GI Anatomy

Overview

Alimentary canal

Ch. 12
- (1) Oral cavity (mouth)
- (2) Pharynx
- (3) Esophagus
- (4) Stomach
- (5) Duodenum and small intestine

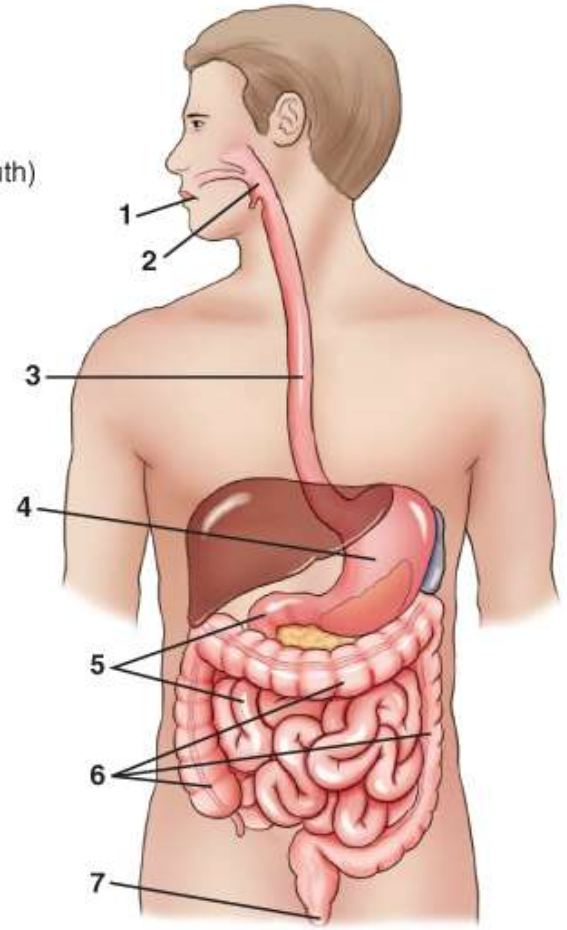
Ch. 13
- (6) Large intestine
- (7) Anus

Accessory organs

- —Salivary glands
- —Pancreas
- —Liver
- —Gallbladder

Functions

1. Intake and digestion
2. Absorption
3. Elimination



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Overview of Digestion

Main organs of the digestive system form a continuous muscular tube

- Alimentary canal
  - Digestive tract
  - Includes: mouth, pharynx, esophagus, stomach, small bowel, large bowel, rectum
- Approximately 9 meters long
- Open at both ends to the outside of the body

Accessory Organs

These organs are not part of the alimentary canal, but aid the digestive process

- Teeth
- Tongue
- Salivary glands
- Liver
- Gallbladder
- Pancreas
- Appendix

Starting from the Top…

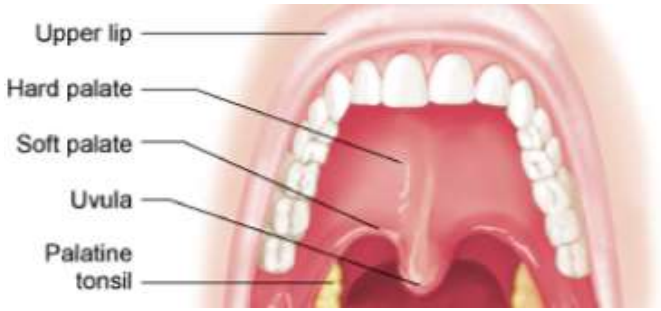
Buccal or Oral Cavity includes:

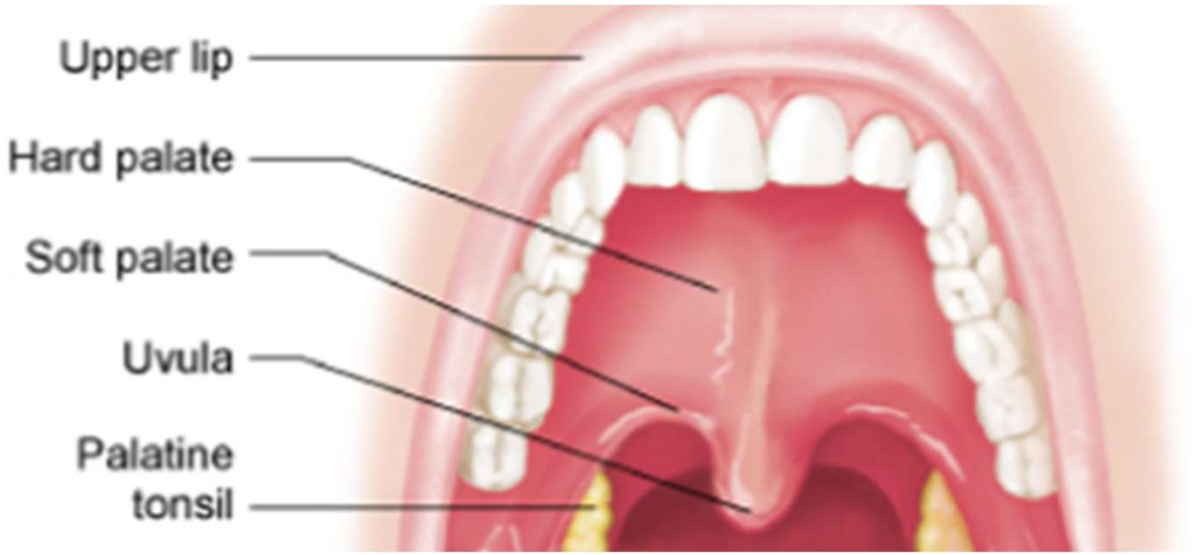
- Lips
- Cheeks
- Hard and soft palate
- Tongue



Hard and Soft Palate

- Roof of the mouth is formed by the hard and soft palate
- Hard palate
  - Anterior part of mouth, formed by parts of the palatine and maxillary bones
- Soft palate
  - Located in posterior of mouth
  - Consists of muscle
  - A process hanging from center of soft palate is the uvula
    - Uvula and soft palate prevent food/liquid from entering nasal cavities
    - Assist with speech and swallowing




Upper lip
Hard palate
Soft palate
Uvula
Palatine tonsil

Tongue

- Occupies most of the buccal cavity when the mouth is closed
- Secured to the floor of cavity by lingual frenulum
- Helps to mix food with saliva to form a bolus
- Pushes bolus into pharynx during deglutition (swallowing)
- One third of tongue lies in oropharynx

Teeth

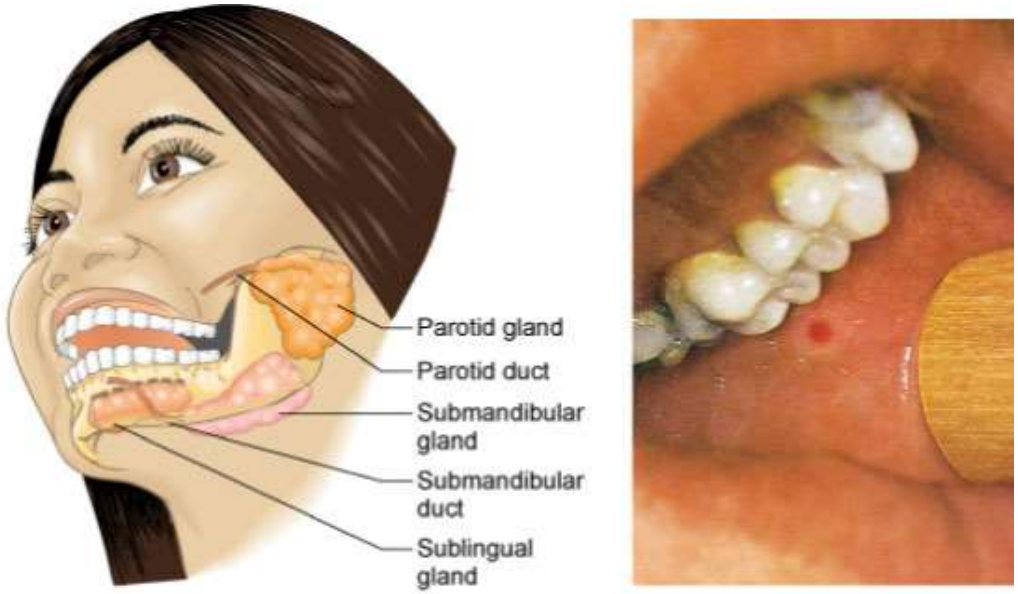
- 32 permanent (adult) teeth
- Categorized into the following types:
  - Incisors
    - "front teeth"
    - Sharp cutting edge, usually for biting food
  - Canines
    - More elongated, pointed in appearance
    - For tearing, piercing
  - Premolars
    - Just posterior to canines
  - Molars
    - Larger surface area, for grinding/crushing

Salivary Glands

- Purpose is to secrete saliva to lubricate, dissolve and begin the breakdown of food
- 3 pairs of glands
  - Parotid, submandibular, and sublingual
- 1-1.5 L of saliva is secreted each day in an adult
- Contains salivary amylase which begins the process of breaking down complex carbohydrates

Salivary Glands

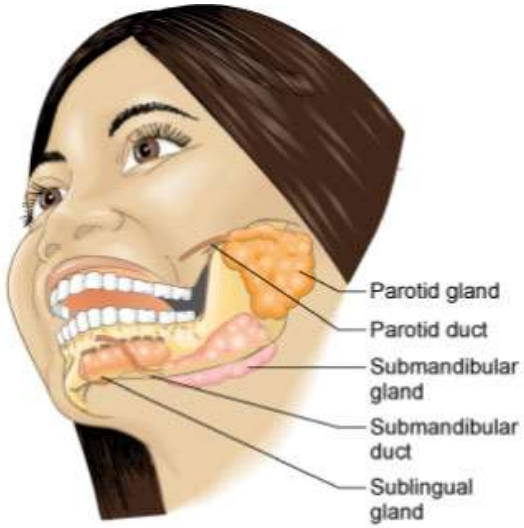
- Parotid
  - Largest
  - Lies inferior and anterior to the ear (at the angle of the jaw)
  - In cheeks on either side of face
  - Parotid duct (Stensen's) opens into the inner cheek opposite of upper second molars



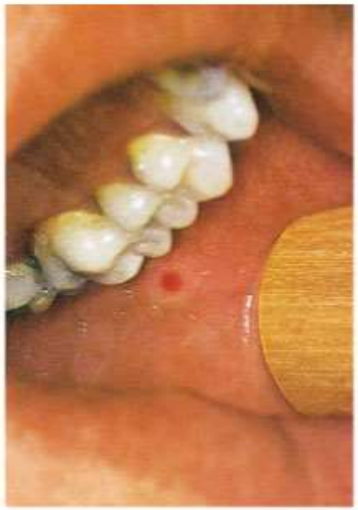
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diagnosis, ed 5, Philadelphia, 2007, Mosby.

Salivary Glands

- Submandibular
  - Underneath tongue at angle of mandible
  - Submandibular duct (Wharton's Duct) opens onto floor of mouth on either side of frenulum
- Sublingual
  - Floor of mouth anterior to submandibular glands, under mucous membrane
  - Sublingual duct beside the gland



A

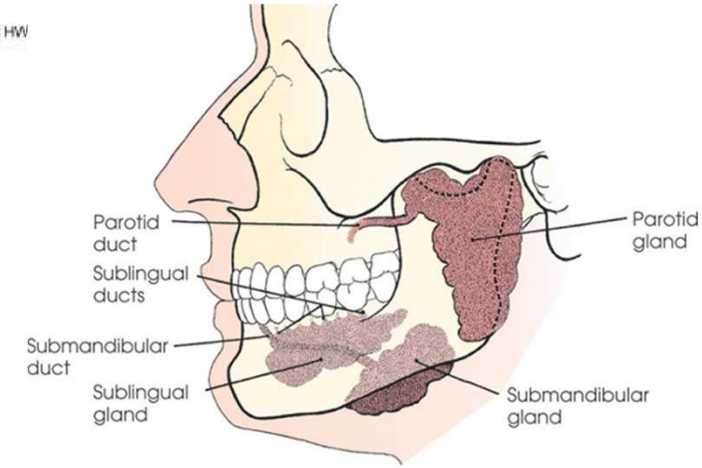


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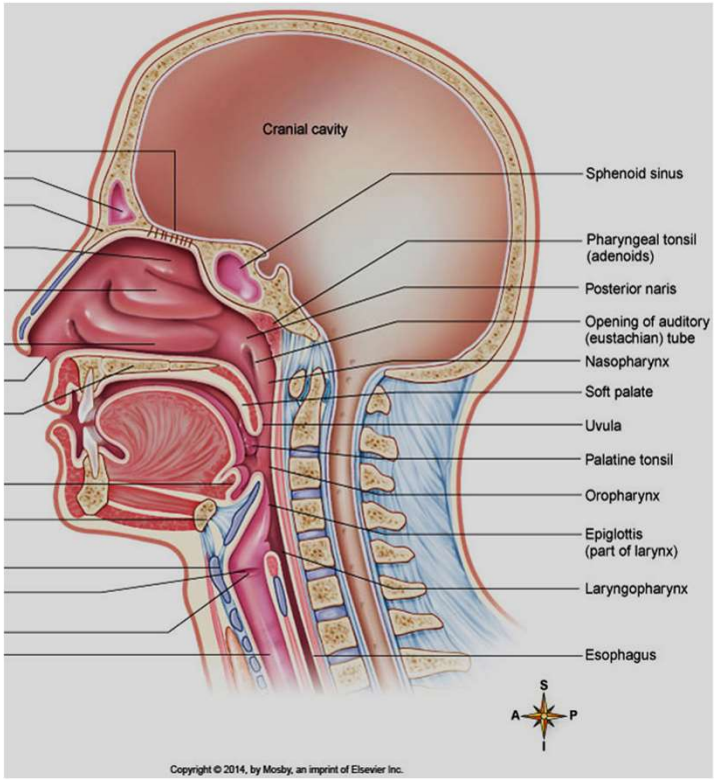
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Pharynx

- Tube like structure made of muscle and lined with mucous membrane
  - Divided into three components:
    - Nasopharynx
    - Oropharynx
    - Laryngopharynx
- Part of both the respiratory and digestive systems
  - Air has to pass through it on its way to the lungs
  - Food must pass through it on its way to the stomach



Oropharynx

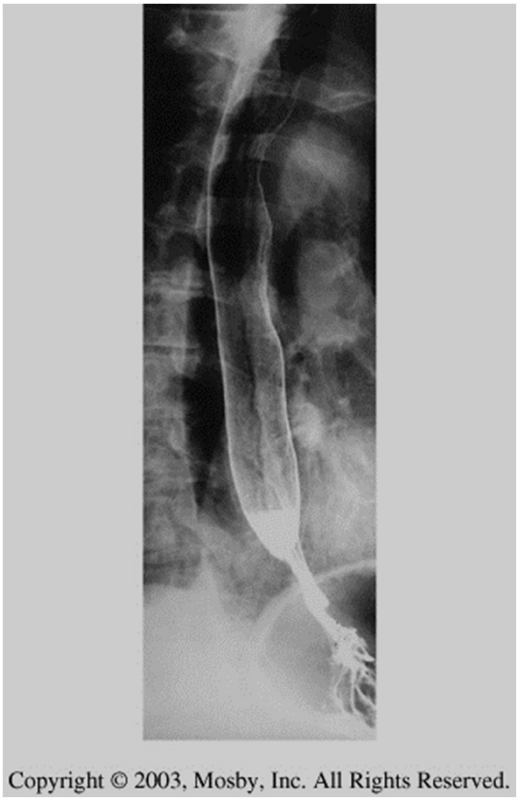
- Most directly involved with the digestive process because of its important role in swallowing
- Mastication (chewing) involves voluntary movements that result in forming a bolus, which is moved involuntarily through the oropharynx and into the esophagus, then into the stomach

Esophagus

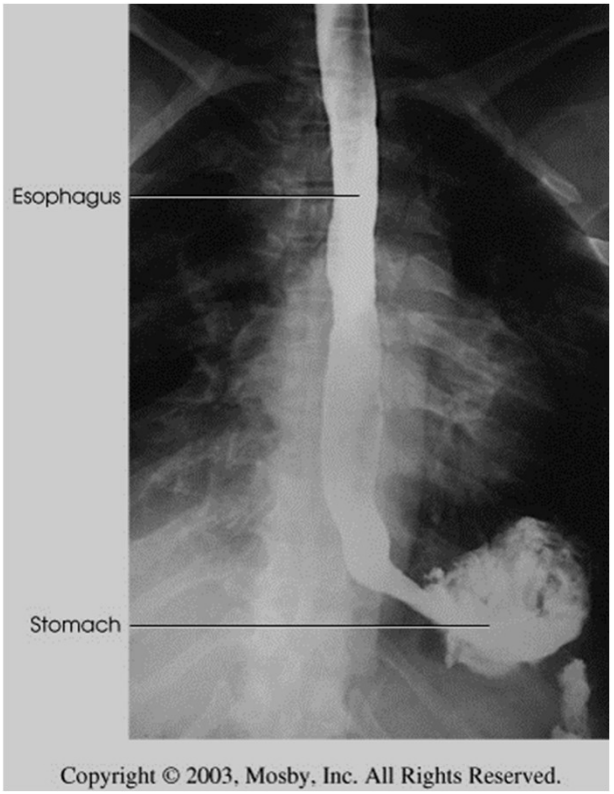
- Long collapsible, muscular, mucus lined tube
  - About 25 cm long, extends from laryngopharynx to stomach
- Located posterior to the trachea
- Collapsed when not full of food
- Epiglottis directs food into it
- Passes through the diaphragm at esophageal hiatus
- Both ends are protected by sphincters
  - Upper – prevents air from entering the tube when breathing
  - Lower – prevents backflow of acidic stomach contents

Fluoroscopic Esophogram

RAO


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AP

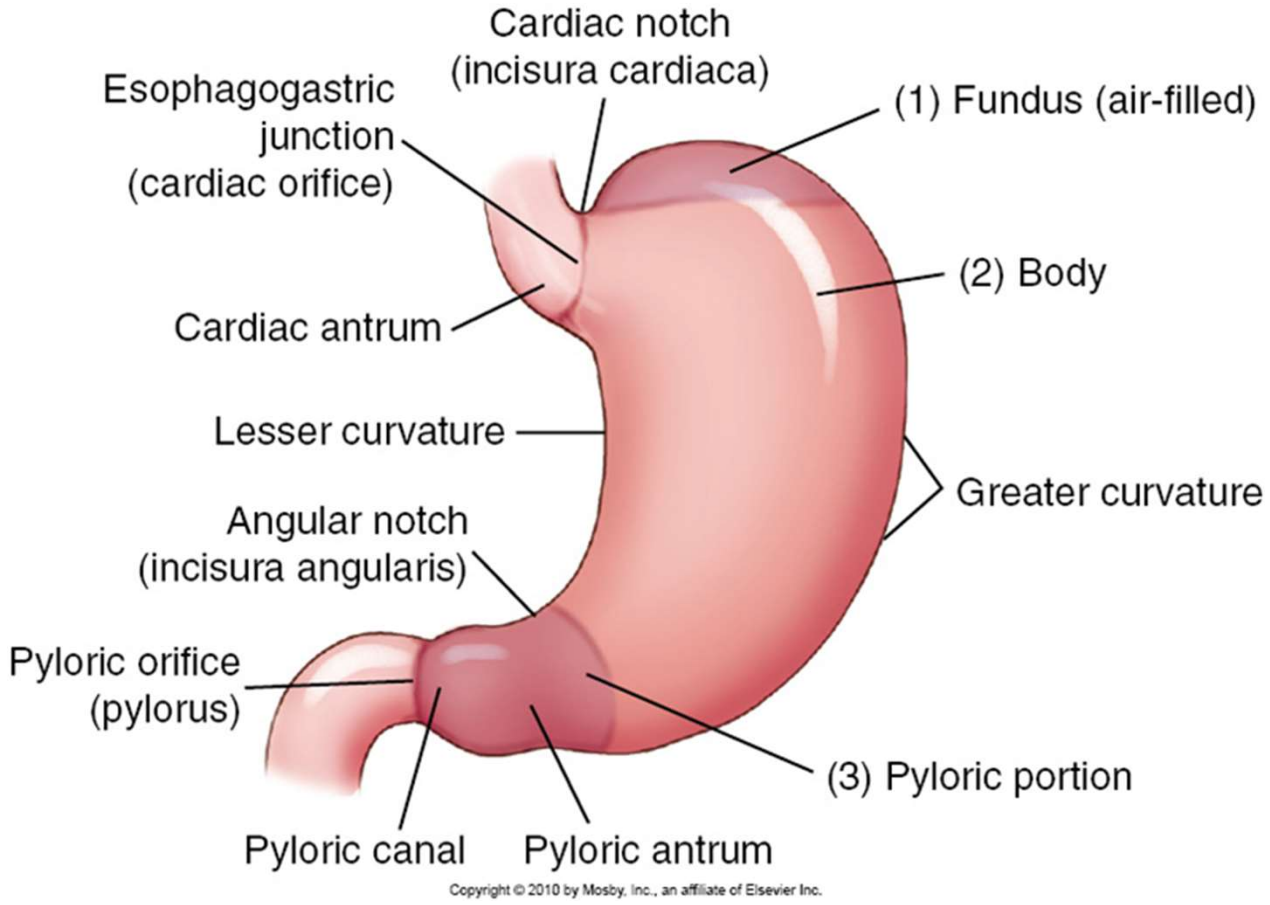


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Stomach

Three divisions: fundus, body and pylorus

- Fundus
  - Is the enlarged portion to the left of and above the opening of the esophagus into the stomach
- Body
  - Large central region
- Pylorus
  - Lower narrow section
  - Joins with the first part of the small intestine



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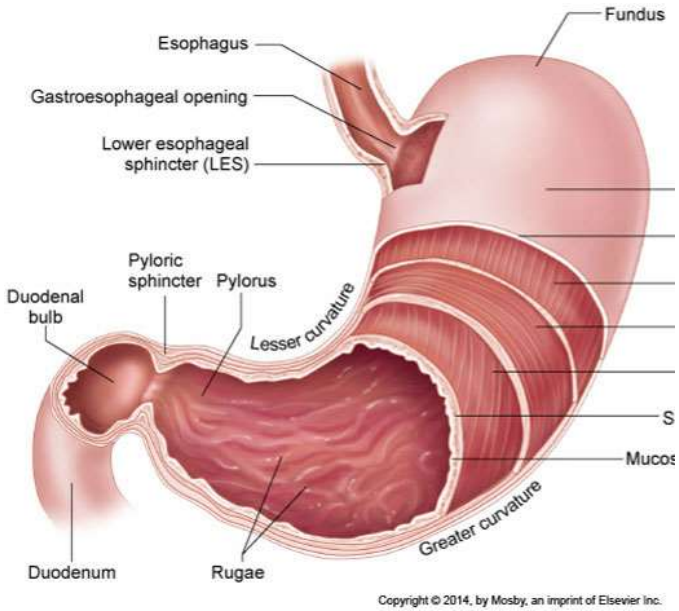
Stomach

- One of the strongest organs due to the muscle fibers that run lengthwise, around and obliquely
  - Breaks food up into particles and mixes it with digestive enzymes and hydrochloric acid (HCl)
    - Forms semi-solid mixture called **chyme**
- When the stomach is empty, it is small, but can expand considerably
- Lined with soft folds of mucosa

called rugae

- When the stomach is full,

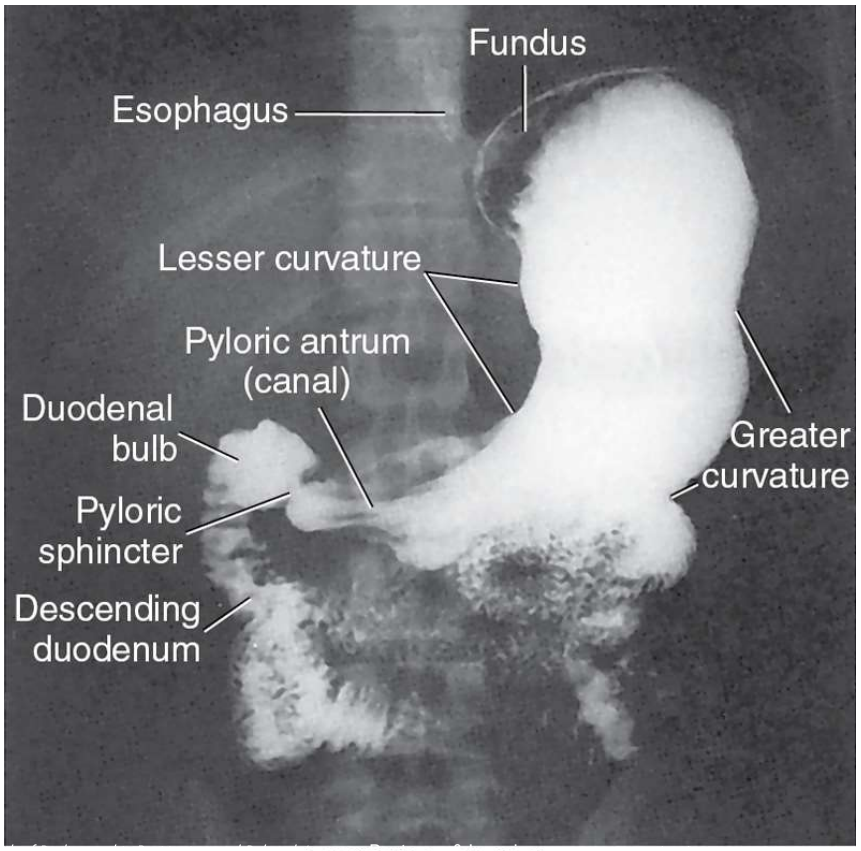
the rugae are smoothed out



Stomach - function

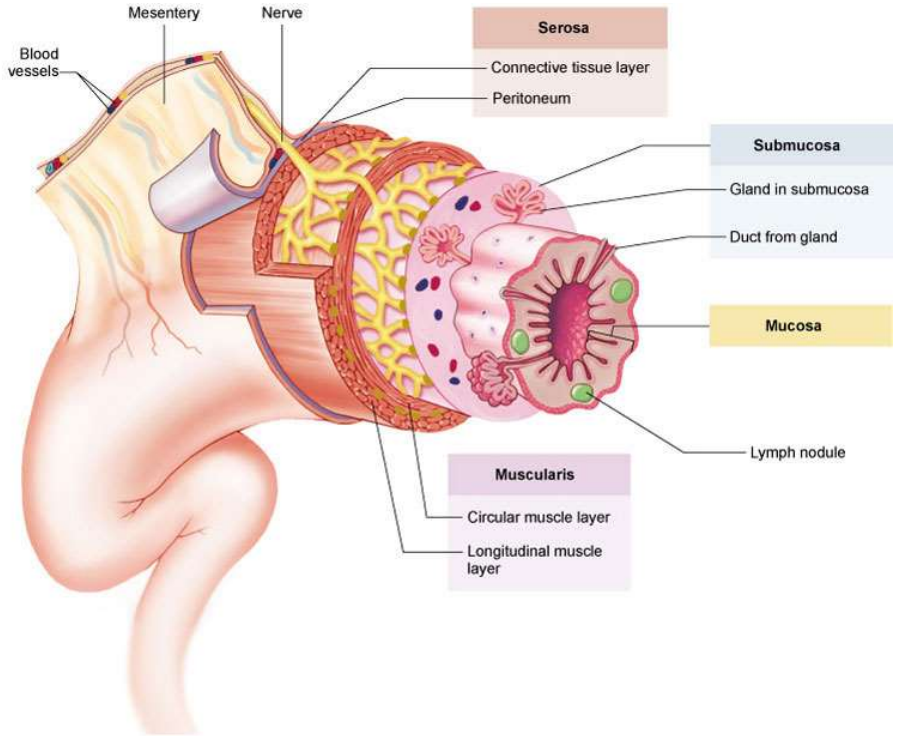
- Food enters the stomach through the lower esophageal sphincter
- Stomach muscles contract to mix the food with gastric juices – breaks it down into chyme
- Chyme stays in the stomach for a while, so that partial digestion of proteins can occur
- The pyloric sphincter (when contracted) closes off the opening of the pylorus to the small intestine
  - Chyme begins its passage through the pyloric sphincter into the first part of the small intestine (duodenum)

Recognize radiographic anatomy



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Gastrointestinal Wall Structure



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Layers of the Gastrointestinal Wall

From the lumen outwards:

Mucosa-epithelium, folds into villi

Submucosa-contains nerves, blood vessels, elastic fibres

Muscular layer – contains longitudinal and circular smooth muscle, for peristalsis

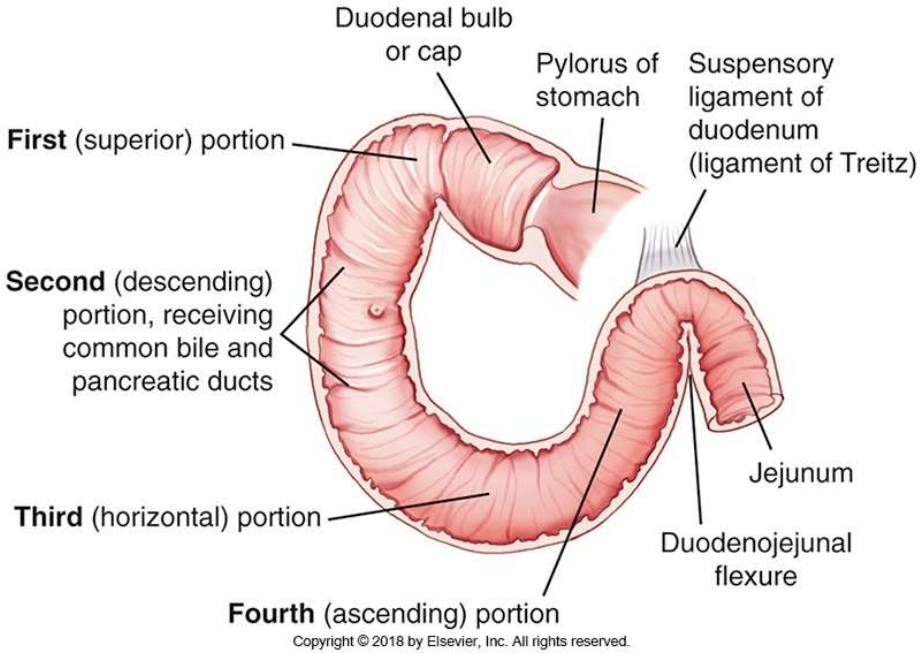
Serosa-loose connective tissue, allows for movement of the intestines without friction

Small Intestine

- Includes the pyloric sphincter of the stomach to the ileocecal valve
- 6.5 -7 m in length, about 4 cm in diameter
- Very long tube to contain within the abdominal cavity – coiled into loops
- Three parts:
  - Duodenum
  - Jejunum
  - ileum

Duodenum

- Approximately 25 cm long
- Retroperitoneal
- Curves around the head of the pancreas
- At second portion, receives pancreatic juice and bile from the liver
- 4 portions



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Jejunum and Ileum

- Located in central and lower part of abdomen
- 20 feet long, jejunum is about 8 feet long and ileum is about 12 feet long
- Attached to the posterior abdominal wall by the mesentery
- Ileum connects to the large intestine at ileocecal valve

Small Intestine - functions

- Most of the chemical digestion and absorption occurs in the small intestine
- Moves chyme along the length though peristalsis
- Absorption of nutrients into blood stream along the way
- Remaining chyme passes through the ileocecal valve into large bowel

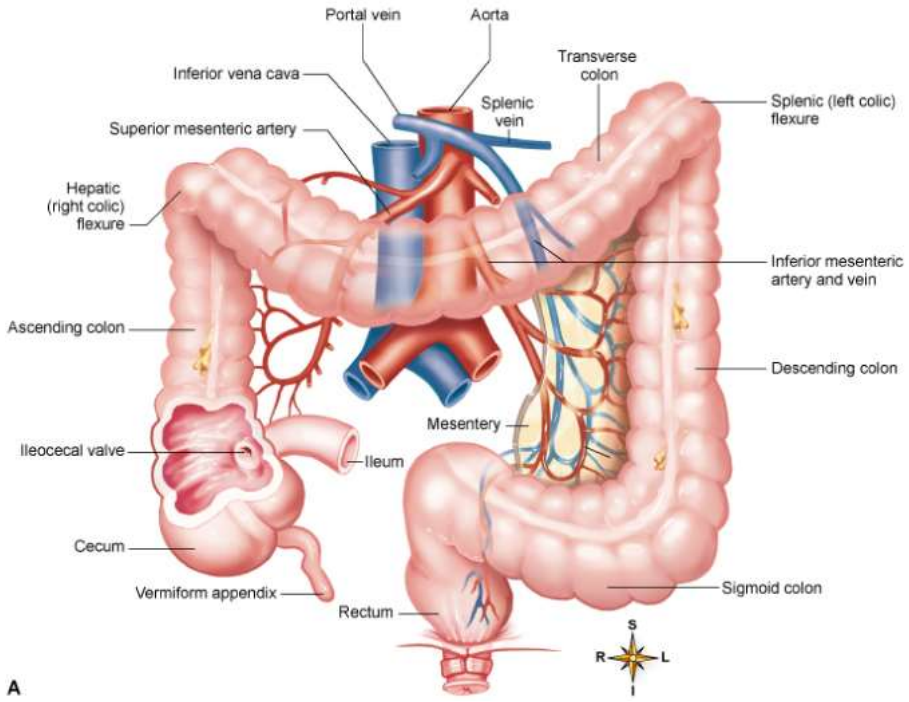
- Structurally, the lining of the small intestine is designed for absorption
  - Circular folds – plicae circularis
  - Plicae are covered with villi (finger-like projections)
    - Increases absorptive surface area
    - Each villus is covered with microvilli

Large Intestine (Colon)

- Extends from ileocecal valve to anus
- Approximately 5 feet long
- Larger diameter than the small intestine, and forms the lower portion of the digestive tract
- Cecum, colon, rectum, anal canal
- Teniae coli – longitudinal muscular bands that form haustra of large bowel

Large Intestine

- Cecum
- Ascending Colon
- Transverse Colon
- Descending Colon
- Sigmoid
- Rectum
- Anus
- Flexures:
  - Hepatic (right colic)
  - Splenic (left colic)



Large Intestine - Functions

- Final absorption of water and formation of feces
- Bacteria in large intestine help to produces some vitamins (K and B)
  - After formation, they are absorbed and enter the blood
- Some absorption of water, salts and vitamins occur in the large intestine, but this segment of the digestive tract is not well suited for absorption of nutrients
  - No villi, less surface area
  - Efficiency and speed of absorption are lower than in the small intestine

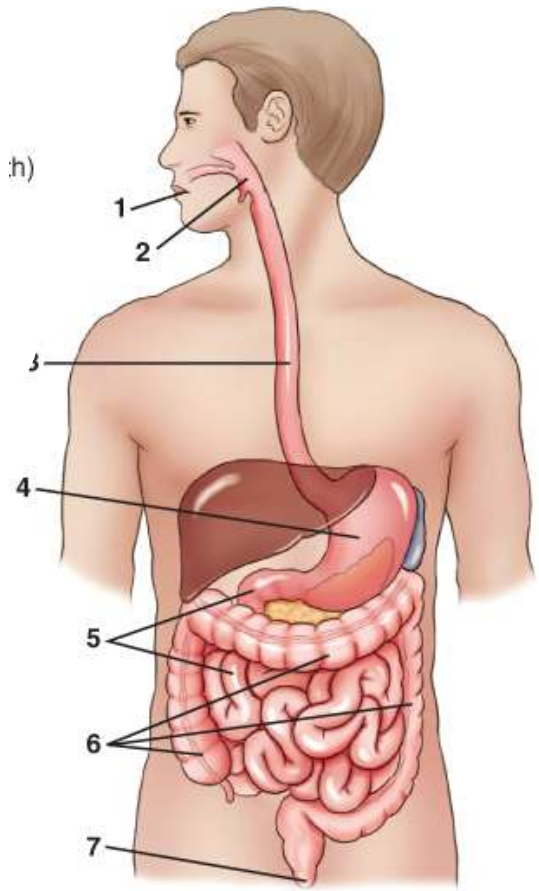
Large Intestine - Functions

- Material enters cecum through ileocecal valve, into cecum (pouch like area)
- Then it flows upward to the colon (ascending) and travels through to the rectum
- Two sphincter muscles stay contracted to keep anus closed
  - Except during defecation
- Passage of material takes about 3-5 days.

Appendix

- Vermiform appendix -"worm like"
- Attached to the back of the cecum
  - Has a lumen that communicates with the large intestine below the opening of the ileocecal valve into the cecum
- Appendix serves as an incubator for nonpathogenic bacteria that normal reside in the colon
- Maintenance of normal gut flora helps prevent pathogenic bacteria from establishing
  - When the normal microbiome of the gut is disrupted, beneficial bacteria hidden in the appendix can easily migrate into colon to restore balance

- Oral cavity
- Pharynx (oropharynx)
- Esophagus
- Stomach
- Duodenum and small intestine
- Large intestine
- Anus



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Accessory organs of Digestion

Liver

The liver has many functions, but in digestion it's function is to help process nutrients in the small intestine

- Bile produced in the liver helps emulsify and digests fats

Gall bladder

The gall bladder stores and secretes the bile produced by the liver, stimulated by the hormone CCK, produced by the duodenum

Pancreas

The pancreas secretes digestive enzymes into the duodenum

The enzymes break down protein, carbohydrates and fats

Also produces insulin, to metabolize sugars

Follow the Food

Summarize the basic process of food as it is eaten and passes through the digestive system.

Follow the food

- Food enters the alimentary canal via the oral cavity
  - Chewing the food starts mechanical digestion
  - The food is broken down and mixed with saliva until it forms a bolus
    - Teeth and salivary glands
  - Tongue helps to push bolus into pharynx during deglutition (swallowing)

2. Bolus passes through oropharynx into the esophagus
   - Epiglottis directs bolus into esophagus
   - Bolus passes through LES into stomach

3. Food bolus enters stomach
    - Stomach muscles contract and mix the bolus with gastric juices to form chyme
4. Chyme enters the small intestine by passing through the pyloric sphincter
    - Sphincter normally contracted, and closes the pylorus off from the duodenum
5. Chyme passes through duodenum, jejunum and ileum
    - Receives pancreatic juices and bile from liver
    - Most of the chemical digestion and absorption and occurs here
        - Villi and microvilli

6. Chyme passes through ileocecal valve into cecum
    - Flows upward to ascending colon
    - Some absorption of water, salts and vitamins
        - No villi
7. Chyme passes through large intestine
    - Formation and storage of feces until evacuation
8. Evacuation of waste
    - Sphincters relax to allow waste to be evacuated

THANKS