Digestive System

How your body obtains nutrients

Vocabulary

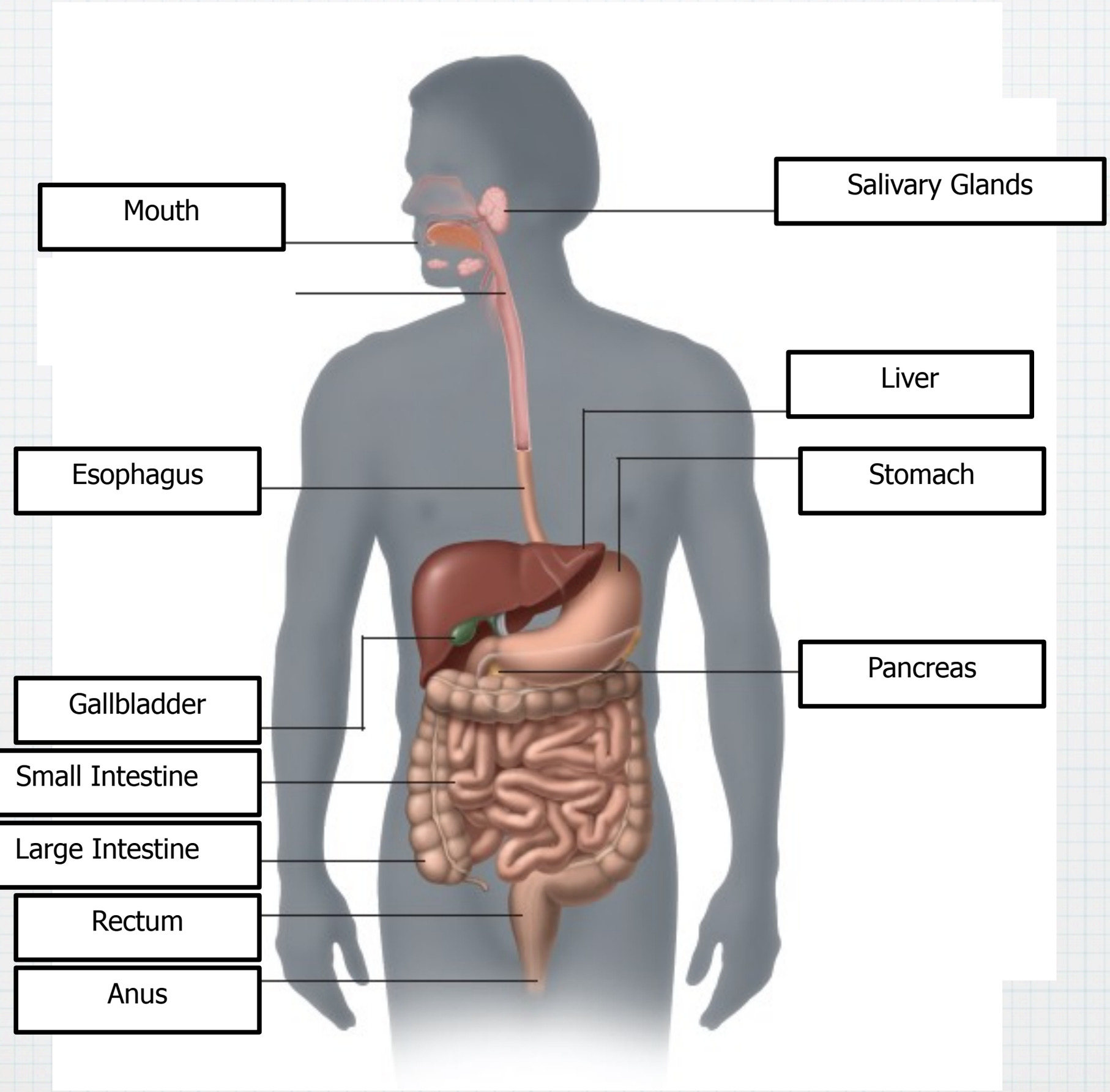
* Ingestion: food enters the system
  * Physical and enzymatic breakdown begins
* Digestion: Further breakdown
  * Chemical/enzymatic

Vocabulary

* **Absorption**: Nutrients enter circulatory system
  * Delivered to tissues of the body
* Elimination of Waste (**Egestion**):
  * Removal of wastes from body

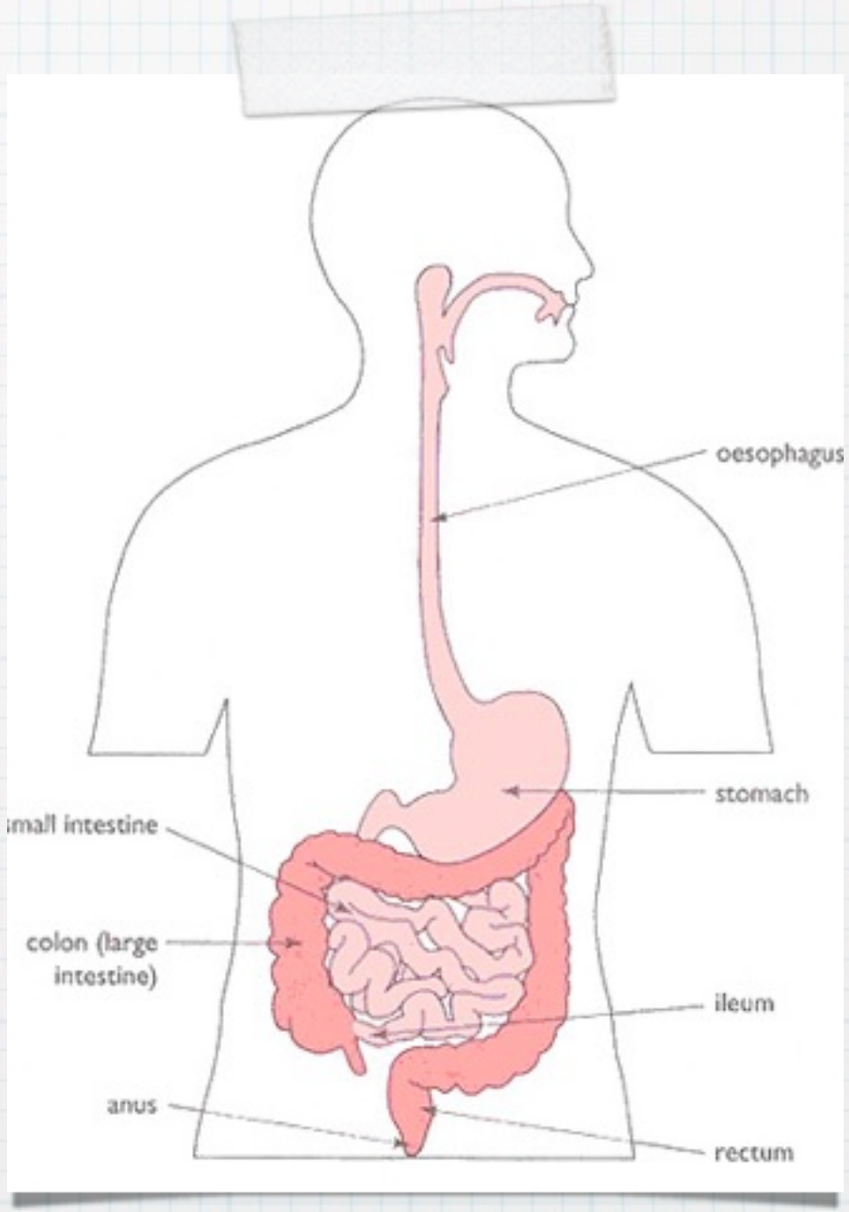
Digestion

* Two types of digestion
  * 1) Mechanical:
    * Chew, Tear, Grind, Mash, Mix
  * 2) Chemical
    * Enzymatic reactions to improve digestion of carbohydrates, proteins, lipids


Mouth
Salivary Glands
Liver
Esophagus
Stomach
Pancreas
Gallbladder
Small Intestine
Large Intestine
Rectum
Anus

Gastrointestinal Tract

* Gastrointestinal (GI) tract
  * Tube within a tube
* Direct link/path between organs



GI TRACT

* Mouth
* Pharynx
* Esophagus
* Stomach
* Small intestine
* Large Intestine
* Rectum

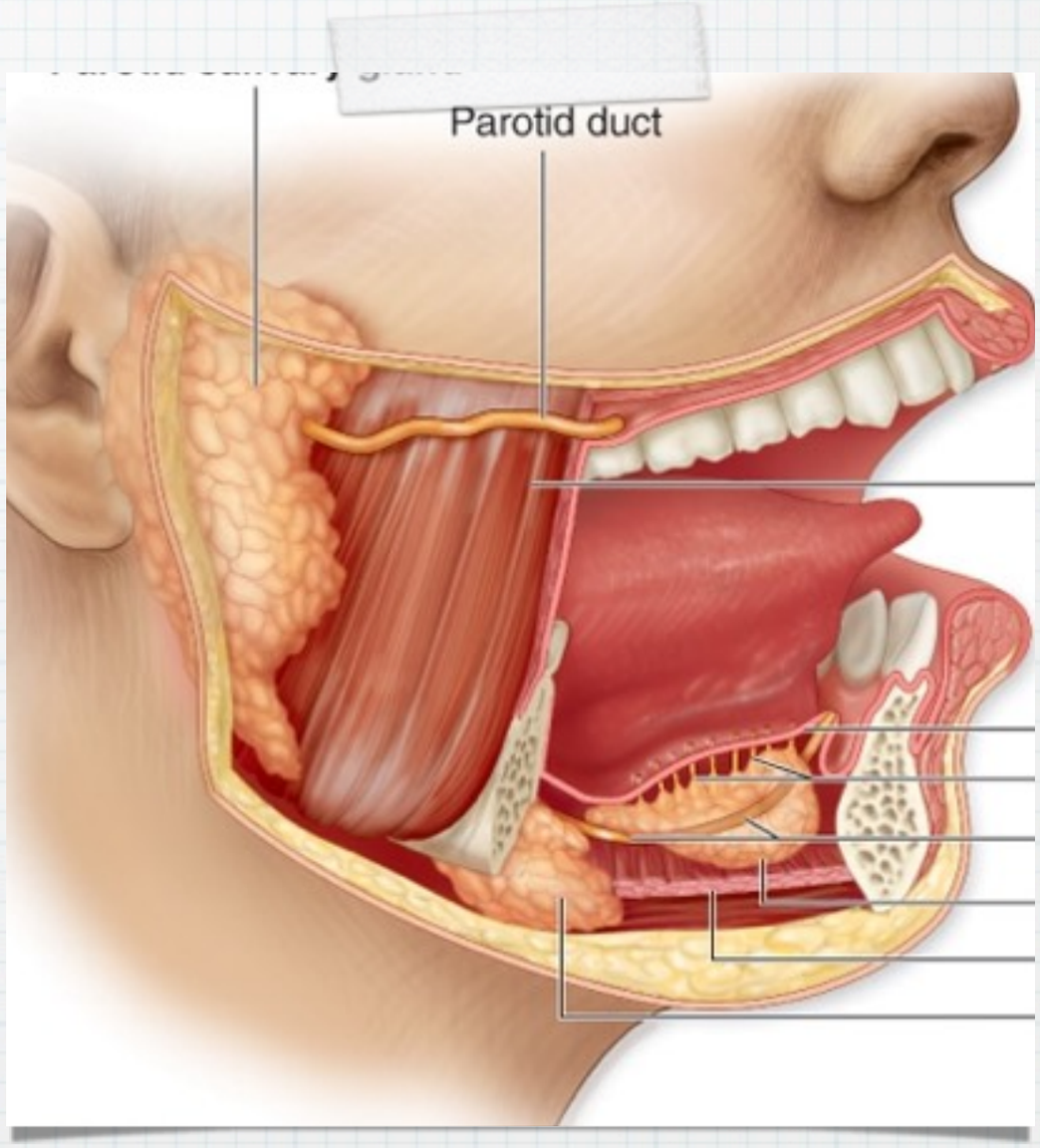
Accessory Organs

* Salivary Glands
* Gallbladder
* Liver
* Pancreas

Part 1:Digestion

Mouth

* Salvia produced by salivary glands.
* Lubricates food so it can be swallowed.
* Dissolves food particles so food can be tasted
    * Food must be dissolved to be tasted



Mouth

* On average we produce .75 to 1.5l of saliva per day
* Most of it is water which moistens the food into a ball or **bolus**

Mouth

* Chemical Digestion:
    * Salvia contains the enzyme amylase which begins to break down carbohydrates.

Mouth

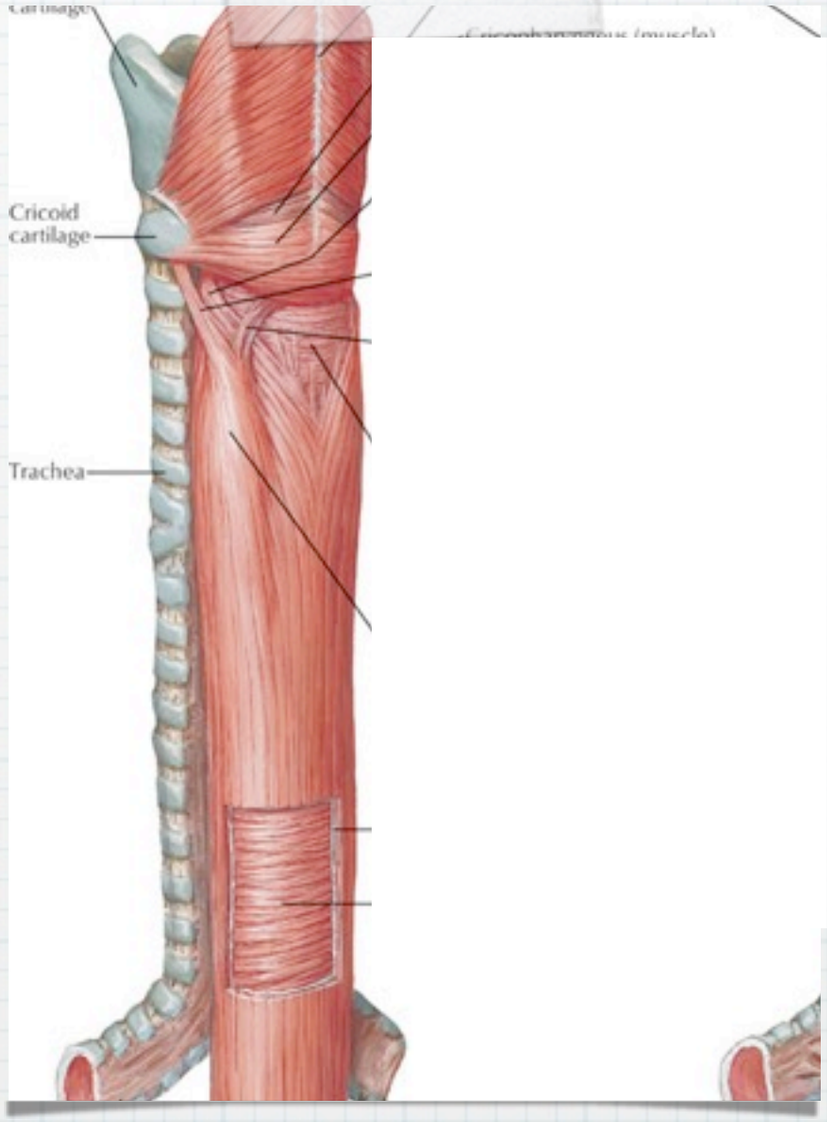
* Physical Digestion:
* Teeth: Incisors (cutting), canines (tearing), premolars (grinding), molars (crushing), wisdom teeth (annoying)
* Tongue: Mixes food with saliva

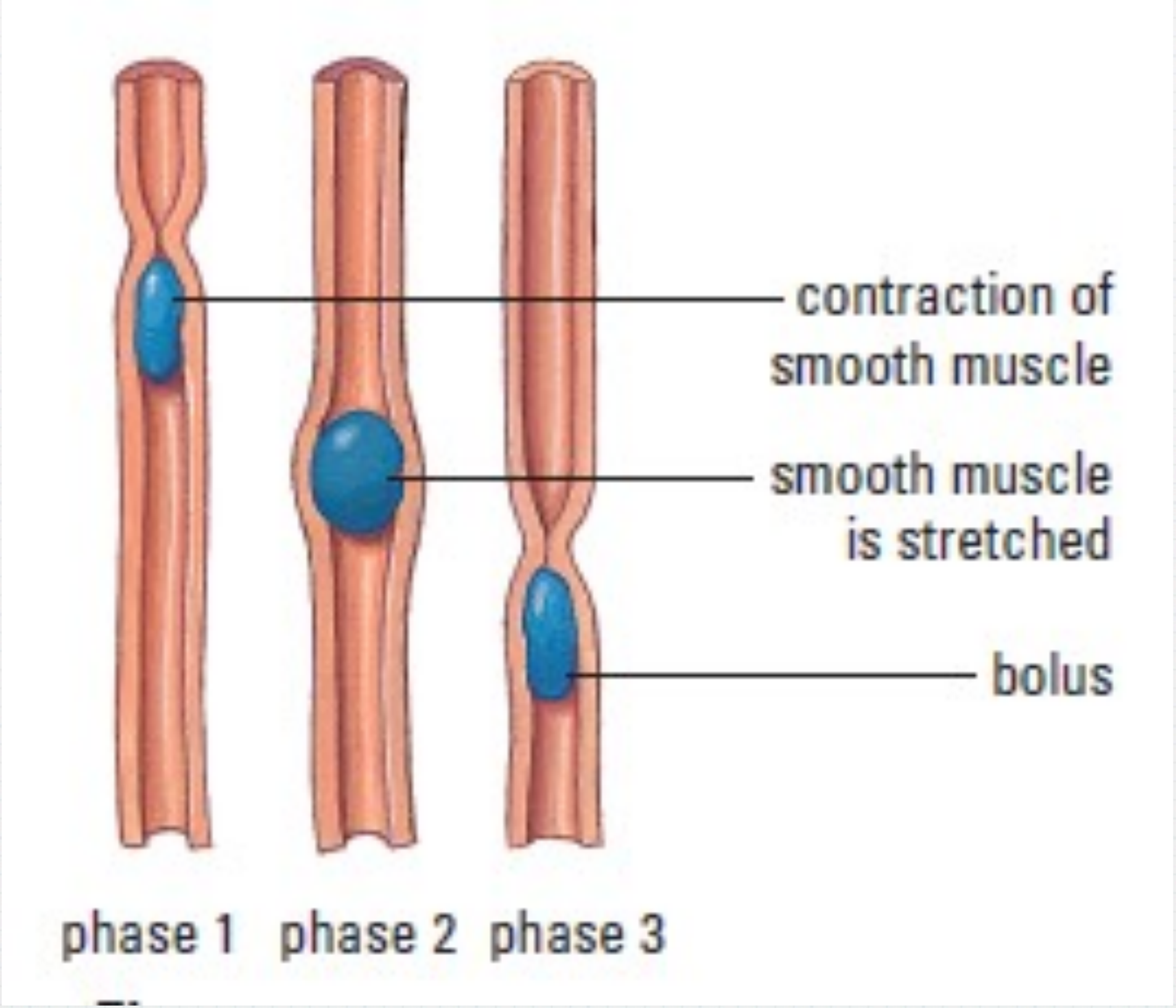
Epiglottis

* A flap of soft tissue covers the entrance to the trachea to prevent food from entering the lungs

Esophagus

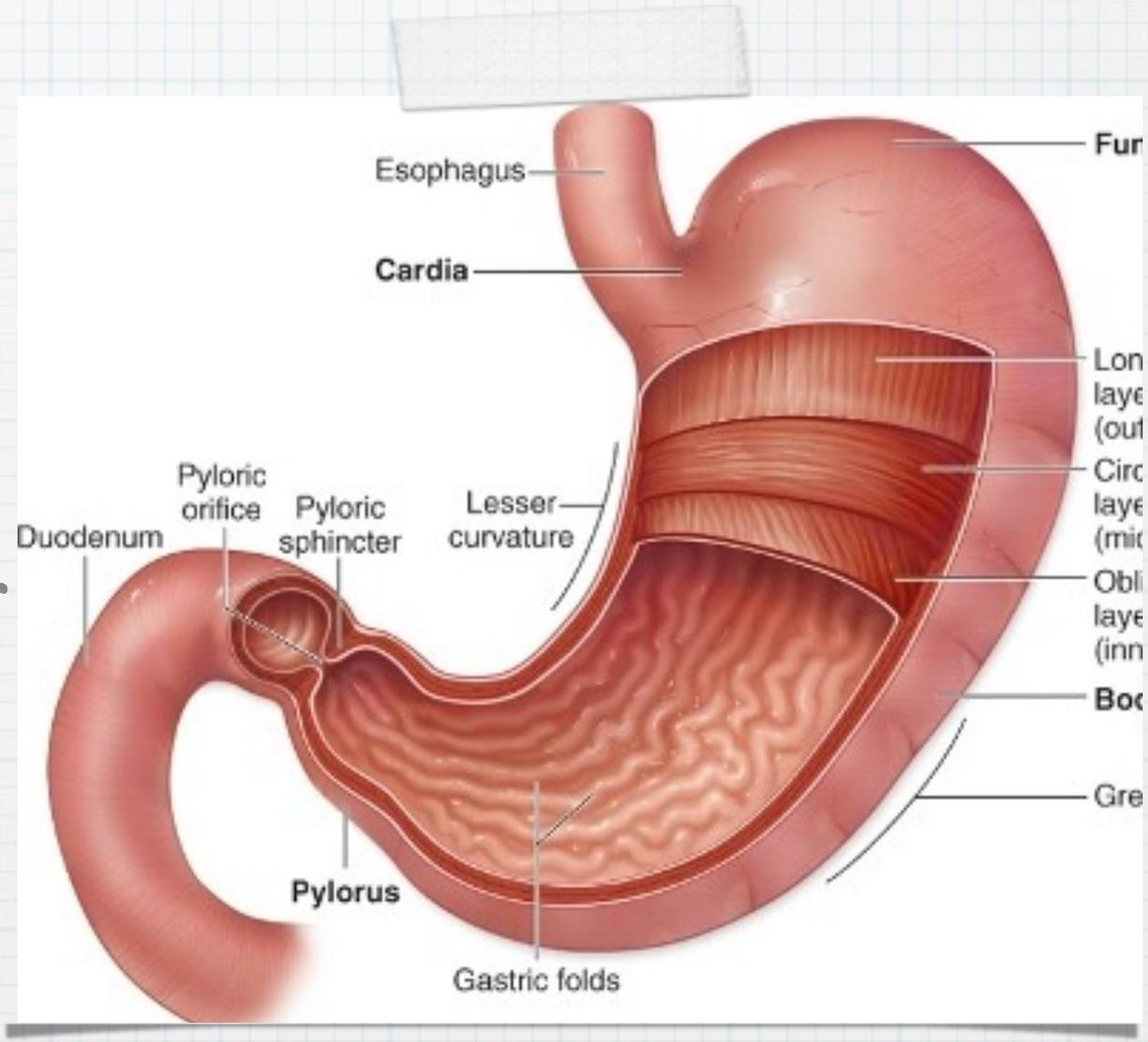
* Connects mouth to stomach
* Composed of smooth muscle (contracts in rhythmic wavelike fashion = peristalsis)
* Peristalsis (not gravity!) moves bolus down esophagus




contraction of smooth muscle
smooth muscle is stretched
bolus
phase 1
phase 2
phase 3

Stomach

* J-shaped muscular bag that stores the food you eat, breaks it down into tiny pieces.



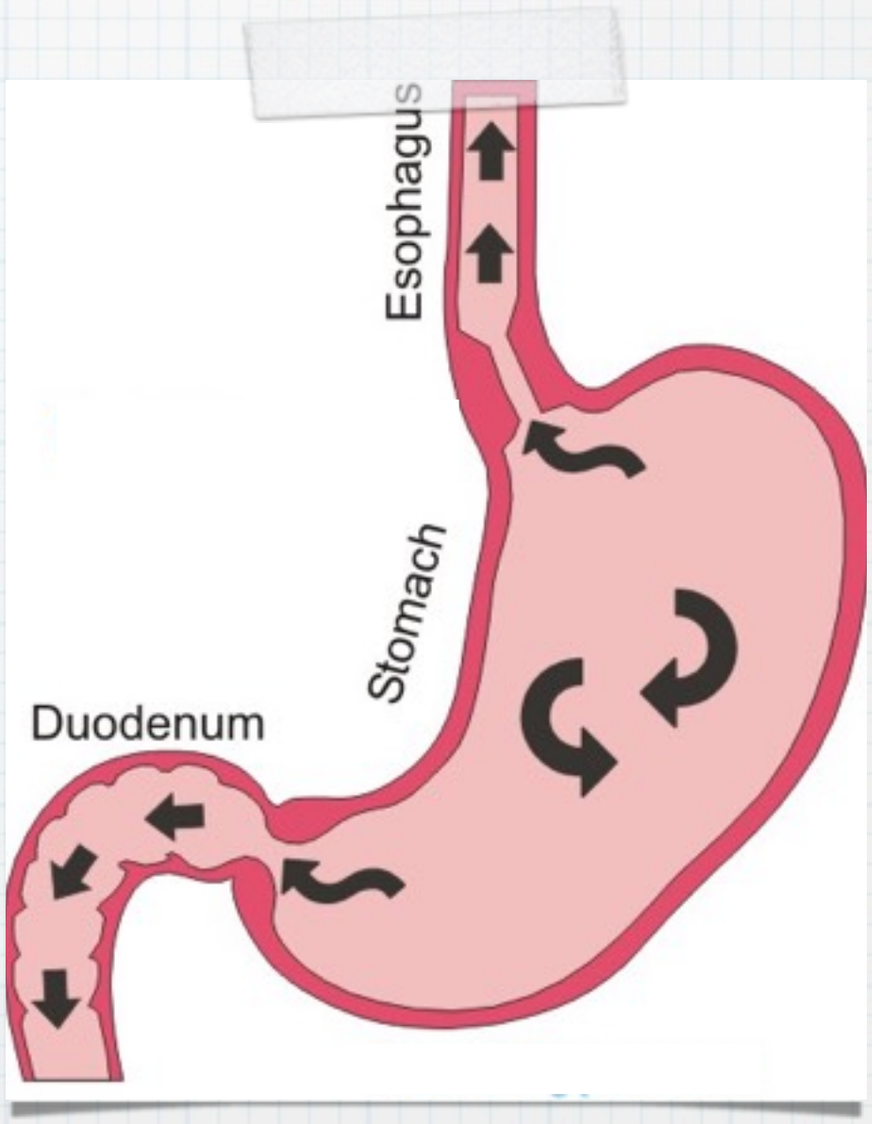
Stomach

* Chemical Digestion:
  * Gastric Juices:
    * **Mucus** provides a protective coating.
    * **Hydrochloric acid** kills many harmful substances that are ingested with food.
    * Pepsin is a **protein**-digesting enzyme.

Stomach

* Mechanical Digestion

* Stomach churning helps to mix food.

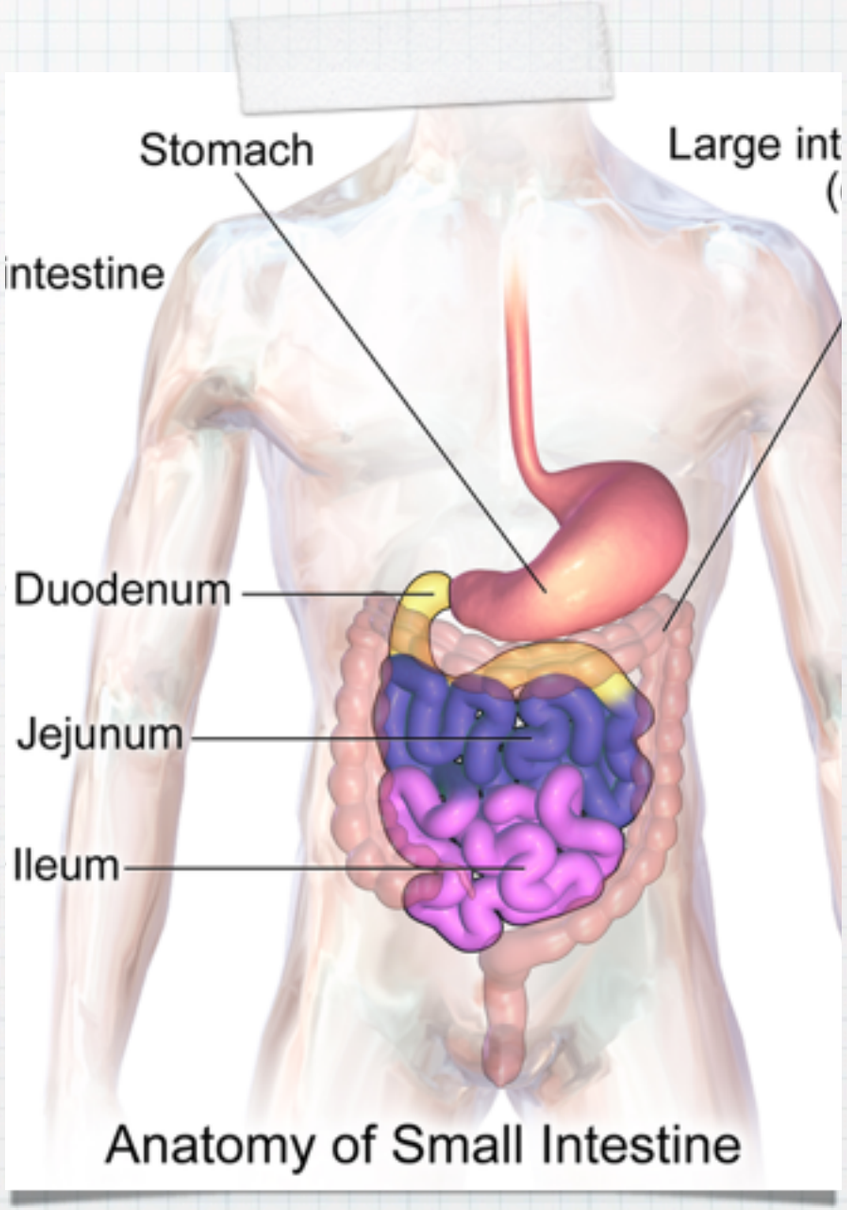


Small Intestine

* 2.5cm diameter, 7m in length
* Digestion in the first portions
* Absorption in the latter portions
* Food entering the small intestine from the stomach is a liquid known as chyme

Small Intestine

* Small intestine broken into three sections:
  * Duodenum: Most digestion happens here
  * Jejunum: Most nutrient absorption happens here
  * Ileum: Absorbs mostly B12 and bile salts



Anatomy of Small Intestine

Small Intestine

* Chemical Digestion:
    * Digestive enzymes line the cells of the small intestine and breakdown small food particles.

Small Intestine

* Chemical Digestion:
    * Carbohydrates: Broken down by sucrase, maltase, and lactase.
    * Proteins: Broken down by peptidase.
    * Fats: Broken down by lipase.

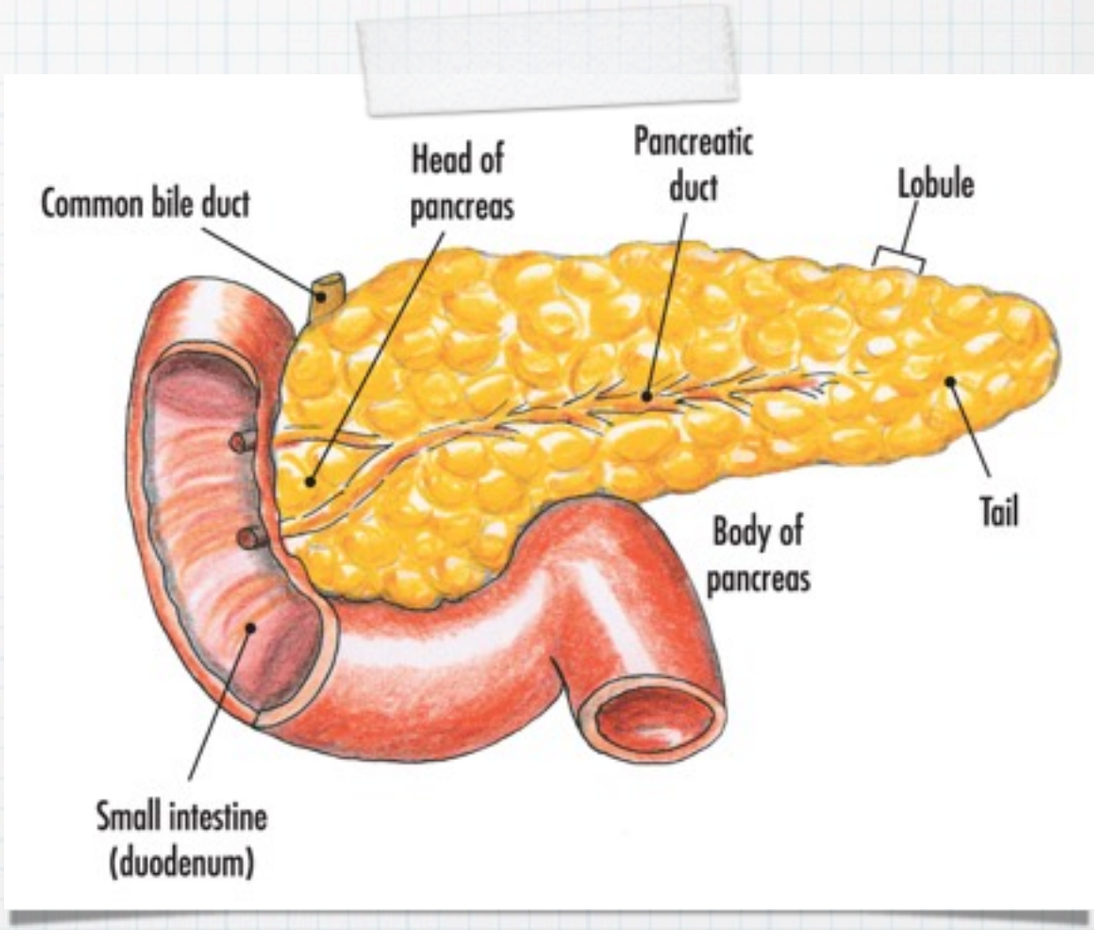
Small Intestine

* Mechanical Digestion:
  * Peristalsis helps break food into smaller particles.

Pancreas

* Secretes enzymes for digestion and hormones that regulate absorption and storage of glucose.

* Food entering small intestine is very acidic therefore the pancreas releases bicarbonate ions to neutralize the acid.



Pancreas

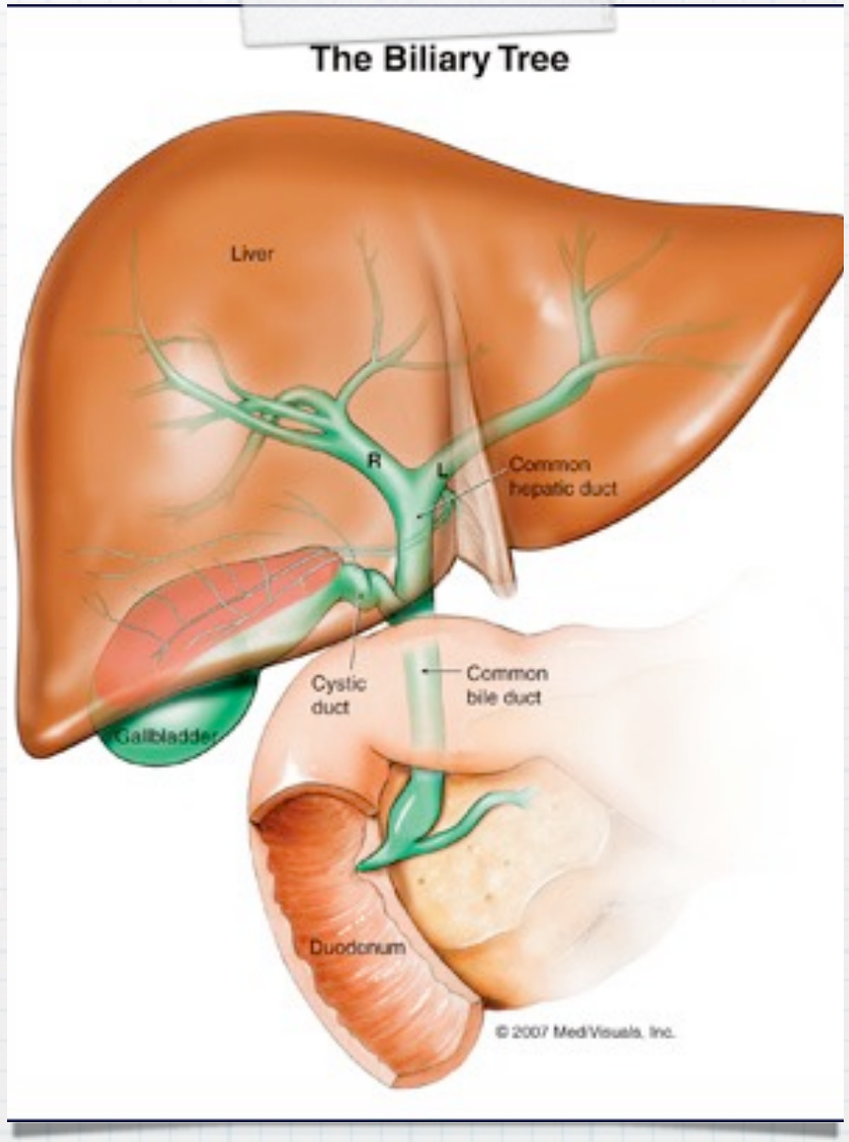
* Regulates blood sugar by producing insulin

Liver

* Involved in the removal and breakdown of toxins (such as alcohol)

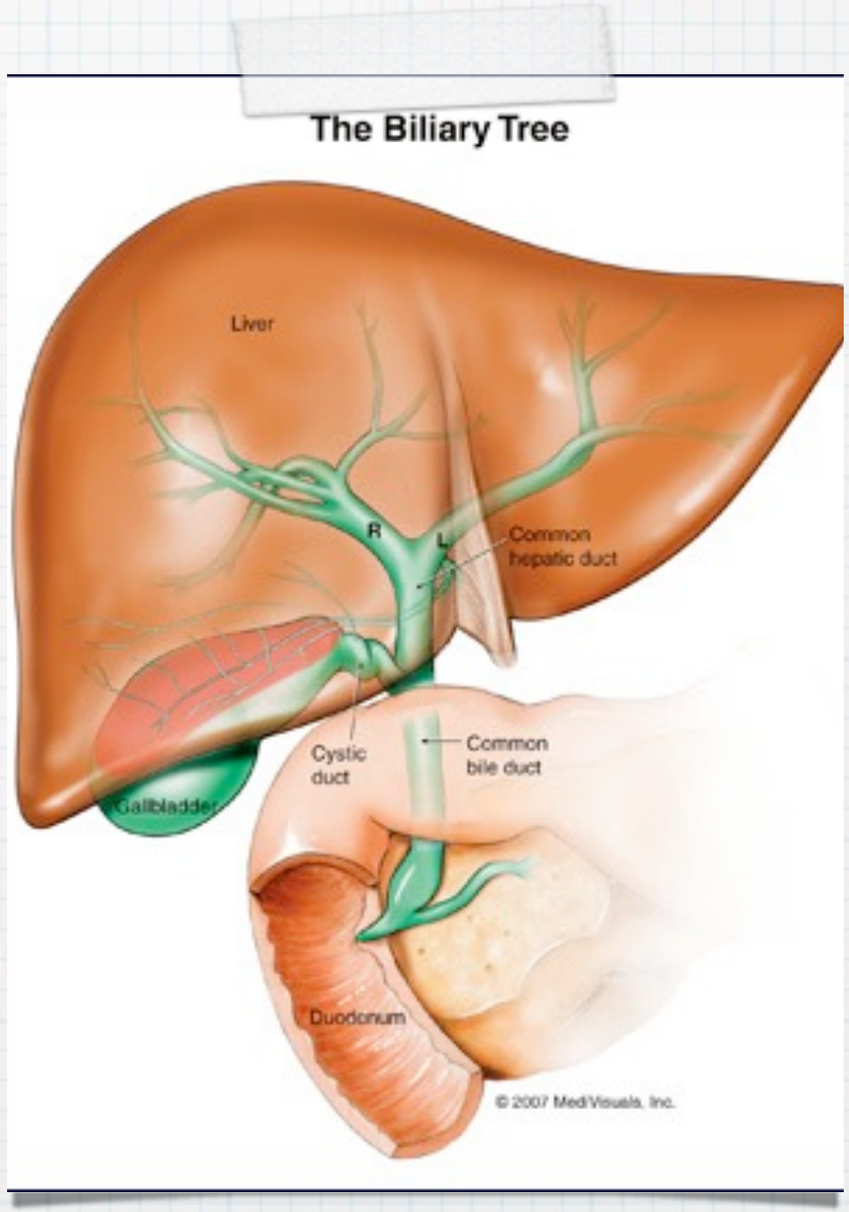
* Liver produces and secretes bile

  * Bile: a substance that emulsifies fats for faster breakdown



Gallbladder

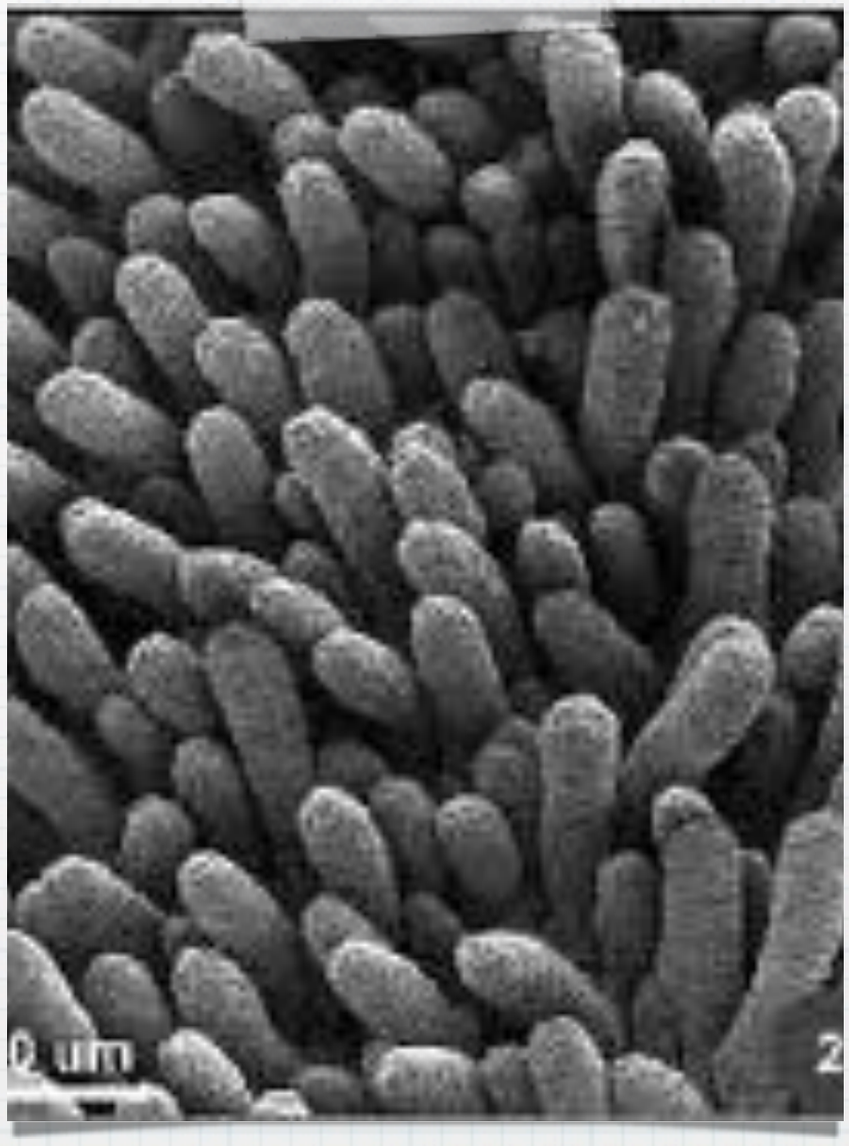
* Stores bile until food enters the duodenum
* Fatty diets can cause gallstones



Part 2: Absorption

Small Intestine

* Long finger-like folds/ tubes (villi, singular: villus) project from the lining of the small intestine to increase the surface area for absorption



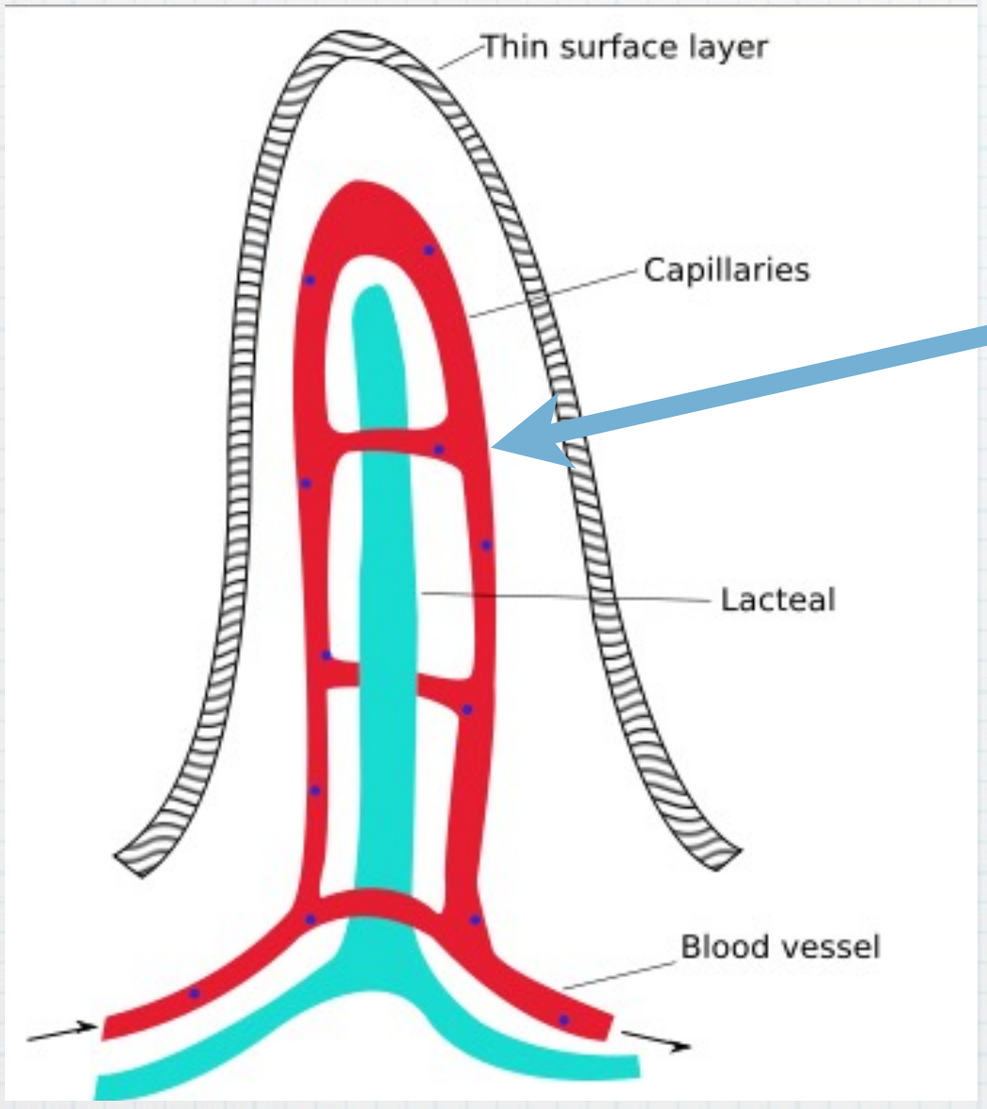
Small Intestine

* Microvilli project from the cell membranes of the villi to increase the surface area even more

Small Intestine

* Microvilli project from the cell membranes of the villi to increase the surface area even more

Small Intestine



Capillaries

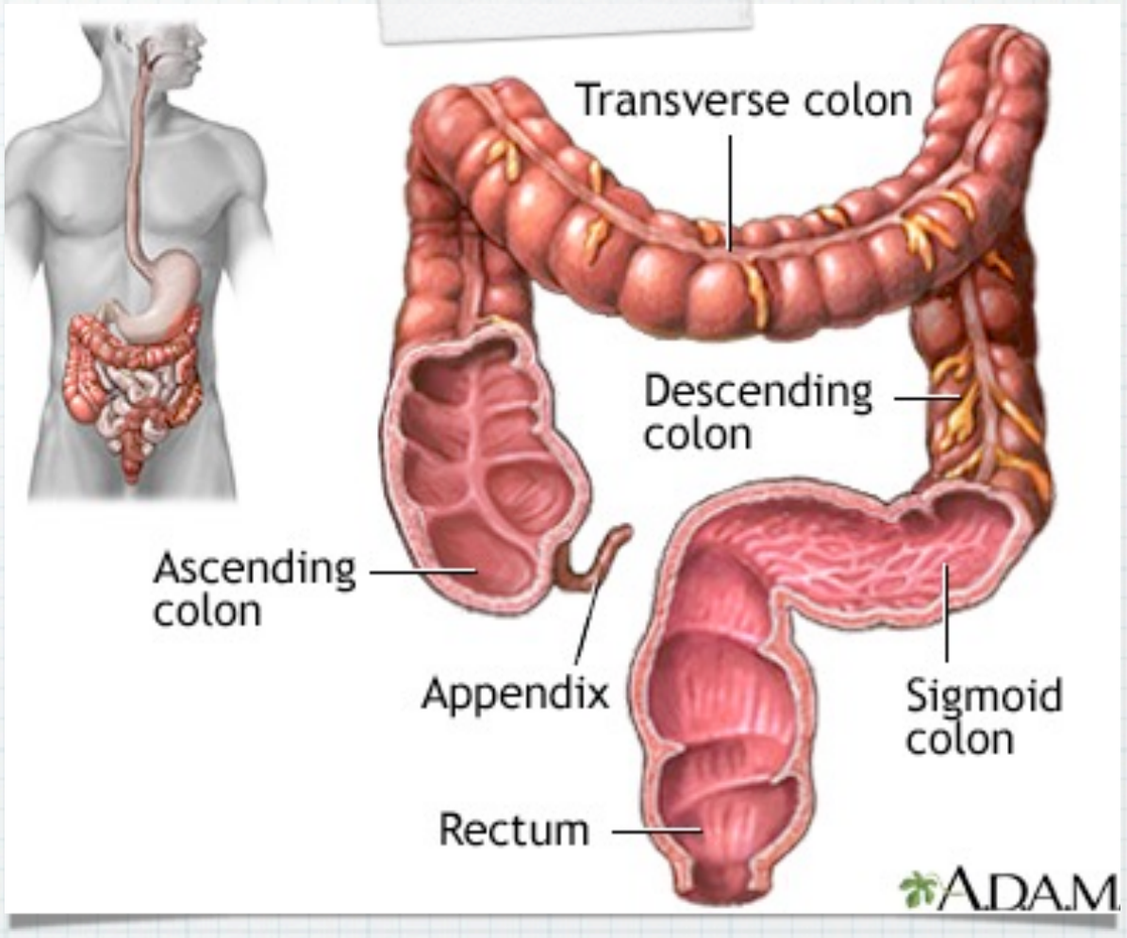
(tiny blood vessels) line the inside of villi to absorb nutrients into the circulatory system

Small Intestine

* Villi/microvilli increase the surface area of the small intestine 10-30x
* More surface area = more efficient absorption
* All of these folds give the small intestine a surface area close to that of a tennis court

Large Intestine

* 7.6cm diameter, 1.5m in length
* **Colon**: largest part of the large intestine



Large Intestine

* Water, salts, minerals are absorbed here

* Nearly 8 L of fluid enters the large intestine - only about 0.1 L or so comes out as solid waste.

Large Intestine

* Contains bacteria that help further breakdown food.
* Further absorbs vitamin K, B12, and other vitamins.
* Absorbs water.

Rectum

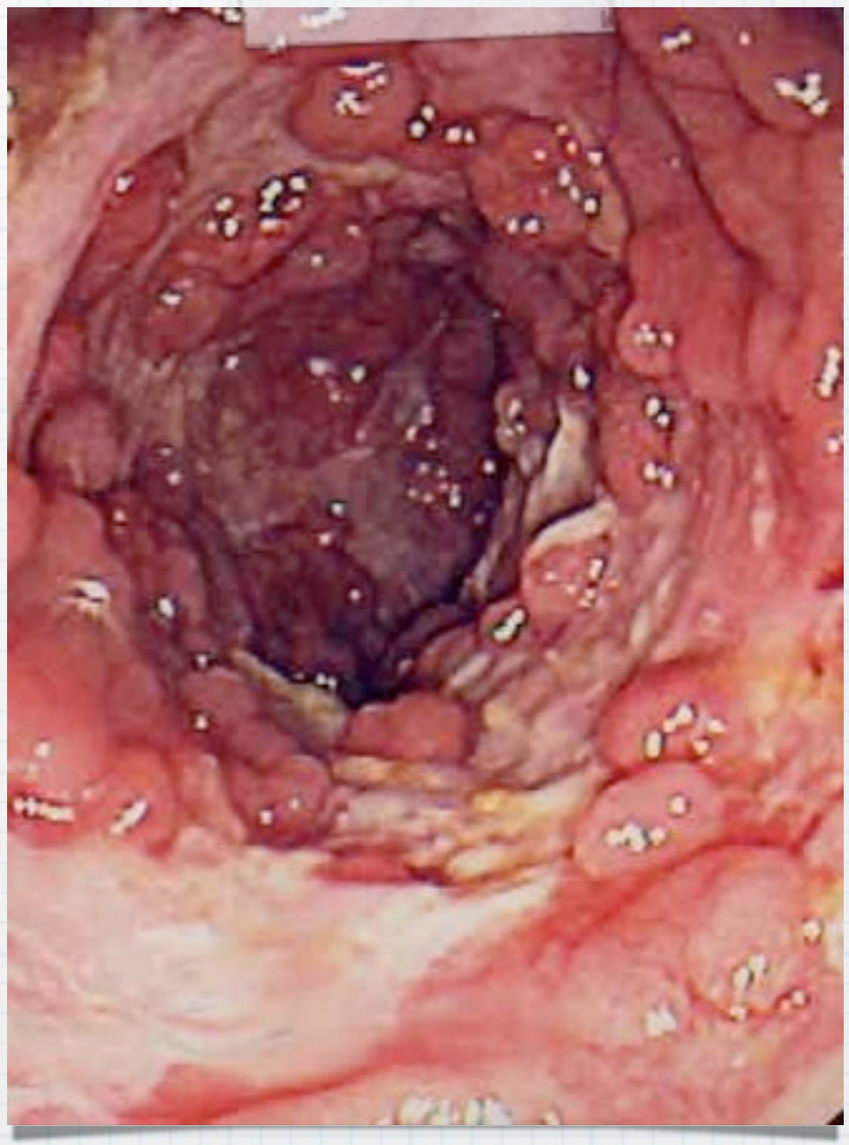
* The lower 20cm of the large intestine where feces are stored

* It may take 4 to 72 hours for the undigested material to pass through the large intestine, depending on the types and volume of food eaten

Digestive Disorders

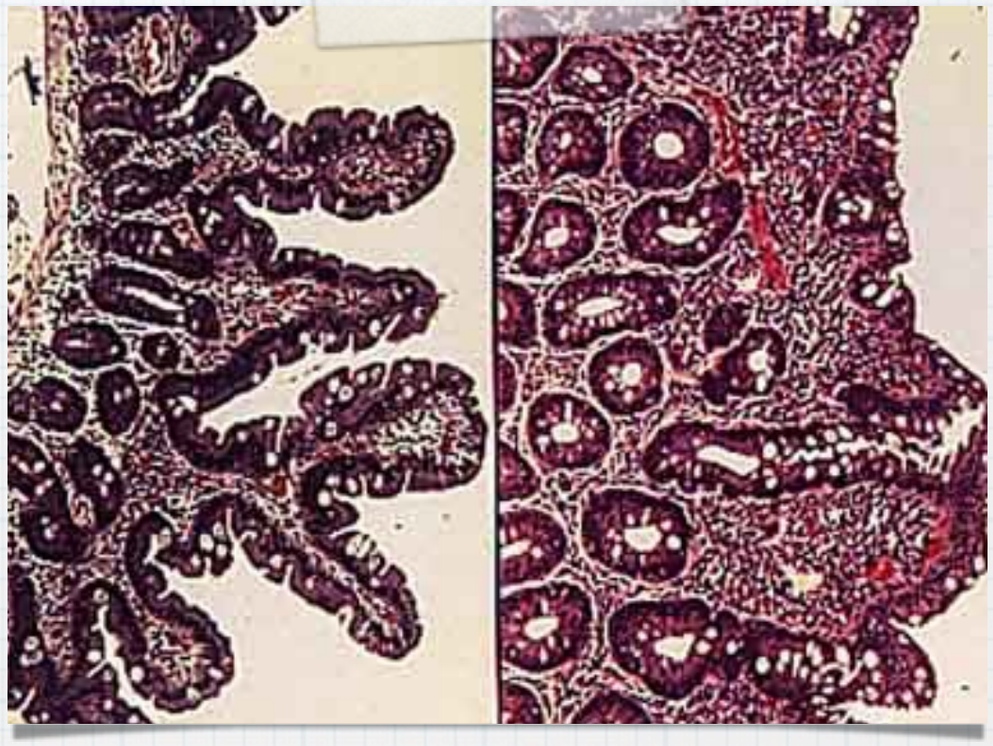
Crohn's Disease

* Inflammatory disorder
* A chronic inflammation of the intestines.
* Ulcers in the intestines.
* Rectal bleeding, weight loss and fever.



Celiac Disease

* Malabsorptive disorder.
* An allergic reaction to gluten, a protein present in most grains.



Hiatus Hernia

* Structural disorder
* A portion of the stomach pushes up into the chest cavity through the spot normally occupied by the esophagus.