


Biology 12

Mrs. Frost



# Digestive System

# The Basics

## Primary Functions

- 1) Ingest food
- 2) Break down food to nutrients
- 3) Absorb nutrients
- 4) Eliminate indigestible remains

## Main Processes (occur simultaneously)

- **Mechanical digestion** : large pieces turned into smaller pieces, performed mainly by mouth & stomach
- **Chemical digestion** : specific enzymes breakdown specific macromolecules to small organic molecules

## Body System Connections

- **Circulatory**: nutrients absorbed, carried through body
- **Endocrine**: hormones stimulate appetite, release of gastric enzymes, bile, insulin, etc
- **Excretory**: removes nitrogenous and liquid wastes

# The Path of Food

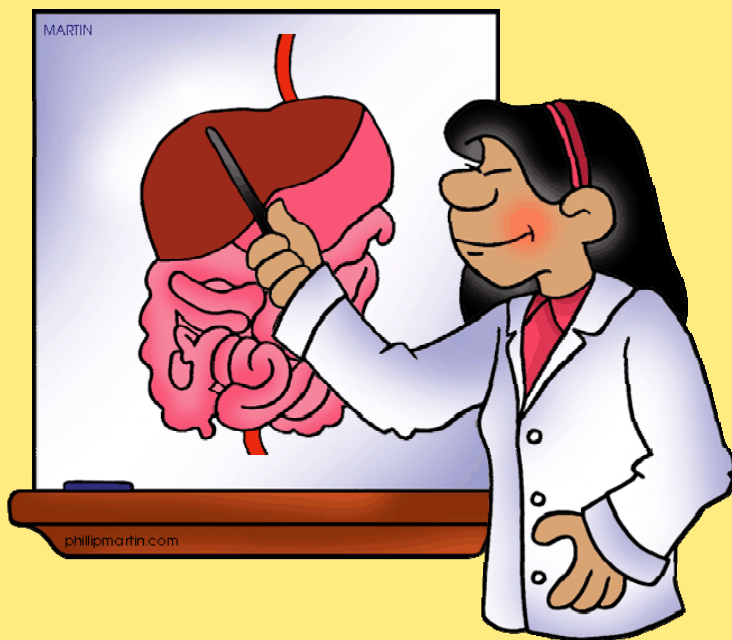
Mouth

Pharynx

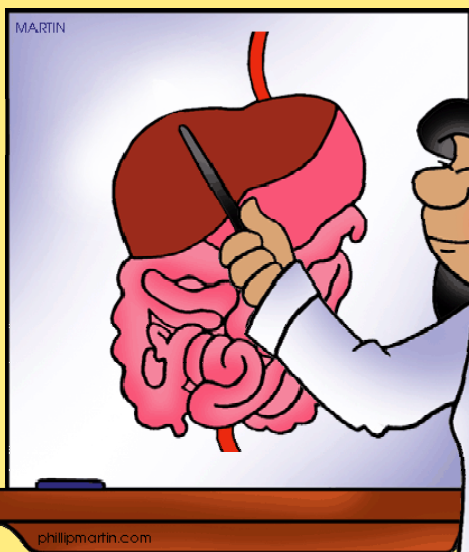
Esophagus

Stomach

Upper Digestive Tract



# The Path of Food



## Lower Digestive Tract

Small Intestine

Large Intestine

- Rectum

- Anus

# Structures of the Mouth

**Mouth** - entrance, bound externally by lips & cheeks, "roof" of mouth is hard palate (bone) & soft palate (muscle)

**Teeth** - 28-32 adult teeth chew food into smaller pieces, made up of **crown** (enamel, dentin, pulp) and **root** (dentin and pulp only)

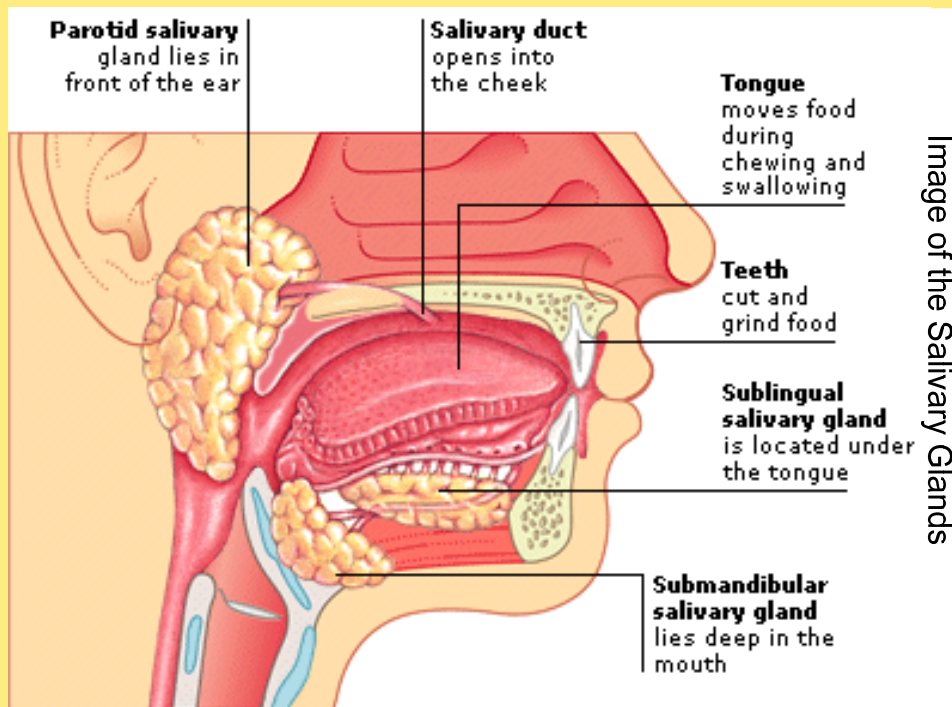
**Salivary glands** - 3 pairs send saliva to mouth by way of ducts, salivary amylase begins digesting starch

**Tongue** - skeletal muscle to change the shape of tongue and sensory receptors (taste buds) send impulses via cranial nerves to brain, moves food **bolus** to back to be swallowed

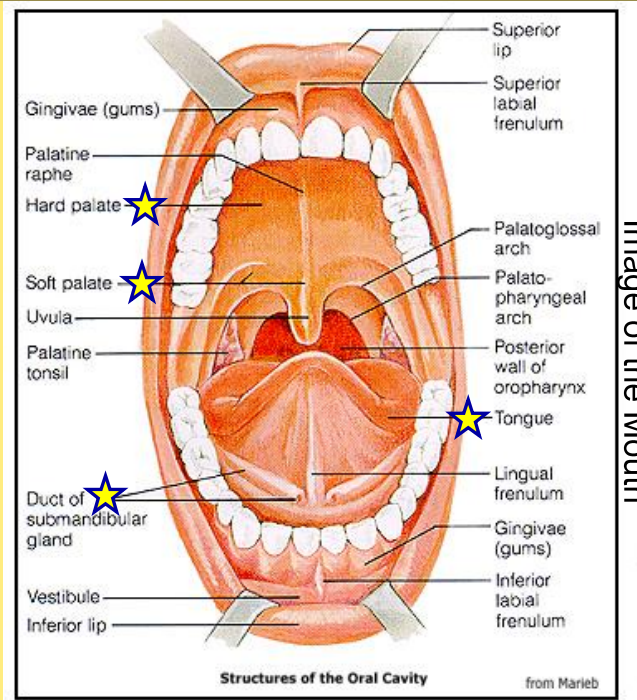
Image of the Mouth  
Image of the Salivary Glands



# Structures of the Mouth



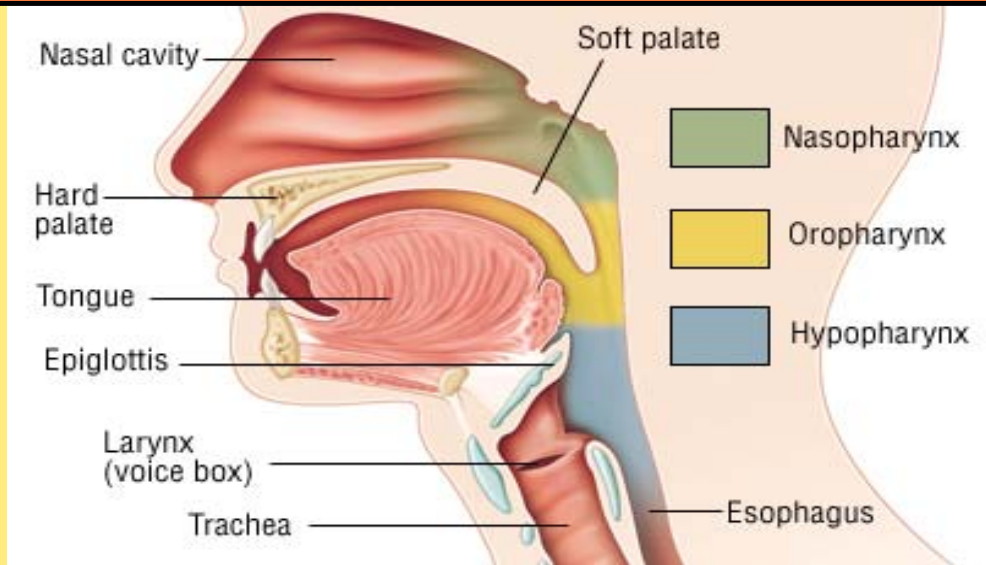
# Structures of the Mouth



# Pharynx

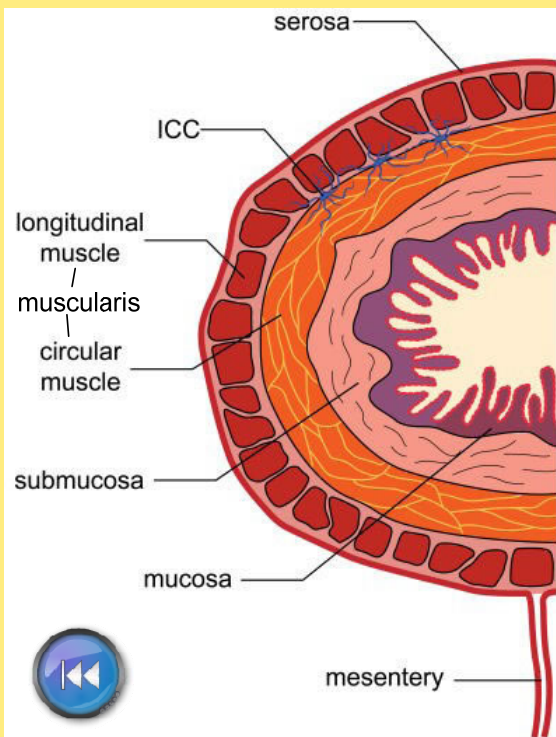
Simple passageway for food bolus to travel from mouth to esophagus (swallowing occurs automatically)

- soft palate moves back to close nasopharynx
- epiglottis covers the airway





# Esophagus



Muscular tube, rhythmic contractions called **peristalsis** push food down to stomach



**Cardiac sphincter** muscle found at entrance to stomach

# Stomach



Image of the Stomach

Thick walled (3 muscle layers), J-shaped, left side of abdominal cavity

- deep folds (**rugae**) in wall
- **gastric pits** lead into

which produce **gastric juice**:

- \*  $\text{pepsinogen} + \text{HCl} = \text{pepsin}$
- \* **mucus**
- main function: break down proteins
- food leaves stomach through **pyloric sphincter** as **chyme**



# Stomach



## The Stomach

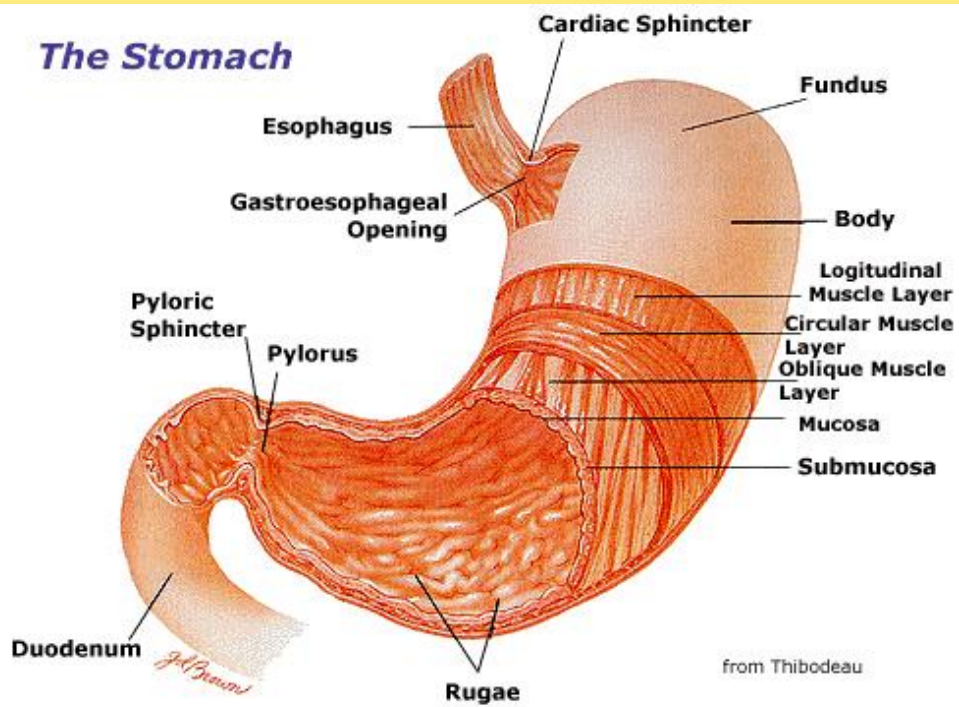


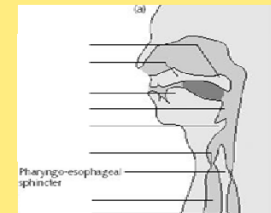
Image of the Stomach

# PLO C1 (Part 2)

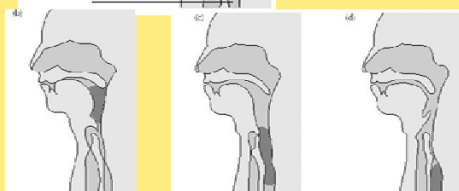
## Swallowing & Peristalsis

Swallowing (scientifically known as deglutition) is the act that moves food from the mouth to the stomach. The pharynx is the passage through which food travels from the mouth into the stomach. Reflex takes over as the pharynx rises to close off the nasal cavity; the larynx rises and the glottis covers the trachea, interrupting the airway. Peristalsis in the stomach and pharynx pushes food toward the stomach whose upper sphincter opens. Saliva and gastric juices are secreted into the stomach. The larynx relaxes and returns to its normal position. As peristalsis forces food into the stomach, the lower esophageal sphincter opens and then closes to prevent reflux. Painful swallowing is usually caused by esophagitis.

**The Parts Involved**



- Epiglottis
- Esophagus
- Glottis
- Hard palate
- Pharynx
- Soft palate
- Tongue
- Trachea



**Coordination and Control**

**Oral Phase (voluntary)**

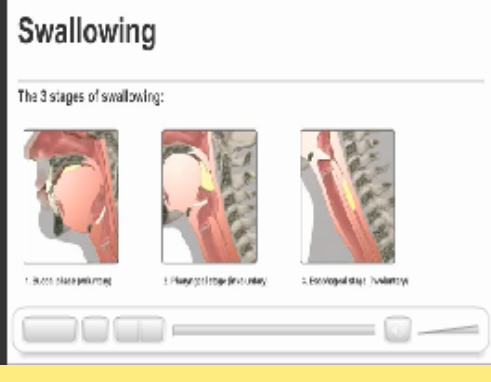
- 1) **M** Mastication  
Food is masticated by mastication produced from the masseter.
- 2) **M** Mechanical  
Food is mechanically broken down by the action of the masseter controlled by swallowing. The food is moved from one side of the oral cavity to the other by the tongue. The bolus is ready for swallowing when the soft palate rises to close off the nasal cavity.
- 3) **T** Tongue  
A trough is formed at the back of the tongue by swallowing. The tongue is elevated to the roof of the mouth and directed posteriorly.
- 4) **M** Mouth  
The soft palate and the uvula rise to close off the nasal cavity. The larynx rises to cover the trachea. Bolus is propelled to back of mouth and pharynx initiates the next phase.

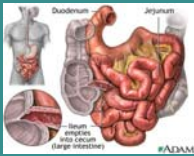
**Pharyngeal Phase (involuntary, controlled by the swallowing reflex in the medulla oblongata and pons)**

- 5) **L** Larynx  
The larynx and glottis close off the nasopharynx.
- 6) **P** Pharynx  
The pharynx is pulled upward and contracts to receive the bolus. The sides of the pharynx are brought close together so that only a narrow opening can pass through.
- 7) **L** Larynx  
The larynx needs to be raised to prevent food from passing to the trachea. Swallowing occurs in the pharynx. The trachea contracts to direct the food bolus into the esophagus. The trachea is directly inhibited by the swallowing reflex in the medulla oblongata.
- 8) **E** Esophagus  
Peristalsis in the pharynx pushes the bolus into the esophagus. The larynx relaxes and returns to its normal position. The pharynx relaxes and returns to its normal position. Swallowing therefore depends on coordination of many muscles and although swallowing is initially under voluntary control, once started it is quite hard to stop it!

**Esophageal Phase (involuntary)**

- 9) **E** Esophagus  
The upper esophageal sphincter relaxes to let food pass, peristaltic contractions push food towards stomach, the lower esophageal sphincter relaxes to let food pass into stomach.
- 10) **R** Relax  
The pharynx and larynx move back to original positions.  
Swallowing therefore depends on coordination of many muscles and although swallowing is initially under voluntary control, once started it is quite hard to stop it!





# Small Intestine

Liver

Pancreas

Duodenum

Jejunum

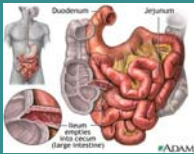
Ileum

- Substances from liver & pancreas enter
- Stomach acid neutralized

- Villi and microvilli greatly increase the surface area available for nutrient absorption

- Also has villi, absorbs mainly B12





# Small Intestine

- \* Largest gland in the body
- \* Produces **bile** to emulsify fat (cause fat droplets to disperse in water)
- \* Excess bile stored in **gall bladder**

Liver

- Pancreatic juice contains **sodium bicarbonate** to neutralize acid in chyme
- Produces hormones including **insulin**
- Digestive enzymes help complete food digestion

Pancreas

# Small Intestine

Surface area is greatly increased by villi (small, fingerlike projections) which are covered in microvilli.

Villi contain:

- blood capillaries (sugars, amino acids)
- lymphatic capillaries (glycerol, fatty acids)



# Large Intestine

Absorbs water, salts, and some vitamins

Stores indigestible material until eliminated

Cecum

Colon

Rectum

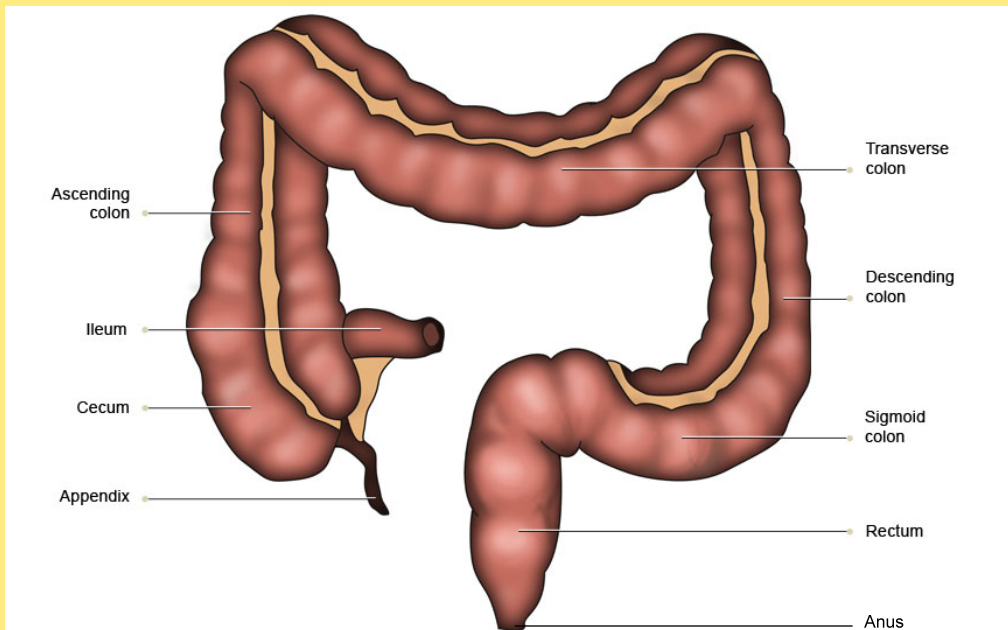
Anus

- Blind end
- Appendix: may play role in fighting infection

- Ascending, transverse, descending, sigmoid

- Stretching of the rectal wall initiates nerve impulses (defecation reflex)

- Anal sphincters relax, defecation occurs
- Feces 3/4 water + 1/4 solids (e.g. fiber)





# PLO C1 (Part 3 & 4)

The Pancreas & Liver

Specializations of the Intestines