

DIGESTIVE SYSTEM

LEC-8-

The Digestive System and Body Metabolism

- Digestion
 - Breakdown of ingested food
- Absorption
 - Passage of nutrients into the blood
- Metabolism
 - Production of cellular energy (ATP)

Organs of the Digestive System

- Two main groups
 - Alimentary canal – continuous coiled hollow tube
 - Accessory digestive organs

Organs of the Digestive System

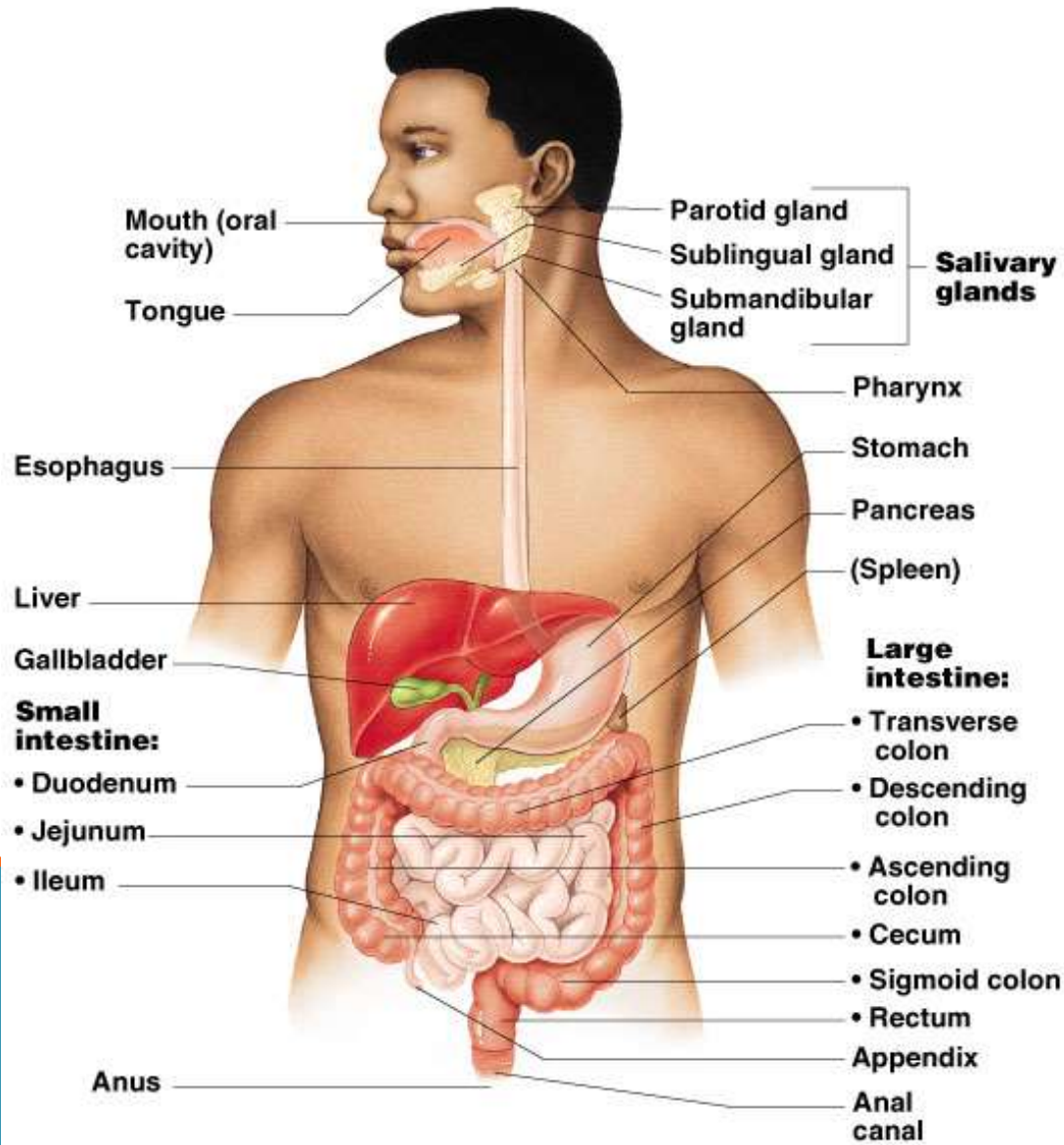


Figure 14.1

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

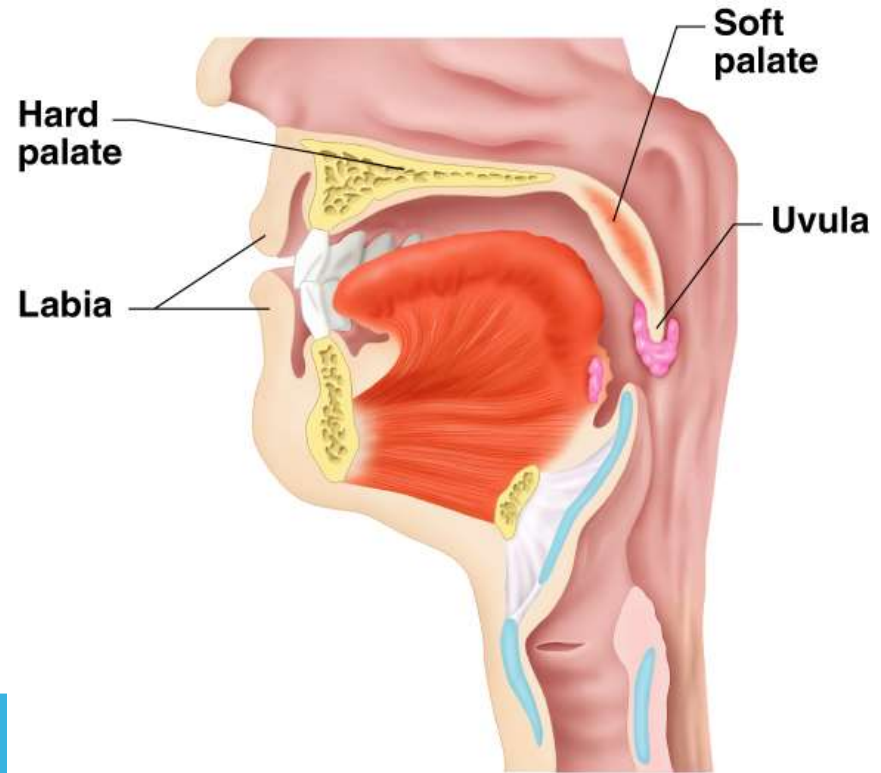


Figure 14.2a

Mouth (Oral Cavity) Anatomy

- Vestibule – space between lips externally and teeth and gums internally
- Oral cavity – area contained by the teeth
- Tongue – attached at hyoid and styloid processes of the skull, and by the lingual frenulum

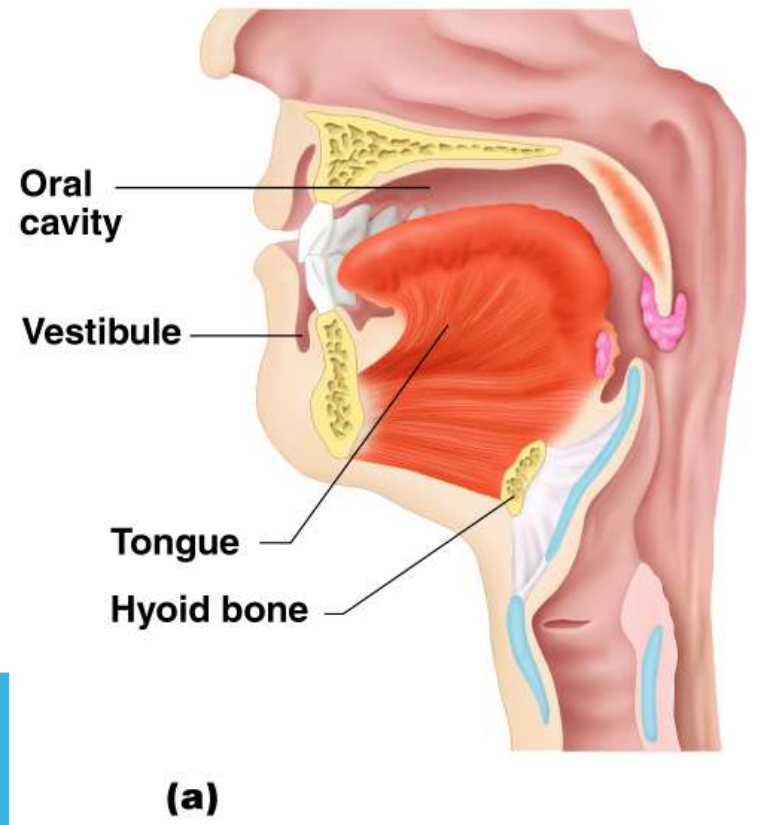
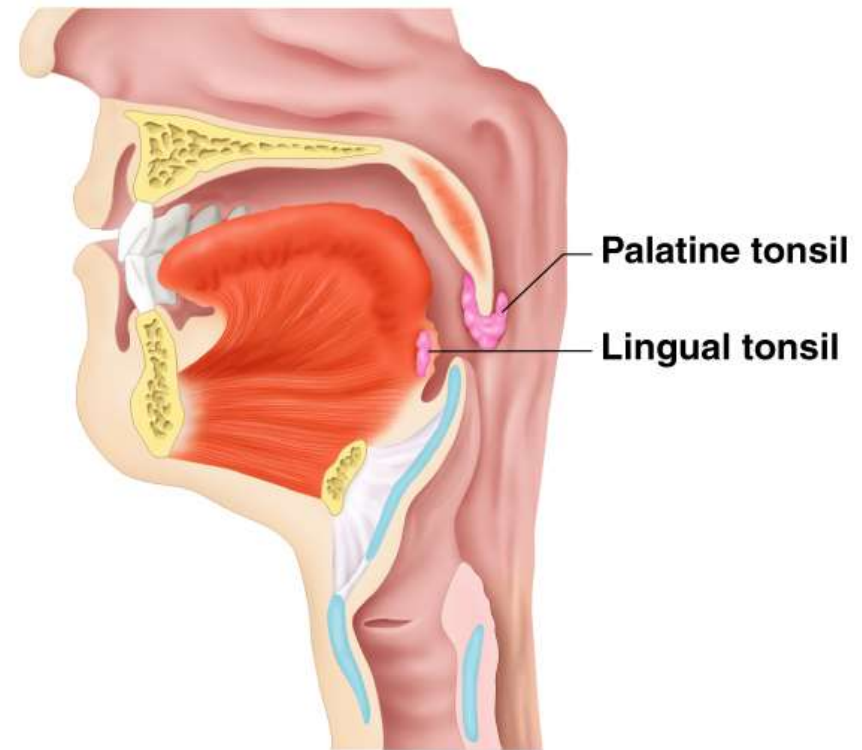


Figure 14.2a

Mouth (Oral Cavity) Anatomy

- Tonsils
 - Palatine tonsils
 - Lingual tonsil



(a)

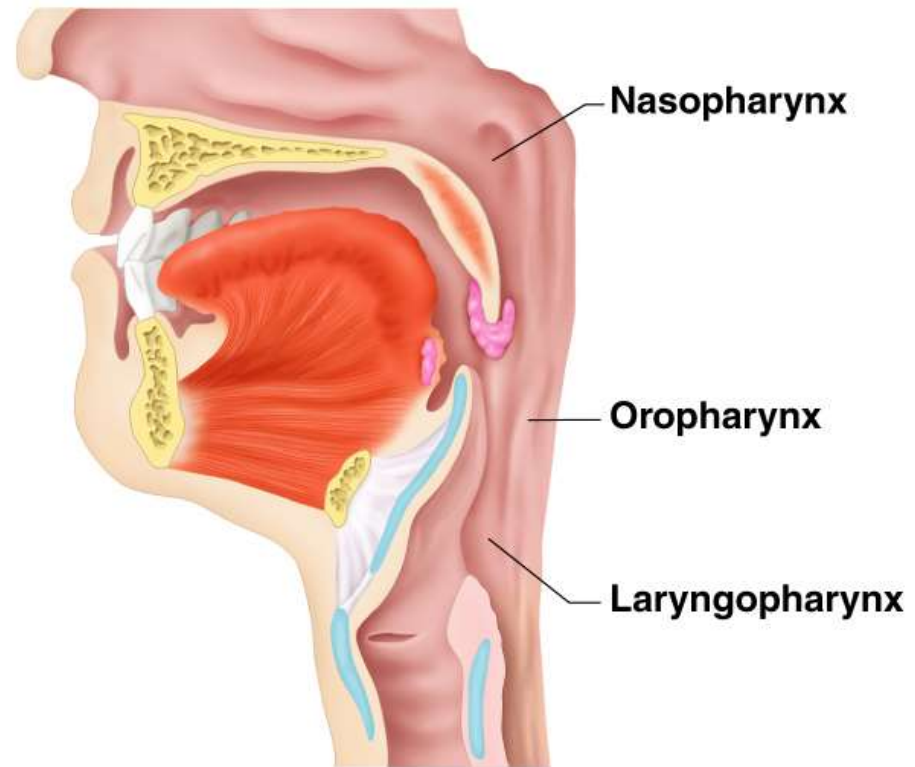
Figure 14.2a

Processes of the Mouth

- Mastication (chewing) of food
- Mixing masticated food with saliva
- Initiation of swallowing by the tongue
- Allowing 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



(a)

Figure 14.2a

Pharynx Function

- Serves as a passageway for air and food
- Food is propelled to the esophagus by two muscle layers
 - Longitudinal inner layer
 - Circular outer layer
- Food movement is by alternating contractions of the muscle layers (peristalsis)

Esophagus

- Runs from pharynx to stomach through the diaphragm
- Conducts food by peristalsis (slow rhythmic squeezing)
- Passageway for food only (respiratory system branches off after the pharynx)

Layers of Alimentary Canal Organs

- Mucosa
 - Innermost layer
 - Moist membrane
 - Surface epithelium
 - Small amount of connective tissue (lamina propria)
 - Small smooth muscle layer

Layers of Alimentary Canal Organs

- Submucosa
 - Just beneath the mucosa
 - Soft connective tissue with blood vessels, nerve endings, and lymphatics

Layers of Alimentary Canal Organs

- Muscularis externa – smooth muscle
 - Inner circular layer
 - Outer longitudinal layer
- Serosa
 - Outermost layer – visceral peritoneum
 - Layer of serous fluid-producing cells

Layers of Alimentary Canal Organs

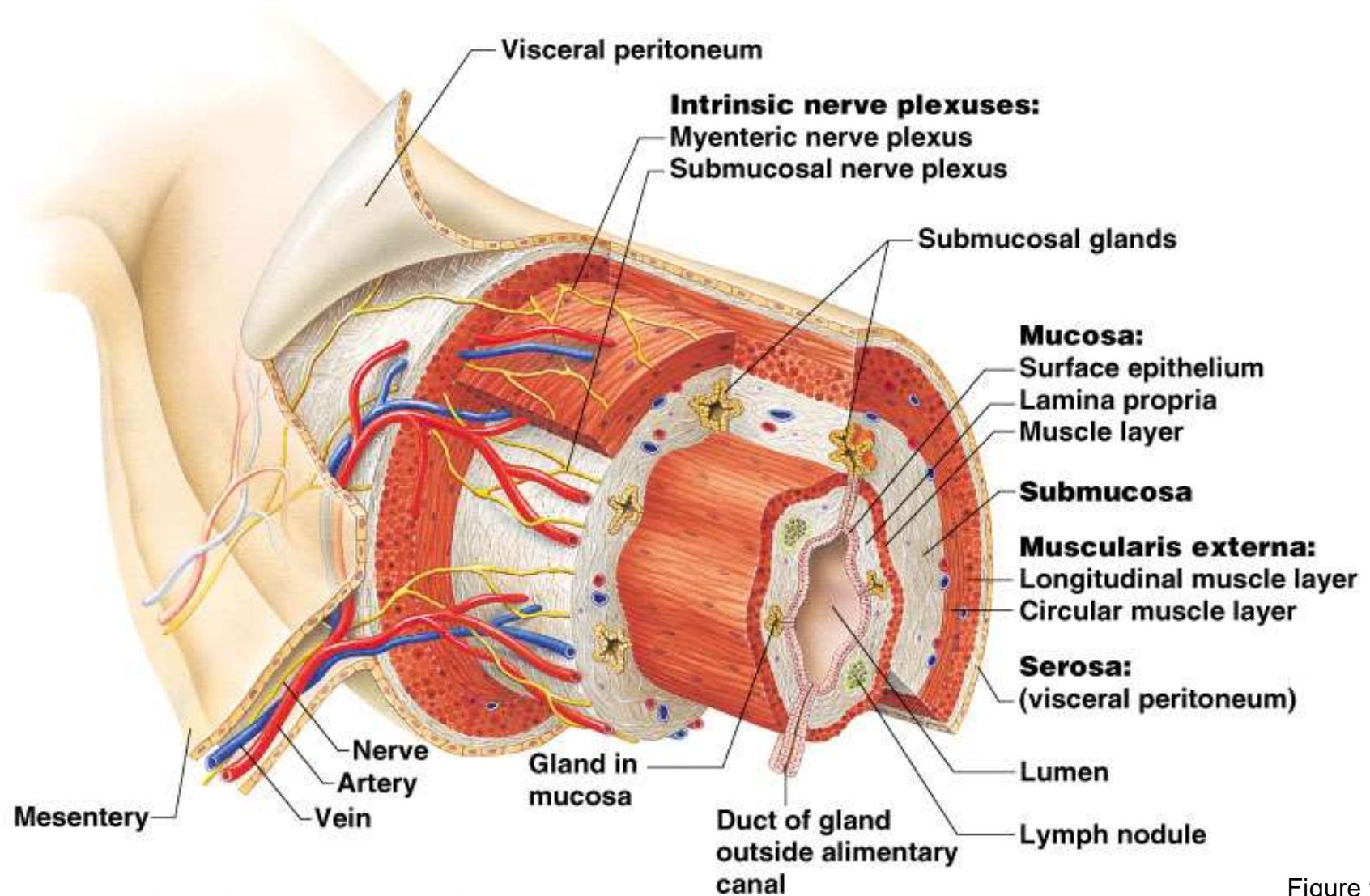


Figure 14.3

Stomach Anatomy

- Located on the left side of the abdominal cavity
- Food enters at the cardioesophageal sphincter

Stomach Anatomy

- Regions of the stomach
 - Cardiac region – near the heart
 - Fundus
 - Body
 - Pylorus – funnel-shaped terminal end
- Food empties into the small intestine at the pyloric sphincter

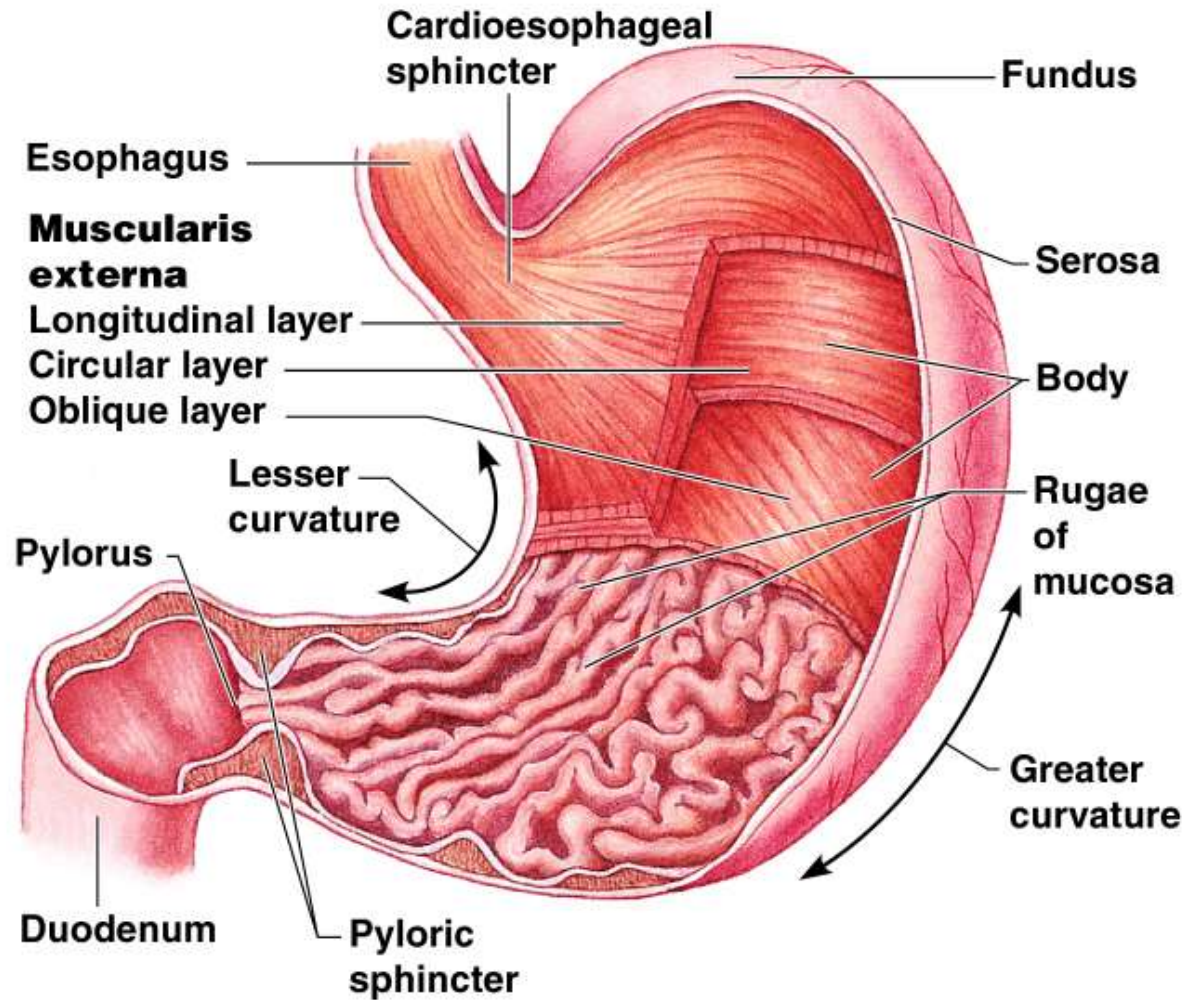
Stomach Anatomy

- Rugae – internal folds of the mucosa
- External regions
 - Lesser curvature
 - Greater curvature

Stomach Anatomy

- Layers of peritoneum attached to the stomach
 - Lesser omentum – attaches the liver to the lesser curvature
 - Greater omentum – attaches the greater curvature to the posterior body wall
 - Contains fat to insulate, cushion, and protect abdominal organs

Stomach Anatomy



(a)

Figure 14.4a

Stomach Functions

- Acts as a storage tank for food
- Site of food breakdown
- Chemical breakdown of protein begins
- Delivers chyme (processed food) to the small intestine

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

Subdivisions of the Small Intestine

“Dogs Just Itch!”

- 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

- Source of enzymes that are mixed with chyme
 - Intestinal cells
 - Pancreas
- Bile enters from the gall bladder

Chemical Digestion in the Small Intestine

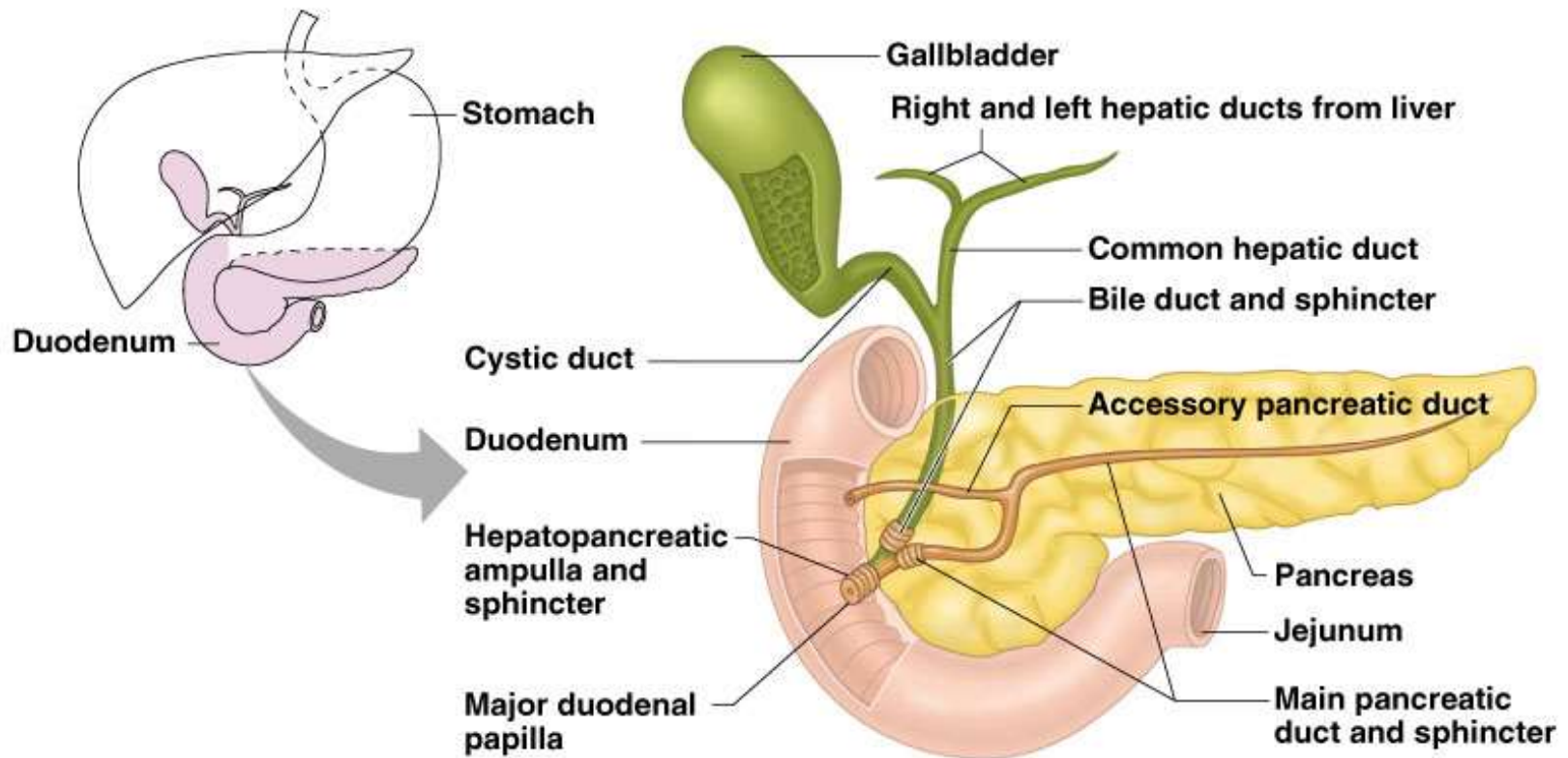


Figure 14.6

Villi of the Small Intestine

- Fingerlike structures formed by the mucosa
- Give the small intestine more surface area

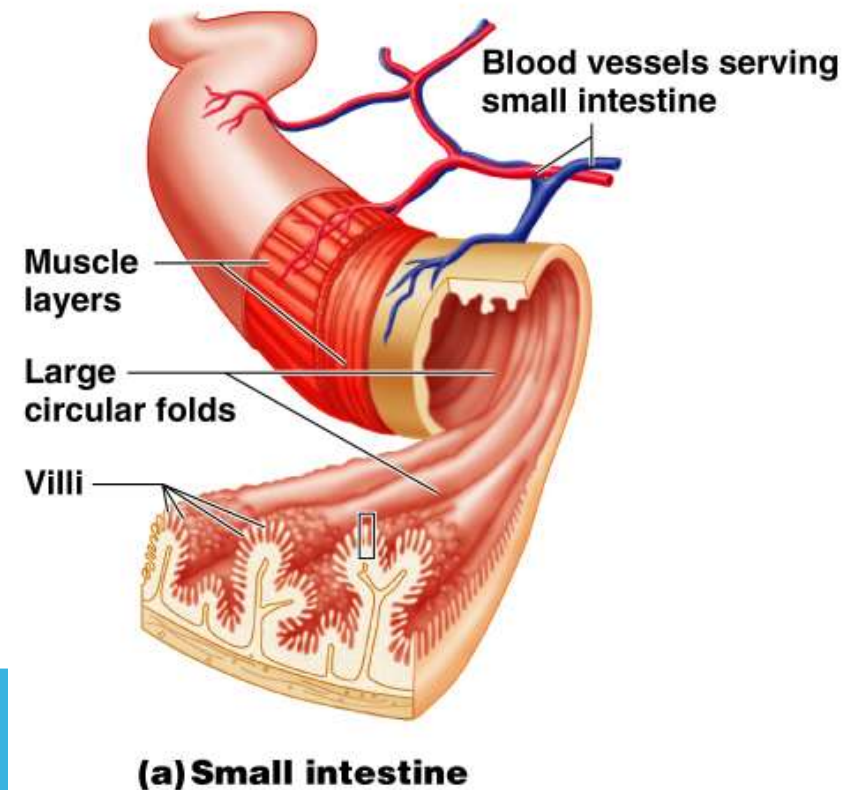
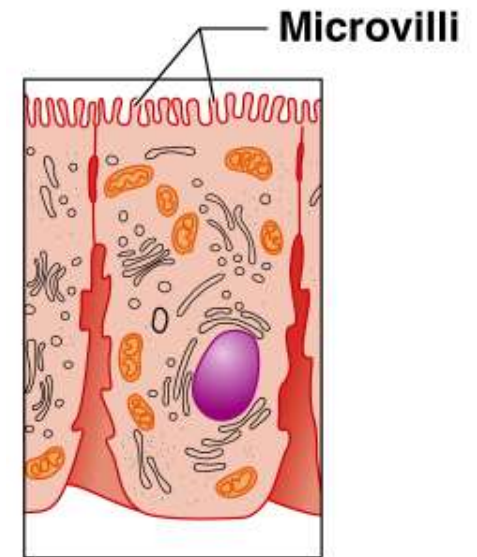


Figure 14.7a

Microvilli of the Small Intestine

- Small projections of the plasma membrane
- Found on absorptive cells



(c) Absorptive cells

Figure 14.7c

Structures Involved in Absorption of Nutrients

- Absorptive cells
- Blood capillaries
- Lacteals (specialized lymphatic capillaries)

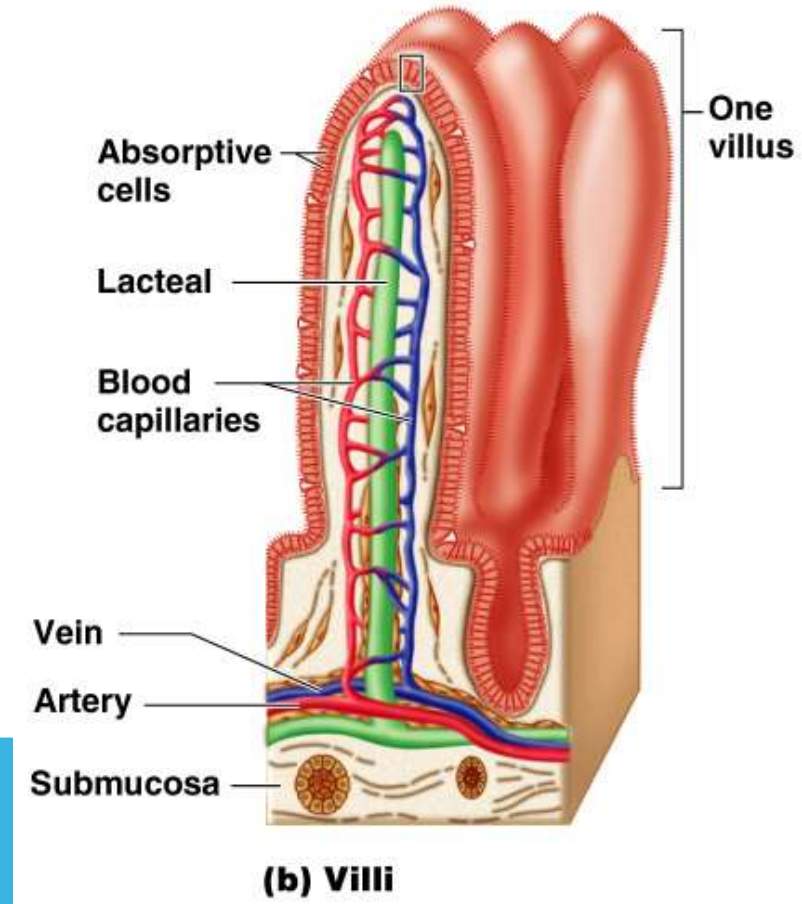


Figure 14.7b

Large Intestine

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

Large Intestine

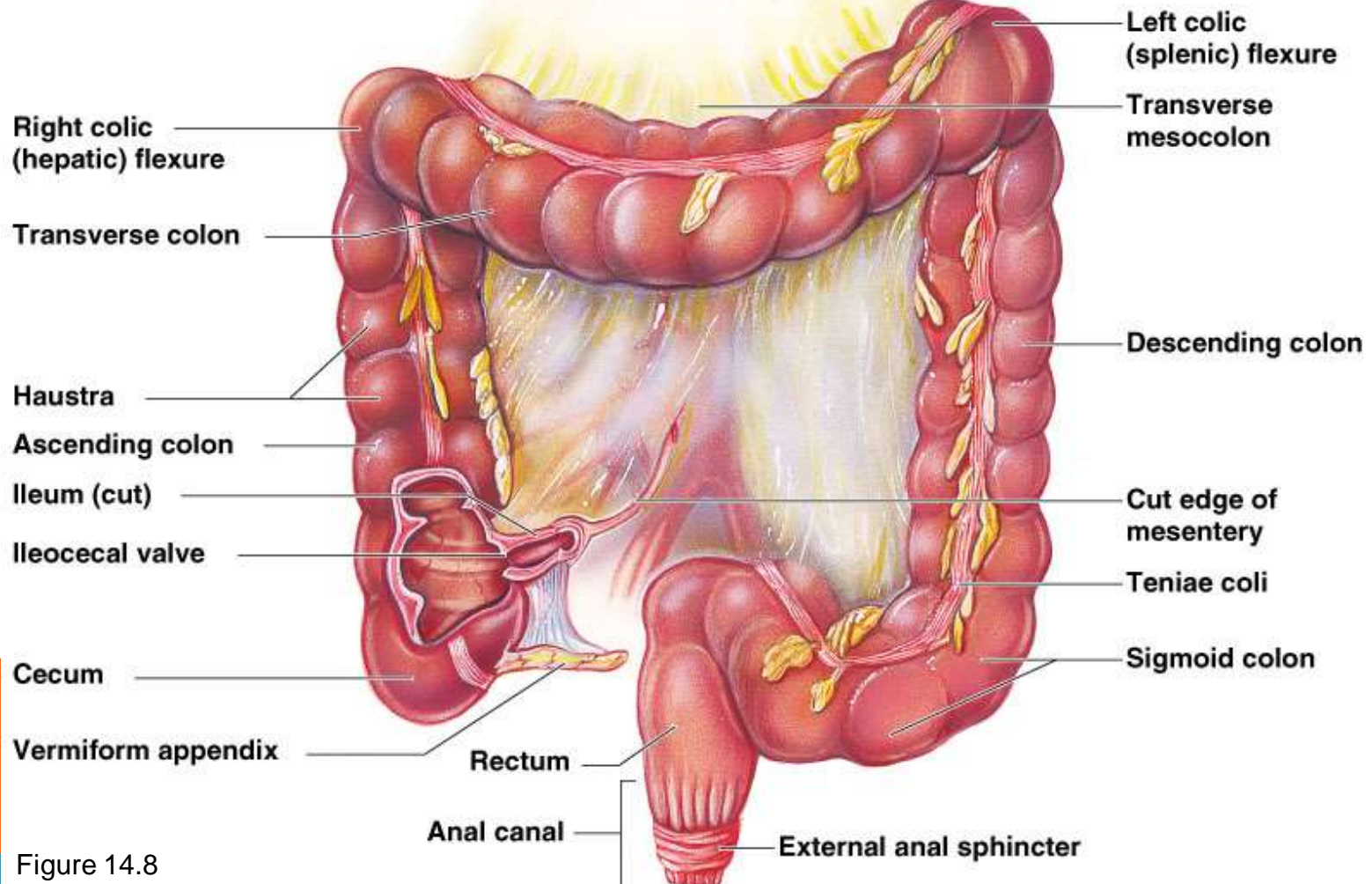


Figure 14.8

Functions of the Large Intestine

- Absorption of water
- Eliminates indigestible food from the body as feces
- Does not participate in digestion of food
- Goblet cells produce mucus to act as a lubricant

Structures of the Large Intestine

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

Structures of the Large Intestine

- Colon
 - Ascending
 - Transverse
 - Descending
 - S-shaped sigmoidal
- Rectum
 - Anus – external body opening

Accessory Digestive Organs

- Salivary glands
- Teeth
- Pancreas
- Liver
- Gall bladder

Salivary Glands

- Saliva-producing glands
 - Parotid glands – located anterior to ears
 - Submandibular glands
 - Sublingual 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

Teeth

- The role 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 beginning between the ages of 6 to 12
 - A full set is 32 teeth, but some people do not have wisdom teeth

Pancreas

- 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
- Endocrine products of pancreas
 - Insulin
 - Glucagons

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 gall bladder via the common hepatic duct

Bile

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

Gall Bladder

- Sac found in hollow fossa of liver
- Stores bile from the liver by way of the cystic duct
- Bile is introduced into the duodenum in the presence of fatty food
- Gallstones can cause blockages