The Digestive System and Body Metabolism

- Gross Anatomy
- Function

The Digestive System Functions

- Ingestion—taking in food
- Digestion—breaking food down both physically and chemically
- Absorption—movement of nutrients into the bloodstream
- Defecation—rids the body of indigestible waste

Organs of the Digestive System

- Two main groups
  - Alimentary canal (gastrointestinal or GI tract)—continuous coiled hollow tube
  - Accessory digestive organs

Organs of the Digestive System

Figure 14.1
Organs of the Alimentary Canal

- Mouth
- Pharynx
- Esophagus
- Stomach
- Small intestine
- Large intestine
- Anus

Mouth (Oral Cavity) Anatomy

- Lips (labia)—protect the anterior opening
- Cheeks—form the lateral walls
- Hard palate—forms the anterior roof
- Soft palate—forms the posterior roof
- Uvula—fleshy projection of the soft palate

Mouth (Oral Cavity) Anatomy

- Vestibule—space between lips externally and teeth and gums internally
- Oral cavity proper—area contained by the teeth
- Tongue—attached at hyoid bone and styloid processes of the skull, and by the lingual frenulum to the floor of the mouth
- Tonsils
  - Palatine
  - Lingual

Mouth (Oral Cavity) Anatomy

- Hard palate
- Oral cavity
- Lips (labia)
- Vestibule
- Lingual frenulum
- Palatine tonsil
- Hyoid bone
- Trachea
Mouth (Oral Cavity) Anatomy

Mouth Physiology

- Mastication (chewing) of food
- Mixing masticated food with saliva
- Initiation of swallowing by the tongue
- Allows for the sense of taste

Pharynx Anatomy

- Nasopharynx—not part of the digestive system
- Oropharynx—posterior to oral cavity
- Laryngopharynx—below the oropharynx and connected to the esophagus
Pharynx Physiology
• Serves as a passageway for air and food
• Food is propelled to the esophagus by muscle layers
• Food movement is by alternating contractions of the muscle layers (peristalsis)

Esophagus Anatomy and Physiology
• Anatomy
  • About 10 inches long
  • Runs from pharynx to stomach through the diaphragm
• Physiology
  • Conducts food by peristalsis (slow rhythmic squeezing)
  • Passageway for food only (respiratory system branches off after the pharynx)

Stomach Anatomy
• Located on the left side of the abdominal cavity
• Food enters at the cardioesophageal sphincter
• Food empties into the small intestine at the pyloric sphincter (valve)

Stomach Anatomy
• Regions of the stomach
  • Cardiac region—near the heart
  • Fundus—expanded portion lateral to the cardiac region
  • Body—midportion
  • Pylorus—funnel-shaped terminal end
Stomach Anatomy

- Rugae—internal folds of the mucosa
- External regions
  - Lesser curvature—concave medial surface
  - Greater curvature—convex lateral surface
Slide 21

Stomach Anatomy

Slide 22

Stomach Physiology
- Temporary storage tank for food
- Site of food breakdown
- Chemical breakdown of protein begins
- Delivers chyme (processed food) to the small intestine

Slide 23

Small Intestine
- The body’s major digestive organ
- Site of nutrient absorption into the blood
- Muscular tube extending from the pyloric sphincter to the ileocecal valve
- Suspended from the posterior abdominal wall by the mesentery

Slide 24

Subdivisions of the Small Intestine
- Duodenum
  - Attached to the stomach
  - Curves around the head of the pancreas
- Jejunum
  - Attaches anteriorly to the duodenum
- Ileum
  - Extends from jejunum to large intestine
Chemical Digestion in the Small Intestine

- Chemical digestion begins in the small intestine
- Enzymes are produced by
  - Intestinal cells
  - Pancreas
- Pancreatic ducts carry enzymes to the small intestine
- Bile, formed by the liver, enters via the bile duct

Small Intestine Anatomy

- Three structural modifications that increase surface area
  - Microvilli—tiny projections of the plasma membrane (create a brush border appearance)
  - Villi—fingerlike structures formed by the mucosa
  - Circular folds (plicae circulares)—deep folds of mucosa and submucosa
Small Intestine Anatomy

Large Intestine

- Larger in diameter, but shorter in length, than the small intestine
- Frames the internal abdomen

Large Intestine Anatomy

- Cecum—saclike first part of the large intestine
- Appendix
  - Accumulation of lymphatic tissue that sometimes becomes inflamed (appendicitis)
  - Hangs from the cecum
Large Intestine Anatomy

- Colon
  - Ascending—travels up right side of abdomen
  - Transverse—travels across the abdominal cavity
  - Descending—travels down the left side
  - Sigmoid—enters the pelvis
- Rectum and anal canal—also in pelvis

Large Intestine Anatomy

- Anus—opening of the large intestine
  - External anal sphincter—formed by skeletal muscle and under voluntary control
  - Internal involuntary sphincter—formed by smooth muscle
  - These sphincters are normally closed except during defecation
Large Intestine

Figure 14.8

Large Intestine Anatomy

- No villi present
- Goblet cells produce alkaline mucus which lubricates the passage of feces
- Muscularis externa layer is reduced to three bands of muscle called teniae coli
- These bands cause the wall to pucker into haustra (pocketlike sacs)

Accessory Digestive Organs

- Teeth
- Salivary glands
- Pancreas
- Liver
- Gallbladder

Teeth

- Function is to masticate (chew) food
- Humans have two sets of teeth
  - Deciduous (baby or “milk”) teeth
  - 20 teeth are fully formed by age two
Teeth
• Permanent teeth
  • Replace deciduous teeth between the ages of 6 and 12
  • A full set is 32 teeth, but some people do not have wisdom teeth (third molars)
  • If they do emerge, the wisdom teeth appear between ages of 17 and 25

Classification of Teeth
• Incisors—cutting
• Canines—tearing or piercing
• Premolars—grinding
• Molars—grinding

Regions of a Tooth
• Crown—exposed part
  • Enamel—hardest substance in the body
  • Dentin—found deep to the enamel and forms the bulk of the tooth
  • Pulp cavity—contains connective tissue, blood vessels, and nerve fibers
  • Root canal—where the pulp cavity extends into the root
Slide 45

Regions of a Tooth
- Neck
  - Region in contact with the gum
  - Connects crown to root
- Root
  - Cementum—covers outer surface and attaches the tooth to the periodontal membrane

Slide 46

Regions of a Tooth

Slide 47

Salivary Glands
- Three pairs of salivary glands empty secretions into the mouth
  - Parotid glands
  - Submandibular glands
  - Sublingual glands

Slide 48

Salivary Glands
Saliva
- Mixture of mucus and serous fluids
- Helps to form a food bolus
- Contains salivary amylase to begin starch digestion
- Dissolves chemicals so they can be tasted

Pancreas
- Found posterior to the parietal peritoneum
- Extends across the abdomen from spleen to duodenum
- Produces a wide spectrum of digestive enzymes that break down all categories of food
- Enzymes are secreted into the duodenum
- Alkaline fluid introduced with enzymes neutralizes acidic chyme coming from stomach
- Hormones produced by the pancreas
  - Insulin
  - Glucagon
Liver

- Largest gland in the body
- Located on the right side of the body under the diaphragm
- Consists of four lobes suspended from the diaphragm and abdominal wall by the falciform ligament
- Connected to the gallbladder via the common hepatic duct
Bile

- Produced by cells in the liver
- Composition is:
  - Bile salts
  - Bile pigments (mostly bilirubin from the breakdown of hemoglobin)
  - Cholesterol
  - Phospholipids
  - Electrolytes

Bile

- Function—emulsify fats by physically breaking large fat globules into smaller ones

Gallbladder

- Sac found in hollow fossa of liver
- When no digestion is occurring, bile backs up the cystic duct for storage in the gallbladder
- When digestion of fatty food is occurring, bile is introduced into the duodenum from the gallbladder
- Gallstones are crystallized cholesterol which can cause blockages