

Pancreas

- Mixed exocrine-endocrine gland producing digestive enzymes and hormones
- Thin capsule of connective tissue surrounds the pancreas, sending septa inside the organ to divide pancreatic lobules
- Digestive enzymes produced by the larger exocrine portion of the gland, which are acinar glands
- Hormones are synthesised in clusters of endocrine epithelial cells known as pancreatic islets

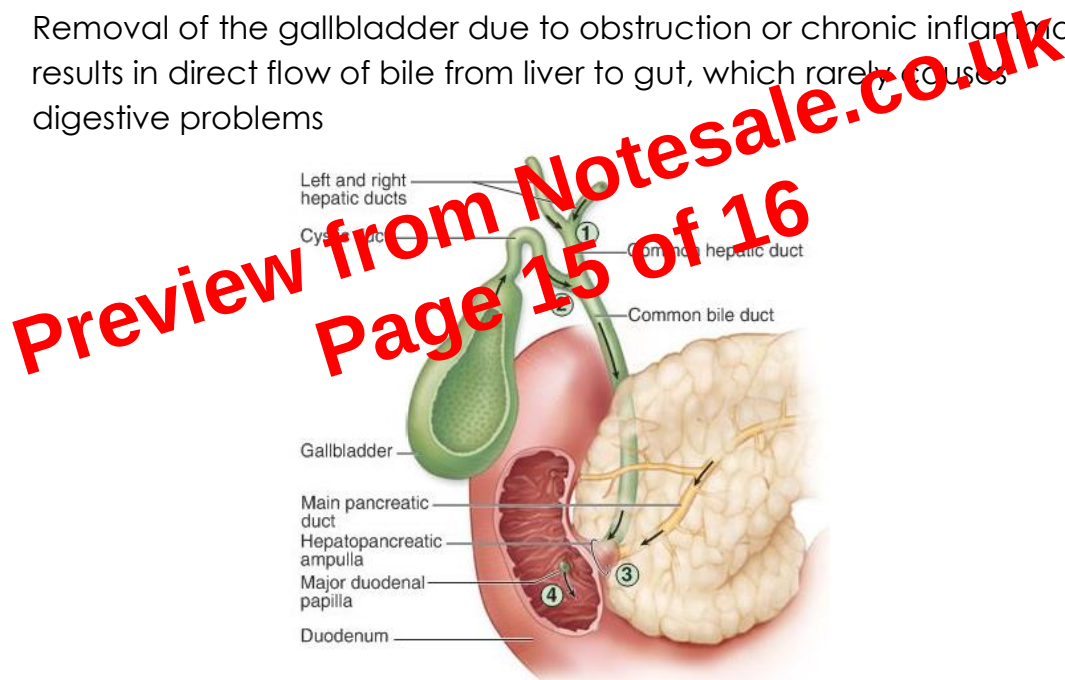
Exocrine pancreas

- Exocrine acini are composed of serous cells surrounding a small lumen
- Varied number of zymogen granules per cell (max after fasting)
- Exocrine pancreas secretes 1.5-2L of fluid each day
- Pancreatic juice is rich in HCO_3^- and digestive enzymes, including
 - Proteases (trypsinogen, chymotrypsinogen, proelastase, protease E, kallikreinogen, procarboxypeptidases)
 - Amylase
 - Lipase
 - Nuclease (DNase and RNase)
- Proteases stored as inactive zymogens and activated by enterokinase in the small intestine
 - Trypsin activated first, which leaves the other zymogens to active form in cascade
 - Prevents autodigestion of the pancreas
- Pancreatic secretion controlled mainly via polypeptide hormones CCK and secretin
 - Both produced by the enteroendocrine cells of the duodenum and jejunum
- PNS stimulation also increases pancreatic secretions
- Acid and partially digested food in the gastric chyme enters the duodenum and stimulates local release of CCK and secretin
- CCK promotes exocytosis of zymogens and other enzymes from pancreatic acinar cells
- Secretin causes addition of HCO_3^- and water, causing abundant alkaline fluid – neutralises the acidic chyme allowing enzymes to work at their optimal pH

- Mucous glands found in some areas of the cystic duct
- Thin muscularis layer, which becomes thicker toward the duodenum, then forms a sphincter that regulates bile flow

Gallbladder

- Hollow, pear shaped organ
- Attached to lower surface of the liver, can store 30-50mL of bile
- Wall is simple columnar epithelium and lamina propria with thin muscularis, and external adventitia
- Abundant folds in the mucosa
- Lining epithelia are active absorptive cells, with microvilli
- Main function of gallbladder is storing bile and concentrating it by absorbing water, then releasing it when necessary into the duodenum
- Na⁺ pump produces a sodium gradient, resulting in passive absorption of water
- CCK released from the small intestine stimulates contraction of the gallbladder
- Removal of the gallbladder due to obstruction or chronic inflammation results in direct flow of bile from liver to gut, which rarely causes digestive problems



Taken from Mescher, Junqueira's Basic Histology: Text and Atlas, Twelfth Edition.

Clinical note

Hepatic cancer

- Most malignant liver tumours from hepatocytes or cholangiocytes
- Usually associated with acquired disorders e.g. Hep B/C infection or cirrhosis
- In exocrine pancreas, tumours also arise from duct epithelia