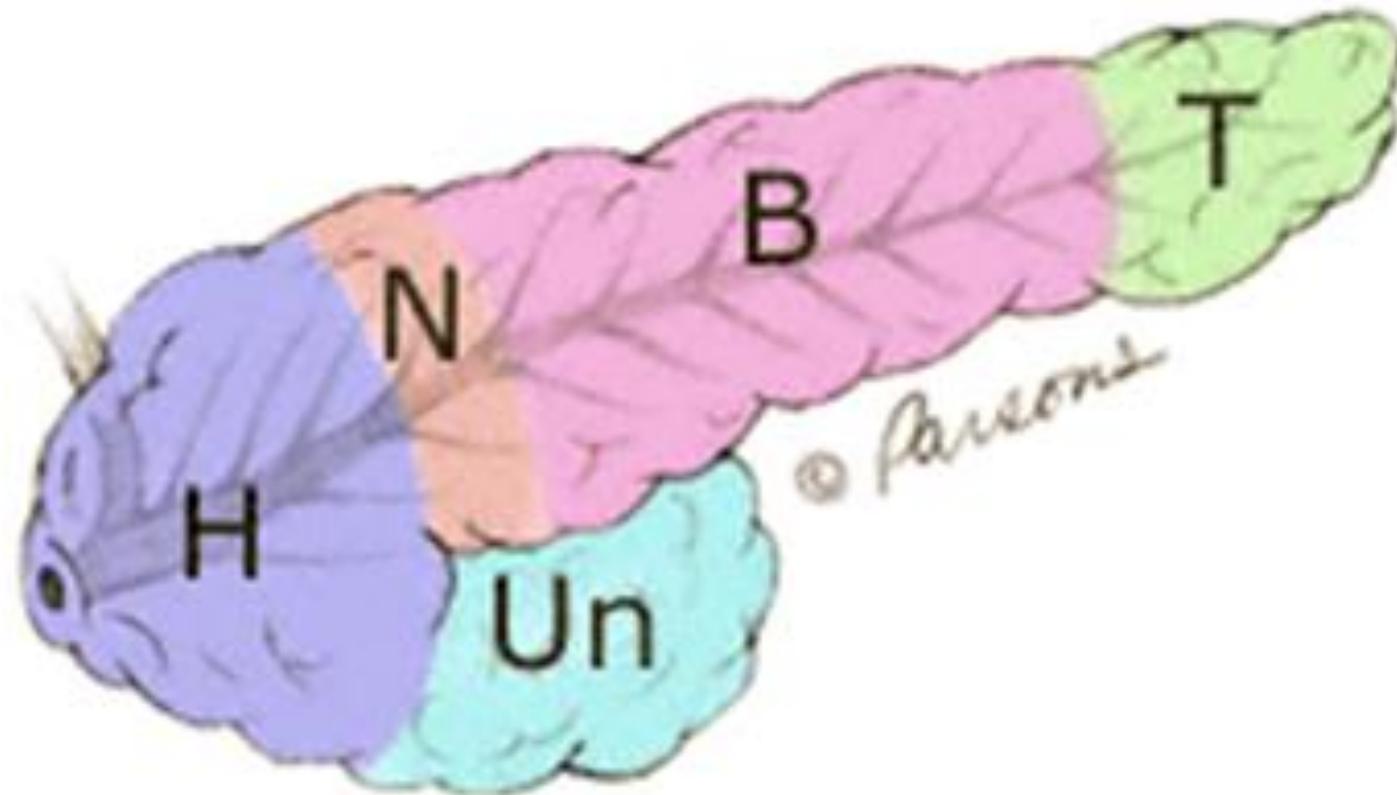
B=body

H=head

N=neck

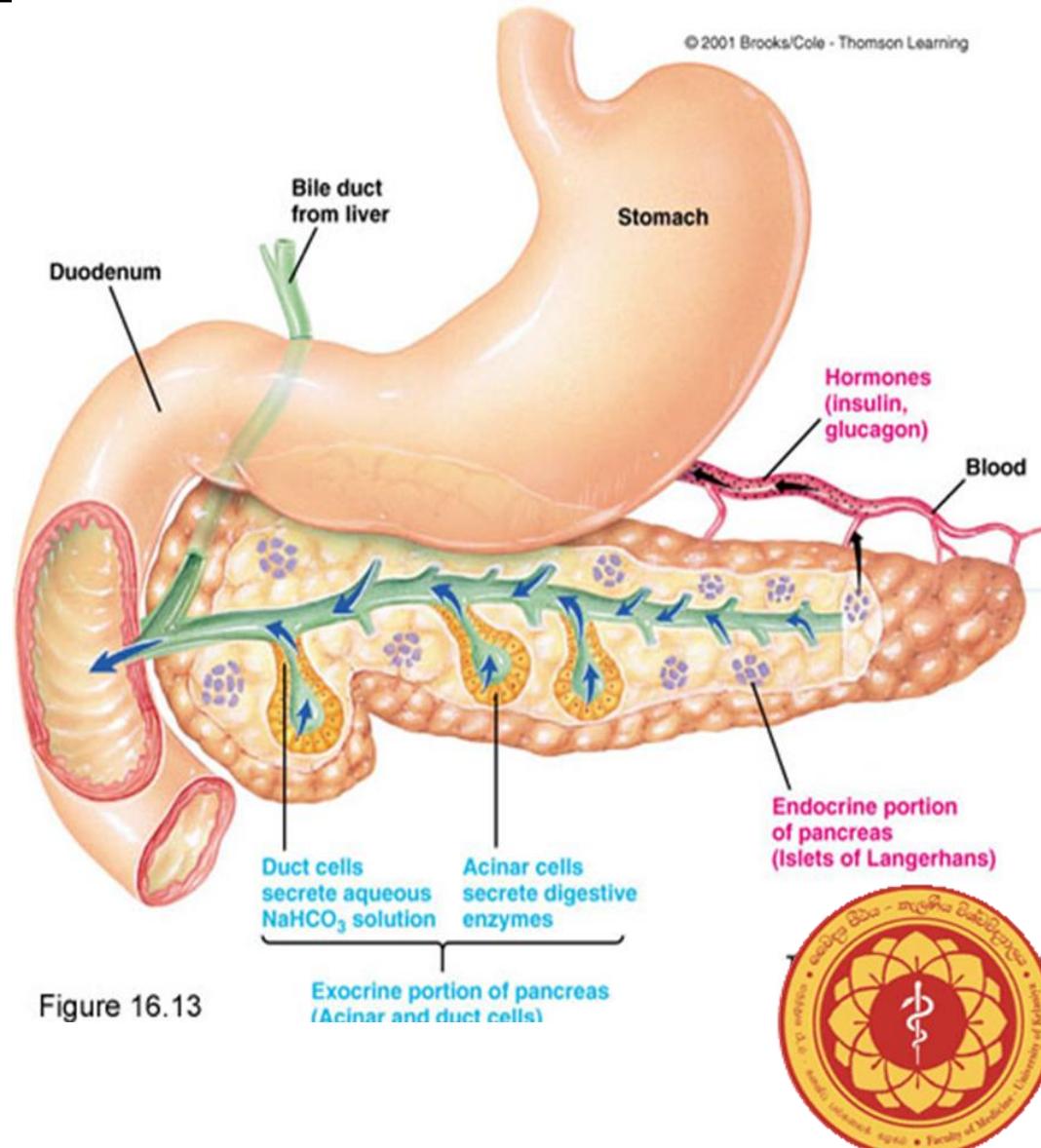
T=tail

Un=uncinate



# Head of Pancreas

- Includes uncinate process
- Flattened structure, 2 – 3 cm thick
- Situated within C-Shape curve of duodenum
- Attached to the 2<sup>nd</sup> and 3<sup>rd</sup> portions of duodenum on the right



# Head of Pancreas : Relations

- **Right lateral border:**

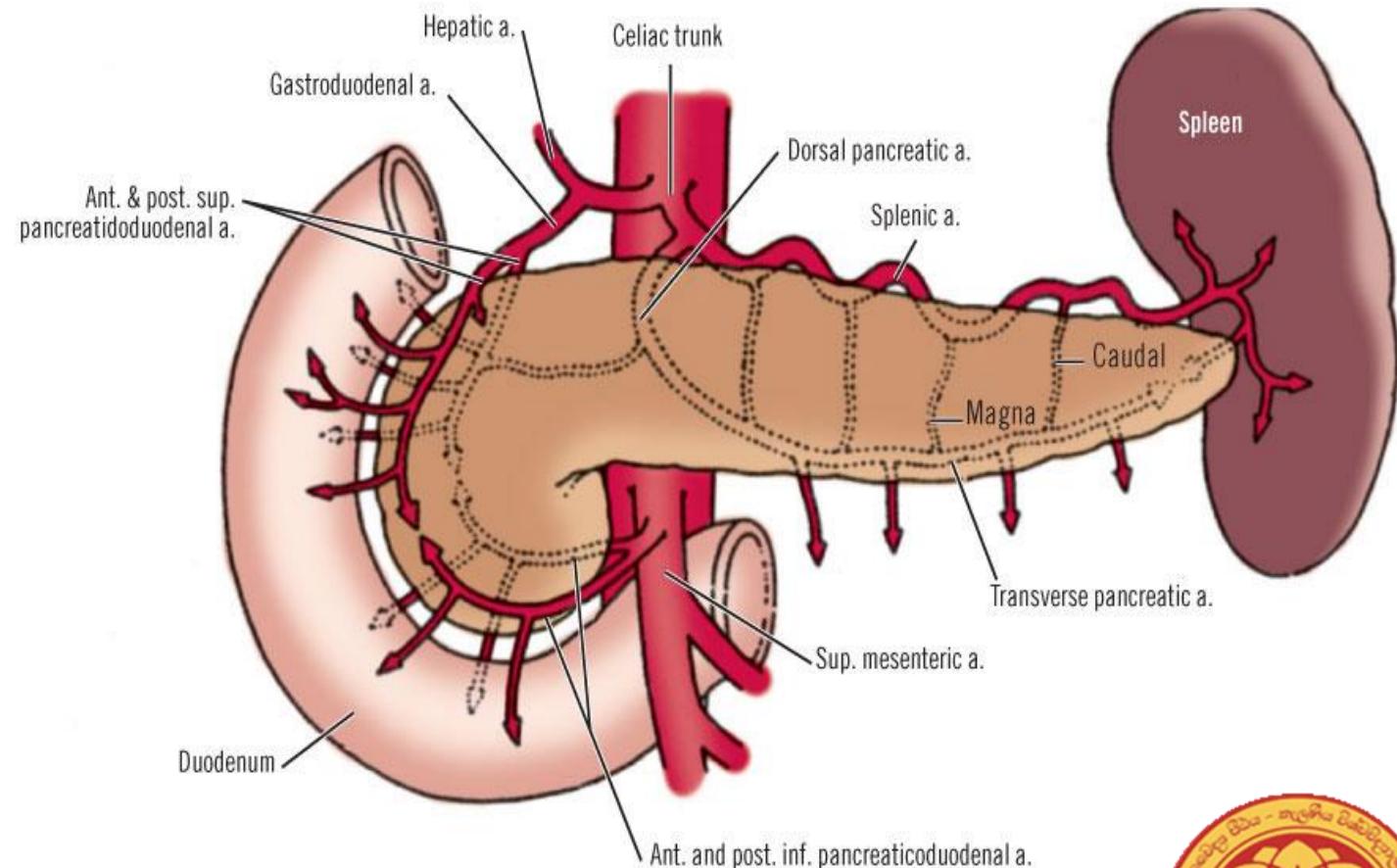
- 2nd part of Duodenum
- Terminal part of bile duct

- **Superior border:**

- Related to 1<sup>st</sup> part of Duodenum
- SPDA (Sup pan duodenal art)

- **Inferior border:**

- Related to 3<sup>rd</sup> part of Duodenum
- IPDA (inferior pan: duodenal art)



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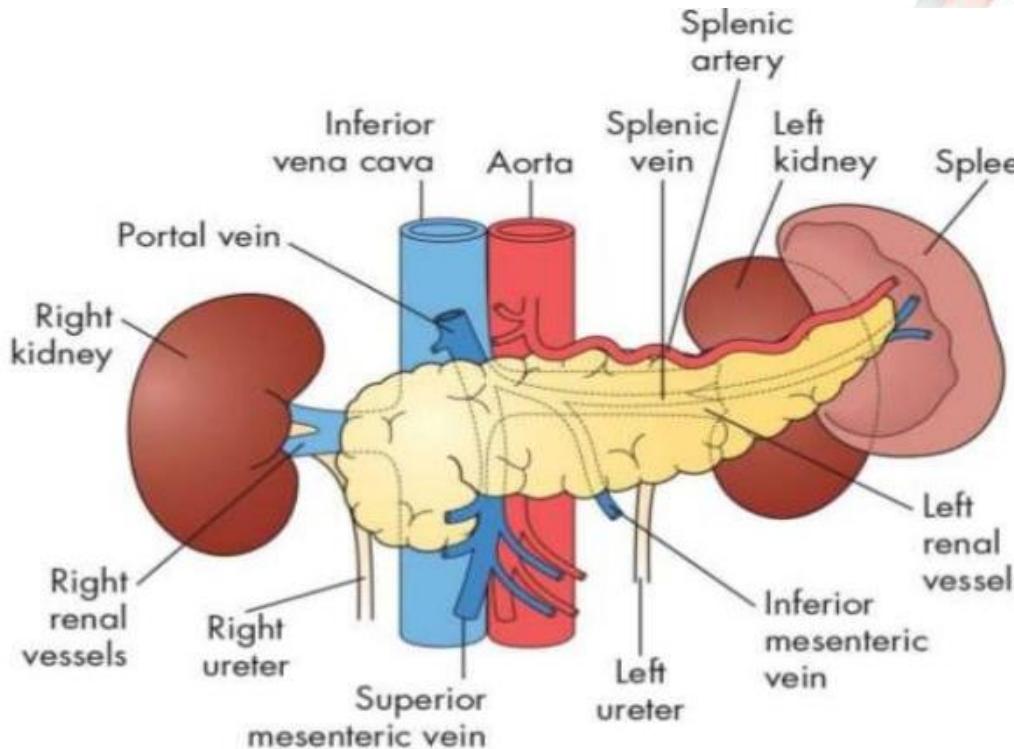
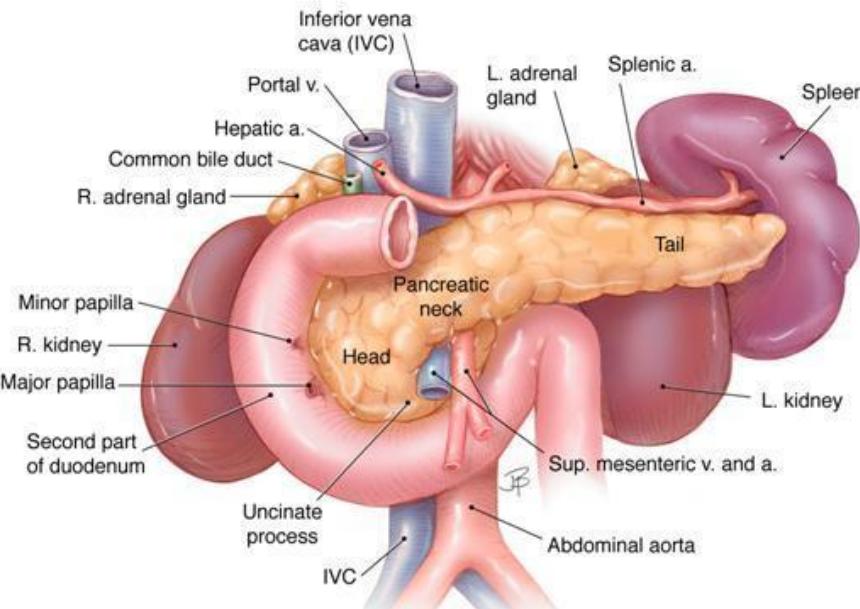
# Head of Pancreas : Relations

- **Anterior relations:**

- First part of duodenum
- Transverse colon
- Jejunal loops

- **Posterior relations:**

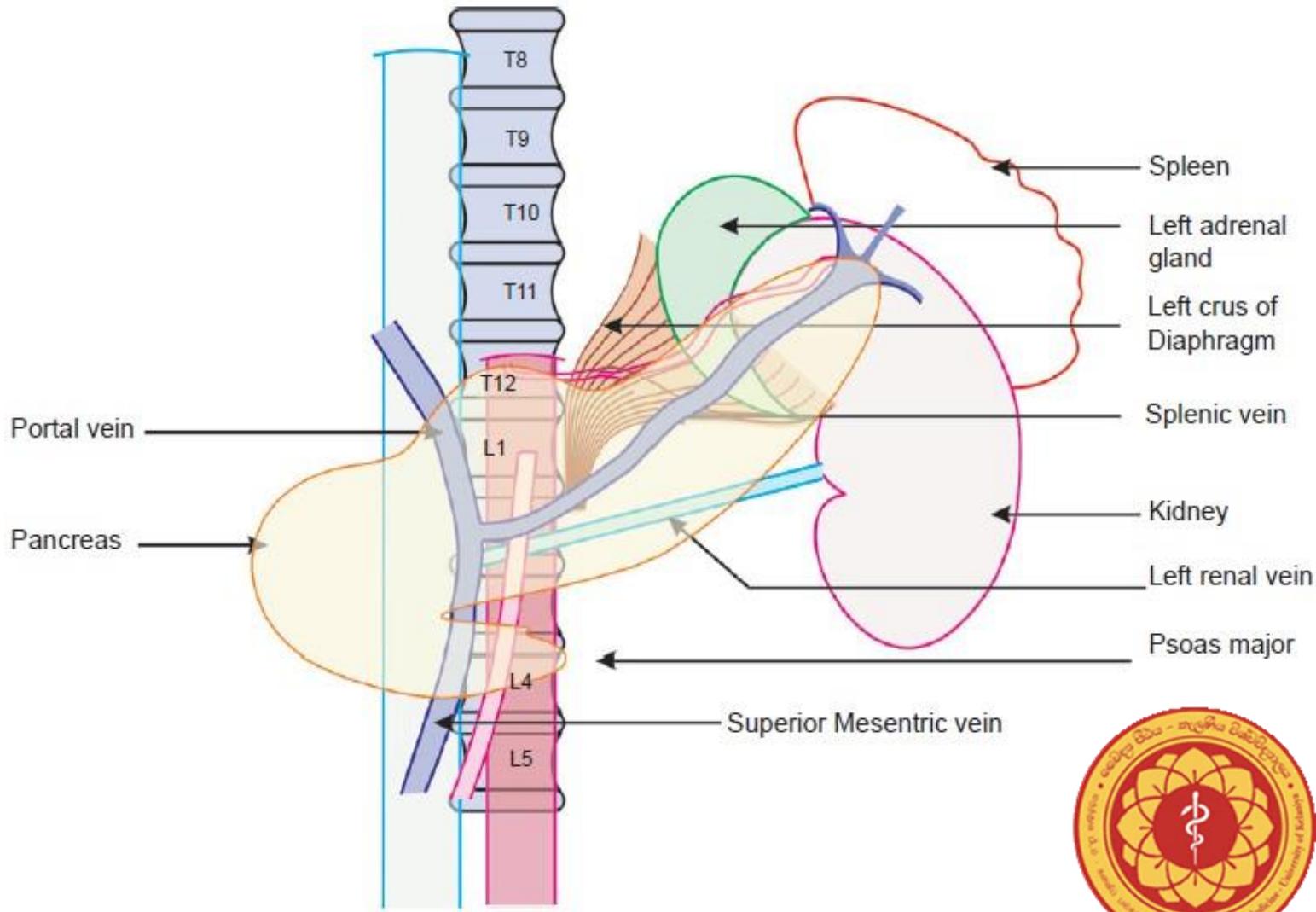
- IVC
- Terminal parts of right renal veins
- Bile duct – Embedded in substance
- R/crus of the diaphragm



# Neck of Pancreas : Relations

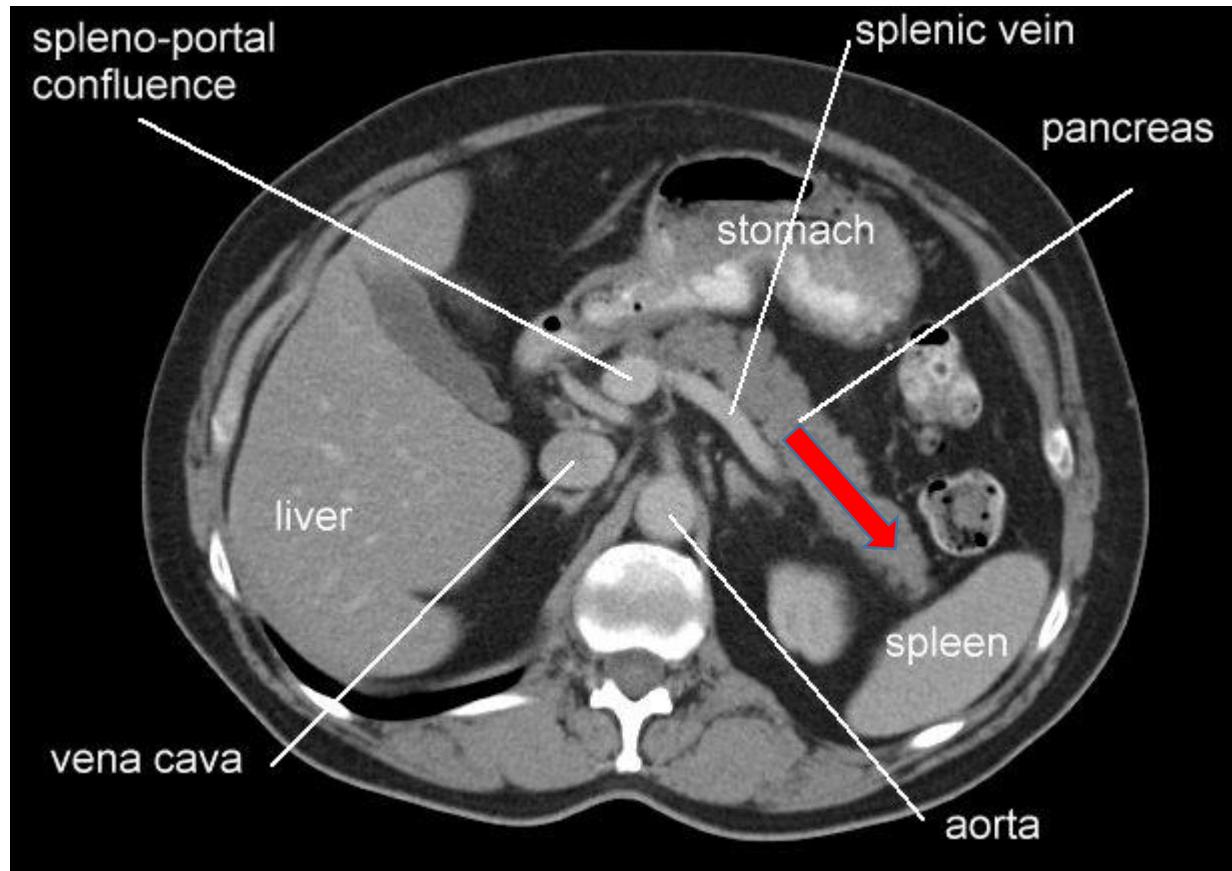
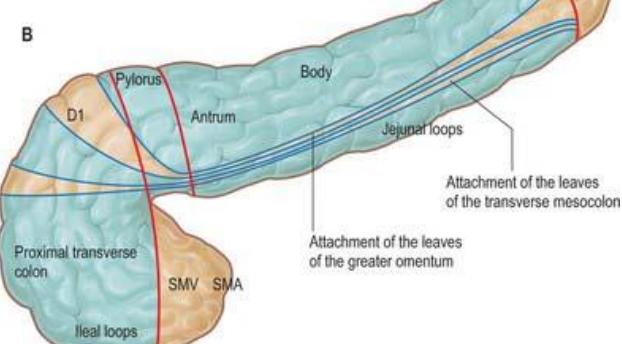
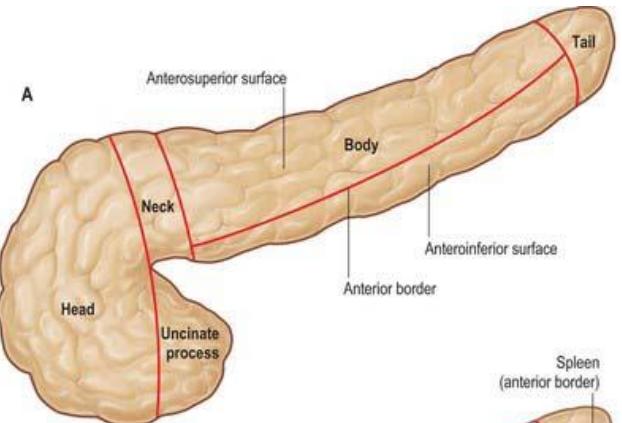
- **Posterior relations:**

- Terminal portion of SMA
- Commencement of portal vein



# Body of Pancreas

- Extends towards left , slight upward and backwards
- Triangular in cross section



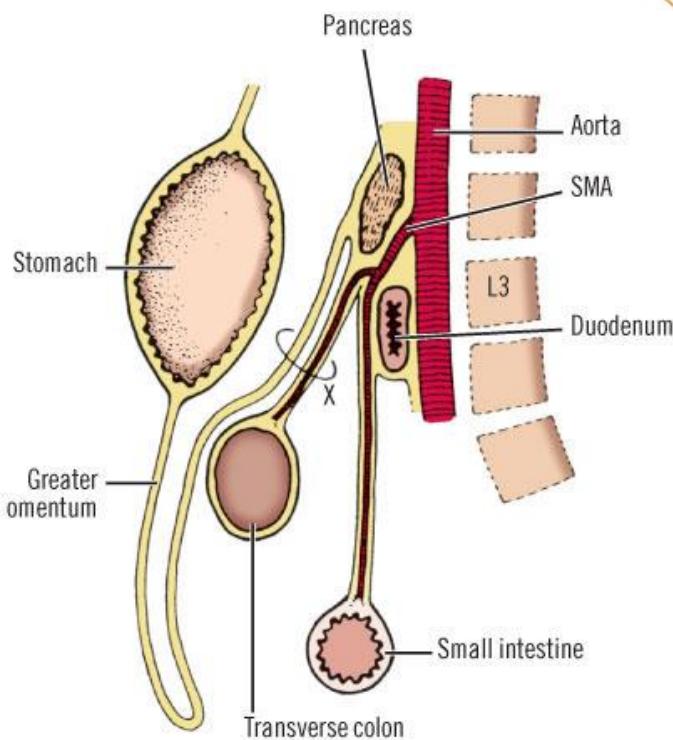
# Body of Pancreas : Relations

- **Anterior relations:**

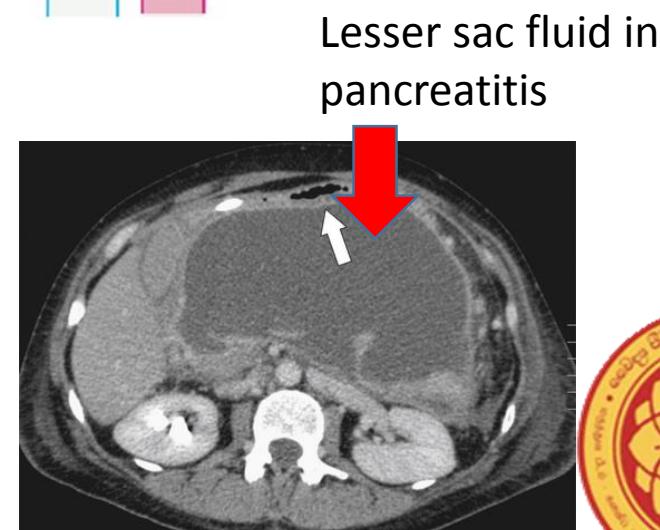
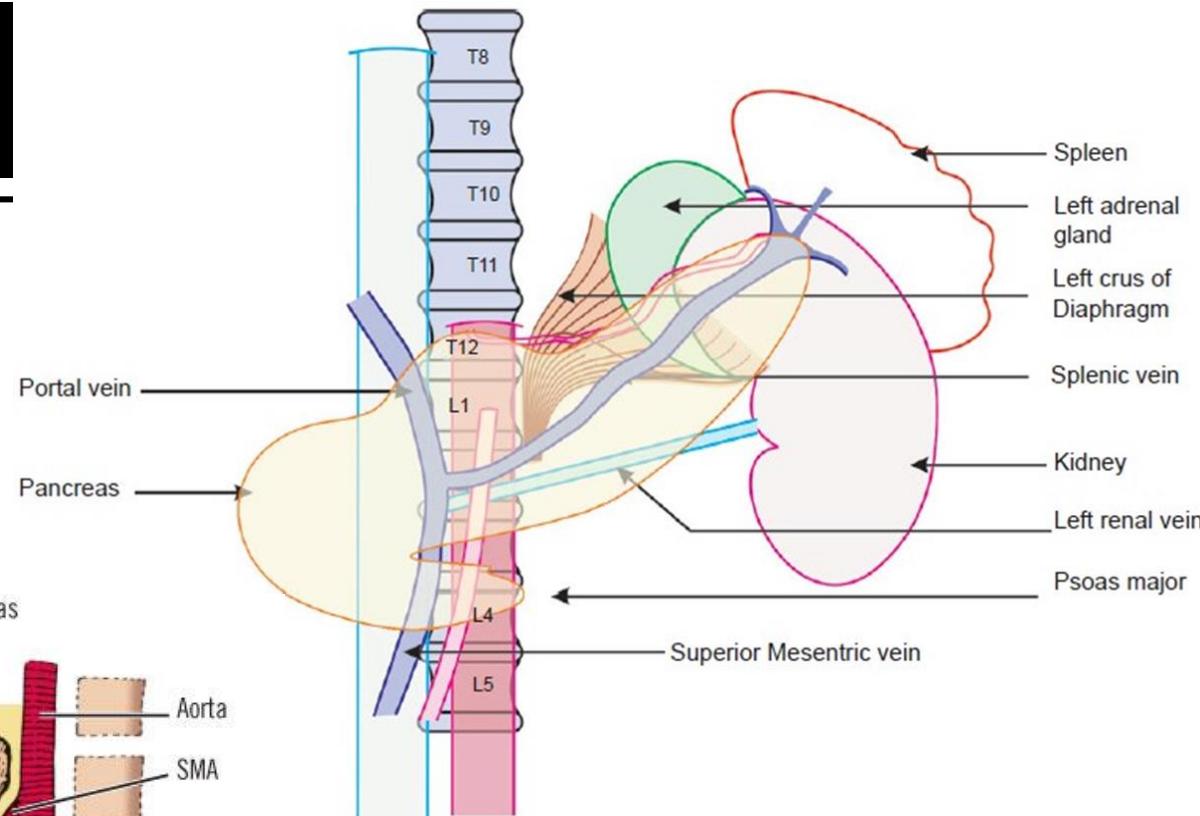
- Transverse colon
- Attachment of the transverse mesocolon
- Lesser sac
- Stomach

- **Posterior relations:**

- Aorta
- Origin of SMA
- Left psoas muscle
- Left suprarenal gland
- Left kidney and vessels
- Splenic vein

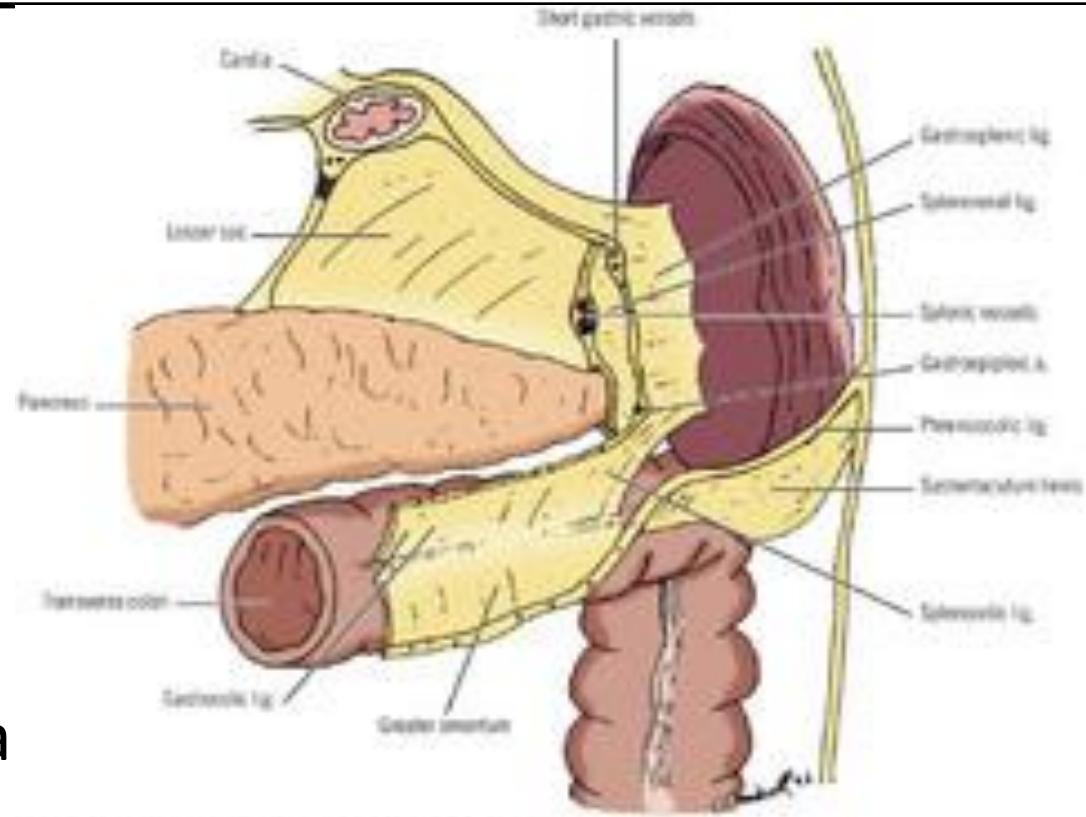


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# Tail of pancreas

- Last part of the organ
- Lies in the Lienorenal ligament
- Contact with the hilum of spleen.
- Ends within the splenic hilum
- Lies at the level of the 12<sup>th</sup> thoracic vertebra
- Anteriorly, related to splenic flexure of colon
- May be injured during splenectomy (fistula)



Chandrasekhar J.S., Colborn G.L., Waddell R.D., et al.: "Chandrasekhar's Applied Anatomy". McGraw-Hill Education, 2016.  
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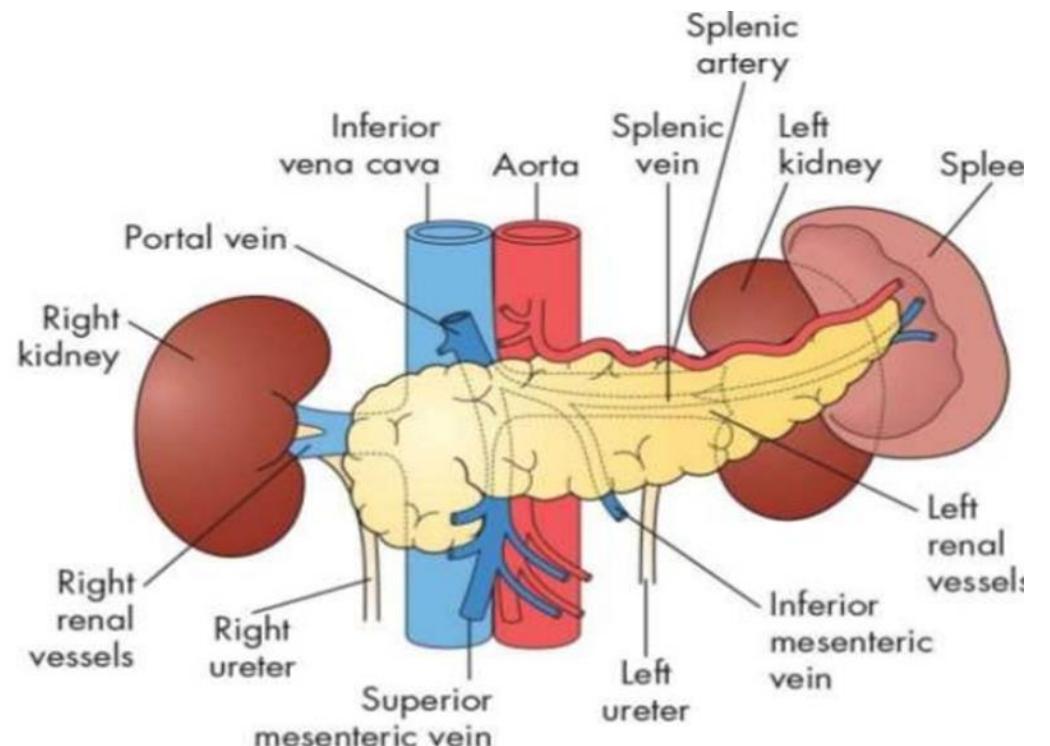


# MCQ

- A patient has a small tumour located posterior at the level of the neck of the pancreas. What other structures might be affected by this tumour?
  - a. Inferior vena cava
  - b. Inferior mesenteric artery
  - c. Inferior mesenteric vein
  - d. Portal vein
  - e. Superior mesenteric artery

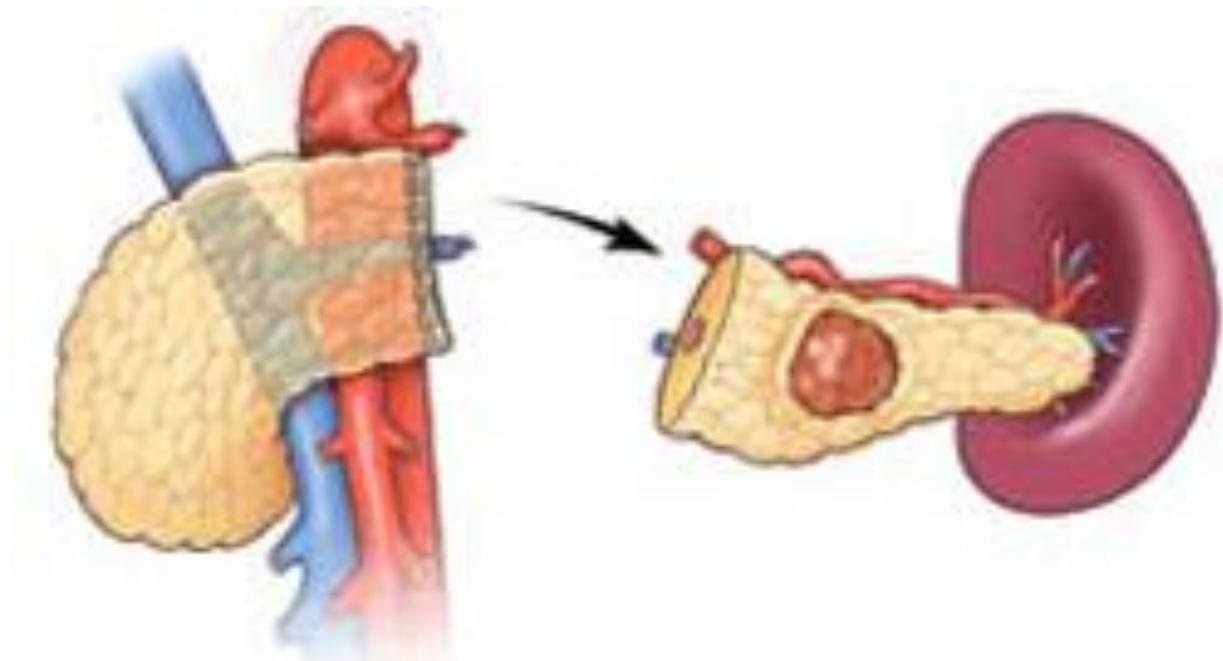
# MCQ

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  - Inferior vena cava
  - Inferior mesenteric artery
  - Inferior mesenteric vein
  - Portal vein
  - Superior mesenteric artery



# Distal pancreatic cancer- Mx

- Patients with body or tail tumours
- Managed with distal pancreatectomy.
- Remove body and tail & spleen.
- Technically a straightforward procedure
- Can be done open or laparoscopically.
- Complications are less frequent

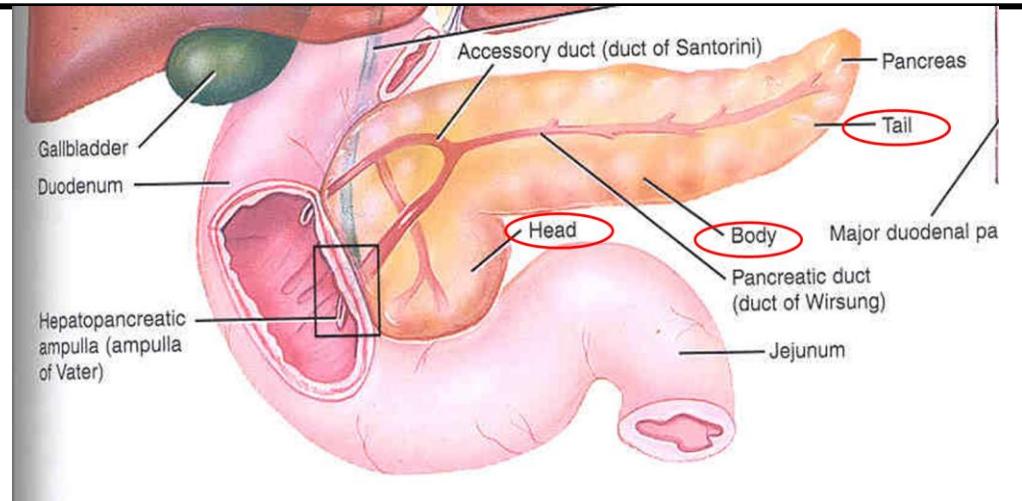


*In a Distal Pancreatectomy procedure with Splenectomy, the tail of the pancreas containing the tumor and the spleen are removed.*



# Ducts of the pancreas -Main duct

- Main duct (Wirsung) runs the entire length of pancreas



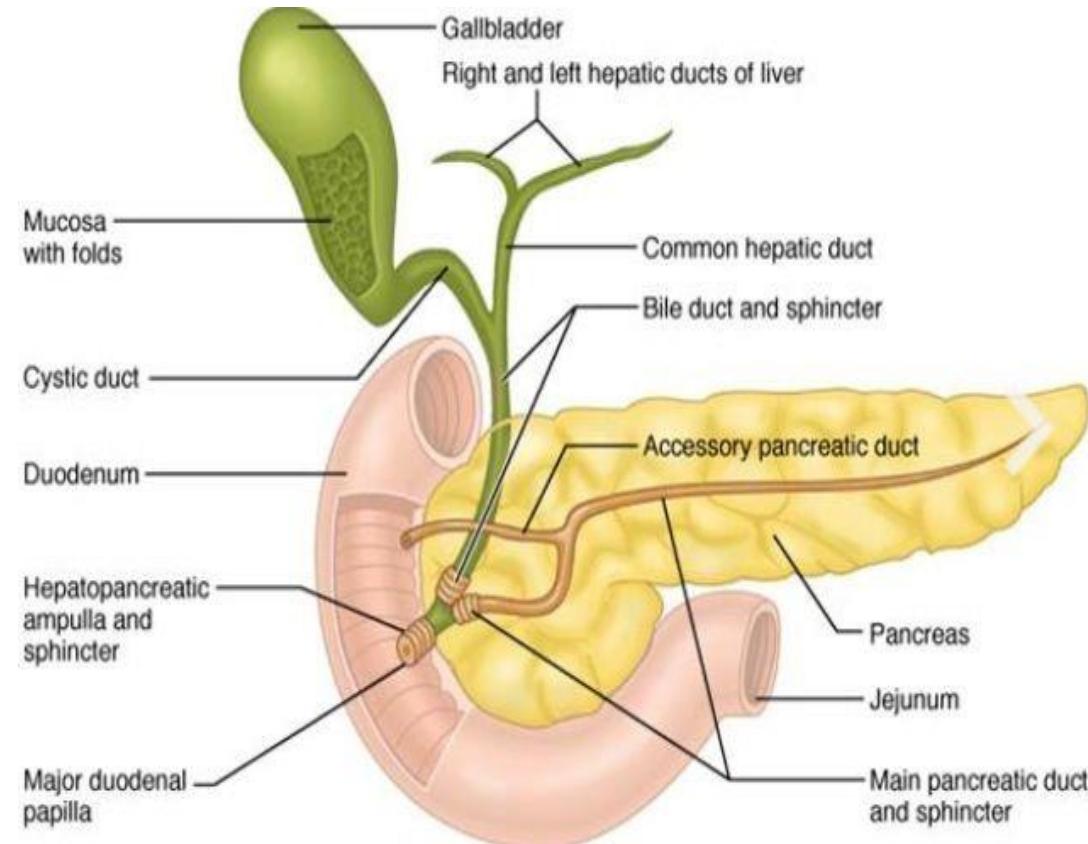
- Joins CBD at the ampulla of Vater
- 3 mm in diameter, 20 secondary branches
- Ductal pressure is 15 – 30 mm Hg (vs. 7 – 17 in CBD)
  - preventing damage to panc. duct



JOHANN GEORG WIRSUNG /n(1589-1643). The shooting of the German anatomist who discovered the pancreatic duct

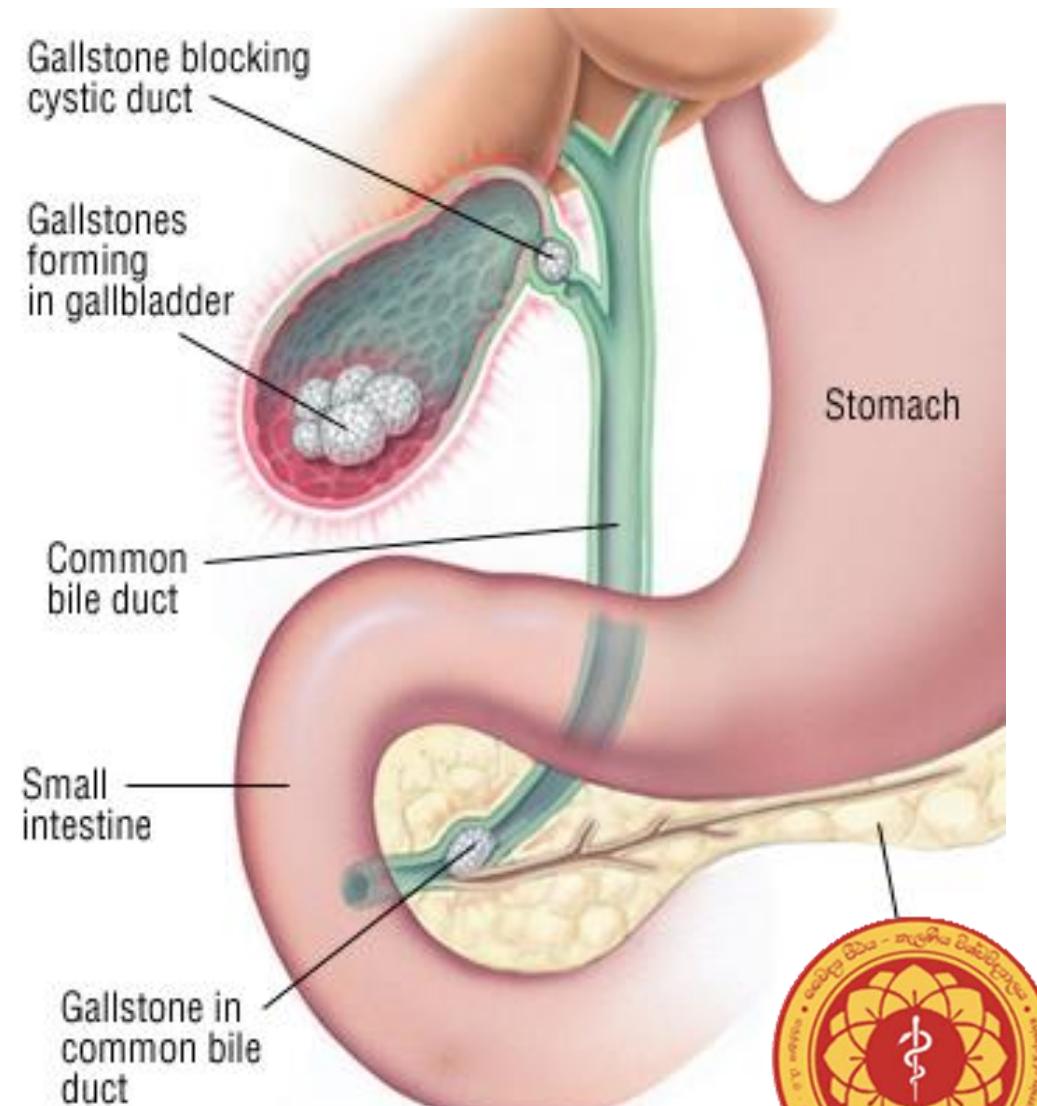
# Ducts of the pancreas -Accessory or Lesser duct

- Accessory or Lesser duct (Santorini)
- Drains superior portion of head
- Empties separately - 2nd part of duodenum
- Papilla situated 6-8 cm from pylorus.
- This papilla situated proximal  
and ventral to main papilla.
- Which drains the dorsal pancreatic bud during foetal development.



# Ducts of the pancreas -Clinical significance

- Compression, obstruction or inflammation of the pancreatic duct may lead to acute pancreatitis.
- The most common cause for obstruction is choledocholithiasis, or gallstones in the common bile duct.
- Obstruction can also be due to duodenal inflammation in Crohn's disease.
- Bile backing up into the pancreatic duct may initiate pancreatitis.
- Pancreatic ductal carcinoma is a common form of pancreatic cancer



# Blood supply to the pancreas

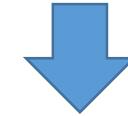
- Variety of major arterial sources : Celiac and SMA

## Arterial supply to head

Coeliac trunk



Common Hepatic Artery



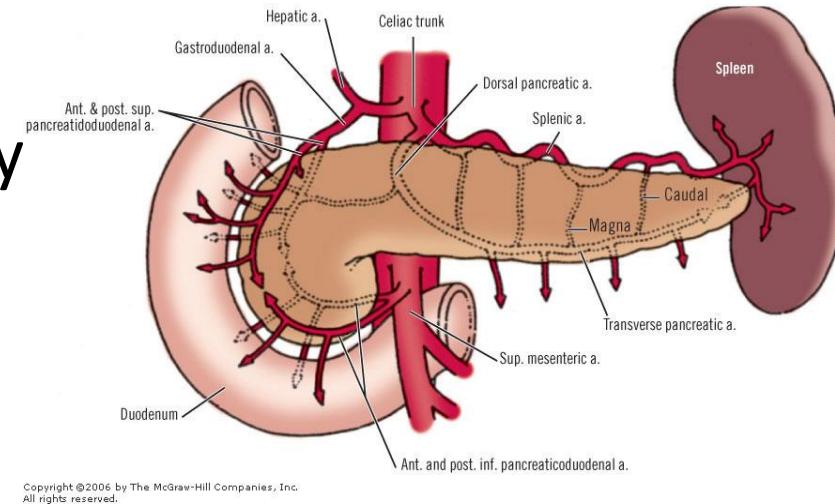
Gastroduodenal Artery



Superior pancreaticoduodenal artery



anterior and posterior branches



SMA



Inferior pancreaticoduodenal artery



Anterior and Posterior  
branches

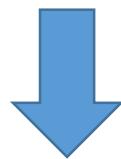


# Blood supply to the pancreas

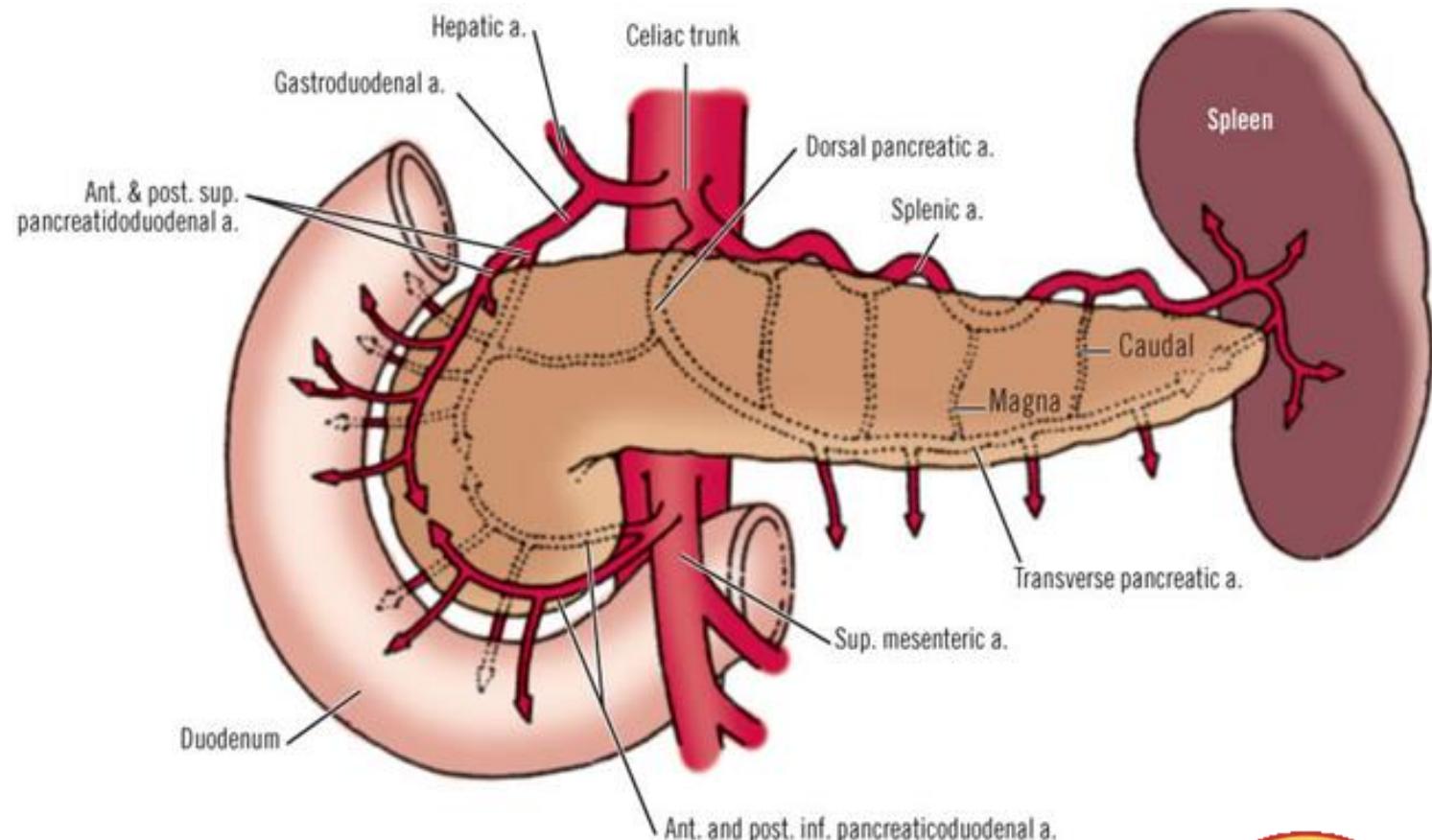
Coeliac trunk



Splenic artery ( Largest branch)



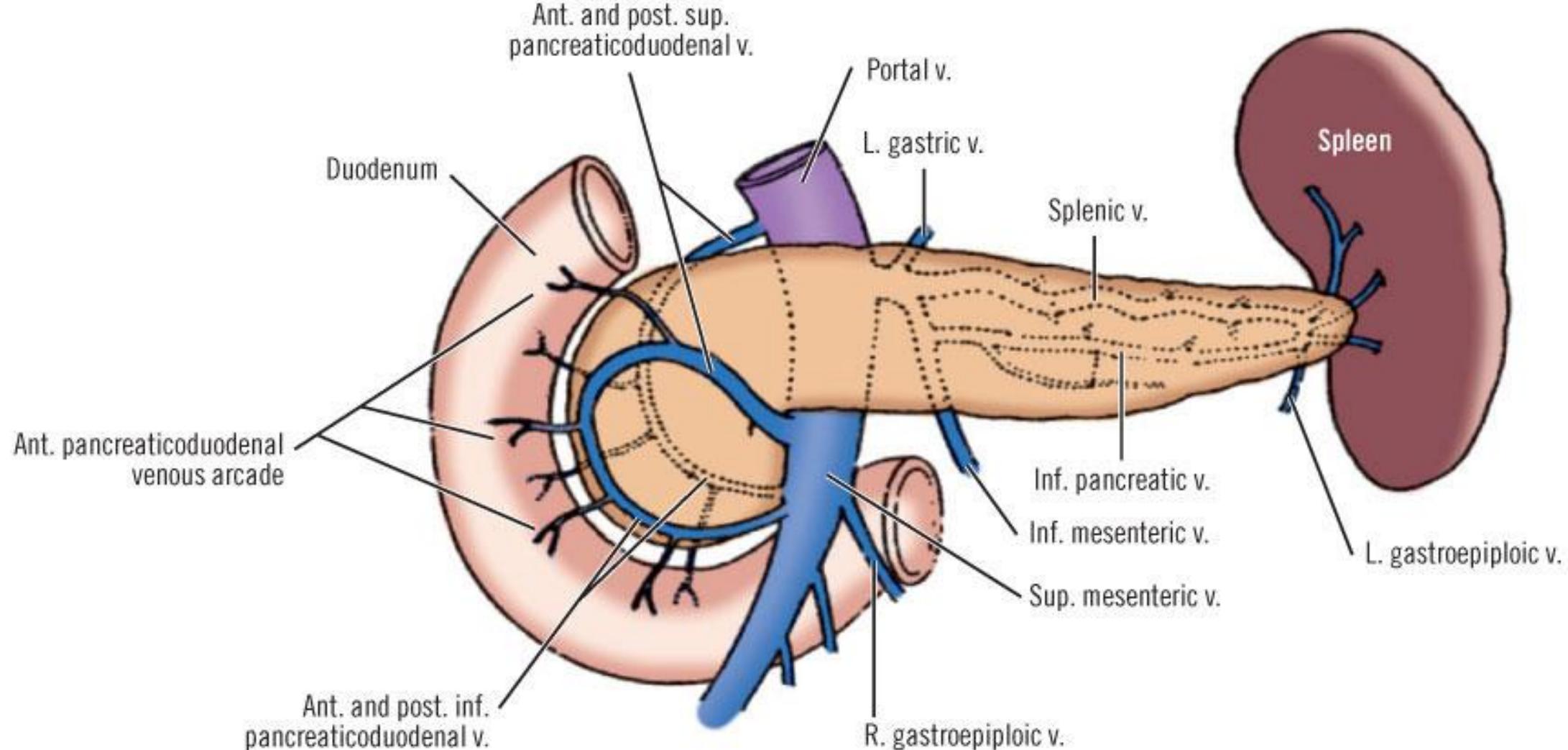
Supply neck, body and tail



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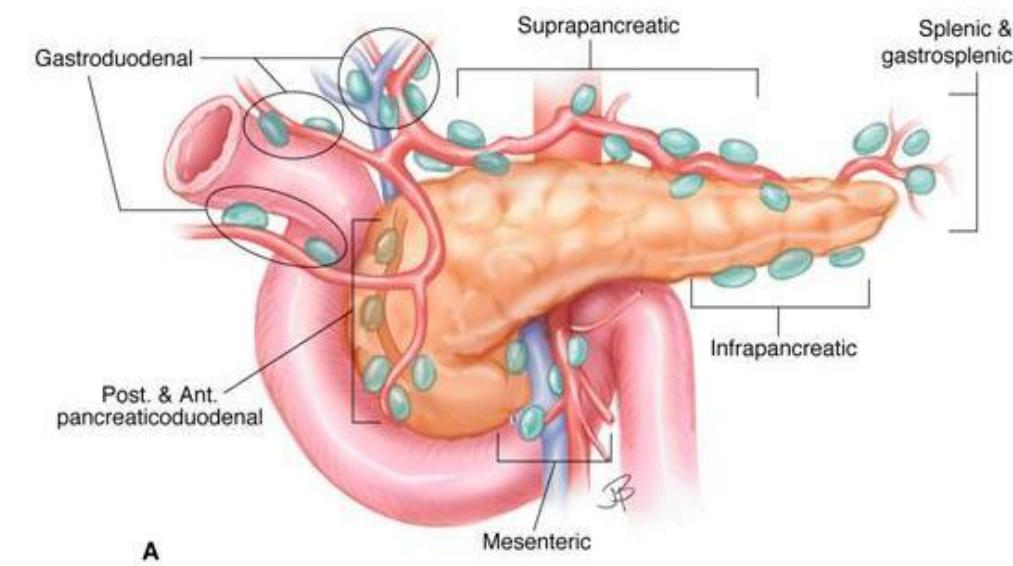


# Pancreas –Venous supply

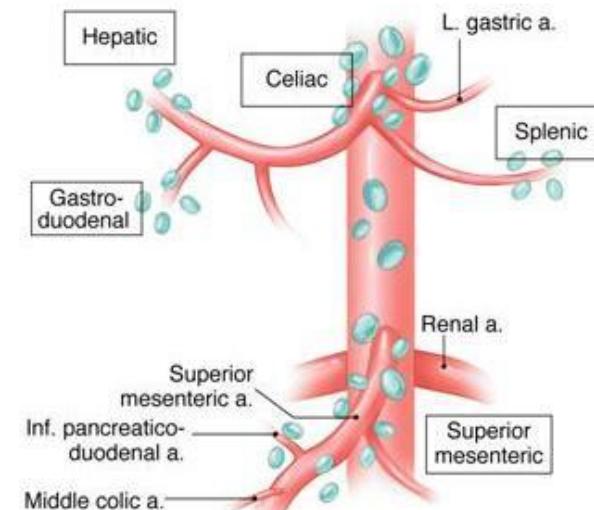


# Pancreas –Lymphatic drainage

- Lymphatics follow the course of the arteries to the
  - Coeliac nodes
  - Superior mesenteric lymph nodes

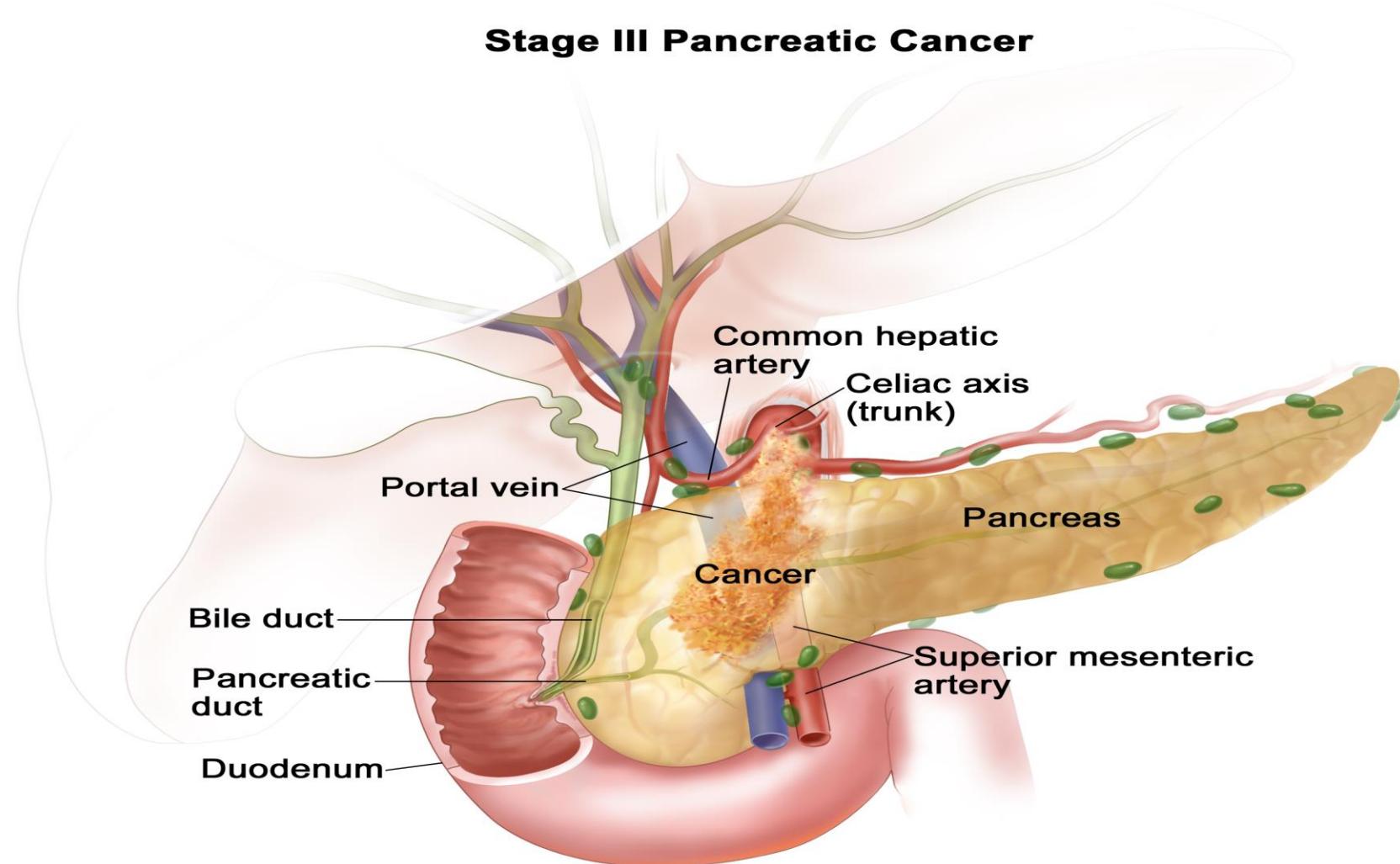


A



B

# Pancreatic cancer and lymphatic drainage

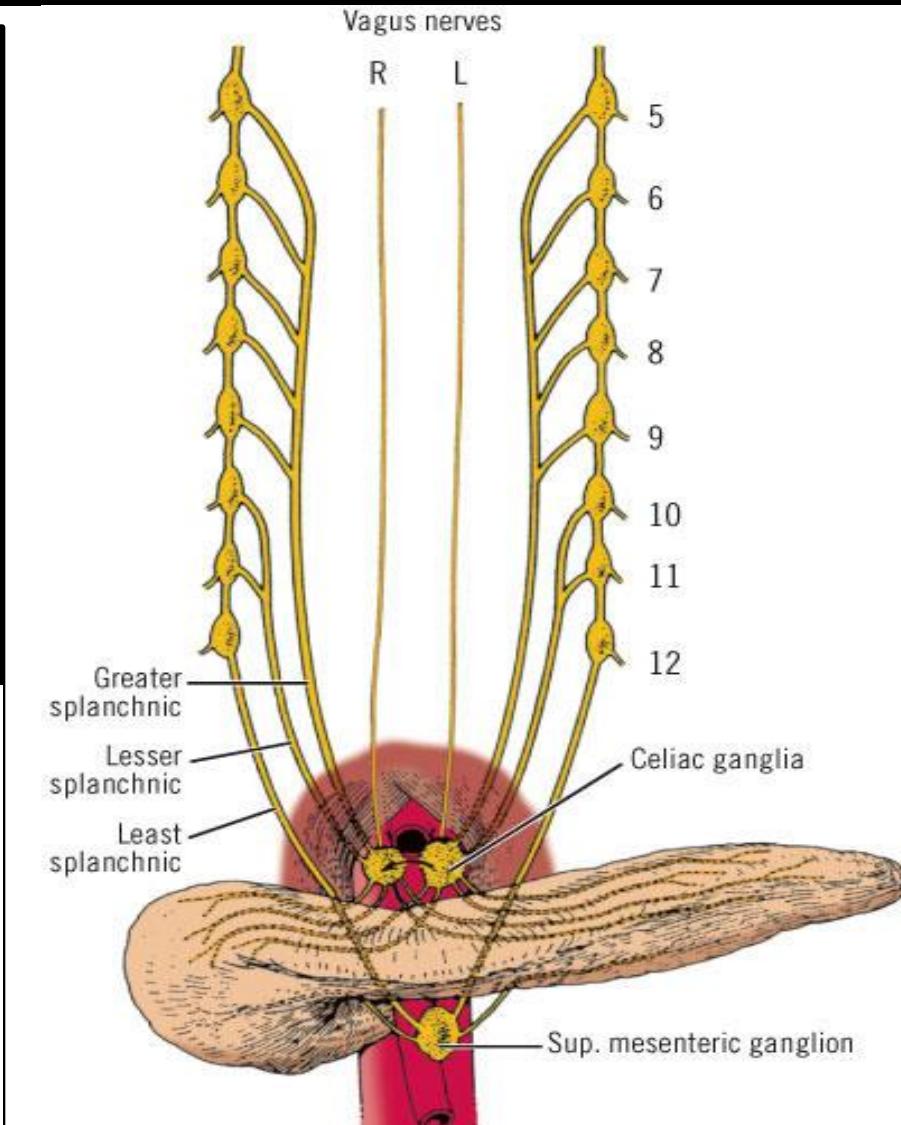
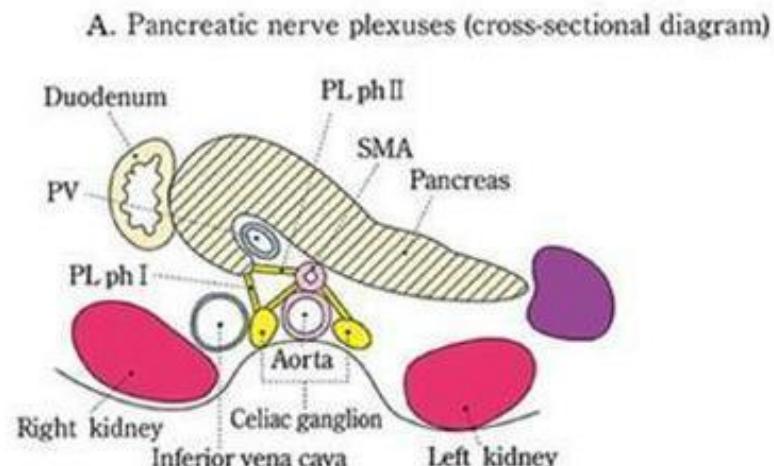


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# Pancreas –Nerve supply

- Autonomic supply via **pancreatic plexus**
- **Sympathetic trunk branches** - from **T6-T10**
  - Are vasomotor
- **Parasympathetic nerve fibres** - from the **vagus nerve**
  - Control pancreatic secretion



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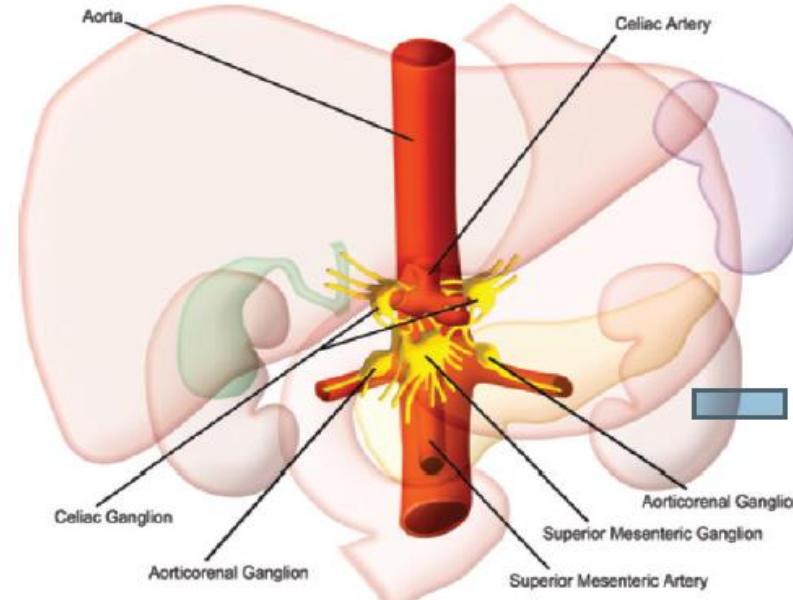


# Mx of severe pain in chronic pancreatitis/Ca pancreas.

## CT-guided Celiac Plexus Neurolysis: A Review of Anatomy, Indications, Technique, and Tips for Successful Treatment<sup>1</sup>

ONLINE-ONLY  
CME

Avinash Kambadakone, MD, FRCR • Ashraf Thabet, MD • Debra A. Gervais, MD • Peter R. Mueller, MD • Ronald S. Arellano, MD



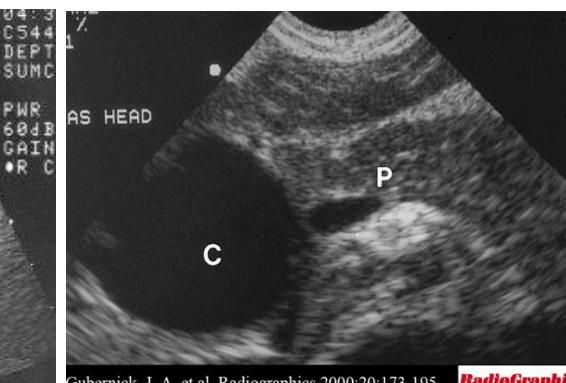
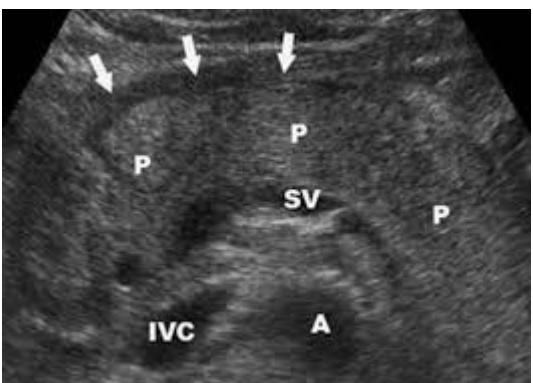
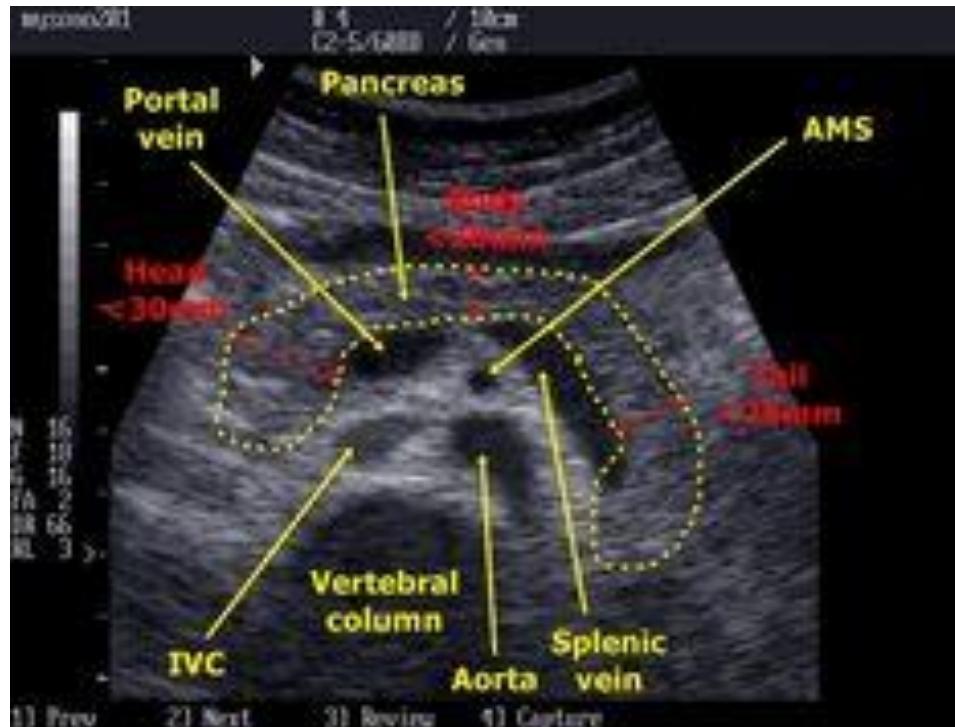
# Radiological investigations of pancreas

- Ultrasound scan
- X Ray Abdomen.
- CT Scan
- MRI Scan
- MRCP
- ERCP



# Ultrasound scan

- Good first line Ix.
- Appear as echogenic structure.
- Important in acute pancreatitis.
- May see pancreatic cancers/Ca++.
- Good Ix to see pancreatic pseudocyst.



Gubernick, J. A. et al. Radiographics 2000;20:173-195

RadioGraphics



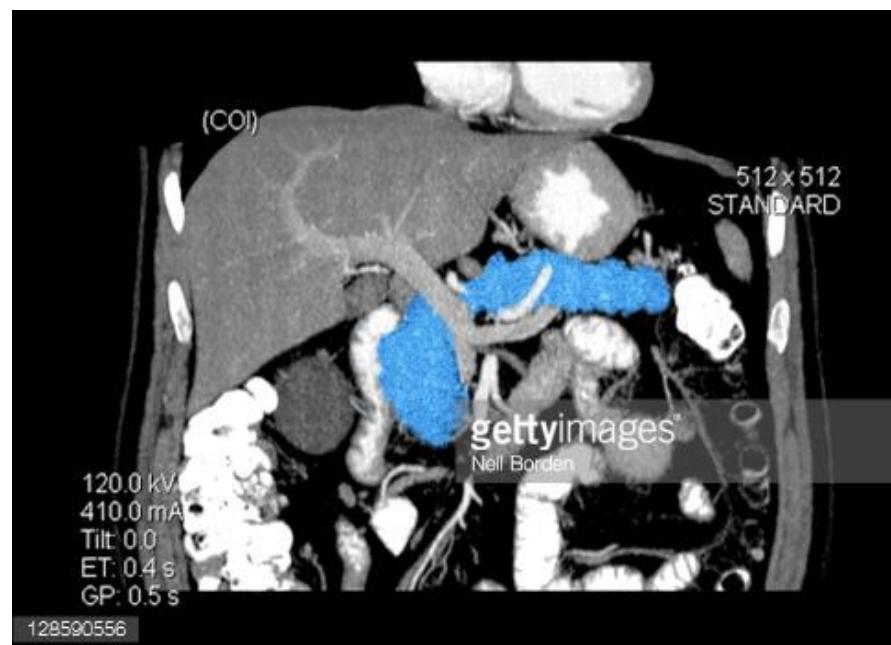
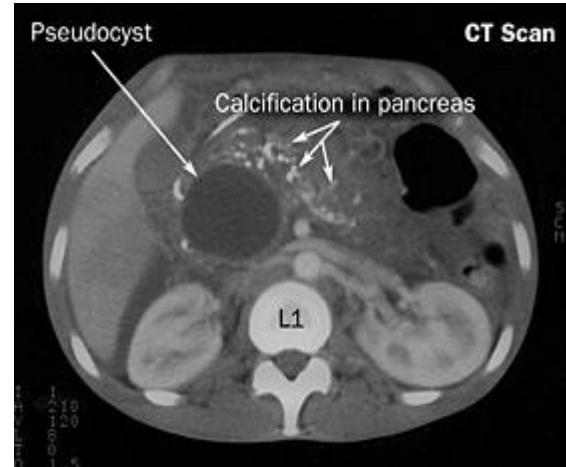
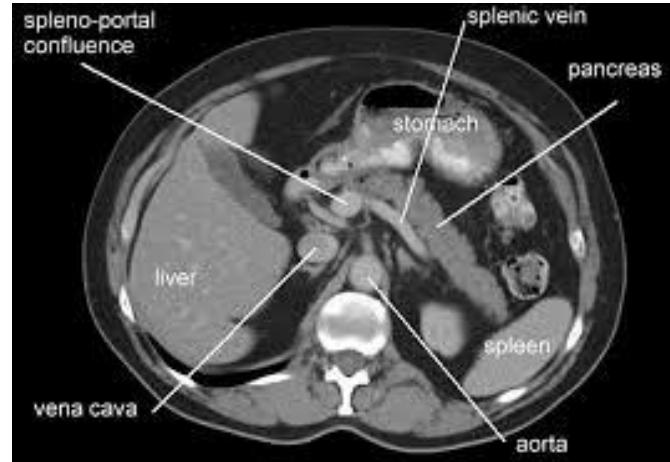
# X Ray Abdomen

- Basic investigation to see pancreatic calcifications in chronic pancreatitis.

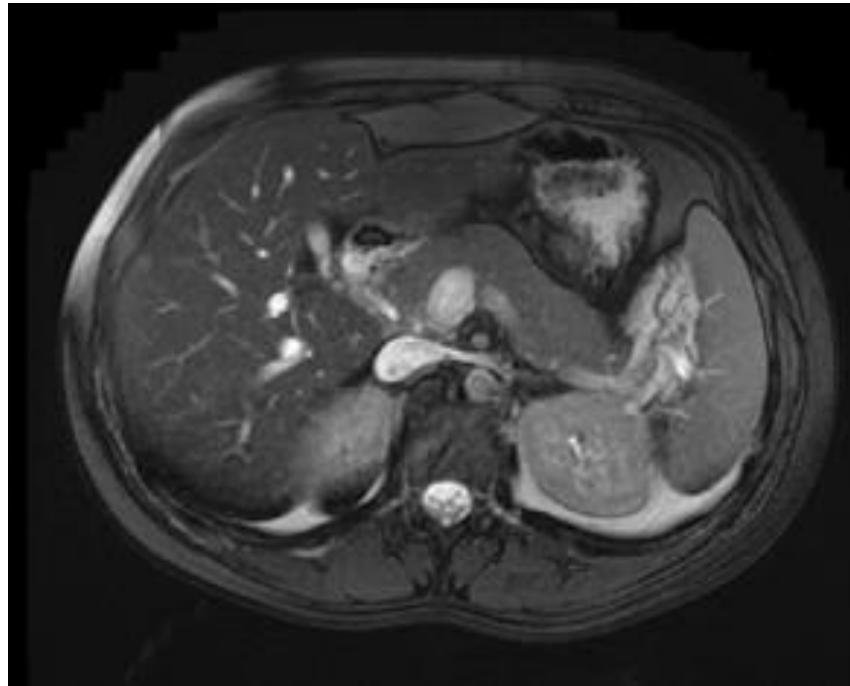


# CT Scan

- Pancreas is well visualized.
- Can see dilated pancreatic duct /Ca++
- Important Ix in
  - acute and chronic pancreatitis
  - To see complications pancreatitis
  - Pancreatic cancers
  - Guided procedures.

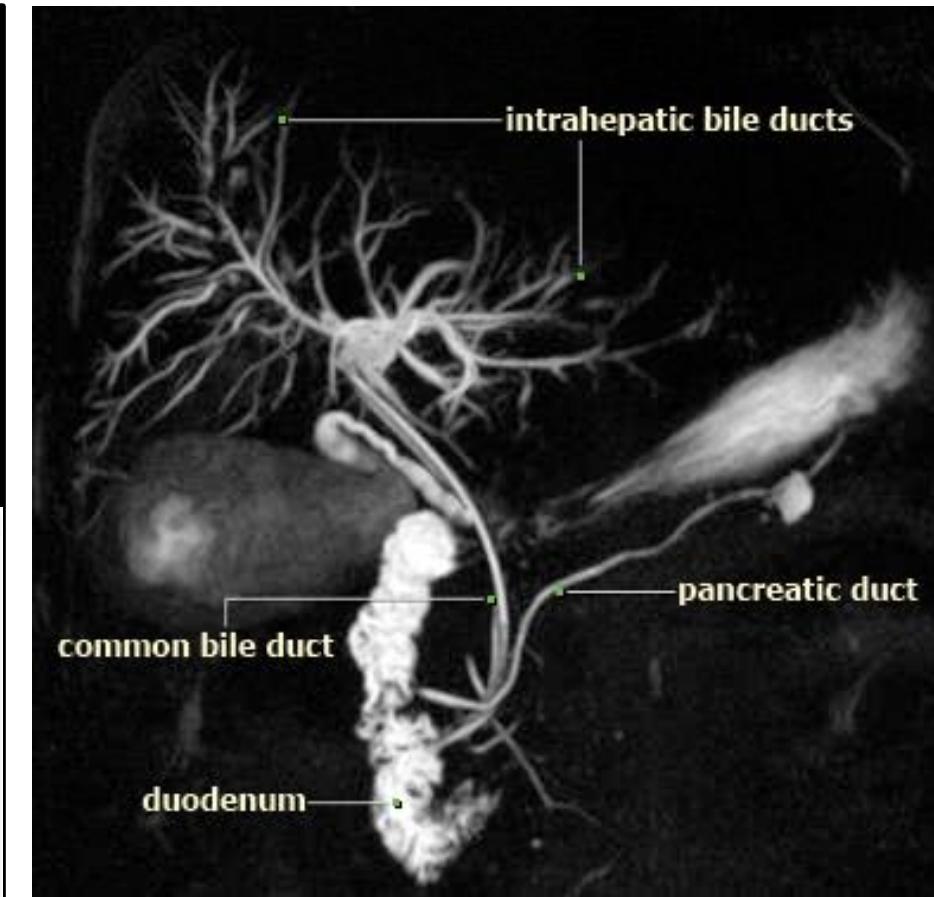
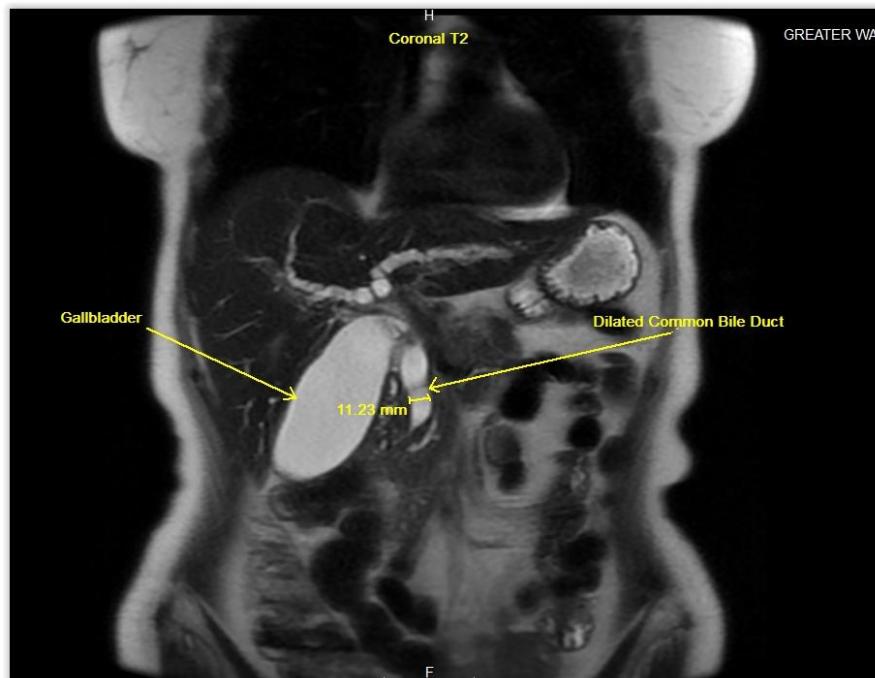


# MRI Scan



# Magnetic resonance cholangiopancreatography- MRCP

- Non-invasive technique
- Can see pancreatic and bile ducts
- Unlike ERCP, it does not require an infusion of a contrast dye.



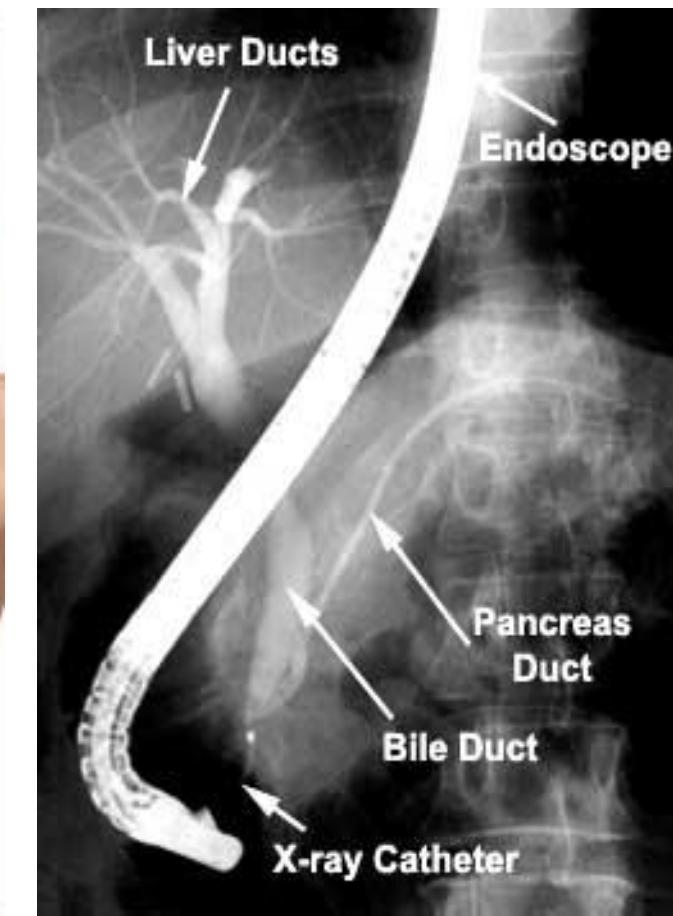
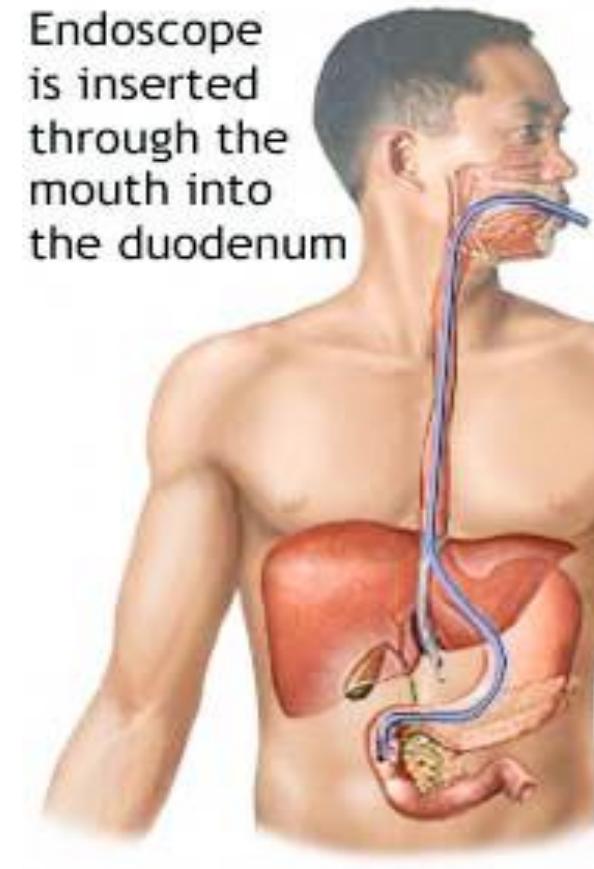
# Magnetic resonance cholangiopancreatography

- Examine diseases of the liver, gallbladder, bile ducts, pancreas and pancreatic duct.
- Detect tumors, stones, inflammation or infection.
- Evaluate patients with pancreatitis to detect the underlying cause
- Help to diagnose unexplained abdominal pain.
- Provide a less invasive alternative to endoscopic retrograde cholangiopancreatography (ERCP).



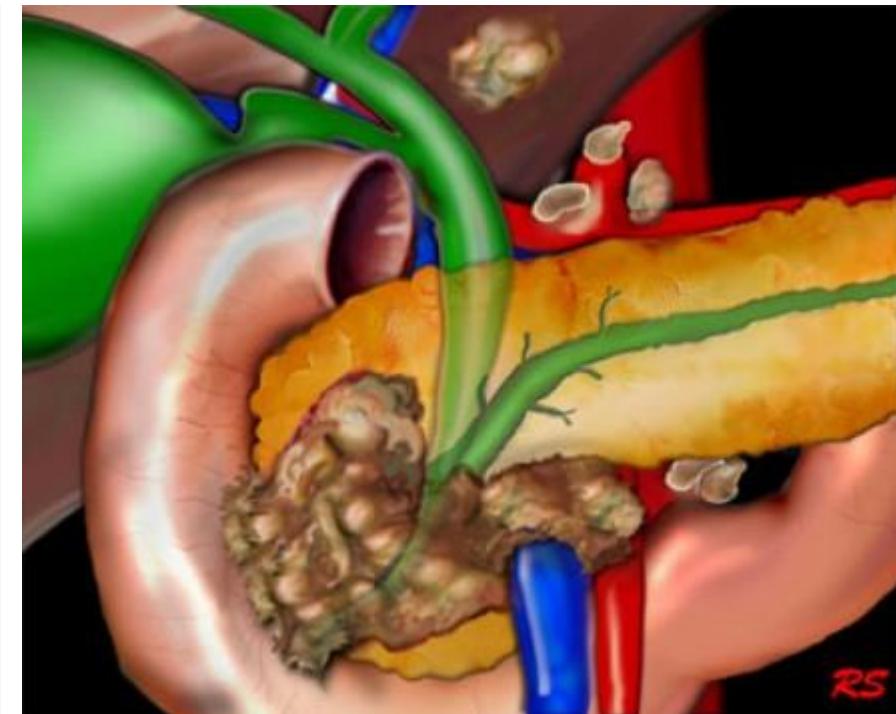
# Endoscopic retrograde cholangiopancreatography (ERCP)

- An endoscope is passed through the mouth, esophagus, stomach and into the first part of the small intestine.
- A catheter is then inserted through the endoscope
- Contrast material is injected into the biliary ducts.
- X-rays are then taken.

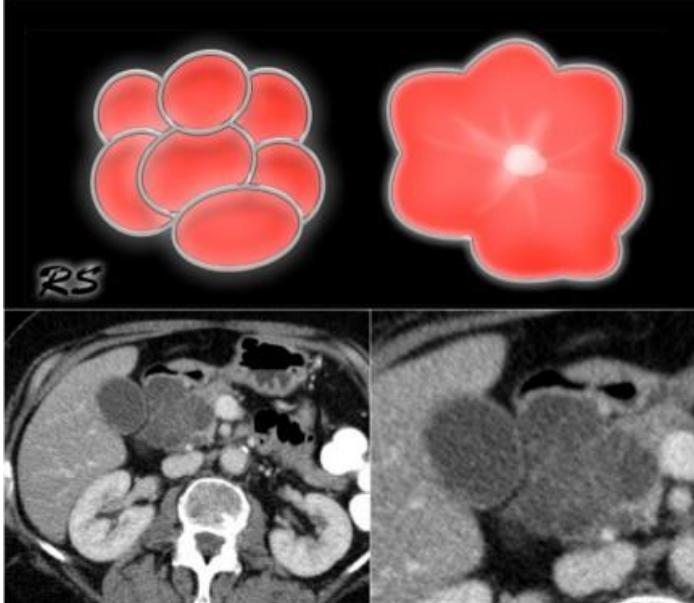
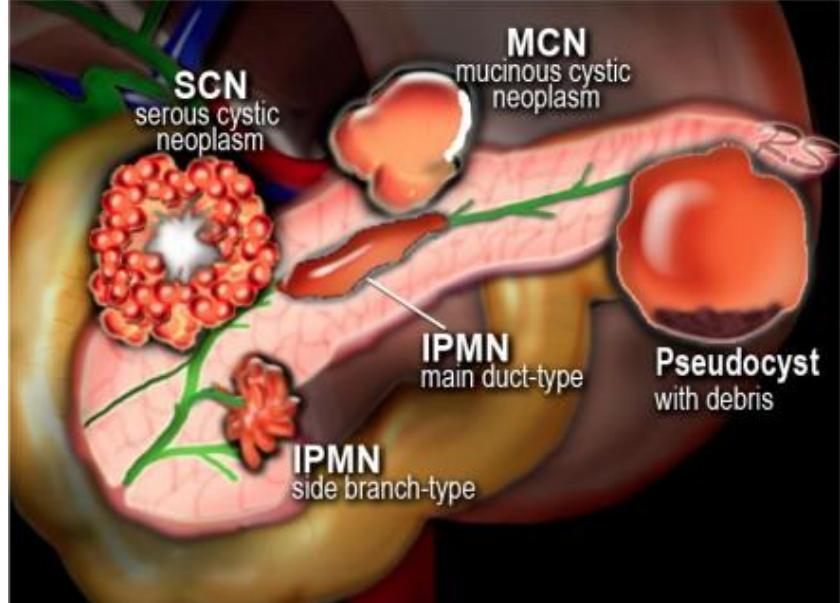


# Carcinoma of pancreas

- Relatively common tumour
- men > women (men: woman 1,5:1)
- Age of 60 - 70 years
- 75 % occurs in pancreatic head.
- 80% of pancreatic head cancers are not eligible for resection at the time of diagnosis.
- This is due to advanced local tumour extension or the presence of distant metastatic disease



# Cystic pancreatic tumors



# Pancreatic pseudocyst

- A circumscribed collection of fluid rich in pancreatic enzymes, blood, and necrotic tissue,
- typically located in the lesser sac of the abdomen.
- Pancreatic pseudocysts are usually complications of pancreatitis
- In children occurs after pancreatic trauma
- Complications: Secondary infection, rupture, haemorrhage, obstruction of other structures

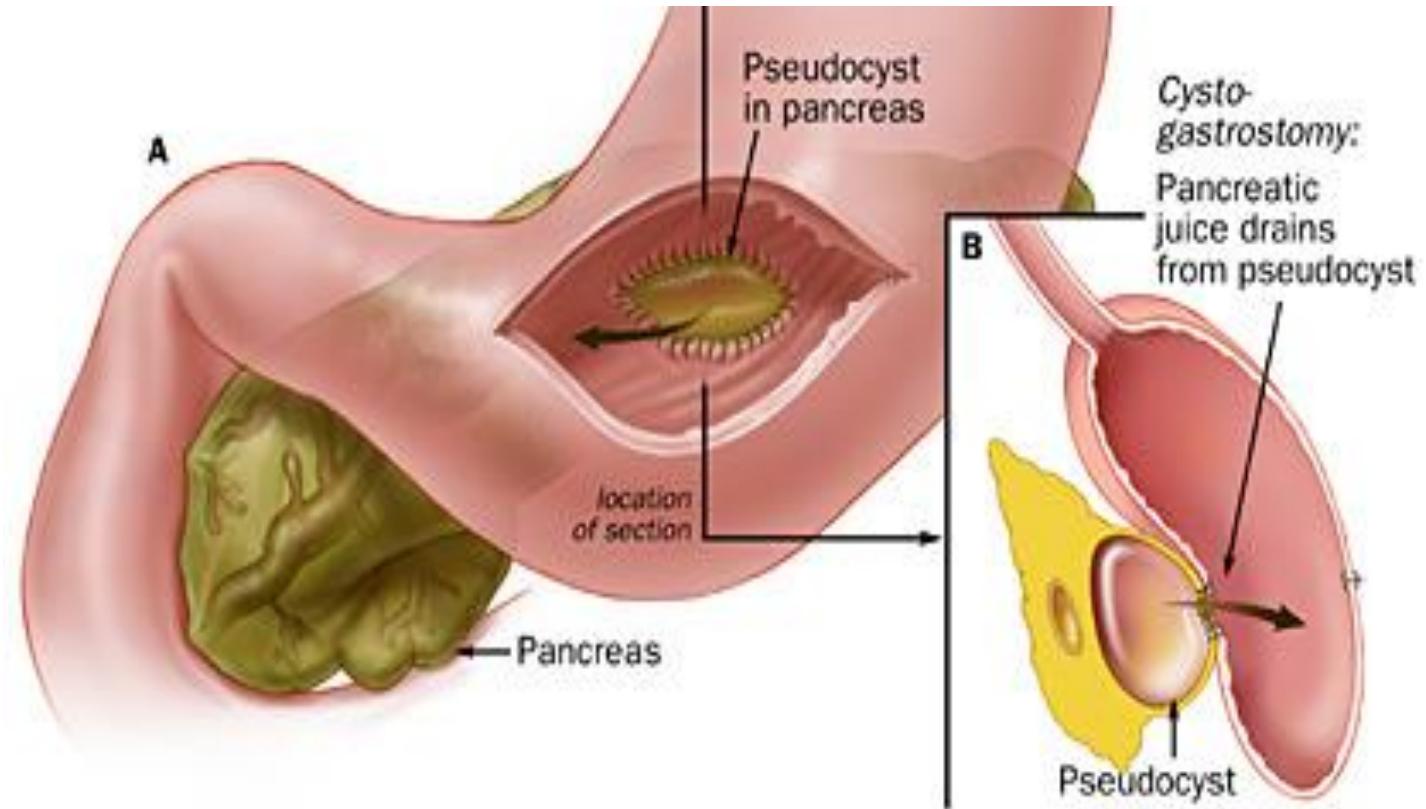
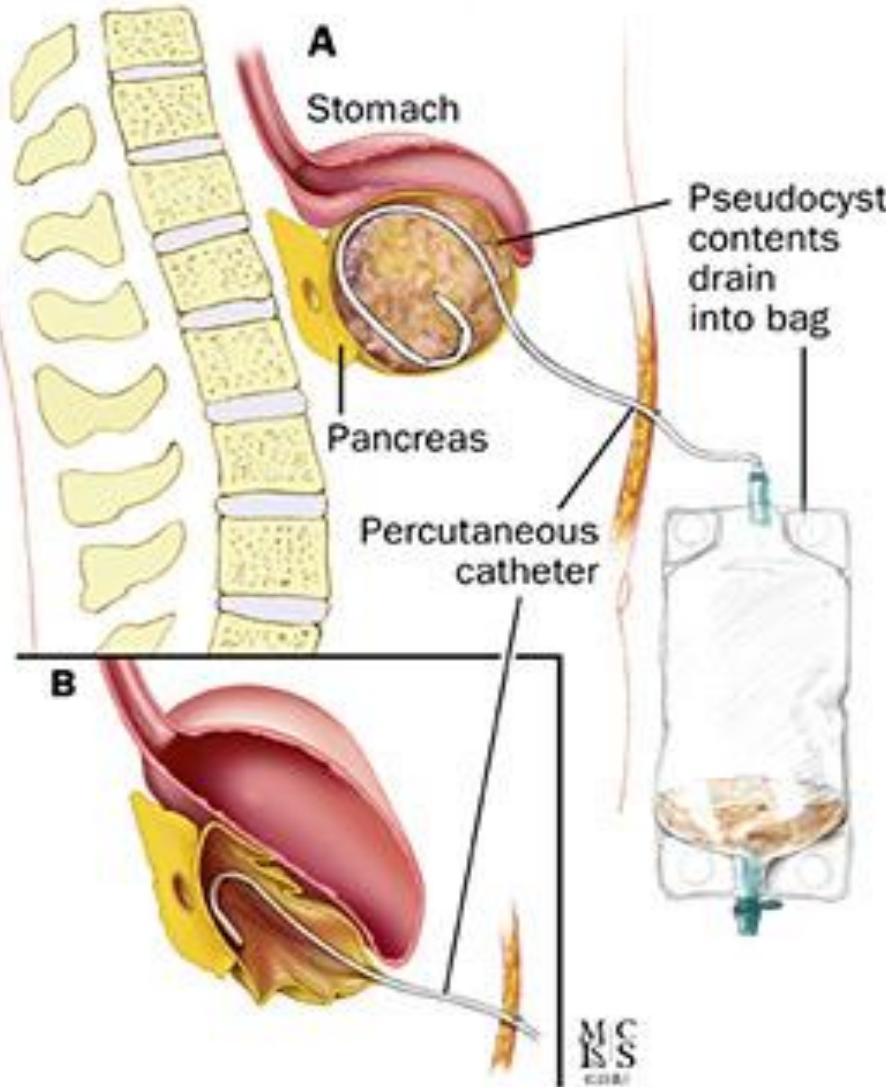


# Management of Pseudocysts

- USS guided percutaneous drainage
- Cystogastrostomy: connection is created between the back wall of the stomach and the cyst drains into the stomach.
- Cystojejunostomy: connection is created between the cyst and the small intestine -cyst fluid directly into the small intestine.
- Cystduodenostomy: connection is created between the duodenum -drainage of the cyst content into duodenum.
- Type of surgical procedure depends on the location of the cyst.



# Management of Pseudocysts



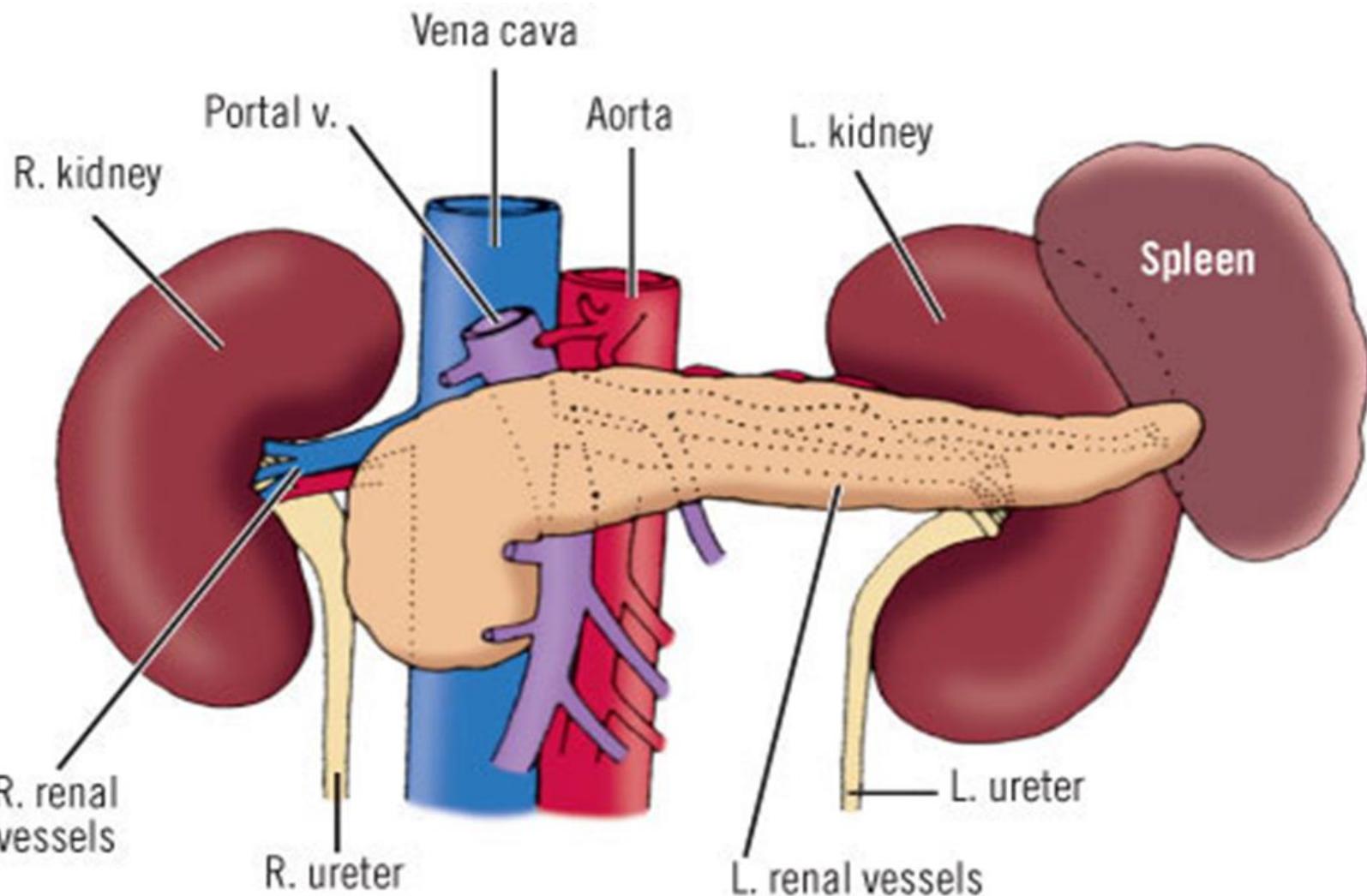
# MCQ

## 1. The pancreas

- A. has a main duct which opens in to vertical part of duodenum
- B. has a body which lies in front of the IVC
- C. has a neck which lies anterior to the commencement of portal vein
- D. has a head in front of the right kidney
- E. pancreas is posterior to the splenic vein



# MCQ



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# MCQ

- The pancreas
- T** A. has a main duct which opens in to vertical part of duodenum
- F** B. has a body which lies in front of the IVC
- T** C. has a neck which lies anterior to the commencement of portal vein
- F** D. has a head in front of the right kidney
- F** E. pancreas is posterior to the splenic vein



# MCQ

## 2. The pancreas

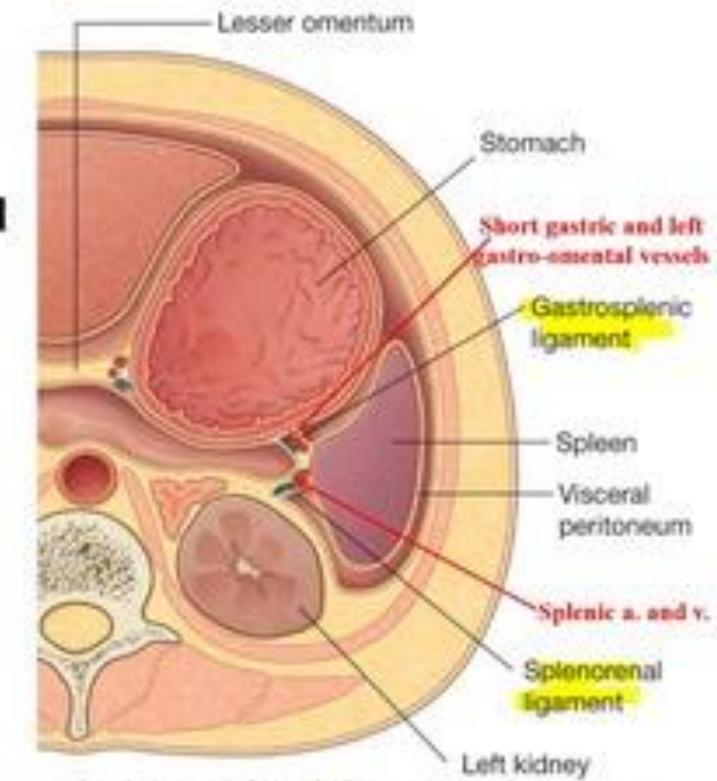
- A. develops from foregut
- B. has a uncinate process which lies behind the SMV
- C. has a tail which lies in the gastrosplenic ligament
- D. lies behind the stomach
- E. has a head which lies anterior to the bile duct



# MCQ

## 2. The pancreas

- T A. develops from foregut
- T B. has a uncinate process which lies behind the SMV
- F C. has a tail which lies in the gastrosplenic ligament
- T D. lies behind the stomach
- T E. has a head which lies anterior to the bile duct



Drake: Gray's Anatomy for Students, 2nd Edition.  
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A 50-year-old female patient with severe jaundice was diagnosed with pancreatic cancer. The tumor is located in which portion of the pancreas?

- A. Head
- B. Neck
- C. Body
- D. Tail
- E. Uncinate process



Thank You !



# **Histology of the pancreas**

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# Histology of the pancreas

- Exocrine pancreas
- Endocrine pancreas



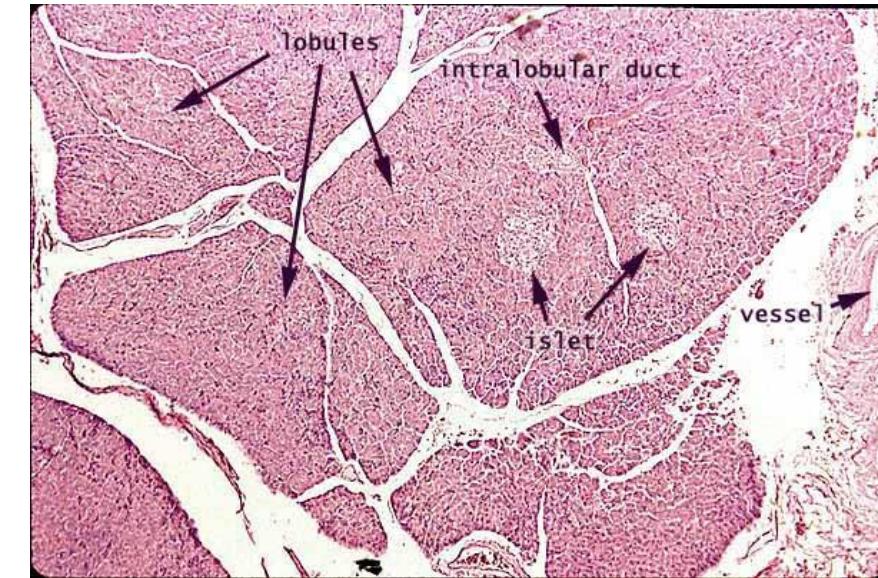
# Exocrine-Pancreas

- The exocrine portion of the pancreas is a compound acinar gland
- Histologically similar to parotid gland
- Distinction
  - Absence of striated ducts
  - Presence of islets of Langerhans

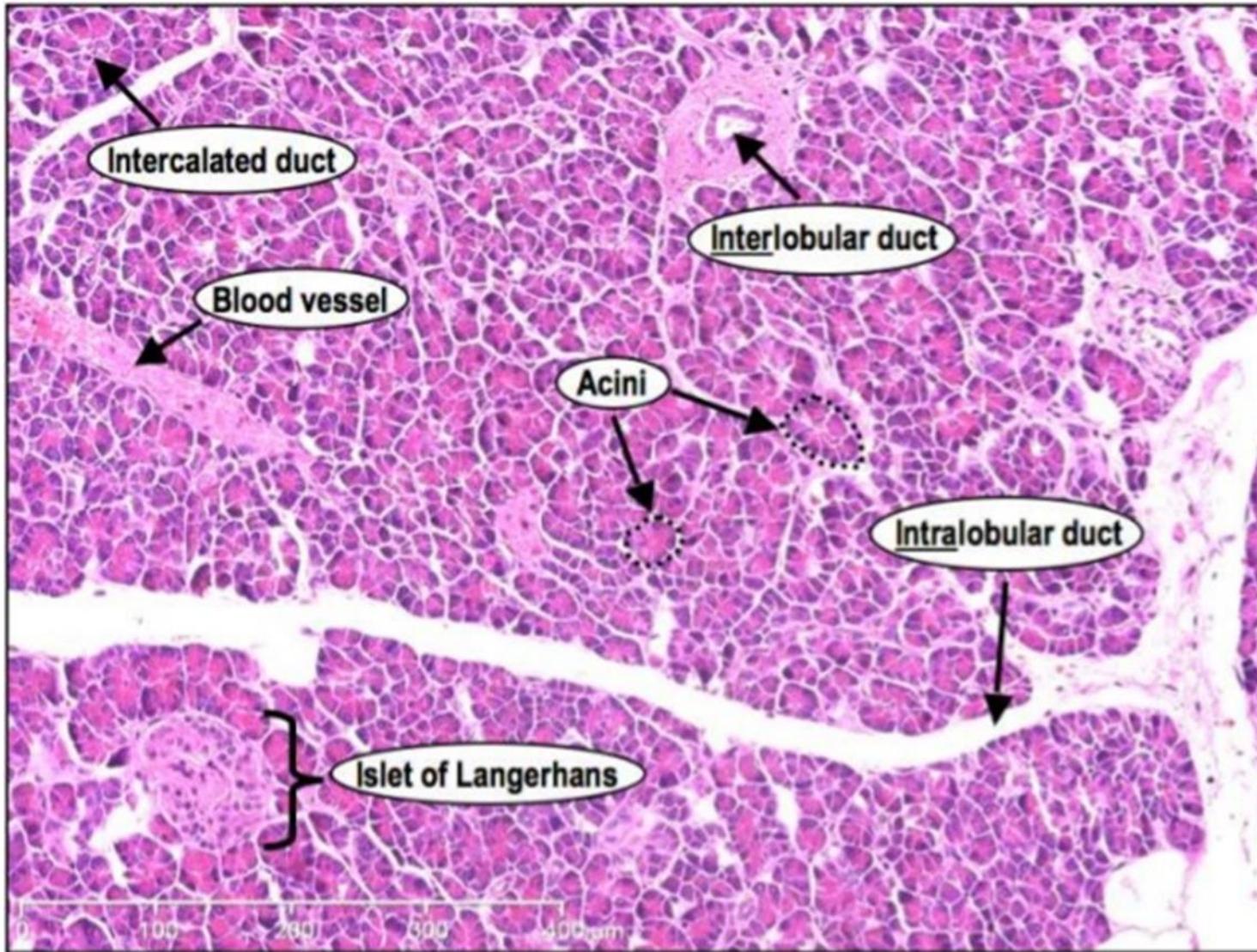


# Exocrine-Pancreas

- The pancreas is surrounded by a very thin connective tissue capsule
- Invaginate into the gland to form septae
- Septae serve as support for large blood vessels.
- Septae divide the pancreas into distinctive lobules

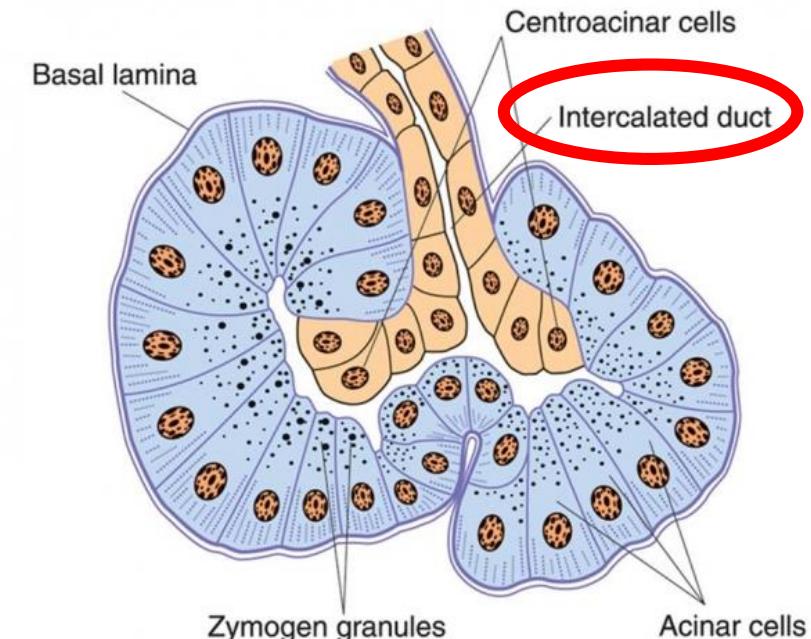


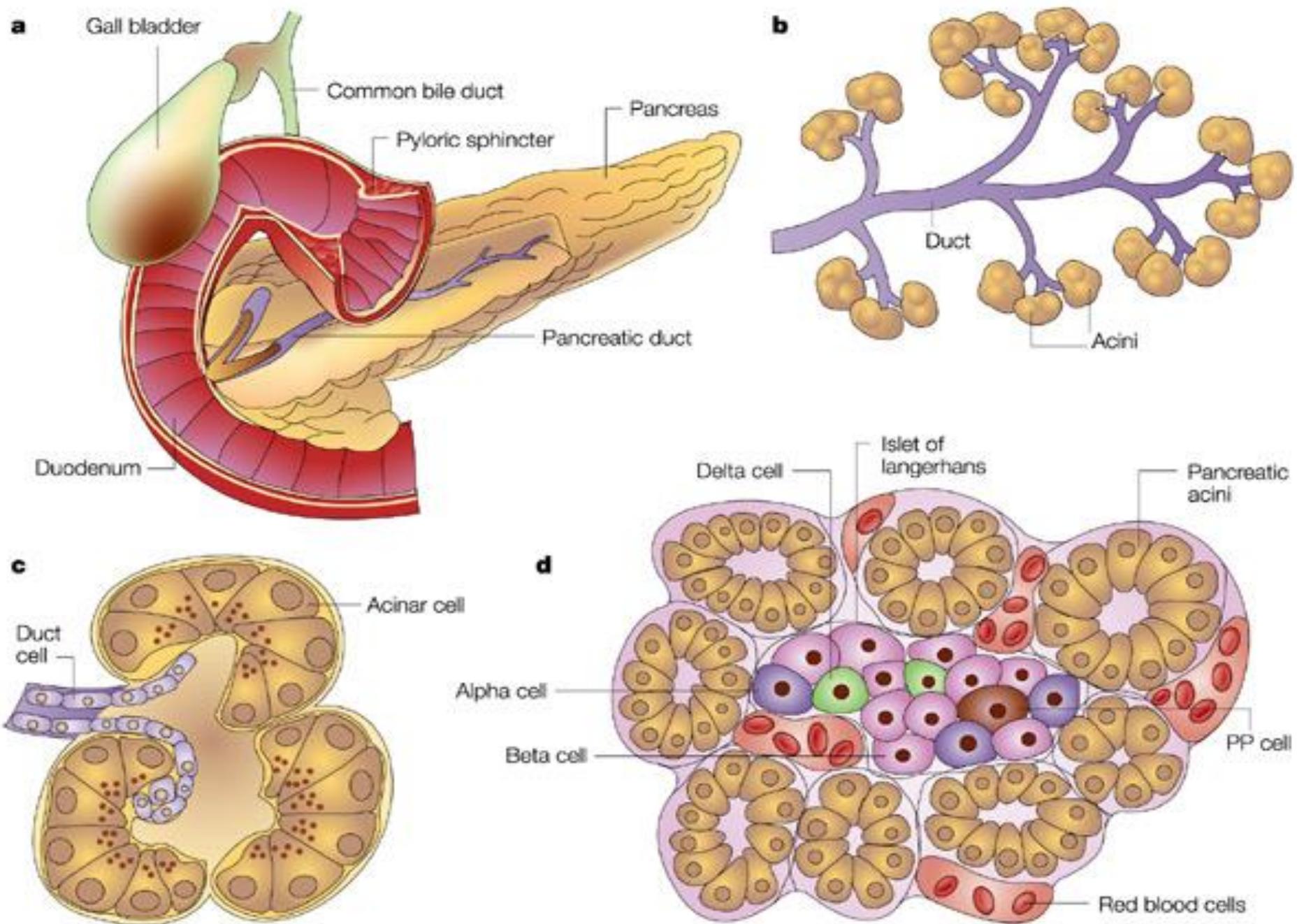
# Exocrine-Pancreas



# Exocrine-Pancreas-Acinus

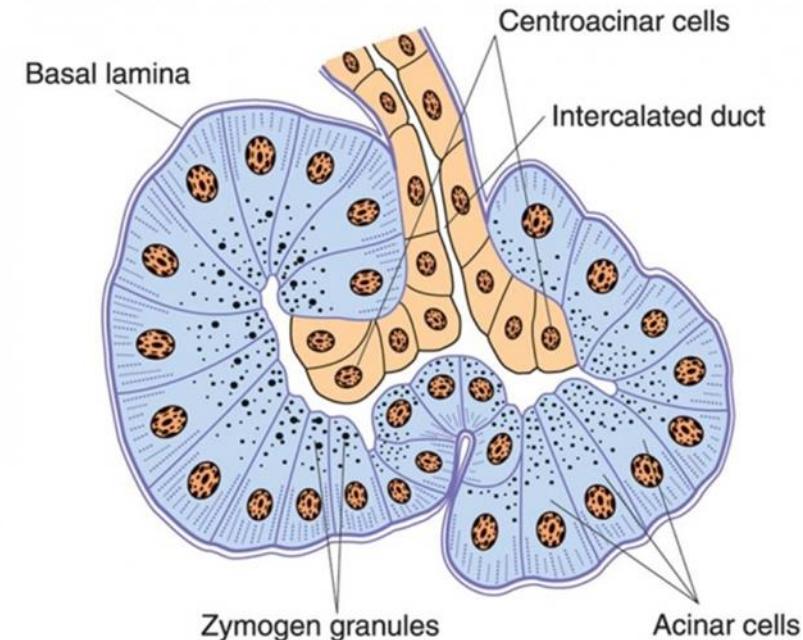
- Exocrine pancreas classified as a compound tubuloacinous gland.
- The cells that synthesize and secrete digestive enzymes are arranged in grape-like clusters -called acini
- Very similar to salivary glands
- In standard histologic sections, most acini are cut obliquely, making it difficult to separate their characteristic shape.

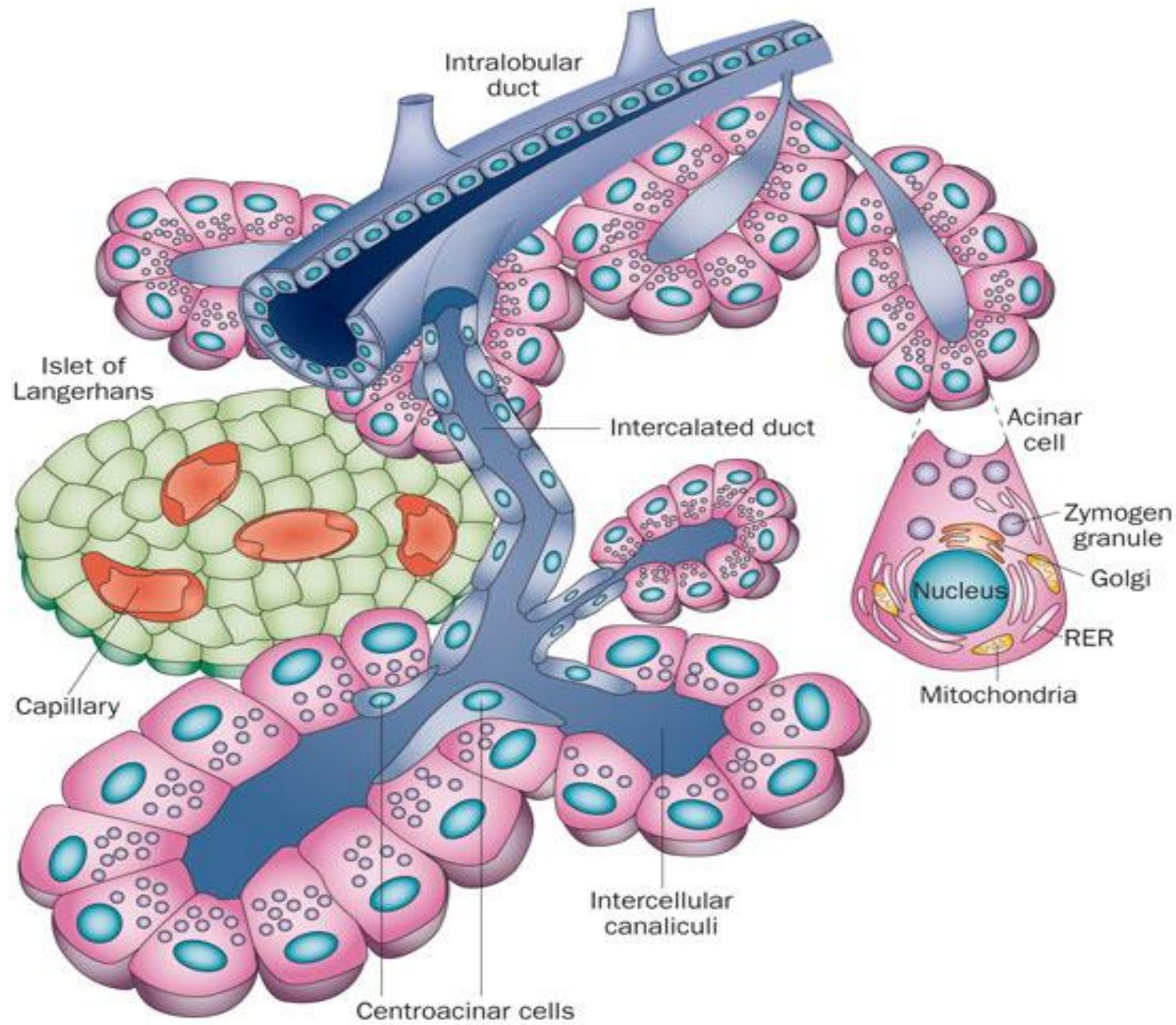




# Exocrine-Pancreas-Acinus

- Secretory acini lined by several serous cells surrounding a lumen
- Contain basal spherical nucleus
- Cytoplasm at base is basophilic
- Apical cytoplasm is granular and acidophytic
- Typical protein secreting cells





# Exocrine-Pancreas-Pancreatic Ducts

- Secretions from acini flow through a tree-like series of ducts.
- Duct cells secrete a watery, bicarbonate-rich fluid which flush the enzymes
- Help to neutralize acid within the small intestine.
- Digestive enzymes from acinar cells ultimately delivered into the duodenum
- Pancreatic ducts are classified into four types



# Exocrine-Pancreas-Pancreatic Ducts

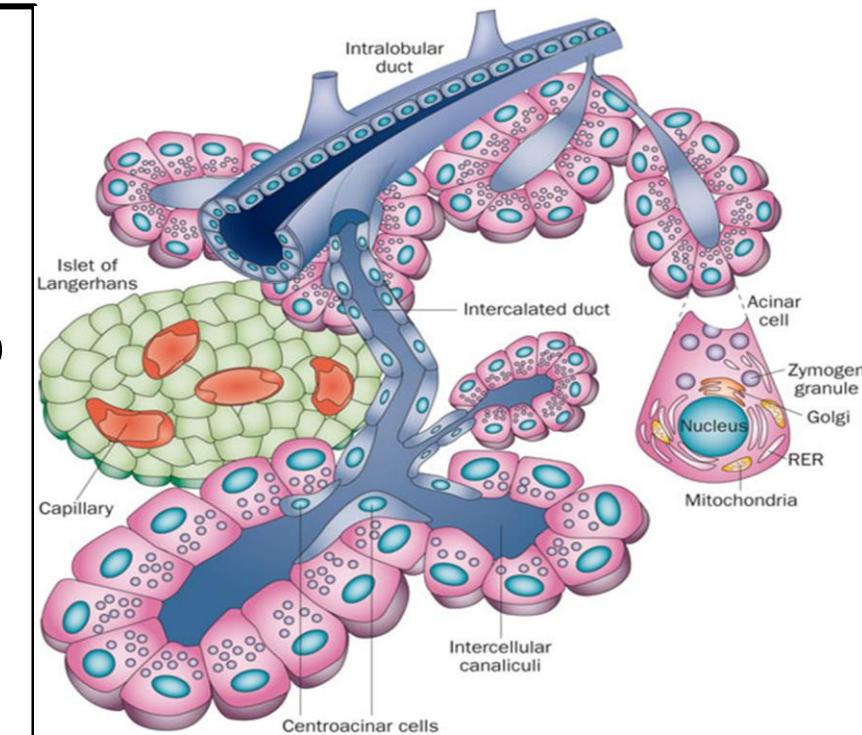
## Intercalated ducts -

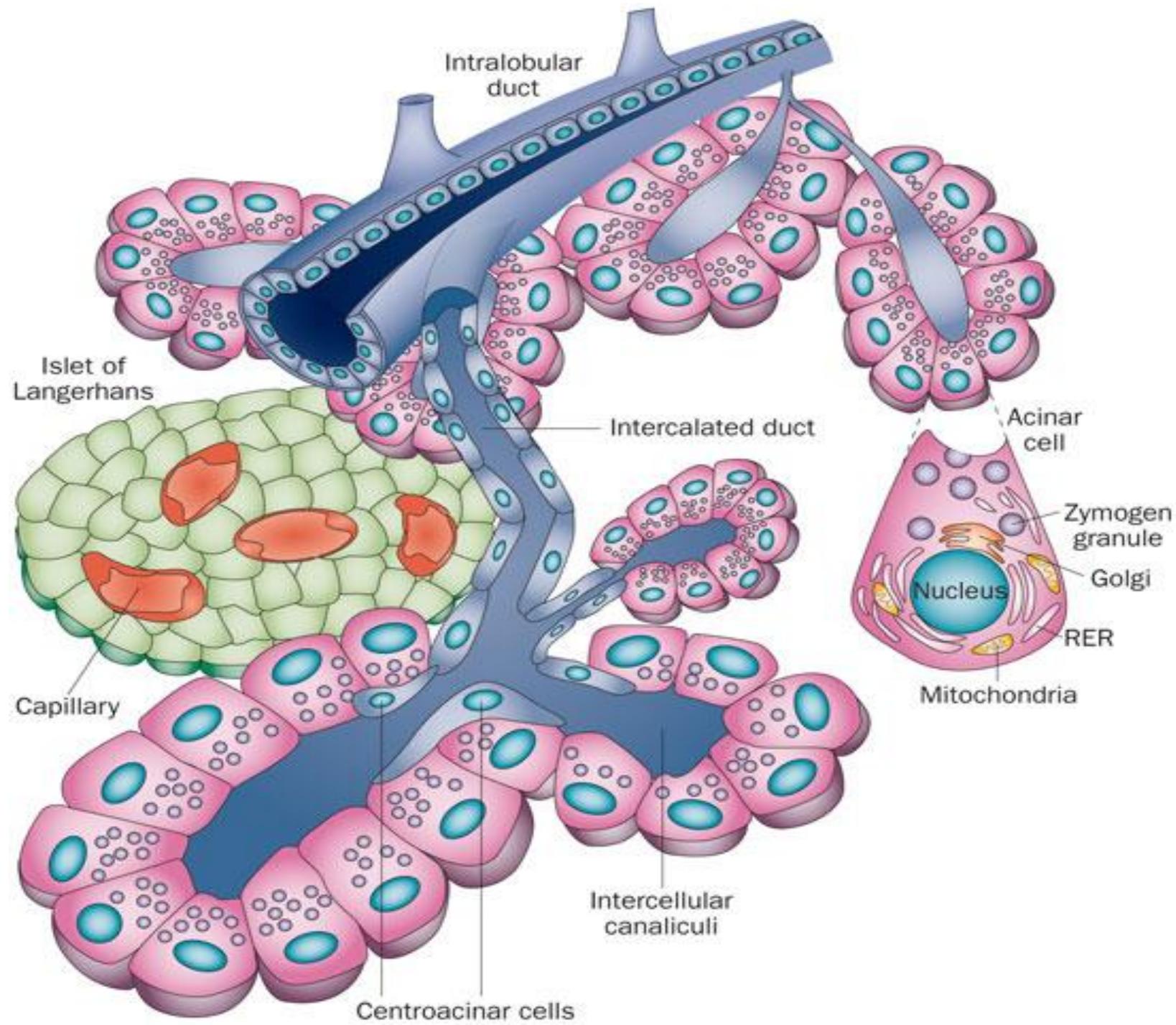
- receive secretions from acini.
- They have flattened cuboidal epithelium that extends up into the lumen of the acinus to form - centroacinar cells.

## Intralobular ducts

have a classical cuboidal epithelium ( Small ducts) and columnar (larger ducts),

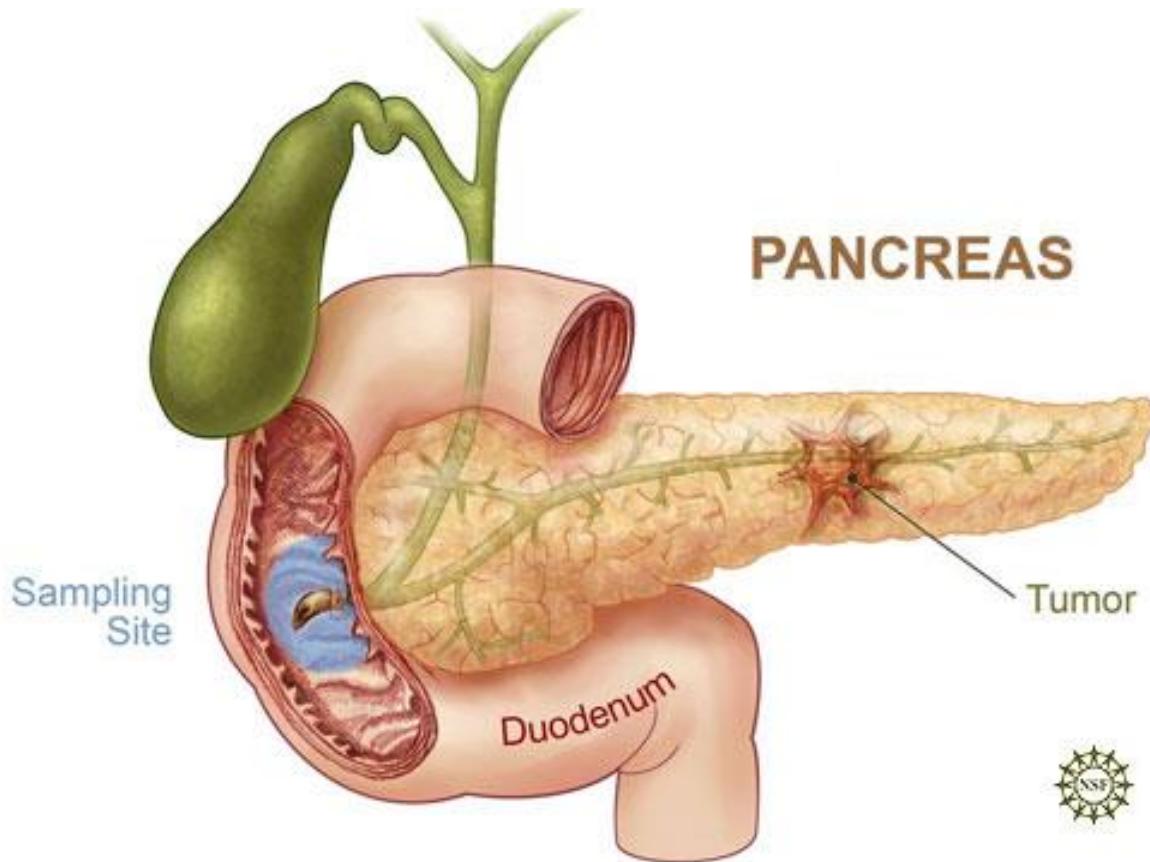
Seen within lobules. They receive secretions from intercalated ducts.



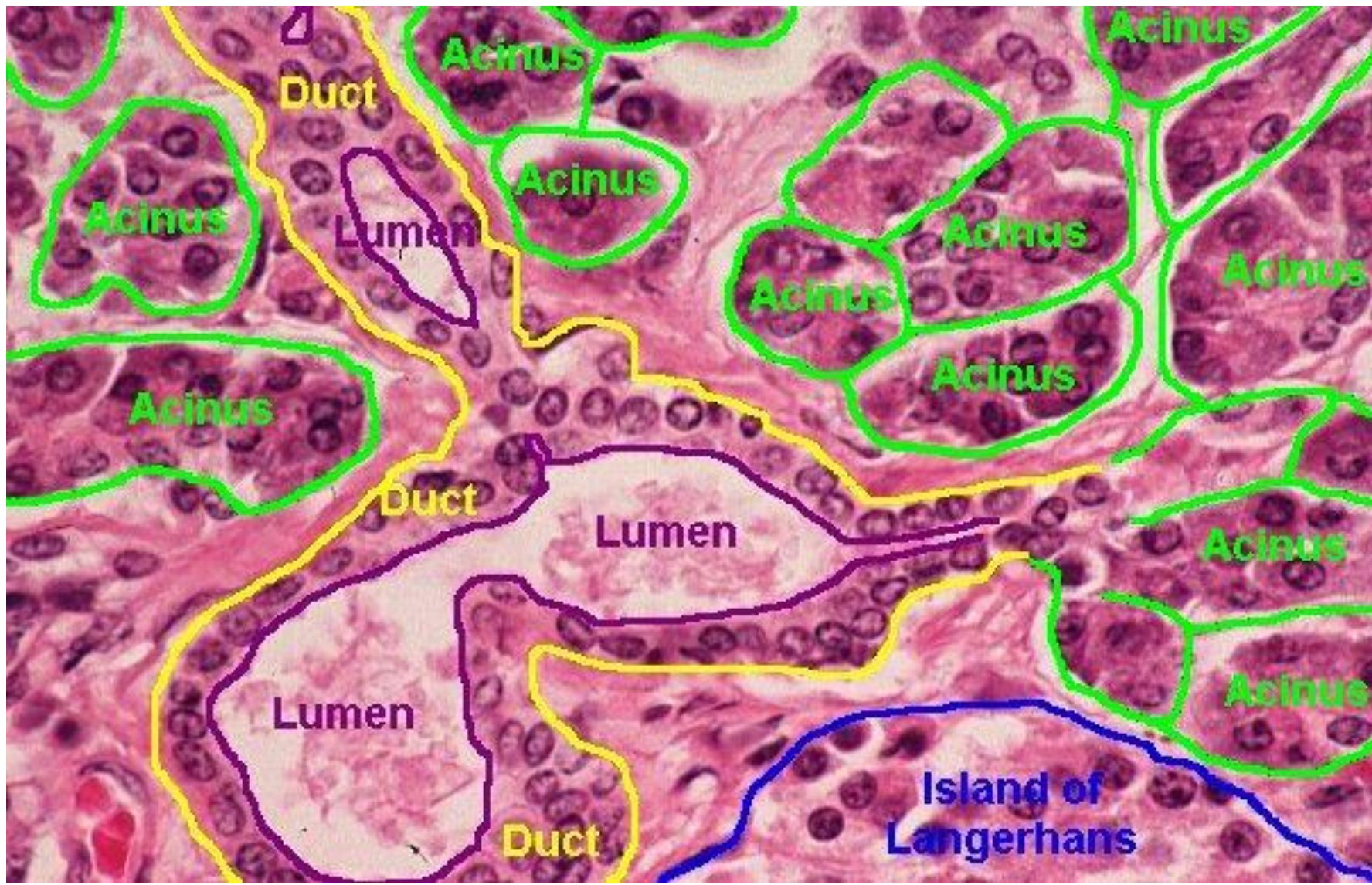


# Exocrine-Pancreas-Pancreatic Ducts

- The main pancreatic duct receive secretion from interlobular ducts and penetrates through the wall of the duodenum.



# Duct system



# Secretions

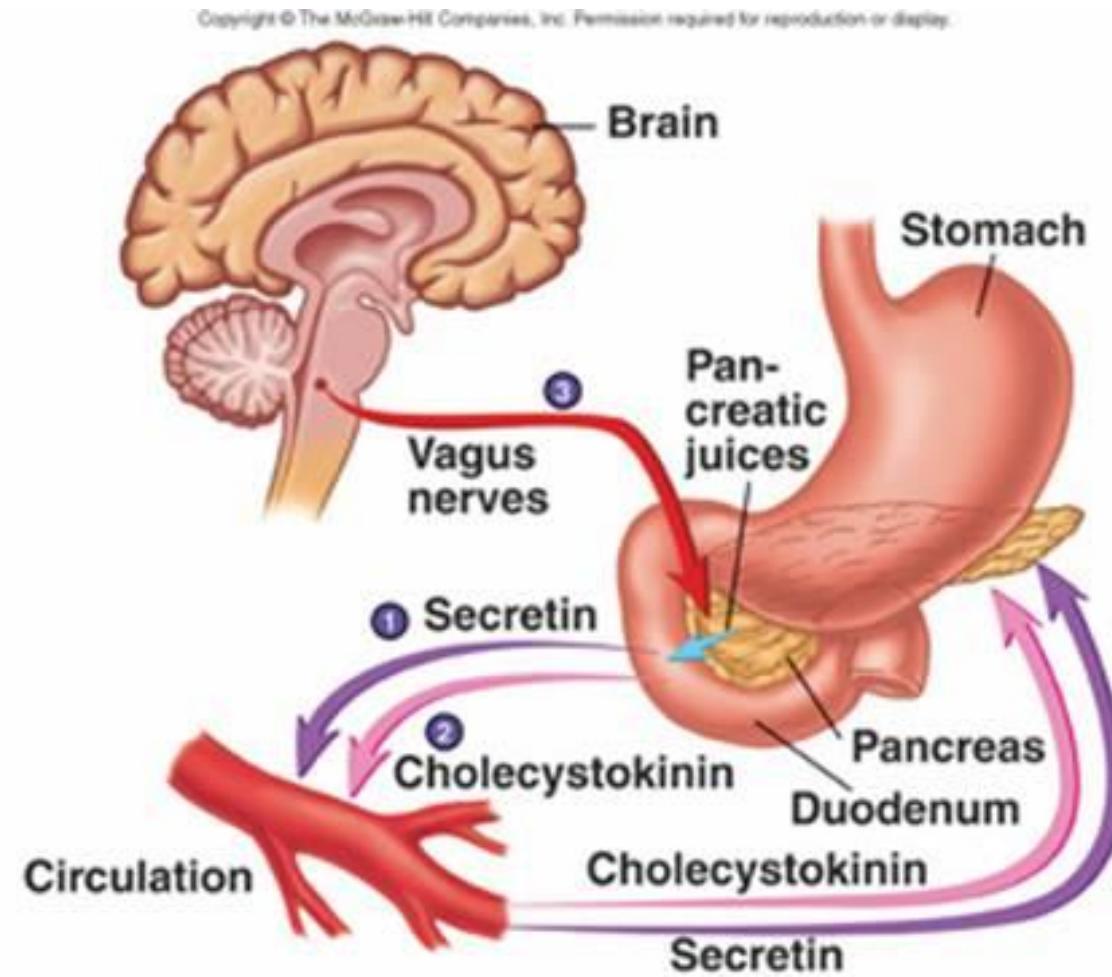
- water and ion
- trypsinogen
- chymotrypsinogen
- carboxypeptidases
- ribonucleases
- deoxyribonucleases
- Triglycerollipases etc.



# Control

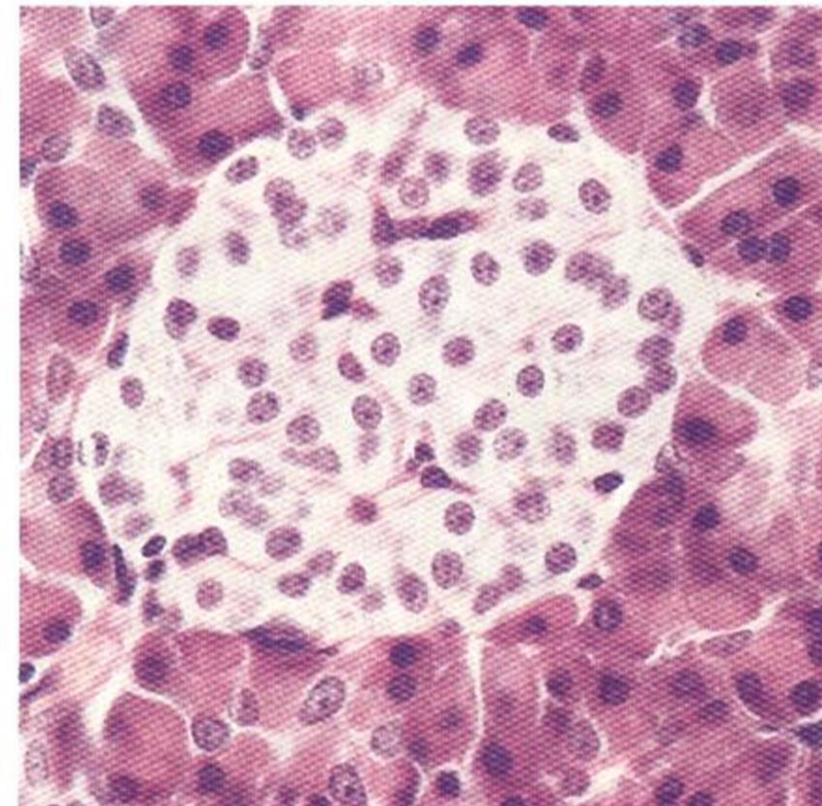
Secretion is controlled mainly by two hormones

- Secretin
- Cholecystokinin



# Histology of pancreas-Islets of Langerhans

- Multi hormonal
- Appear as rounded clusters of cells embedded within exocrine pancreatic tissue.
- Not arranged into acini (as in the exocrine pancreas)
- Most islets are 100-200  $\mu\text{m}$  in diameter.
- More than one million islets in human pancreas
- More abundant in tail of the pancreas
- Each islet consists of lightly stained rounded cells



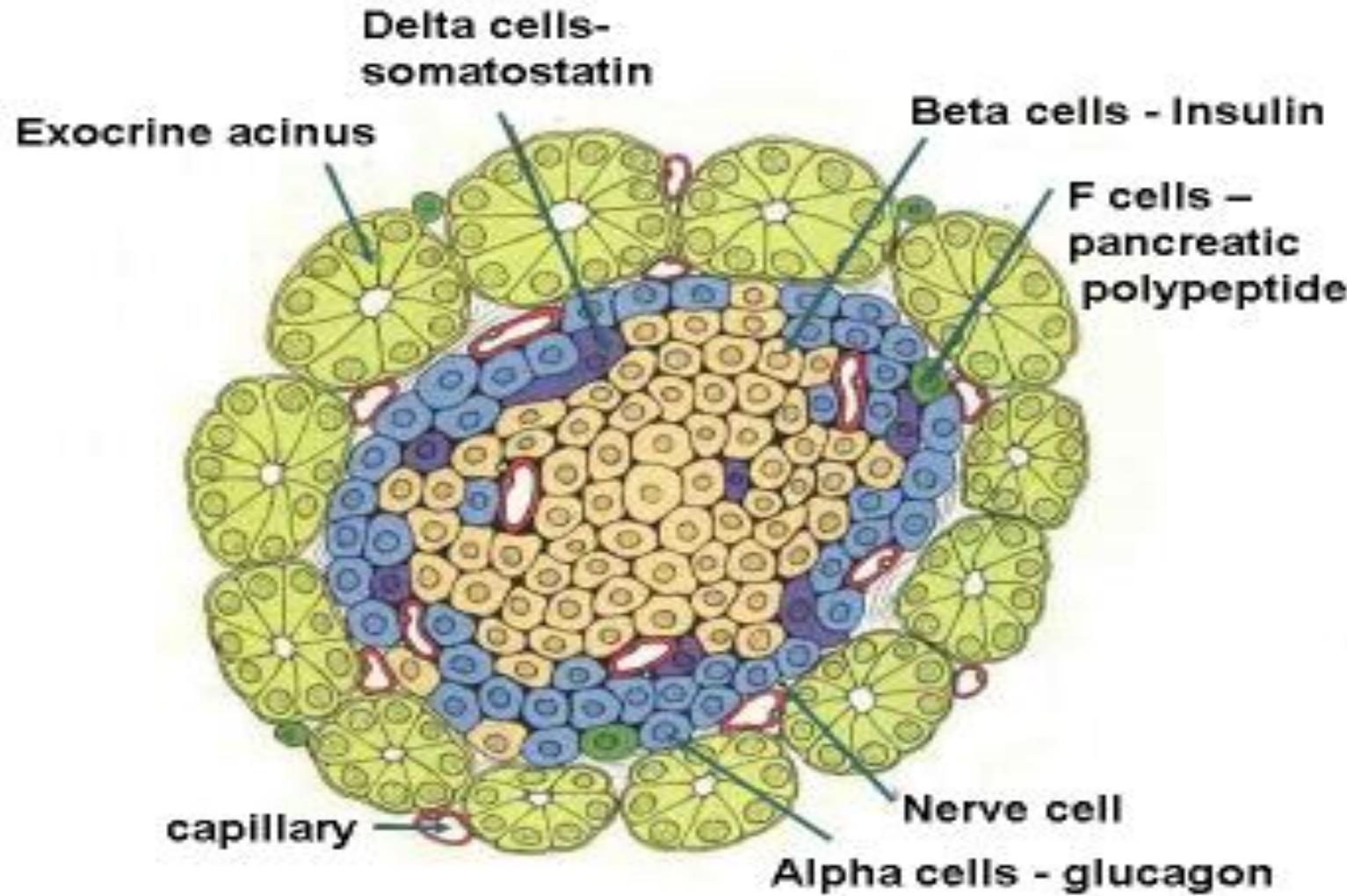
# Islets of Langerhans

- 4 types of cells- Alpha (A),Beta( B),Delta(D) and F cells
- Relative number of 4 cell types are not uniform
- Their location varies.
- Both sympathetic and parasympathetic nerve endings have been found in close association with of A,B,D cells
- Irregular cords and clumps surrounded by a rich capillary plexus.



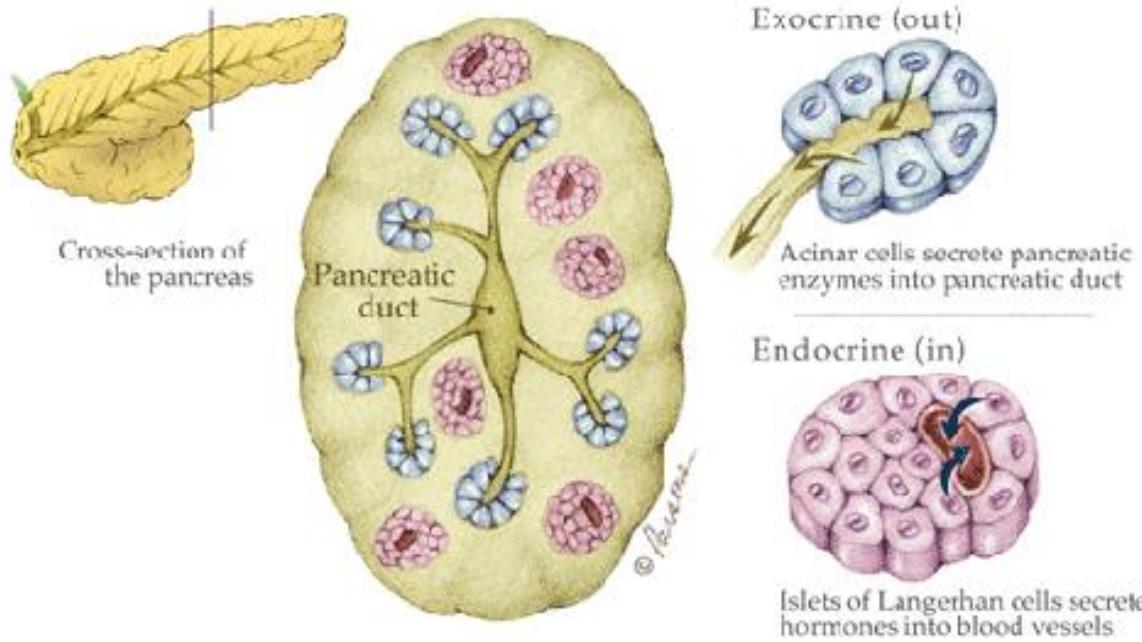
# Islets of Langerhans

## Islet of Langerhans



# Islets of Langerhans

- Arranged in cords separated by a network of fenestrated capillaries.
- Both cells and the blood vessels are innervated by autonomic nerve fibres
- Note that the islets are not separated from the acinar tissue by a capsule.



# Islets of Langerhans

- Alpha -20%
- Usually in periphery
- Secrete Glucagon

- Beta- 70%
- Central region
- Secrete insulin

- D- < 5%
- Variable site
- Secrete somatostatin

- F - rare
- Variable site
- Pancreatic polypeptide



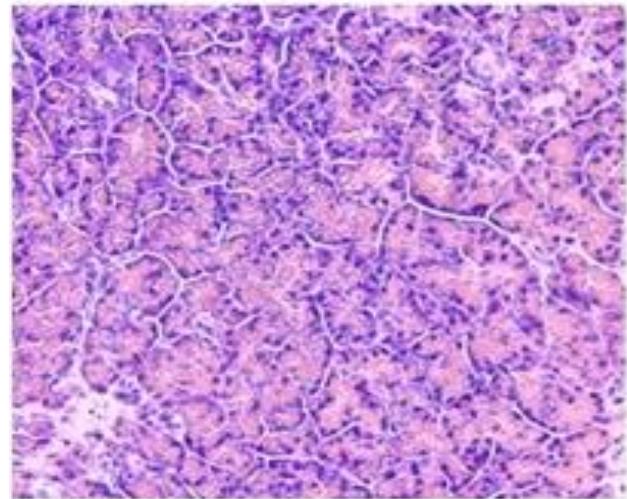
# Islets of Langerhans

- Alpha cells – glucagon - raises blood sugar level
- Beta cells – insulin – lowers blood sugar level
- Delta cells - somatostatin(GHIH) – act on paracrine to inhibit secretion of insulin and glucagon
- F cells – pancreatic polypeptide – regulate release of pancreatic digestive enzymes

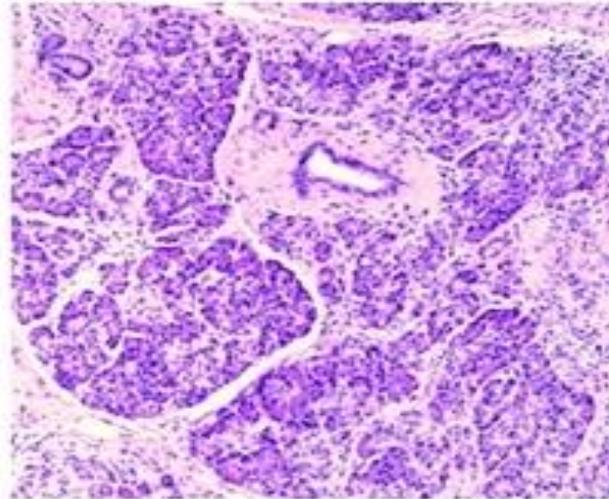


# Why we learn normal histology ?

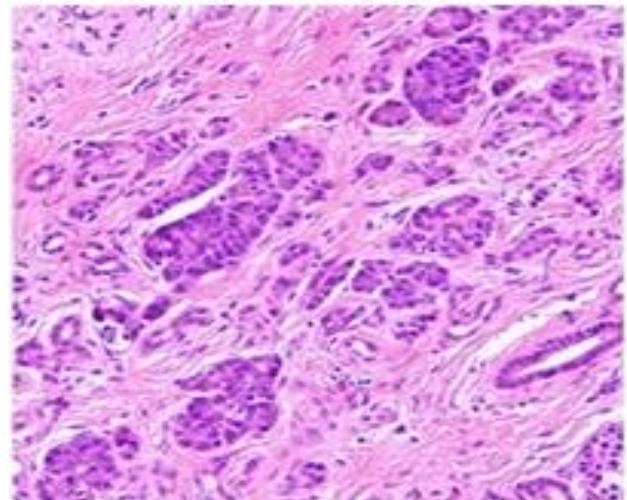
Non-disease control



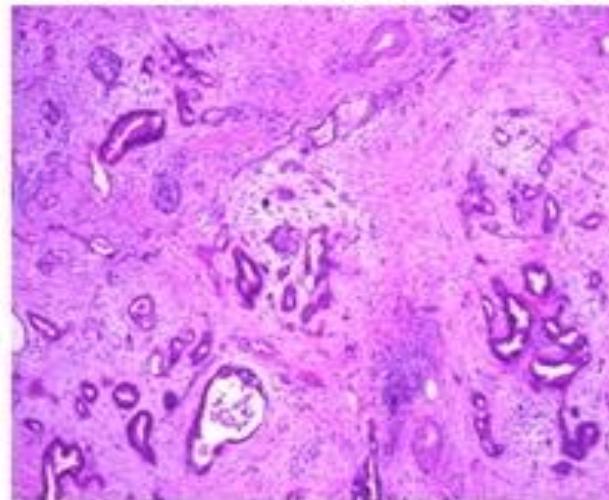
Mild chronic pancreatitis



Severe chronic pancreatitis

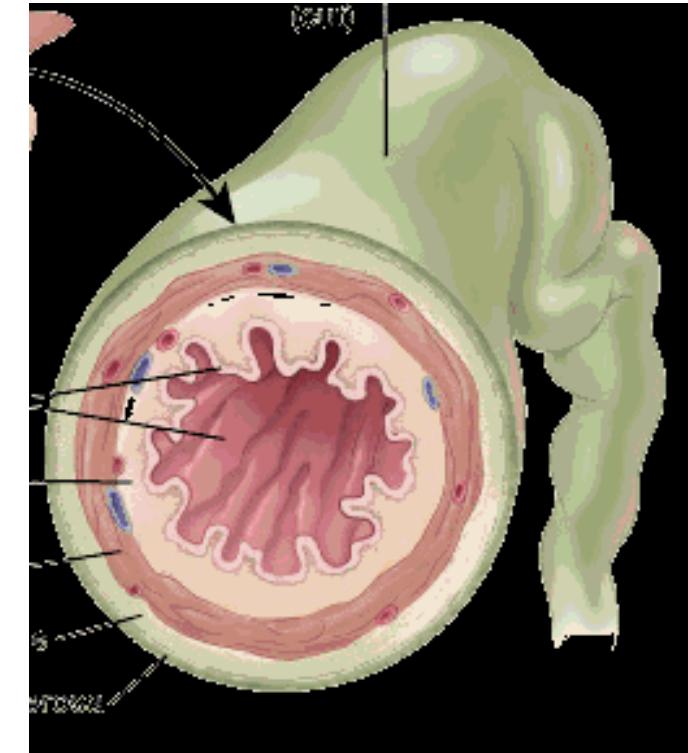


Pancreatic ductal adenocarcinoma



# Gall Bladder

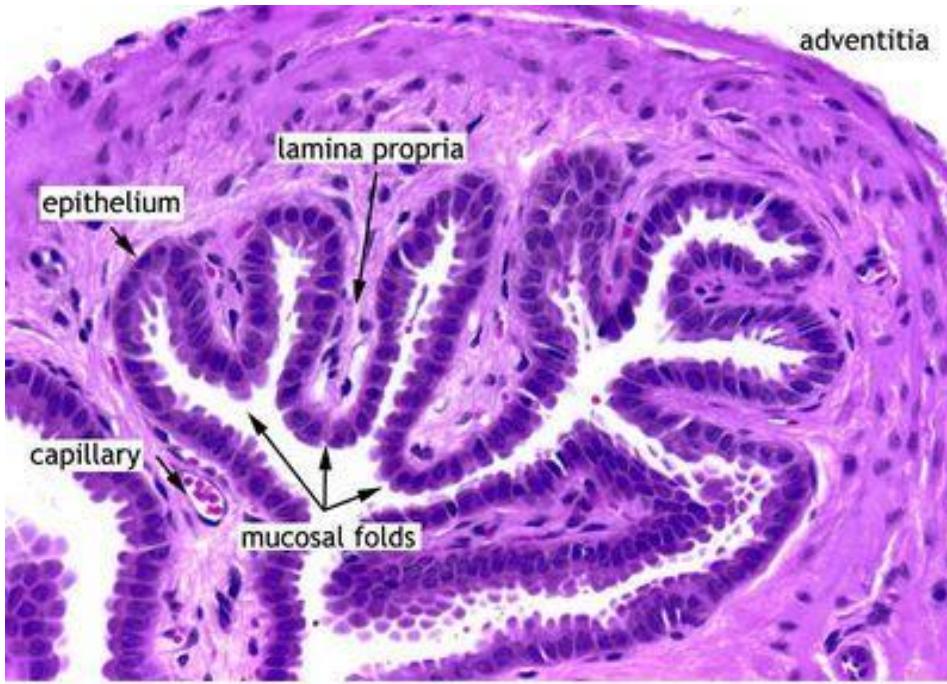
- Hollow pear shaped organ
- Attached to the lower surface of the liver
- Can store 30-50ml of bile.
- Communicates with hepatic duct with the cystic duct
- Wall-
  - mucosa
  - smooth muscle layer
  - perimuscular connective tissue
  - serous membrane



# Histology of Gallbladder

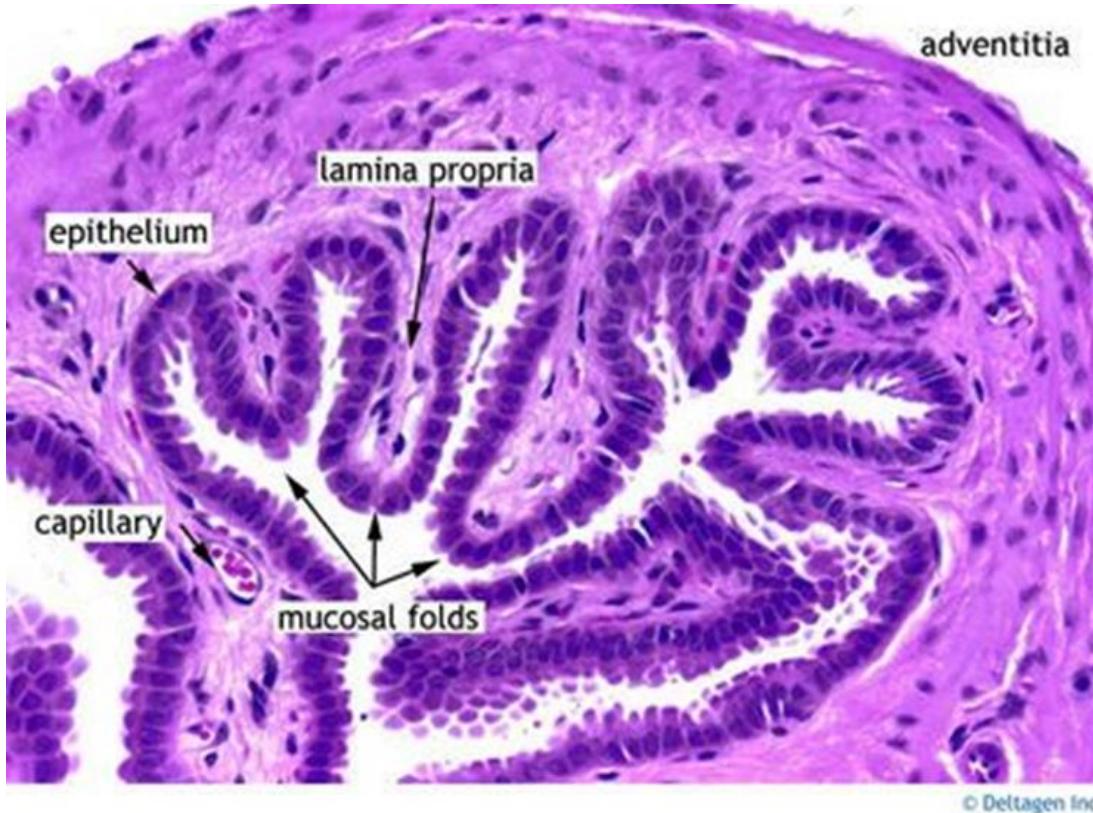
## Mucosa:

Variable branching folds, more prominent if gallbladder not distended



# Histology of Gallbladder

- Has mucosa, muscularis propria and serosa on free surface
- wall of the bladder does not have a muscularis mucosae and submucosa.

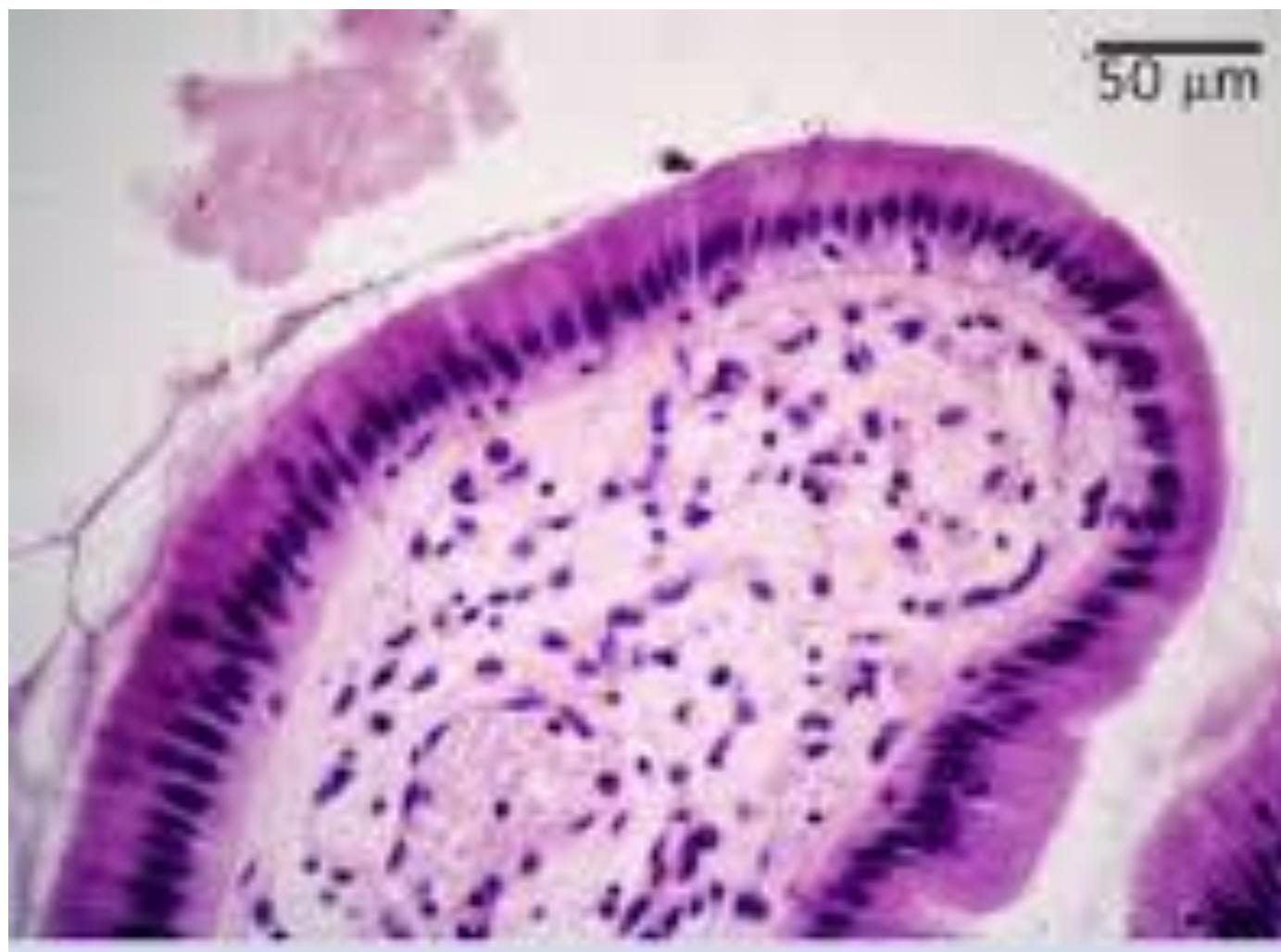


# Histology of Gallbladder: Surface epithelium

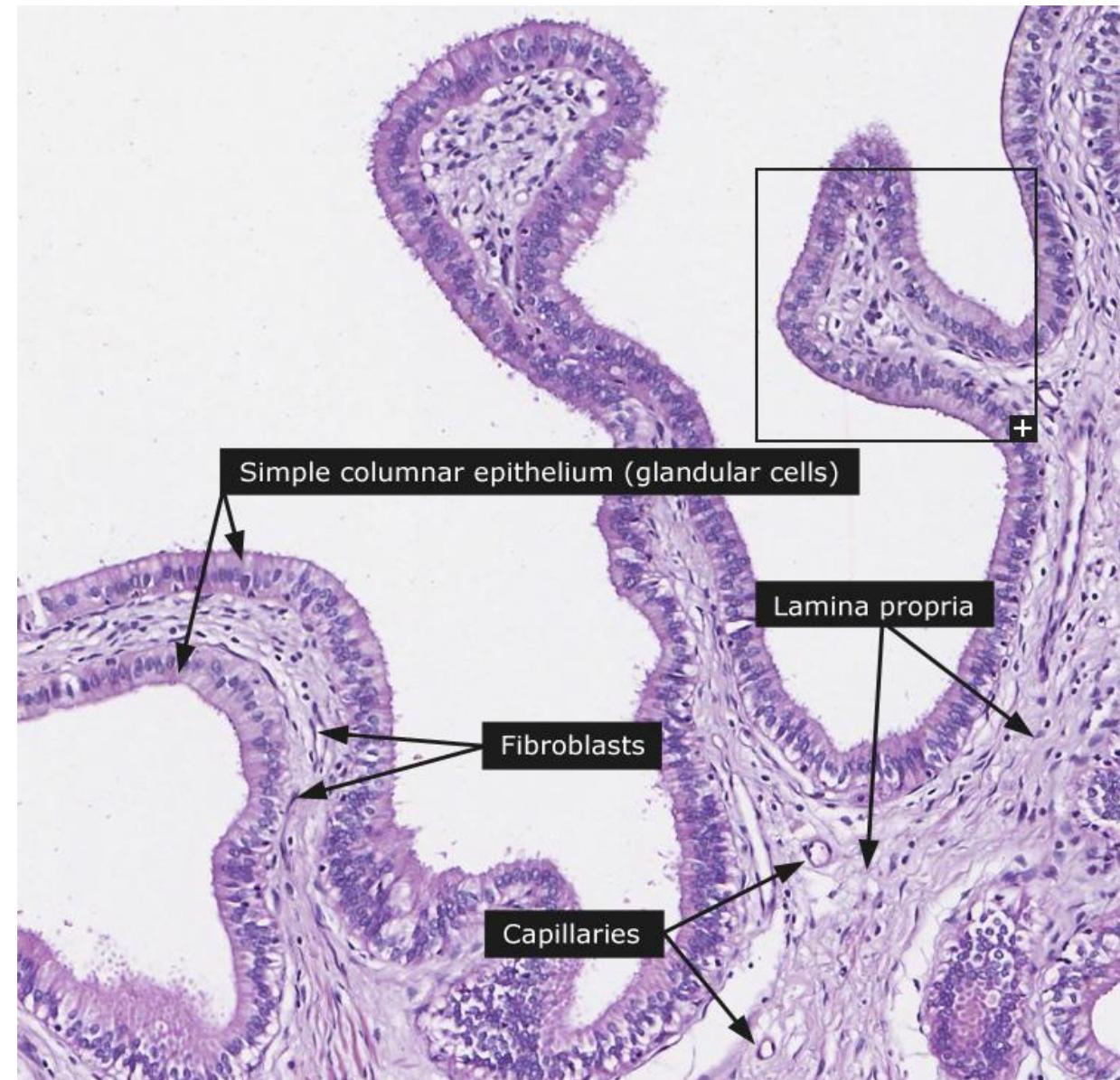
- Composed of single layer of uniform, tall columnar cells with basal nuclei
- Indistinct nucleoli, pale cytoplasm due to sulfomucins
- No goblet cells, myoepithelial cells or melanocytes
- Neck region has tubuloalveolar mucus glands



# Histology of Gallbladder



# Histology of Gallbladder:Lamina propria:

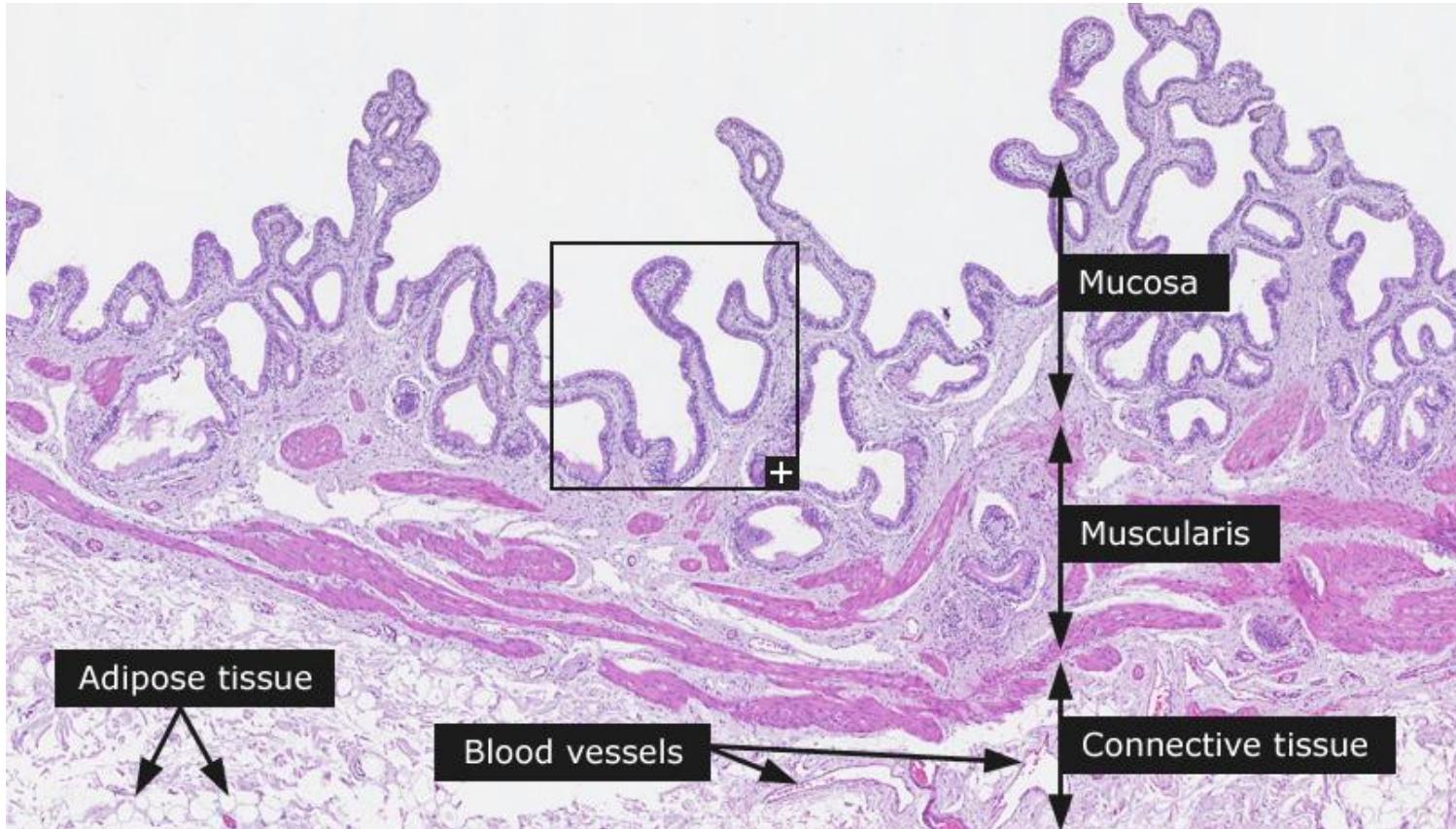


- Loose connective tissue with blood vessels, lymphatics



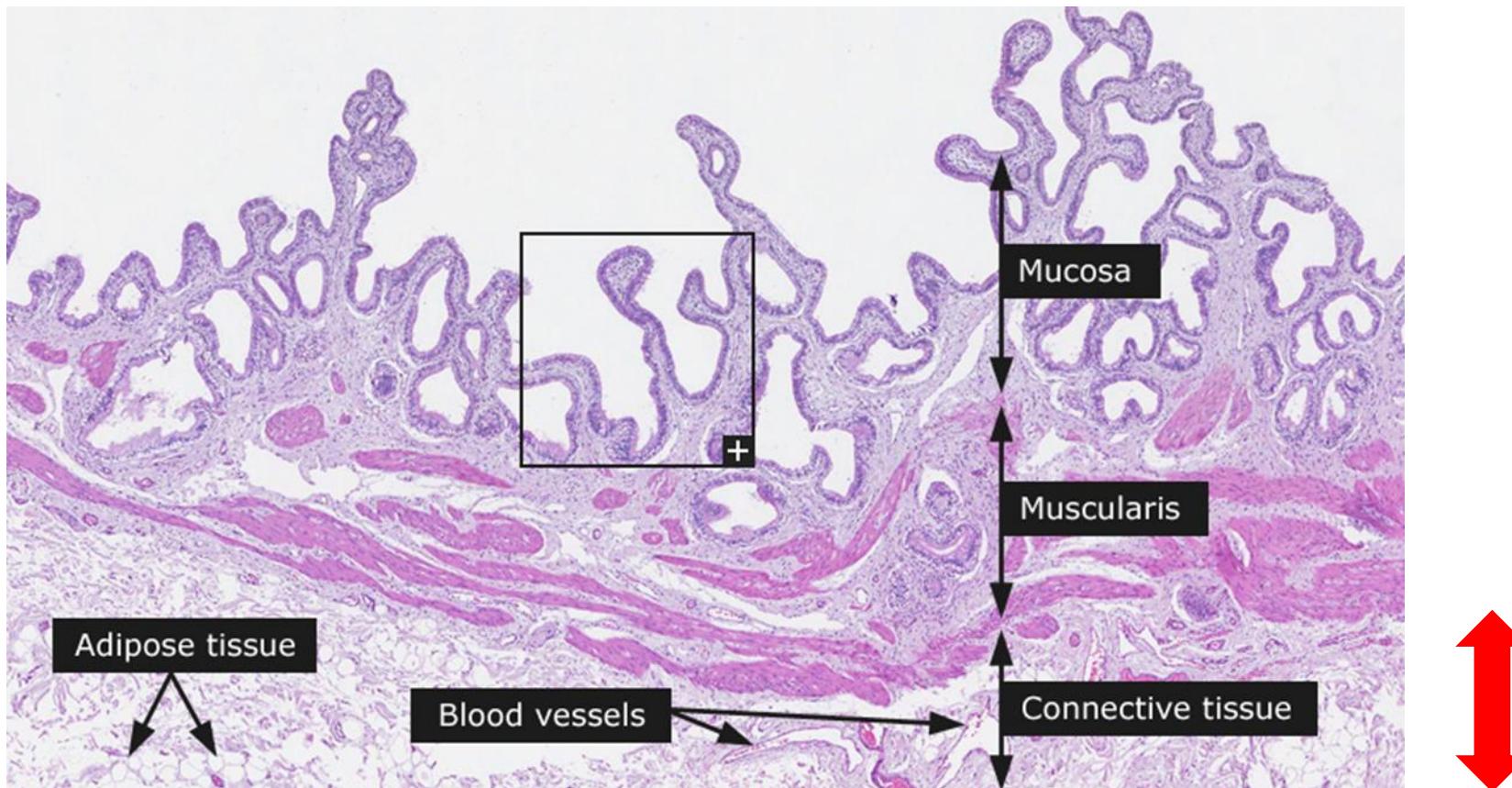
# Histology of Gallbladder: Muscular layer

- Circular, longitudinal and oblique smooth muscle fibers without distinct layers, resembles muscularis mucosa
- Adjacent to lamina propria without an intervening submucosa

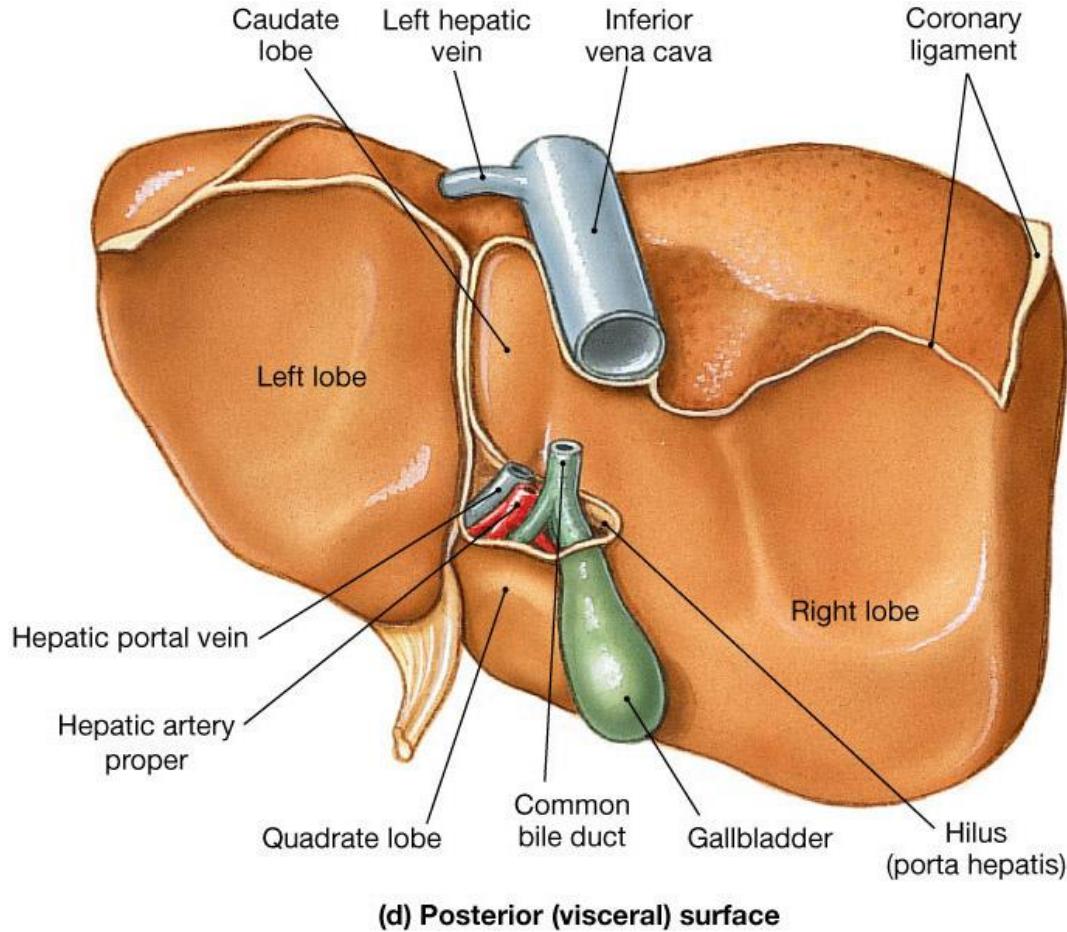


# Histology of Gallbladder: Adventitia

- Perimuscular connective tissue composed of collagen, elastic tissue, fat, vessels, lymphatics, nerves



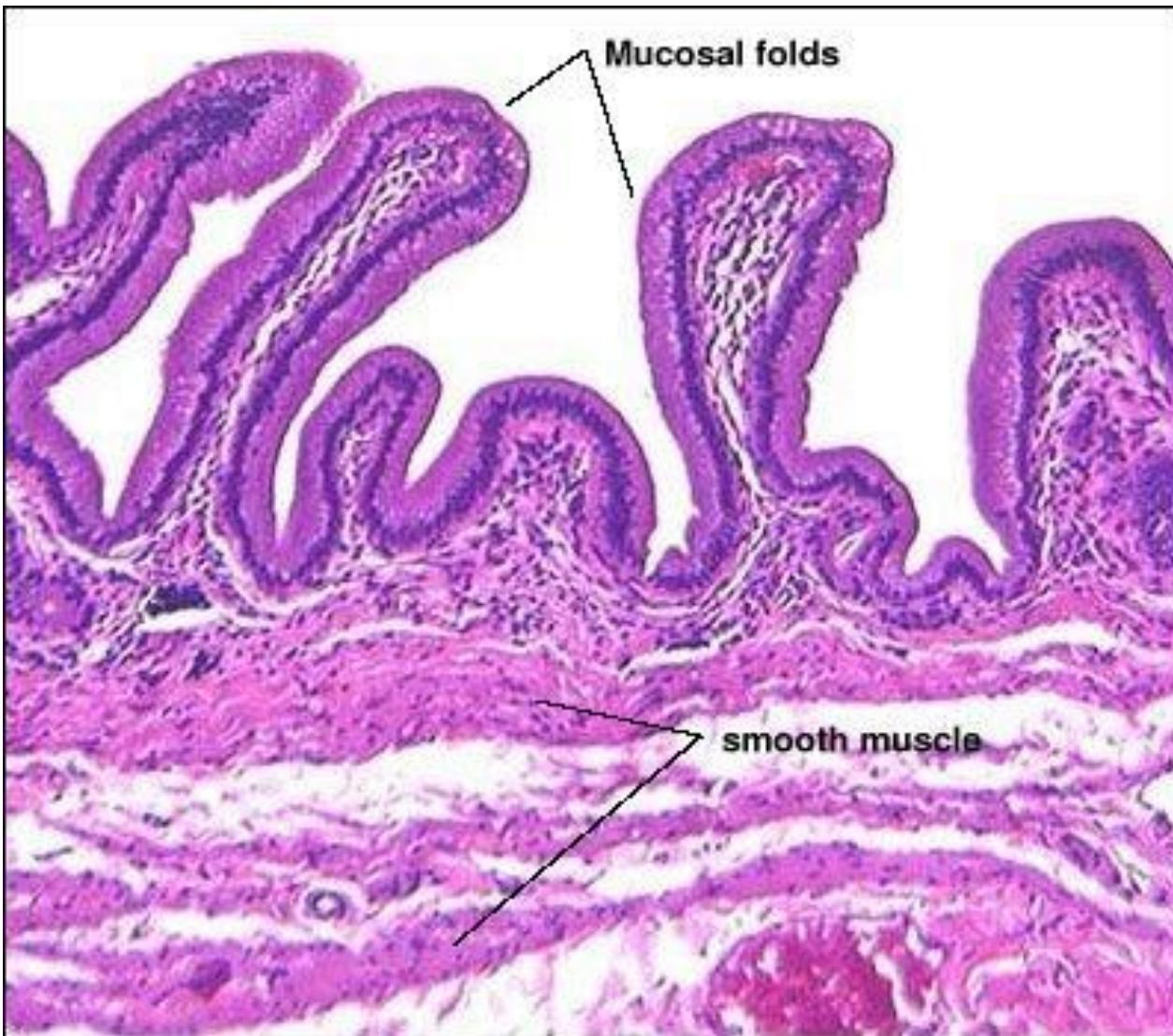
# Histology of Gallbladder: Peritoneum



Lines gallbladder that is not directly attached to liver  
continuous with that of liver



# Histology of Gallbladder



# THANK YOU .....!

