The Digestive System - Chapter 15
Functions of the Digestive System

- **Ingestion** - the process of taking foods and liquid into the mouth.
- **Secretion** - the release of water, acid, buffers, and enzymes by cells and accessory organs into the lumen.
- **Mixing and propulsion** - alternating contraction and relaxation of smooth muscle.
- **Digestion** - mechanical and chemical break down of organic material into small molecules.
- **Absorption** - uptake of fluids, small molecules, and ions by epithelial cells lining the lumen.
- **Defecation** - elimination of indigestible substances, bacteria, cells, and digested materials through the anus.
The Digestive System

• **Long hollow tube** - the gastrointestinal tract.
  – **Lumen** - the hollow region that food, fluids, and waste travels through.

• **Accessory organs** secrete substances into the GI tract (salivary glands, pancreas, liver, gallbladder).
The Mouth

- **Anatomy** - entrance to digestive system.

- **Functions**
  - **Determine quality- taste buds.**
  - **Mechanical breakdown- teeth.**
  - **Chemical breakdown- enzymes are secreted from the salivary glands.**
  - **Formation of a bolus- a soft and round mass of food, formed by the tongue.**
Taste Buds- determine quality

- **Anatomy**: located along the sides of papillae.
- **Function**: to determine food quality.

\[E. coli\]
Salivary Glands - chemical breakdown
Tongue- bolus formation
Pharynx- throat

• **Anatomy**
  – Muscular tube (5 inches long) that hangs from the skull.

• **Functions**
  – **Acts as a passageway for food and air.**
  – **Swallow**
    • Soft palate closes off the nasopharynx, and the larynx moves under the epiglottis to cover the rima glottidus.
The Pharynx - throat

Nasopharynx

Oropharynx

Laryngopharynx
The Esophagus

• **Anatomy**
  – A collapsible 10 inch long muscular tube.

• **Functions**
  – Secrete mucus and transport food from the pharynx to the stomach.
    • Rhythmic waves of muscle contraction (peristalsis).
Stomach Anatomy

- J-shaped muscular sac with 3 layers of smooth muscle and **rugae** lining the inner wall.
Stomach Histology

- Inner lining contains millions of gastric glands.
  - **Gastric juice** - HCL and pepsinogen, 3 liters/day.
  - **Mucus** - protects the stomach from gastric juice, alkaline in pH.
Peptic Ulcer Disease
Stomach Functions

• **3 Major Functions**
  – Storage of food.
  – Liquefaction of food.
  – Initiation of protein digestion.

• **Smooth muscles churn and mix food and gastric juices for 3-5 hours.**
  – **Chyme** - a soupy mixture of food and gastric juices.
Small Intestine

- **Functions**
  - Chemical digestion
  - Nutrient absorption

- **Anatomy**
  - Duodenum (1\textsuperscript{st} 10 inches).
    - Enzymes
    - Bile
      - Sodium Bicarbonate
  - Jejunum (3 feet).
  - Ileum (6 feet).
Greater Omentum - fatty apron.

Small intestine
Small Intestine Histology

• The inner walls contain circular folds, villi, and microvilli (brush border).
Pancreas

- **Anatomy**
  - **Exocrine tissue** - produce and secrete digestive juices.
- **Functions**
  - **Enzymes** - chemical digestion.
Location of the Pancreas
Liver Functions

• All absorbed nutrients are sent to the liver for processing via the hepatic portal vein.
• 500 functions to the liver
  – Detoxifies blood.
  – Stores iron and fat-soluble vitamins (A, D, E, K).
  – Stores glucose as glycogen, breaks down glycogen.
  – Regulates blood cholesterol.
Gallbladder

- **Anatomy** - pear-shaped sac.
- **Function** - stores bile, ~50 ml.
- **Bile**
  - Yellow-green color.
  - **Components:**
    - Water and cholesterol.
    - Na and K salts of bile acids.
    - Bile pigments (bilirubin).
Gallstones
Large Intestinal Anatomy

- Diameter is ~3 inches, length is ~5 feet.
- Consists of 4 specialized regions
  - Cecum (~3 inches long)
  - Colon
    - Ascending, transverse, descending, sigmoid.
  - Rectum
  - Anus
Large Intestine Functions

- Absorb water, sodium, and potassium ions from indigestible foods.
- Store feces.
- Eliminate the feces from the body.
- Passes material in 18-24 hours.

Note:
No enzymes are secreted by the large intestine.
Symbiotic Bacteria Reside in the Colon

- **Numbers** - about 50 species.
- **Fecal component** - accounts for 1/3 of the weight of feces.
- Nourished by undigested foods.
- Metabolic processes produce gas.
- Some produce vitamins B and K.
- They decompose pigmented molecules, which give feces its brown color.
Respiratory System - Chapter 14
Functions of the Respiratory System

- Gas exchange
- Site for sense of smell receptors
- Filters inspired air
- Aides in sound production
- Regulate blood pH
Respiratory Structures

- **Upper respiratory tract**
  - Sinuses
  - Nasal Cavity
  - Pharynx - throat
  - Larynx - voice box

- **Lower respiratory tract**
  - Trachea - windpipe
  - Bronchial tree - airways
  - Lungs
The Nose and Sinuses

- **Anatomy**
  - **Nose**
    - Two cavities.
      - Composed of bone and cartilage.
  - **Sinuses**
    - Four air-filled spaces in the skull.

- **Functions of the Nasal Cavity**
  - Olfaction; filter, warm and moisten air.

- **Functions of the Paranasal Sinuses**
  - Lighten skull, resonate voice, warm and moisten air.
Sinuses

- Frontal sinus
- Ethmoid sinuses
- Maxillary sinus
The Pharynx - throat

- Nasopharynx
- Oropharynx
- Laryngopharynx
- Internal nares
- Tonsils
- Cricoid cartilage
The Larynx - voice box

- Passageway for air.
  - When food is swallowed, the larynx moves against the epiglottis preventing food from passing into it.
- The larynx contains the vocal cords, which are stretched across the rima glottidus.
Cartilage of the Larynx

- Epiglottis
- Thyroid cartilage
- Adam’s Apple
- Cricoid cartilage
Movement of Vocal Cords

- Vocal folds are open during breathing and closed during speech.
Trachea- windpipe

- **Size**- 5 inches long and 1 inch in diameter.
- **Position**- anterior to the esophagus.
- **Tracheal cartilage**- 16 to 20 incomplete rings.
  - Open side faces esophagus.
- **Mucosa**- epithelium with cilia and goblet cells.
• Each bronchiole leads to an elongated space (lobule) that is enclosed by alveoli.
• **Alveoli**- surfaces for gas exchange, 300 million in each lung, surface area of a tennis court.
  – A thin-walled, round chamber, surrounded by a vast network of capillaries.
  – Gases diffuse from alveoli into blood in the capillaries.
• **Inspiration**  
Inhalation, air is conducted toward the lungs.

• **Expiration**  
Exhalation, air is conducted away from the lungs.
Inspiration Versus Expiration

a. Inspiration
- Rib cage moves up and out.
- Diaphragm contracts and moves down.
- Pressure in lungs decreases, and air comes rushing in.
- Diaphragm

b. Expiration
- Rib cage moves down and in.
- Diaphragm relaxes and moves up.
- Pressure in lungs increases, and air is pushed out.
- Diaphragm
"Well, Moby - good thing Sid knew the Heimlich Maneuver."

Give a sudden jerk at a 45-degree angle. Quickly repeat this upward abdominal thrust 6 to 10 times until successful.

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The Lungs

- **Position** - lie on both sides of the heart within the thoracic cavity; lined by pleura.
  - Right lung has 3 lobes
  - Left lung has 2 lobes
- Each lobe is divided into lobules.
2 Circuits of Gas Exchange

- **Pulmonary Circuit** - circulates blood through the lungs.
- **Systemic Circuit** - circulates blood through the rest of the body.
Respiration and Health

• **Upper Respiratory Tract Infections**
  – **Sinusitus**- infection of the cranial sinuses.
  – **Tonsillitis**- inflammation and enlargement of tonsils.
  – **Rhinitis**- chronic or acute inflammation of the mucus membrane of the nose.
  – **Laryngitis**- infection of larynx with hoarseness and inability to talk.

• **Lower Respiratory Tract Infections**
  – **Bronchitis**- infection of primary and secondary bronchi.
  – **Pneumonia**- acute viral or bacterial infection or inflammation of the alveoli.
  – **Tuberculosis (TB)**- a highly variable and infectious communicable disease caused by a bacterium that damages the lungs and the pleurae.
Smoking and Disease

- **Smoking** - leading cause of death in the U.S.
- **One cigarette** - 5-7 minutes off your life, 10 years total on average.
- **Smoke** - 4,000 substances.
  - 3 radioactive substances.
  - 50 carcinogens.
  - **Poisons** - hydrogen cyanide, carbon monoxide, and cresols.