

Digestive System

© Original Artist
Reproduction rights obtainable from
www.CartoonStock.com



search ID : gwan238

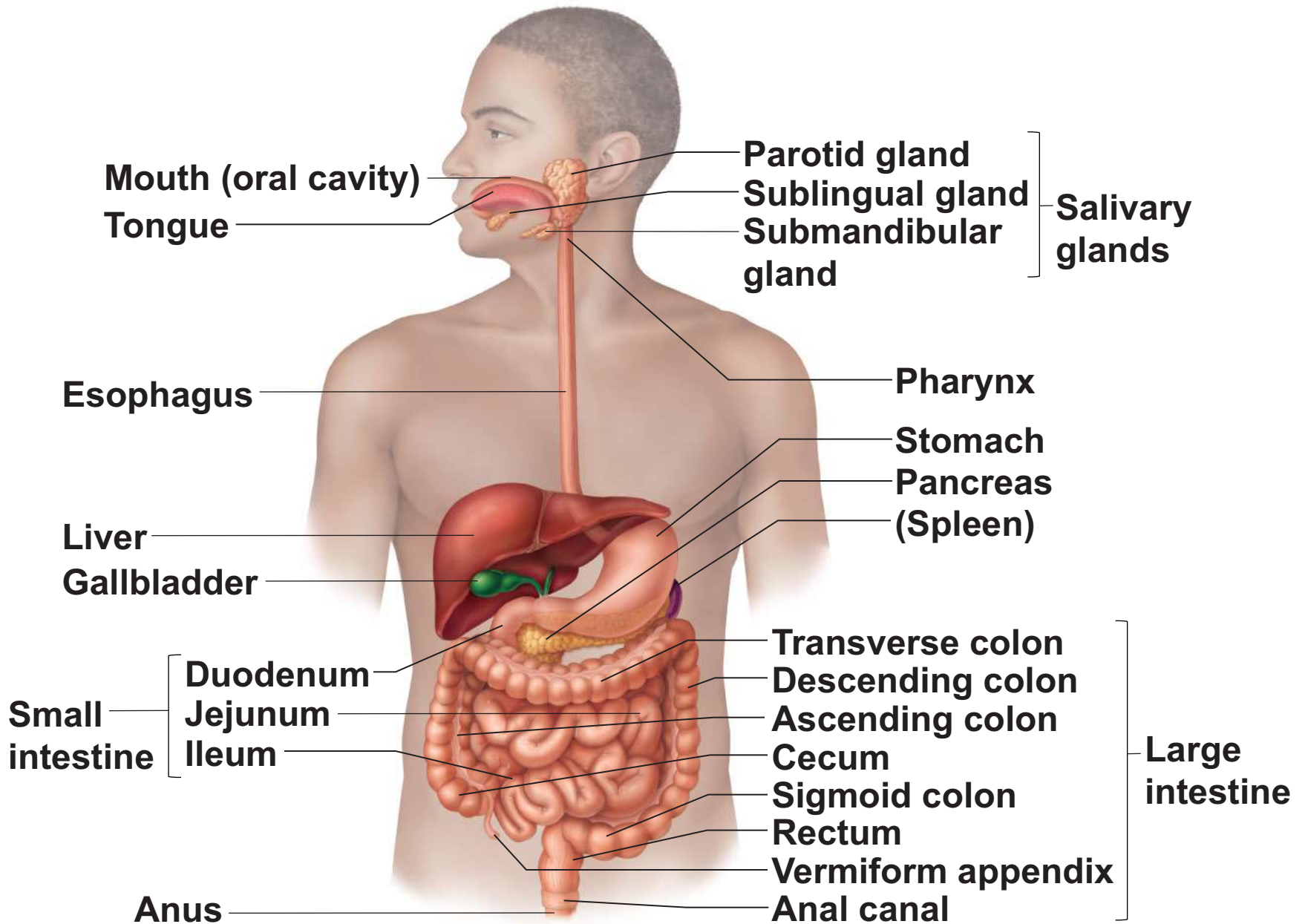
Two groups of organs

1. Major Structures (Alimentary canal) (gastrointestinal or GI tract)

- Digests and absorbs food
- Mouth, pharynx, esophagus, stomach, small intestine, and large intestine

"Does this soup taste funny to you?"

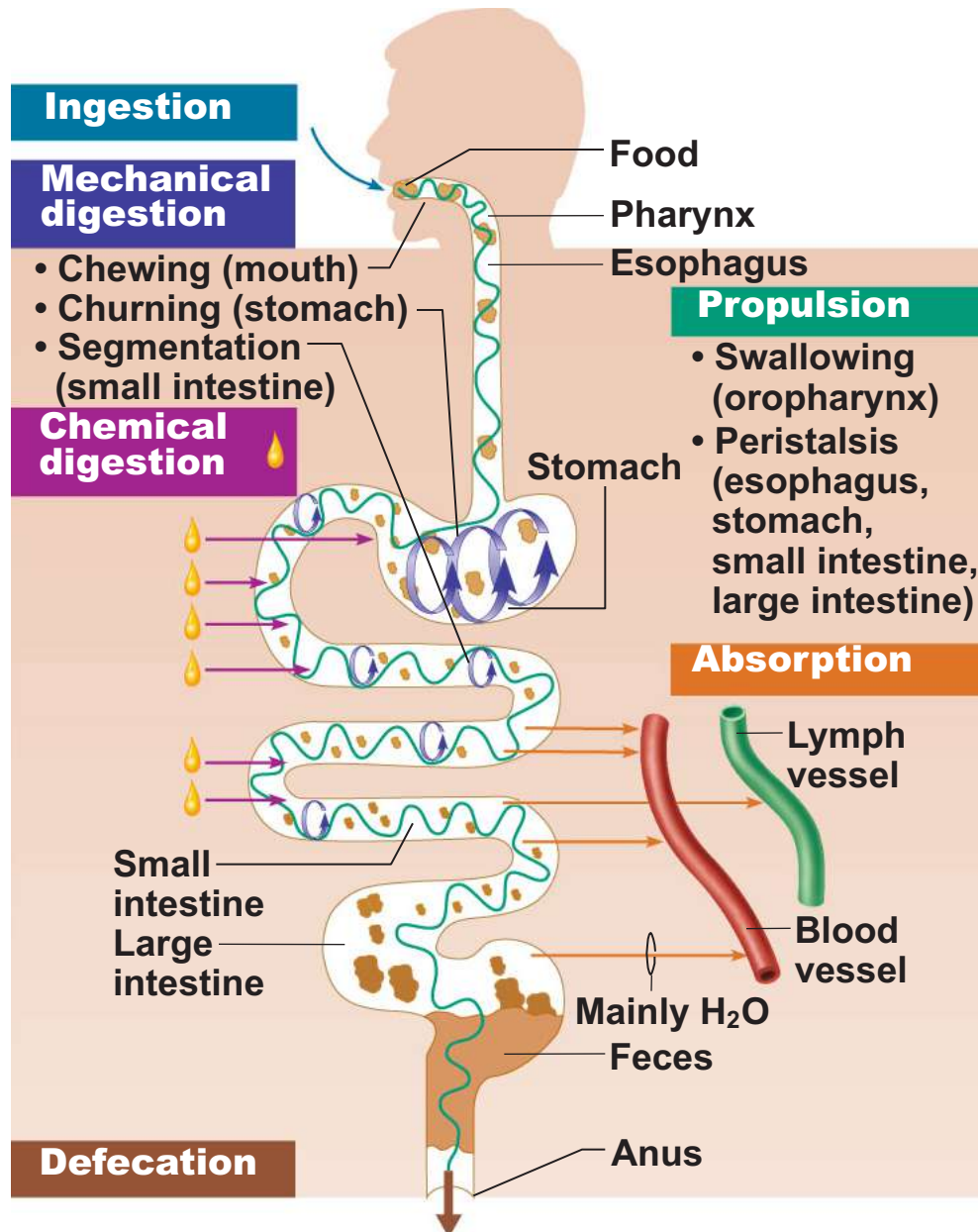
- 2. Accessory digestive organs** - aid with digestion but are not part of the digestive system
- Salivary glands
 - Liver
 - Gall Bladder
 - Pancreas



Digestive Processes

Six essential activities (define these)

1. Ingestion
2. Propulsion
3. Mechanical digestion
4. Chemical digestion
5. Absorption
6. Defecation



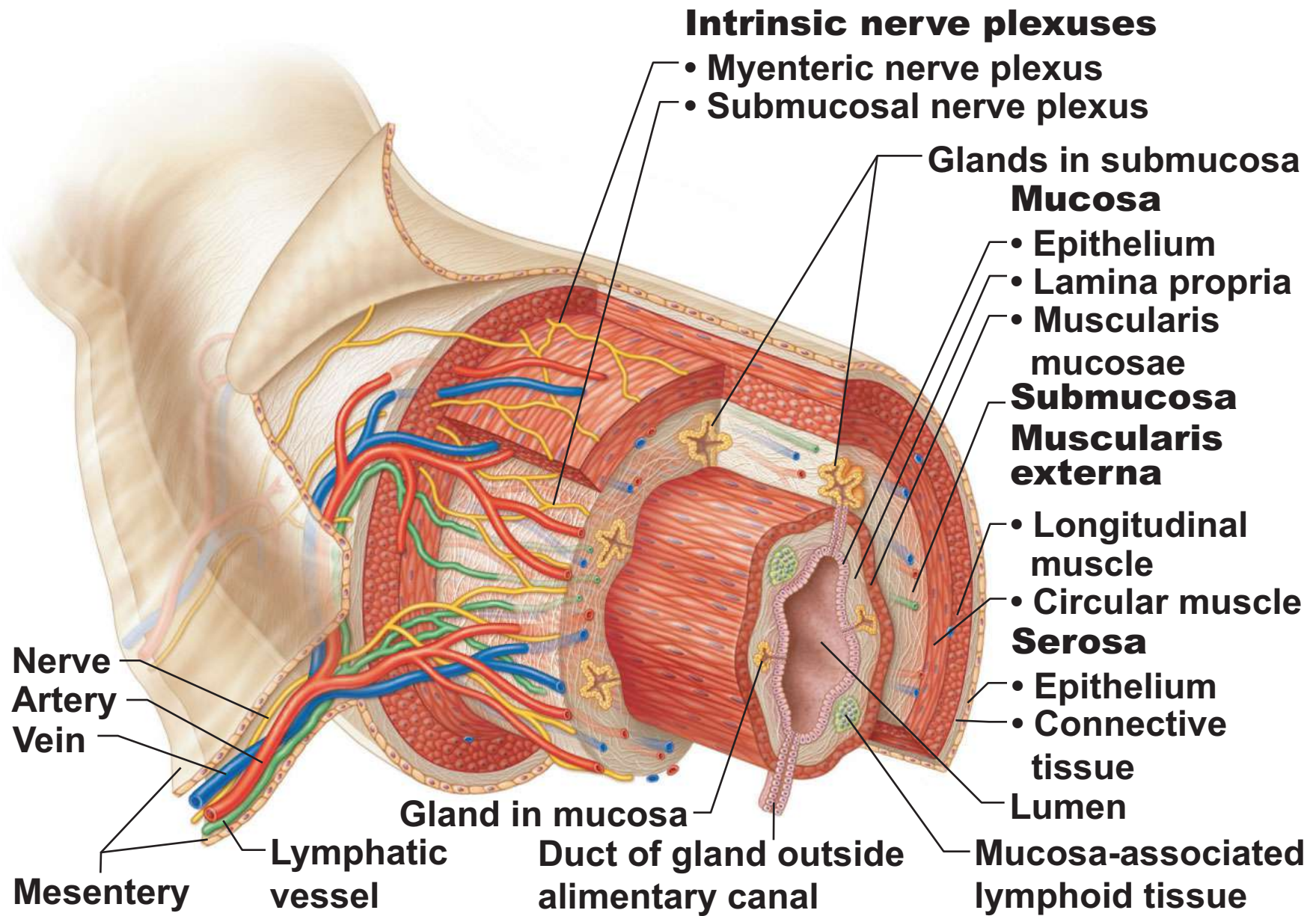
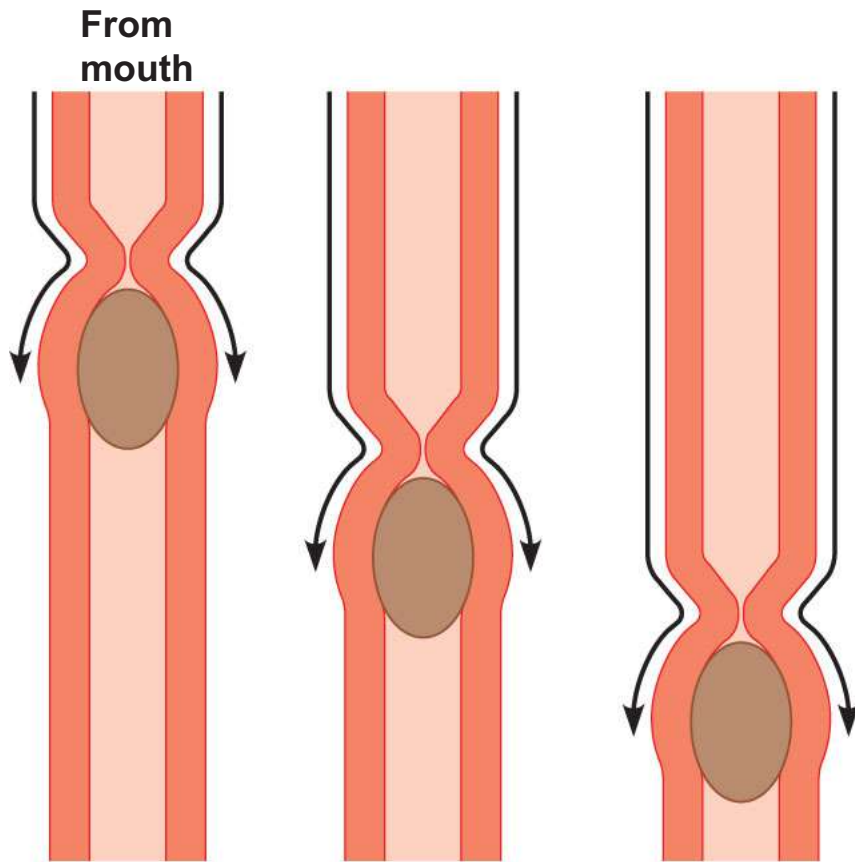
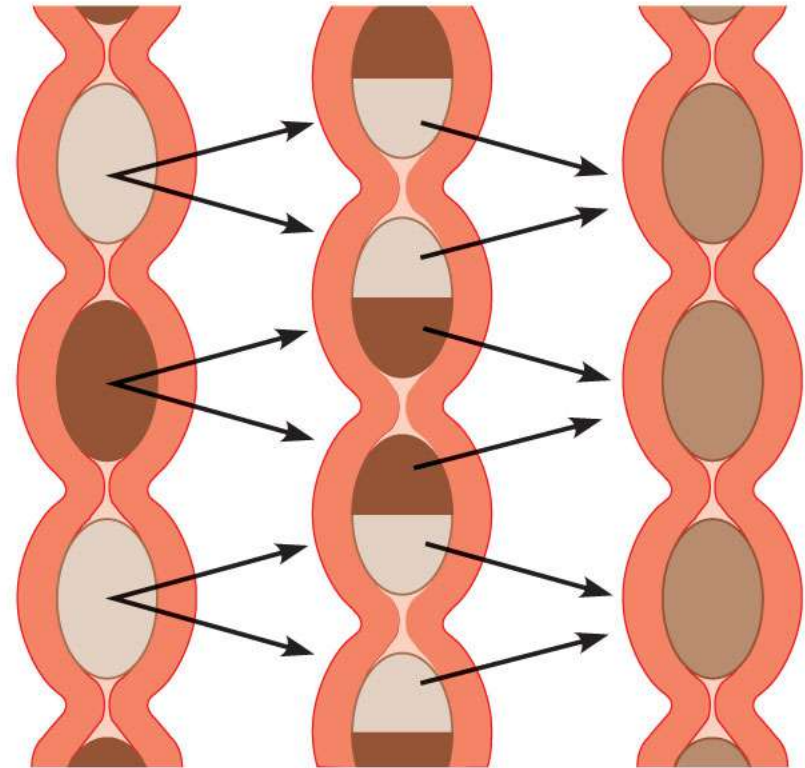


Figure 23.6



(a) Peristalsis: Adjacent segments of alimentary tract organs alternately contract and relax, which moves food along the tract distally.



(b) Segmentation: Nonadjacent segments of alimentary tract organs alternately contract and relax, moving the food forward then backward. Food mixing and slow food propulsion occurs.

Mouth

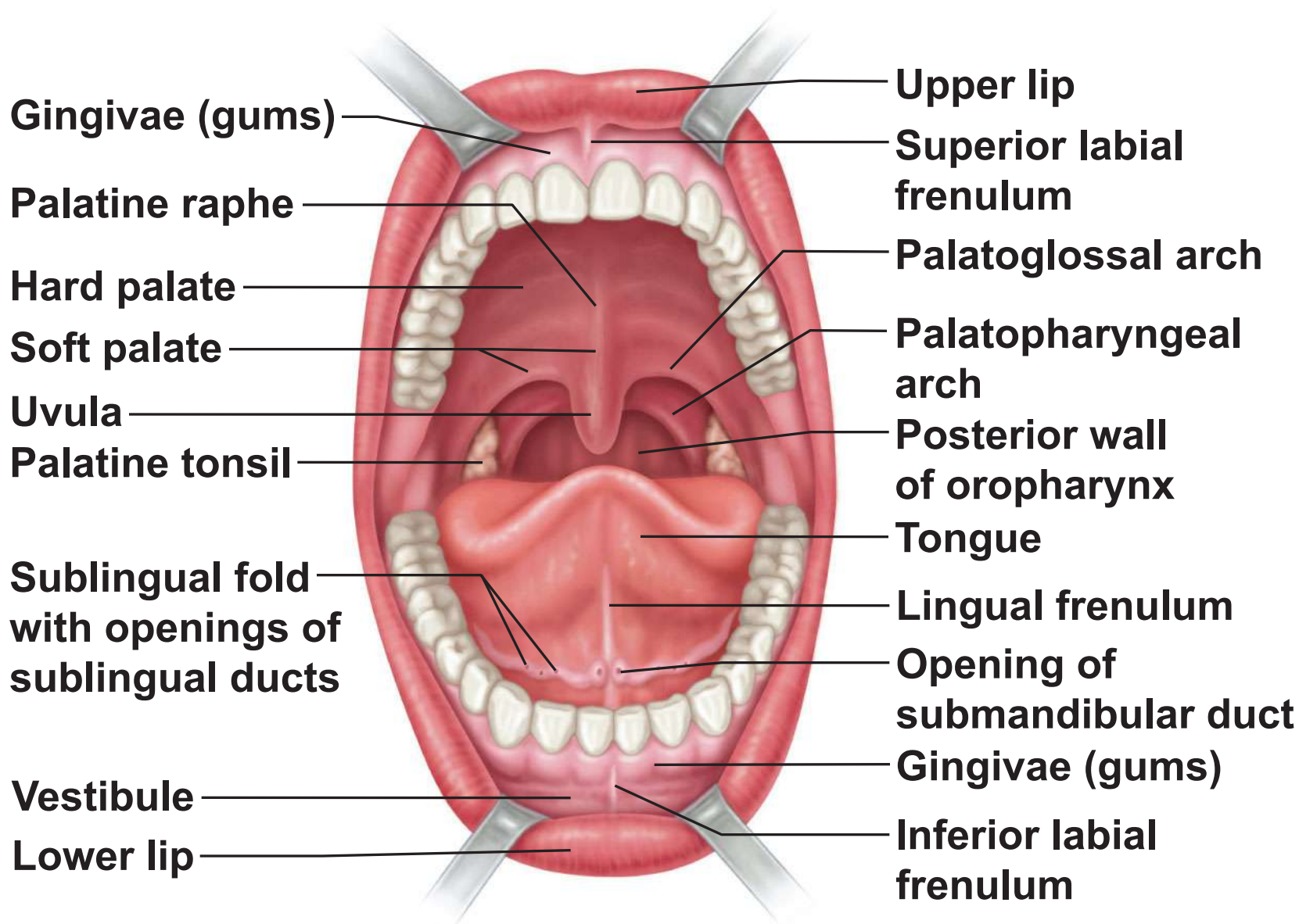


Oral (buccal) cavity

- Surrounded by lips, cheeks, palate, and tongue
- Oral orifice is the anterior opening
- Begins the digestion of carbohydrates and lipids with salivary enzymes

Lips and Cheeks

- Vestibule: The space between the cheeks or lips (**labia**) and the teeth and gums (**gingivae**)
- Oral cavity proper lies within the teeth and gums
- **Labial frenulum**: median attachment of each lip to the gum



(b) Anterior view

The Lips



- During eating, the lips hold food in the mouth and aid the tongue and cheeks in guiding food between the teeth for chewing
- Play an important roll in breathing, speaking, and the expression of emotion.

Palate (roof of mouth)

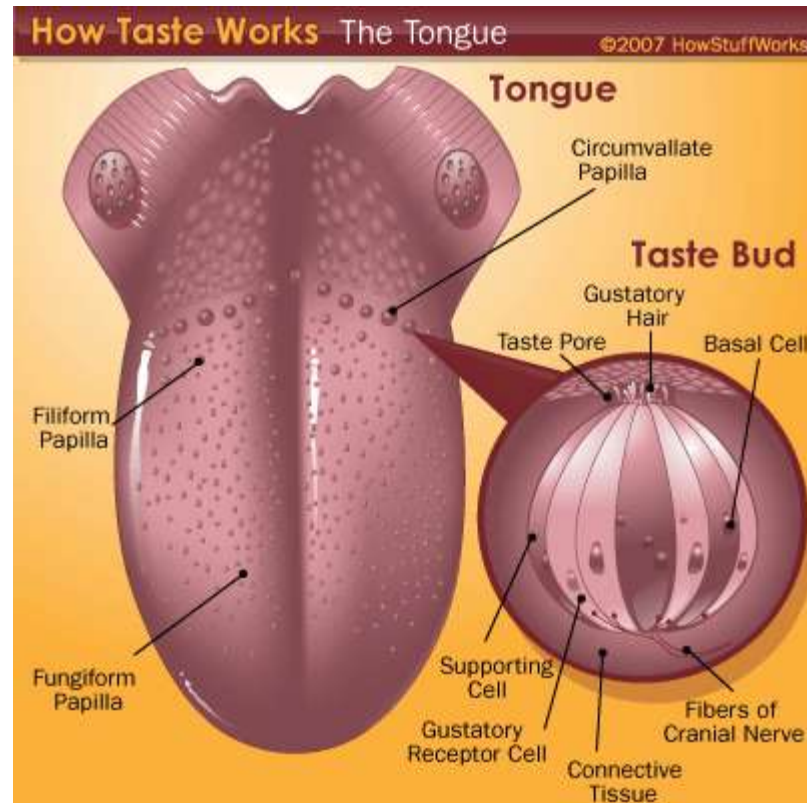
- **Hard palate:** bony anterior portion of the palate that is covered with specialized mucous membrane.
 - Contains *rugae* irregular folds in the mucous membrane that help create friction against the tongue
- **Soft palate:** formed mostly of skeletal muscle, flexible posterior portion of the palate
 - Closes off the nasopharynx during swallowing
 - Contains the **uvula** which projects downward from its free edge

Tongue

- Strong, flexible muscle
- Functions include
 - Repositioning and mixing food during chewing
 - Formation of the bolus
 - Initiation of swallowing, speech, and taste
- Lingual frenulum: attachment to the floor of the mouth



Tongue (upper surface, dorsum)



- Contains **papillae** which are small bumps that contain taste buds

Tongue (sublingual surface)



- Highly vascularized
- Great method for administering medications sublingually (sl) due to the quick absorption into the bloodstream (ex. Nitroglycerine) bypassing the digestive system
- Lingual frenulum – attaches the tongue to the floor of the mouth and limits its motion

Soft Tissues of the Oral Cavity

Peridontium – consists of the bone and soft tissues that surround and support the teeth

Gingiva – commonly known as the *gums* it is the specialized membrane that surrounds the teeth, cover the bone of the dental arches, and lines the cheeks.

Temporomandibular Joint (TMJ)

Formed at the back of the mouth where the maxillary and mandibular arches (jaws) come together

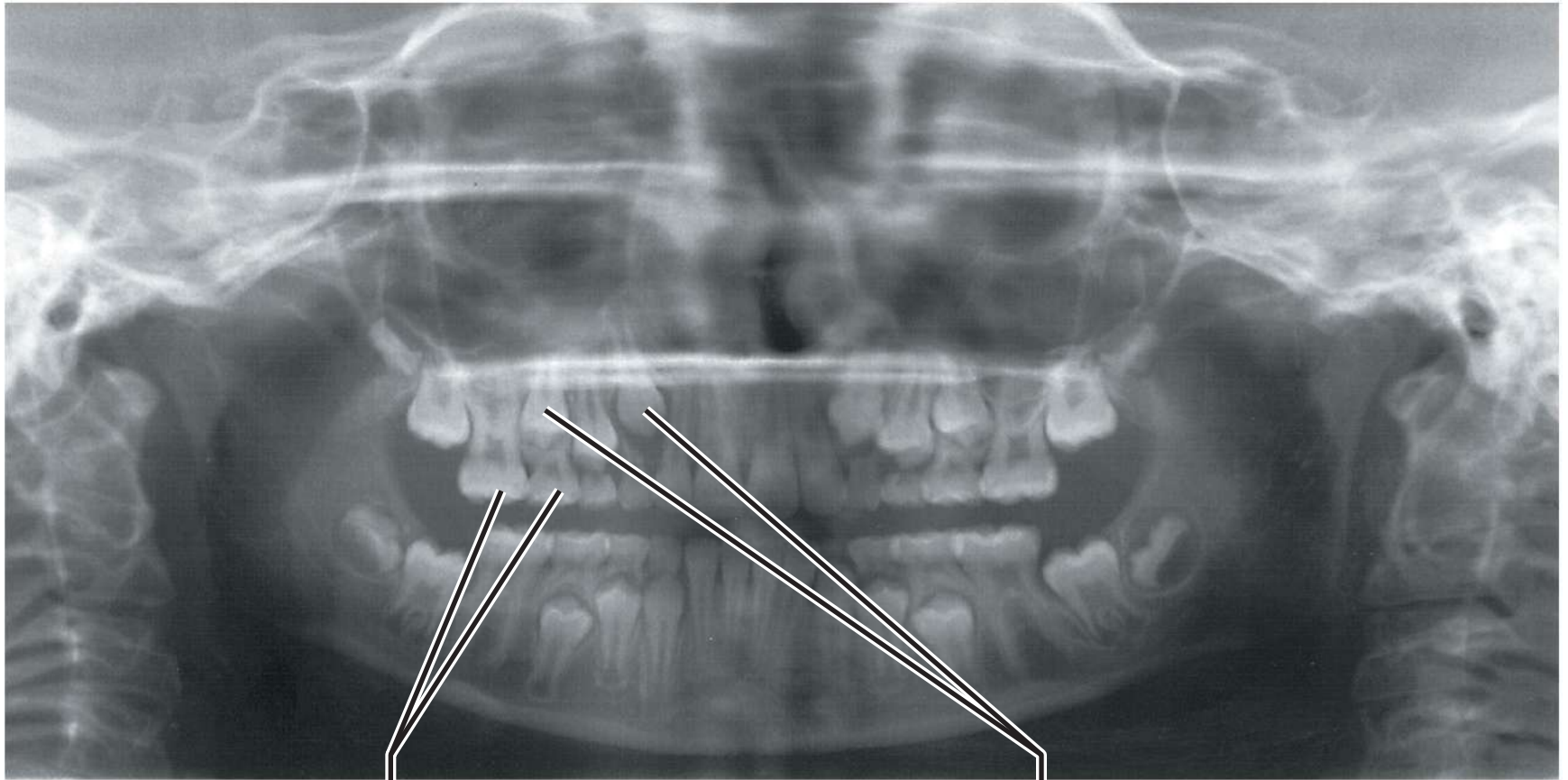
The maxillary arch (jaw) is part of the skull and does not move

The mandibular arch (jaw) is a separate bone and is the moveable component of the joint

Problems of the TMJ referred to as temporomandibular disorders can cause problems such as pain, headache, or difficulty chewing

Teeth (dentition)

- Human **dentition** includes 4 types of teeth
 - Incisors - biting & tearing
 - Canines (cuspids) - biting, tearing
 - Premolars (bicuspid) - grinding
 - Molars - chewing & grinding
- **Primary dentition**
 - 20 deciduous (baby) teeth erupt (6-24 months of age)
 - Roots are resorbed, teeth fall out (6-12 years of age) as permanent teeth develop
 - Include 8 incisors, 4 canines, 8 molars, and **NO** premolars



(b)

Deciduous teeth

Permanent teeth

Teeth (dentition)

Permanent Dentition

32 permanent teeth meant to last a lifetime

All except third molars erupt by the end of adolescence

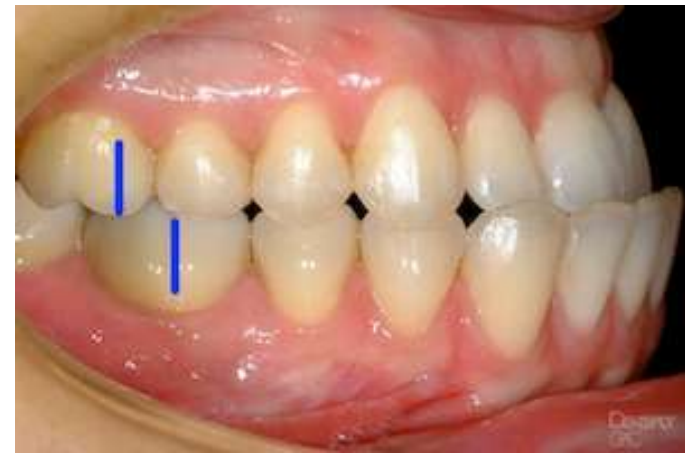
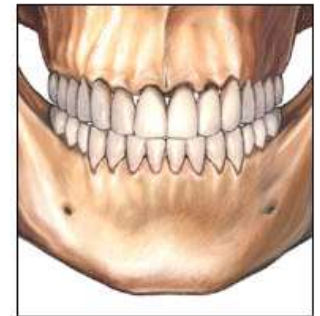
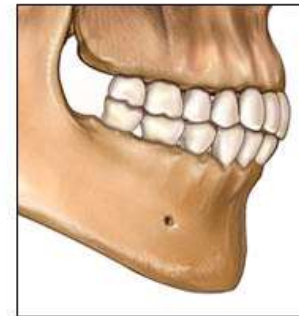
Consist of 8 incisors, 4 canines, 8 premolars, 12 molars

Teeth (dentition)

Edentulous – means without teeth.
Describes the situation after the natural permanent teeth have been lost

Occlusion – as used in dentistry, occlusion describes any contact between the chewing surfaces of the upper and lower teeth

Malocclusion – any deviation from the normal positioning of the upper teeth against the lower teeth



Teeth (Wisdom Teeth)



Usually appear between the ages of 16 & 25
Wisdom teeth commonly affect other teeth as they develop, becoming impacted or "coming in sideways." They are often extracted when this occurs.

Tooth Structure

- **Crown:** the exposed part above the gingiva (gum)
 - Covered by **enamel**—the hardest substance in the body
- **Root:** portion embedded in the jawbone
 - Connected to crown by neck
 - Protected by **cementum**, strong but not as strong as enamel!
- **Dentin:** bulk of the tooth structure
 - protected by enamel and cementum
- **Pulp:** consists of a rich supply of blood vessels and nerves that supply nutrients and innervation to the tooth
 - Located in the pulp cavity and root canals

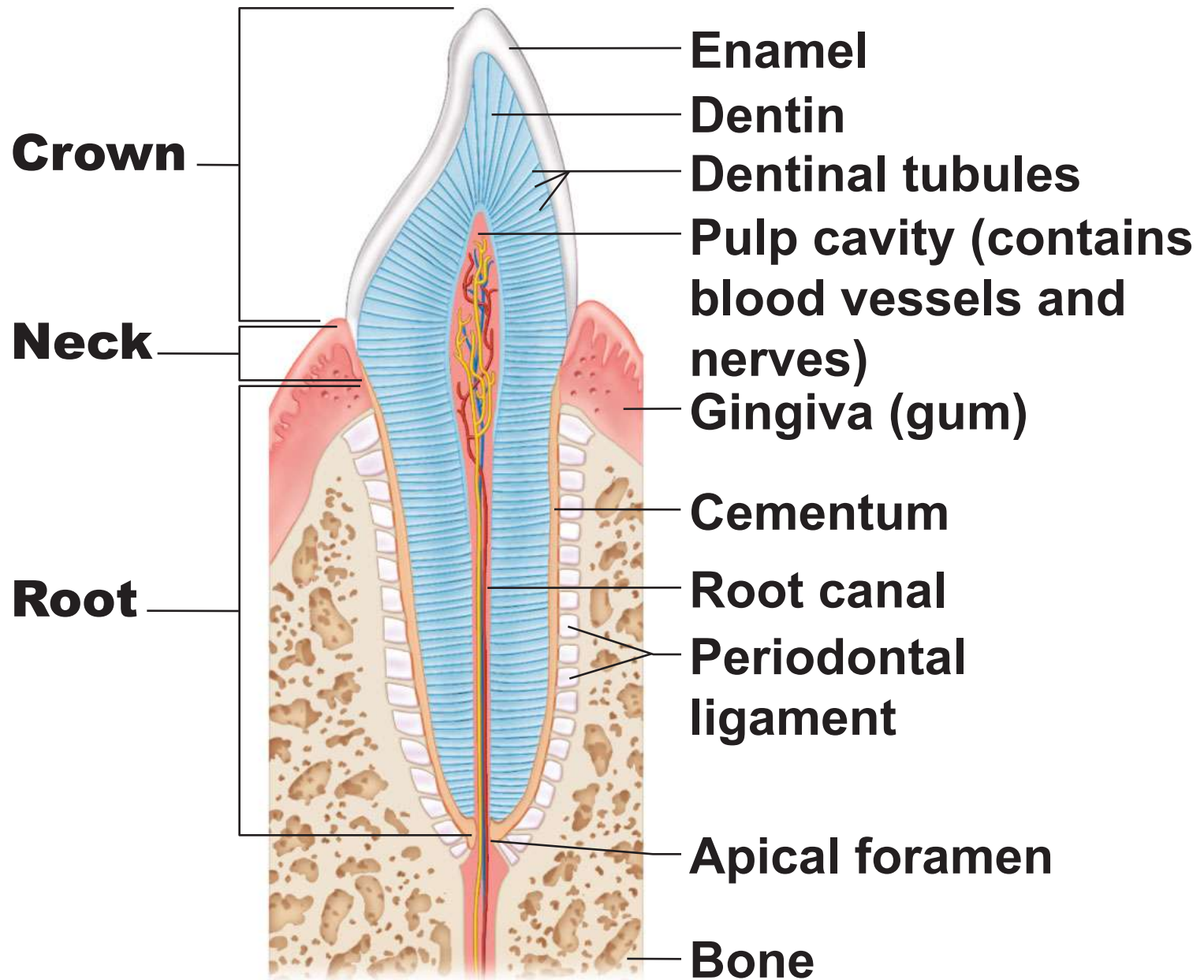


Figure 23.11

Tooth and Gum Disease

- **Dental caries (cavities):** gradual demineralization of enamel and dentin
 - Dental plaque (sugar, bacteria, and debris) adheres to teeth
 - Acid from bacteria dissolves calcium salts
 - Proteolytic enzymes digest organic matter
 - Prevention: daily flossing and brushing

Tooth and Gum Disease



- **Gingivitis**
 - Plaque calcifies to form calculus (tartar)
 - Calculus disrupts the seal between the gingivae and the teeth
 - Anaerobic bacteria infect gums
 - Infection reversible if calculus removed

Salivary Glands



3 pairs of salivary glands secrete into the oral cavity

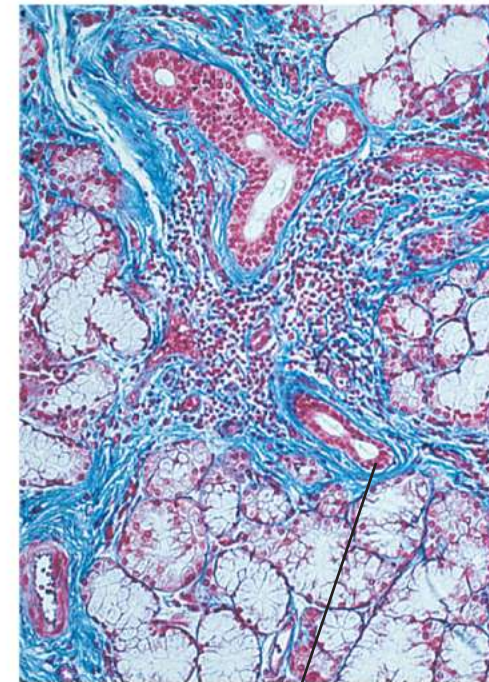
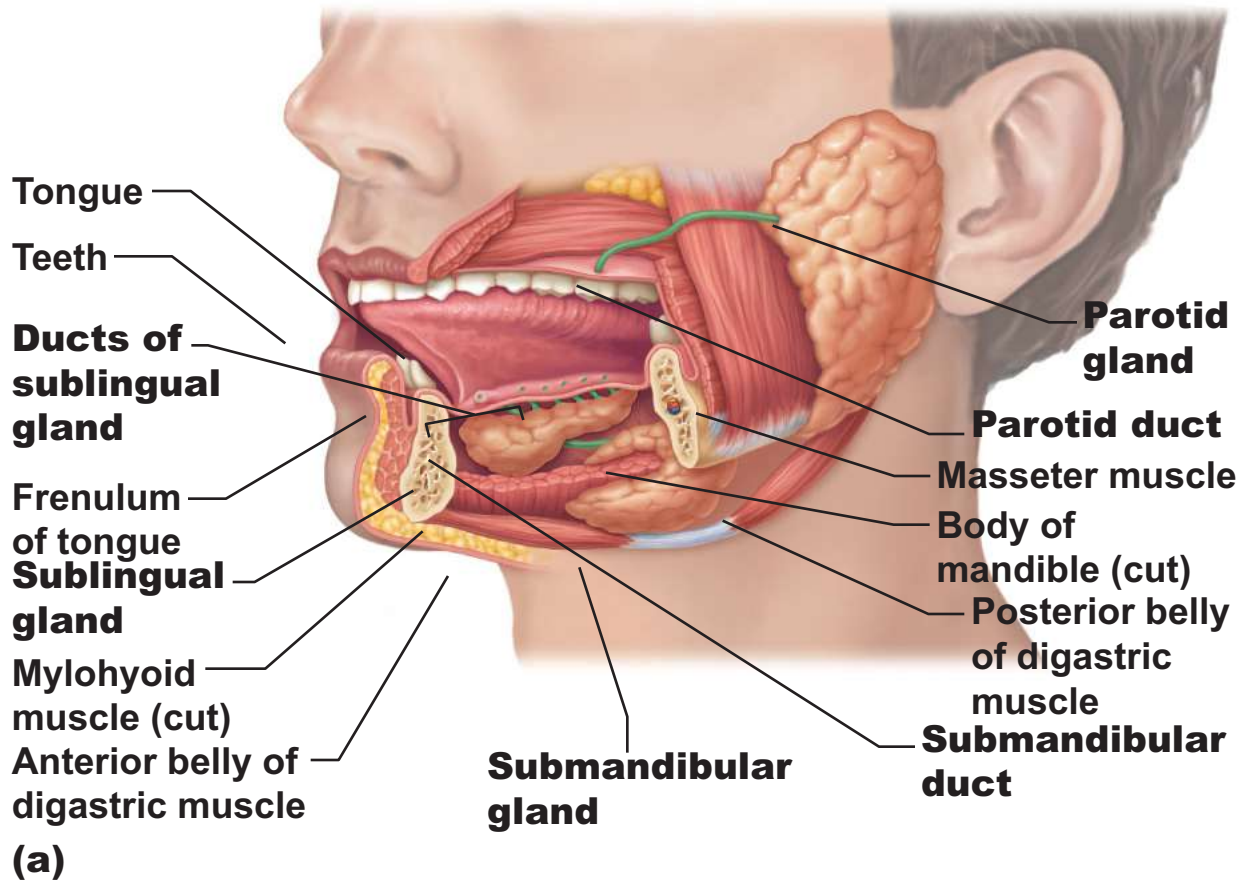
- Parotid
- Submandibular
- Sublingual

Salivary Glands

- Parotid gland
 - Anterior to the ear external to the masseter muscle
 - Parotid duct opens into the vestibule next to second upper molar
- Submandibular gland
 - Duct opens at the base of the lingual frenulum

Salivary Glands

- Sublingual gland
 - Opens via 10-12 ducts into the floor of the mouth under the tongue



(b)
Mucous cells
Serous cells forming demilunes

Salivary Glands

- Secretion (saliva)
 - Cleanses the mouth (slightly acidic)
 - Moistens and dissolves food chemicals
 - Aids in bolus formation
 - Contains enzymes that begin the breakdown of starch
 - 1-1.5 liters produced a day

Control of Salivation

- During eating, all three salivary glands increase their rates of secretion
- 70% of production is provided by the submandibular glands
- Radiation exposure, emotional distress, and other factors can cause decrease saliva production causing "dry mouth" (**xerostomia**)
 - Bacterial population explodes
 - Recurring infections occur and progressive erosion of teeth and gums

The Esophagus

The muscular tube that routes ingested food and fluid from the pharynx to the stomach

The Lower Esophageal Sphincter

Muscular ring that controls the flow between the esophagus and the stomach

Opens to allow food into the stomach and closes to prevent *regurgitation* into the esophagus

The Stomach

Sac-like organ composed of:

Fundus (upper, rounded part)

Body (main portion)

Antrum (lower part)

The Stomach

Rugae

Folds in the mucous lining of stomach which contain glands that produce gastric juices that aid in digestion and mucus to coat and protect the stomach

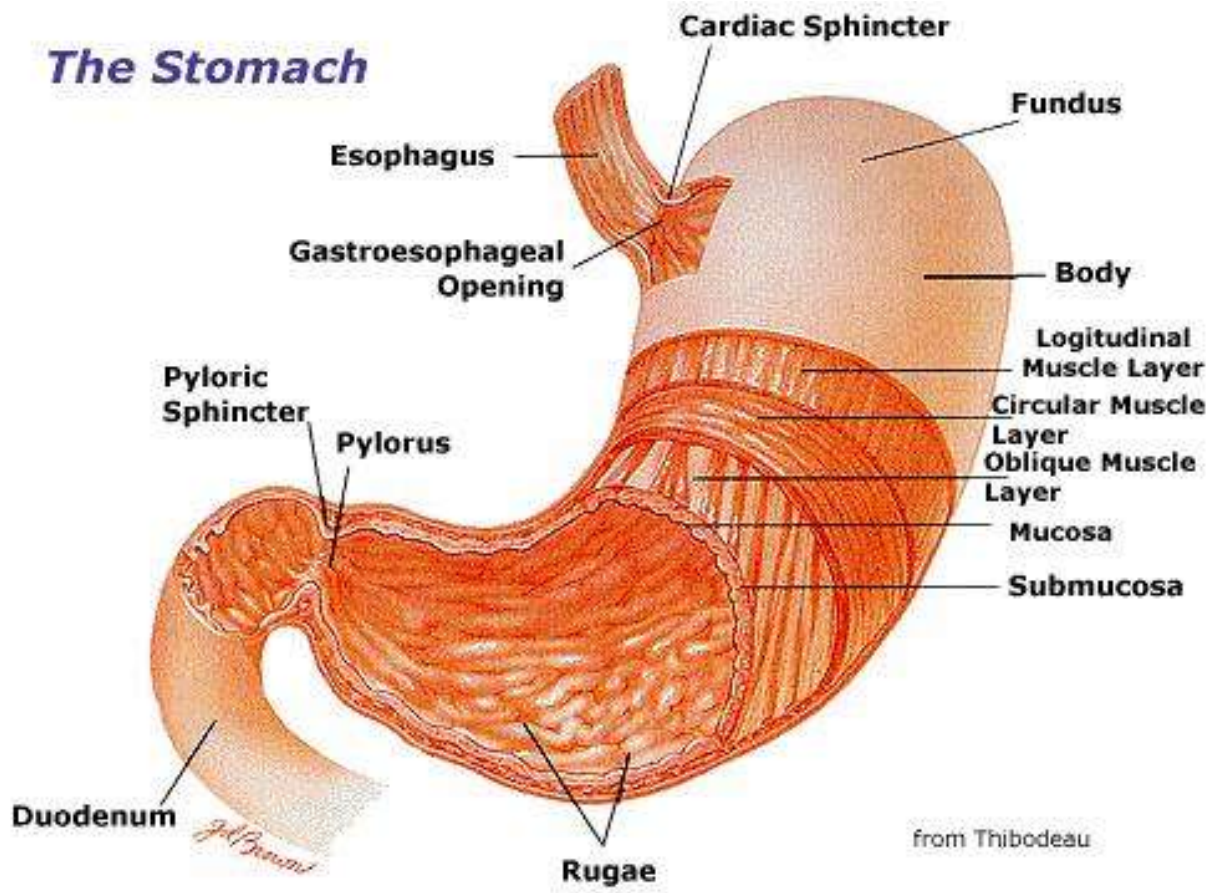
Pylorus

Narrow passage that connects the stomach and small intestine

Pyloric Sphincter

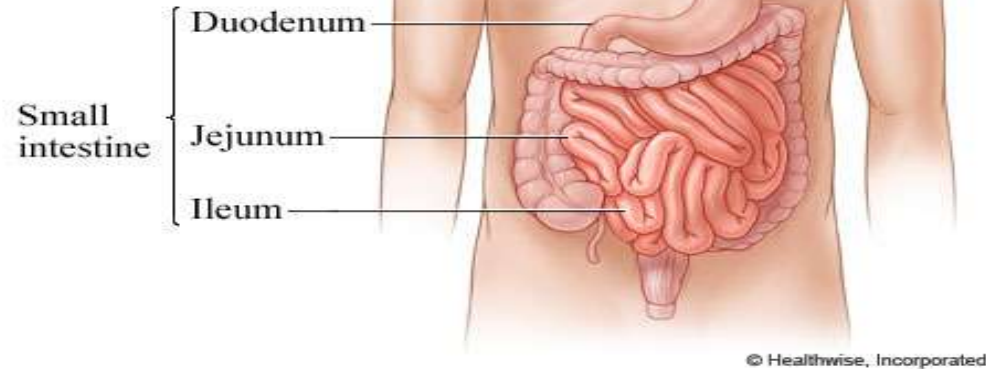
Ring-like muscle that controls the flow from the stomach to the duodenum of the small intestine

The Stomach



from Thibodeau

Small Intestine



Extends from the pyloric sphincter to the first part of the large intestine

Coiled muscular tube extends up to 20 ft. long!

Consists of 3 sections where food is digested and nutrients are absorbed into the bloodstream

Duodenum – 1st part of the small intestine

Jejunum – middle part of the small intestine

Ileum – last and longest part of the small intestine

The Large Intestine

Extends from the end of the small intestine to the anus
Twice as wide as the small intestine but only $\frac{1}{4}$ as long
Processes the waste products of digestion and prepares them for excretion through the anus

Composed of

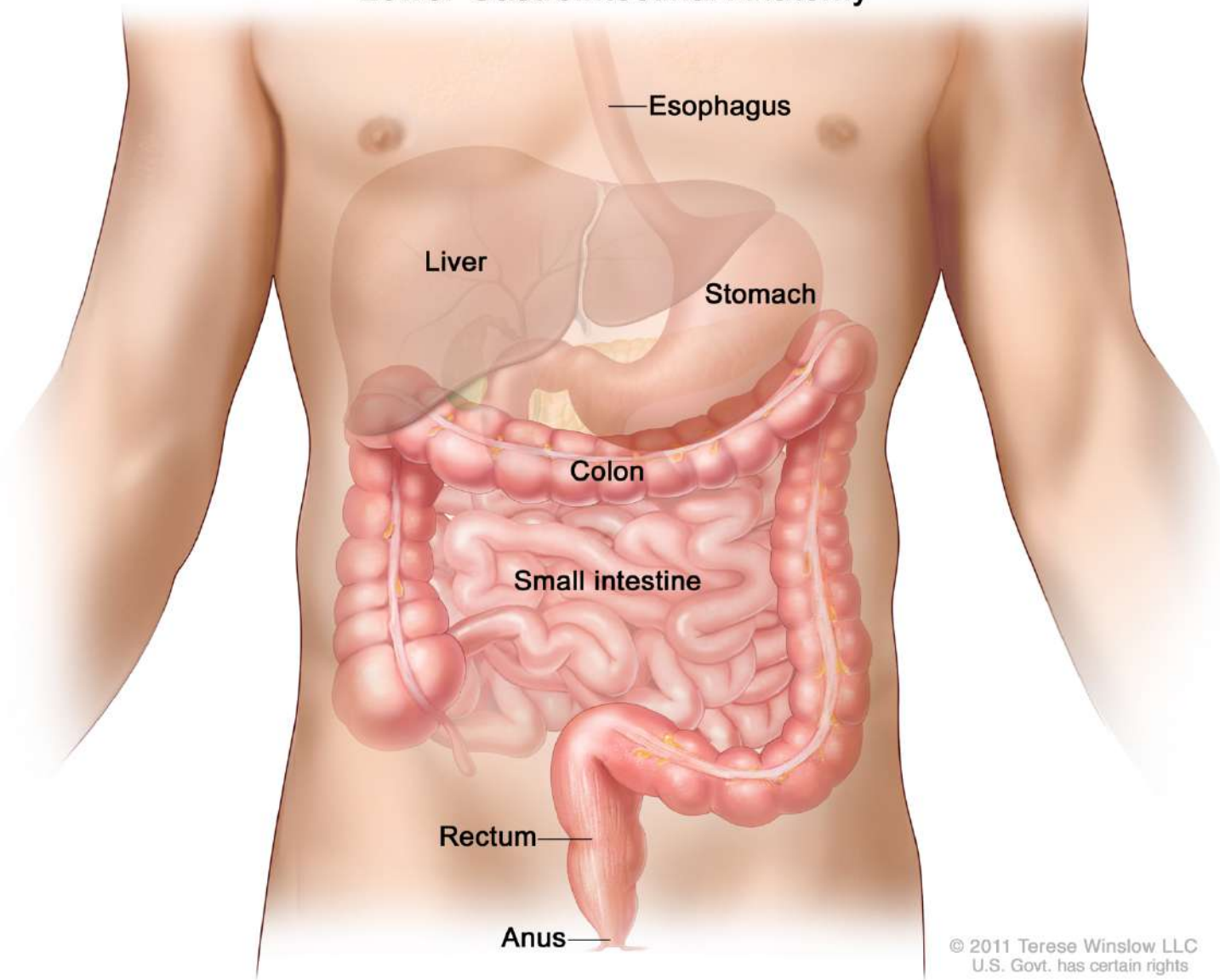
Cecum

Colon (ascending, transverse, descending, sigmoid)

Rectum

Anus

Lower Gastrointestinal Anatomy



Cecum

Pouch on the right side of the abdomen
Extends from the end of the ileum to the
beginning of the colon

Ileocecal sphincter – ringlike muscle that
controls the flow from the ileum of the small
intestine into the cecum of the large intestine

Vermiform appendix – hangs from the lower
portion of the cecum

The Colon

Longest portion of the large intestine

Divided into 4 parts

Ascending colon

Transverse colon

Descending colon

Sigmoid colon – named for its s-like shape

The Rectum and Anus

Rectum

the widest division of the large intestine

Makes up the last 4 inches of the large intestine

Holding tank

Anus

Lower opening of the digestive tract

The flow of waste through the anus is controlled by the internal and external anal sphincters

Accessory Digestive Organs

Play a key role in the digestive process but are not part of the gastrointestinal tract

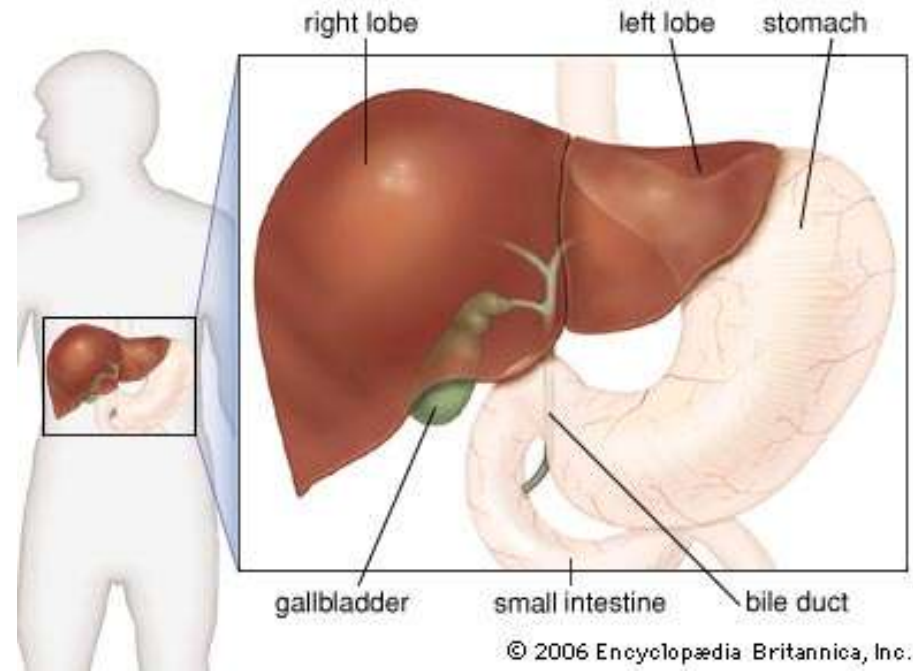
Salivary Glands

Liver

Gall bladder

Pancreas

The Liver



Located in the **RUQ** of the abdomen
Has several important functions related to removing toxins from the blood and turning food into fuel and nutrients

The Liver...Functions

Removes excess glucose (blood sugar) from the blood stream and stores it as glycogen

When blood sugar level is low, the liver converts glycogen back into glucose and releases it for the body to use

Destroys old **erythrocytes** (RBC's), removes toxins from the blood, and manufactures some blood proteins

Bilirubin is the pigment produced from the destruction of hemoglobin and is usually released by the liver in bile

Produces and secretes **bile** which aids in the digestion of fats

Jaundice



Everyday, a small number of red blood cells in your body die, and are replaced by new ones. The liver removes the old blood cells, forming bilirubin. The liver helps break down bilirubin so that it can be removed by the body in the stool. When too much bilirubin builds up in the body, jaundice may result.

Jaundice can occur if:

Too many red blood cells are dying or breaking down and going to the liver

The liver is overloaded or damaged

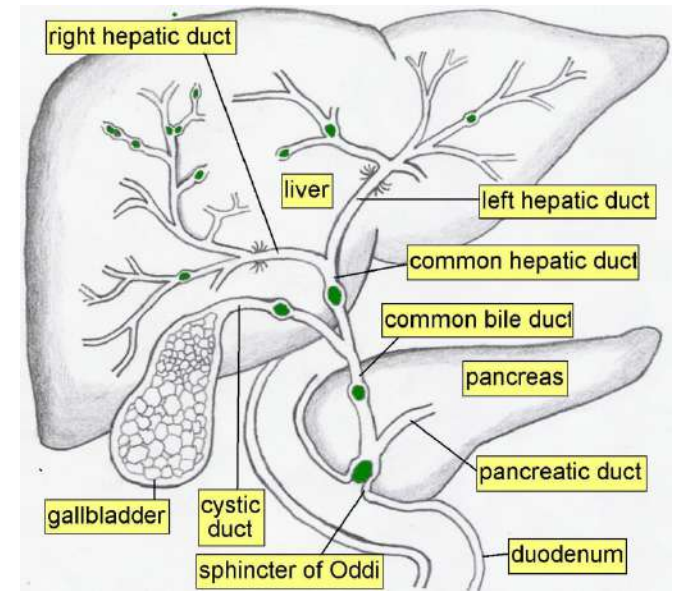
The bilirubin from the liver is unable to move through the digestive tract properly

Jaundice is often a sign of a problem with the liver, gallbladder, or pancreas. Infections, use of certain drugs, cancer, blood disorders, gallstones, birth defects and a number of other medical conditions can lead to jaundice.

The Biliary Tree

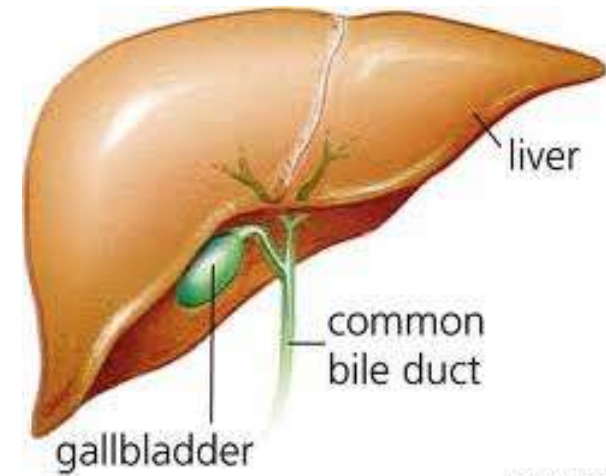
Provides channels through which bile is transported from the liver to the small intestine

Small ducts in the liver join together like the branches of a tree



- Bile travels from the liver through the common bile duct to the gall bladder where it enters and exits through the cystic duct
- The cystic duct leaving the gall bladder rejoins the common hepatic duct to form the common bile duct
- The common bile duct joins the pancreatic duct and together they enter the duodenum of the small intestine

The Gallbladder

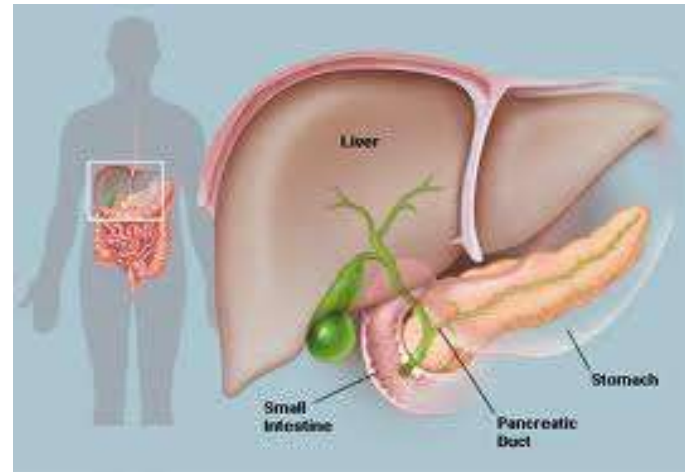


Pear-shaped organ about the size of an egg located under the liver

Stores and concentrates bile for later use

When bile is needed, (after eating a fatty meal) the gallbladder contracts, forcing bile out through the biliary tree

The Pancreas



6 inch long gland located behind the stomach
Plays important roles in both the digestive and endocrine system

Produced and secretes pancreatic juices that aid in digestion and also contain sodium bicarbonate to help neutralize stomach acids and digestive enzymes

The pancreatic juices leave the pancreas through the pancreatic duct, which joins the common bile duct just before entrance into the duodenum

Digestion

The process by which foods are broken down, both mechanically and chemically, into nutrients in a form the body can use

Primary nutrients are carbohydrates, fats, and proteins
Vitamins and minerals are essential nutrients which are required in only small amounts

Metabolism

Includes all of the processes involved in the body's use of nutrients

Consists of 2 parts

Anabolism – building up of body cells and substances from nutrients

Catabolism – the breaking down of body cells or substances, releasing energy and carbon dioxide

Absorption

The process by which completely digested nutrients are transported to the cells throughout the body

The mucosa that lines the intestine is covered with finger-like projections called **villi** which contain blood vessels and lacteals

Blood vessels absorb nutrients directly from the digestive system into the bloodstream for delivery to the cells of the body

Fats and fat-soluble vitamins cannot be transported directly by the bloodstream so the **lacteals** absorb these nutrients and transport them via the lymphatic system