Human Biology

Digestive System:
Accessory Organs
Accessory Organs

- Organs that are not in the digestive tract but aid in the digestive process

1. Pancreas
2. Liver
3. Gall Bladder
Pancreas

• An exocrine and endocrine gland
  • Exocrine Glands: release their products into ducts
  • Endocrine Glands: release their products directly into bloodstream
Pancreas - Exocrine Function

- Produces enzymes that aid in digestion
  - All enzymes released into S. Intestine
    - Via pancreatic duct --> bile duct --> to duodenum
    - In response to chyme from stomach entering S.Intestine
    - Enzymes: Pancreatic Amylase, Trypsin, Lipase, Nuclease

- Sodium bicarbonate
  - Found in pancreatic juice
    - Neutralizes stomach acid
      - Creates an optimal pH for enzymes (7.5-8.5 in duodenum)

Note: Mixture is called “Pancreatic Juice”
Pancreas - Endocrine Function

• **Insulin and Glucagon**
  - Protein hormones
    - Produced in Islets of Langerhans
    - Used to maintain blood sugar levels (glucose levels)
      - Normal blood sugar = 0.1% or 100mg/100mL

• **Insulin**
  - Responds to an increased blood glucose level
  - Makes cell membranes more permeable to glucose
    - By acting on protein carriers

• **Glucagon**
  - Responds to a decreased blood glucose level
    - Acts mainly on liver and fat cells
Diabetes Mellitus

Type 1
- “Insulin dependent”
- Body fails to produce insulin
- Must take insulin injections

Type 2
- Body fails to use insulin properly, combined with relative insulin deficiency
- Insulin injections not necessarily required
Liver

- The “Hepatic System”
- Largest gland/organ in the body
- Can regenerate!
- 4 lobes divided into thousands of lobules
- Produces over 400mL of bile each day!
Liver - Functions

1. Maintain blood homeostasis
   - Removes wastes from blood (detoxifies blood)
   - Recycles RBCs
   - Drug metabolism

2. Stores Vitamins A, D, E, K

3. Produces bile (watery, greenish substance)
   - For the emulsification of fats

4. Secretes bile to the gall bladder via bile ducts

5. Converts glucose to glycogen

6. Converts cholesterol into bile salts

7. Plasma protein synthesis
   - for transport, enzymes, immune function... etc.
RBC Recycling

- RBC continuously undergoes hemolysis (breaking apart)
  - In spleen, liver, bone marrow

- As RBC disintegrate, hemoglobin is broken down:
  - Globin (protein part), iron, and heme

- Heme reduced to BILIRUBIN
  - Transported to liver where it is excreted as BILE
Sugar Homeostasis

- Storage shed for **GLYCOGEN** (storage form of glucose)
  - Insulin promotes conversion of glucose to glycogen (to lower blood sugar)
  - Glucagon promotes conversion of glycogen into glucose (to increase our blood sugar)
Gluconeogenesis

- Generation of glucose from non-carbohydrate precursors such as lactate, glycerol, and amino acids
- Process to maintain blood glucose during periods of fasting, starvation, and/or intense exercise
- Occurs largely in the liver
Liver Disorders

1. Hepatitis (liver inflammation)
   A. Result of sewage contaminated water
   B. Sexually transmitted, thru blood transfusions/needles
   C. Contact with infected blood (no vaccine)

There is also a D and E!!!
Liver Disorders

2. Cirrhosis
   - Chronic condition
   - Liver tissue replaced with scar tissue
   - Irreversible damage
   - Common effect of hepatitis and alcoholism

3. Jaundice
   - Caused by high levels of bilirubin in blood
   - Yellowing of the skin and whites of eyes
Gall Bladder

- Stores BILE in between meals
- Bile is secreted to the duodenum through the bile duct DURING mealtime
**Bile**

- Contains bile salts, pigments, cholesterol and phospholipids

- Bile is an **emulsifier** NOT an enzyme

- Emulsifier - dissolves fat into the watery contents of the intestine
  - Bile DOES NOT breakdown fat or lipid
    - **LIPASE** (from pancreas) does this!