NOTES:
The Digestive System
(Ch 14, part 2)
PANCREAS

Structure of the pancreas:

- The pancreas produces **PANCREATIC JUICE** that is then secreted into a pancreatic duct.
- The **PANCREATIC DUCT** leads to the **DUODENUM** (first portion of the small intestine)
Pancreatic juice contains enzymes that split or break down:

- carbohydrates  
- fats/lipids  
- proteins  
- nucleic acids

*pancreatic juice also has a high bicarbonate ion concentration that helps neutralize chyme and causes intestinal contents to be alkaline (basic).*
Hormones regulate / control pancreatic secretion:

• as chyme enters the duodenum, the duodenal mucous membrane secretes the hormone SECRETIN
  ➔ stimulates secretion of pancreatic juice that has a high conc. of bicarbonate ions

• proteins and fats in the chyme within the duodenum cause the duodenal membrane to release the hormone CHOLECYSTOKININ
  ➔ stimulates secretion of pancreatic juice that has a high conc. of digestive enzymes
LIVER

Structure of the liver:

● The liver is located in the upper right quadrant of the abdominal cavity – just below the diaphragm.

● The liver is divided into a large **RIGHT LOBE** and a smaller **LEFT LOBE**.
Structure of the liver:

- Each lobe consists of **HEPATIC LOBULES**, the functional units of the gland.

- Within the lobules are many small **BILE CANALS** which receive bile from the hepatic cells.

- These bile canals unite to form larger ducts and then converge to become the **HEPATIC DUCTS**.
Cholecystectomy with Injury to the Common Bile and Hepatic Ducts

Correct Post-operative Condition

Normal (Pre-operative) Anatomy

Actual Post-operative Condition

- Right hepatic duct
- Left hepatic duct
- Common hepatic duct
- Cystic duct
- Cystic artery
- Common bile duct
- Triangle of Calot
- Large clip across left hepatic duct
- Three (3) clips across common bile duct

Right hepatic duct
Left hepatic duct
Common hepatic duct
Cystic duct
Cystic artery
Common bile duct
Triangle of Calot
Large clip across left hepatic duct
Three (3) clips across common bile duct
Liver functions include:

- metabolizing carbohydrates, lipids, and proteins;
- storage of some substances;
- filtering the blood;
- destroying toxins;
- secreting bile.

**Bile is the only liver secretion that directly affects digestion!!**
Composition of BILE:

- BILE contains:
  - **bile salts**
  - *bile pigments*
  - **cholesterol**
  - **electrolytes**

*only the BILE SALTS have digestive functions!***
GALLBLADDER

→ the gallbladder stores bile between meals and releases bile into the small intestine via the **CYSTIC DUCT** and **COMMON HEPATIC DUCT**

→ cholesterol in the bile may form solid may form **GALLSTONES** which could block the ducts
Functions of Bile Salts:

- emulsify fats (surround and break them down into small droplets)

- aid in the absorption of fatty acids, cholesterol, and certain vitamins
SMALL INTESTINE

*the small intestine receives secretions from the pancreas and liver, completes nutrient digestion, absorbs the products of digestion, and transports the residues to the large intestine.
SMALL INTESTINE

- the small intestine consists of the:
  - DUODENUM (first 25 cm)
  - JEJUNUM
  - ILEUM
Structure of the small intestine wall:

- the wall is lined with **villi** that increase the surface area and aid in mixing and absorption
  (these, in turn, are covered with smaller extensions called **microvilli**)
- intestinal glands are located between the villi
Secretions of the small intestine:

- secretions include: **MUCUS** and **DIGESTIVE ENZYMES**
- digestive enzymes split molecules of **SUGARS, PROTEINS, and FATS** into simpler forms

*these secretions are released when stimulated by gastric juice, chyme, and stretching of the small intestine’s wall*
Absorption in the small intestine:

- the intestinal villi absorb the products of carbohydrate, protein, and fat digestion
- the villi also absorb electrolytes and water
**if food is rushed through the small intestine, not enough absorption of these things takes place and the result is DIARRHEA.**
LARGE INTESTINE

*the large intestine reabsorbs water and electrolytes, and forms and stores FECES
LARGE INTESTINE

- the large intestine consists of the:
  - CECUM
  - COLON
    (divided into the ASCENDING, TRANSVERSE, DESCENDING, and SIGMOID COLON)
  - RECTUM
  - ANAL CANAL
Functions of the Large Intestine:

- has little or no digestive function
- secretes mucus
- absorbs water and electrolytes
- forms and stores FECES
FECES consist of:
- Water
- Electrolytes
- Bacteria
- Undigested material
- Mucus
OMENTUM

- Curtain of fatty tissue that hangs down from stomach and liver, wraps around intestines
OMENTUM

• Functions
  – Temporary energy storage
  – Cushions and insulates abdomen
  – Role in immune responses
  – Role in metabolism (e.g. digesting of fatty acids)
OMENTUM

• “Milky Spots”
  – Clusters of white blood cells scattered throughout omentum
  – Filter abdominal fluid and control body’s reaction to gut bacteria (“police of gut”)
    • If detect harmful bacteria, it will kick off an immune response
    • If bacteria not harmful, tells body to stand down in immune response
• Omentum stretched out... darker spots are the “milky spots” with arrows pointing at them
OMENTUM

• It’s role in metabolism
  – A build up of the fat cells of this organ have been tied to diabetes
  – Loss of cells that can break down the fatty acids have also been linked to obesity and insulin sensitivity