

Digestion

Learning Targets

Explain the importance of enzymes to metabolism.

Identify and describe the structure and function of the human digestive system.



What are the functions of the digestive system?

1. Ingest food
2. Digest food
3. Absorb nutrients
4. Eliminate solid waste

What are the two forms of digestion?

Mechanical

- Physically changing the size of the food.
- Teeth grind food into smaller pieces.
- Stomach churns food to mix it.

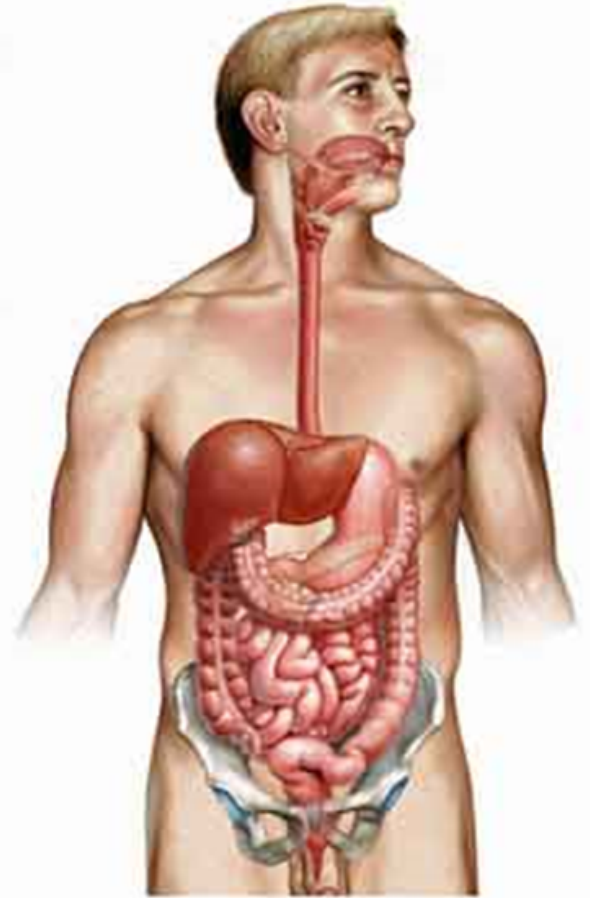
Chemical

- Breaking down polymers into smaller pieces.
- Example= an enzyme digesting starch

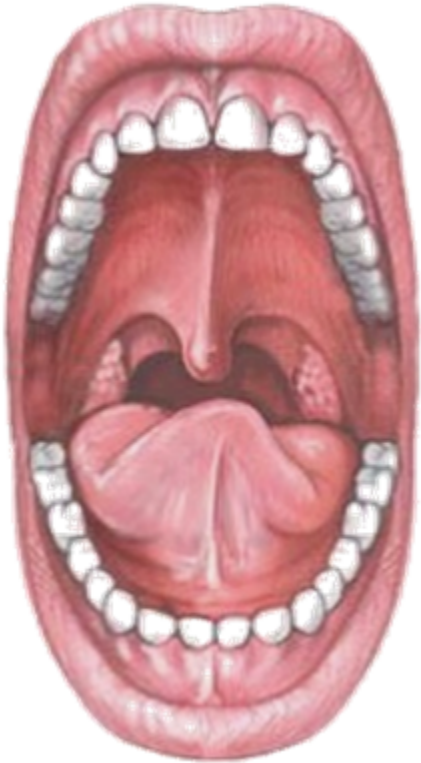
What is the gastrointestinal tract?

Hollow series of organs that food passes through.

- Also known as the “alimentary canal”
- “GI Tract”
- In adults, approximately 8 meters long.

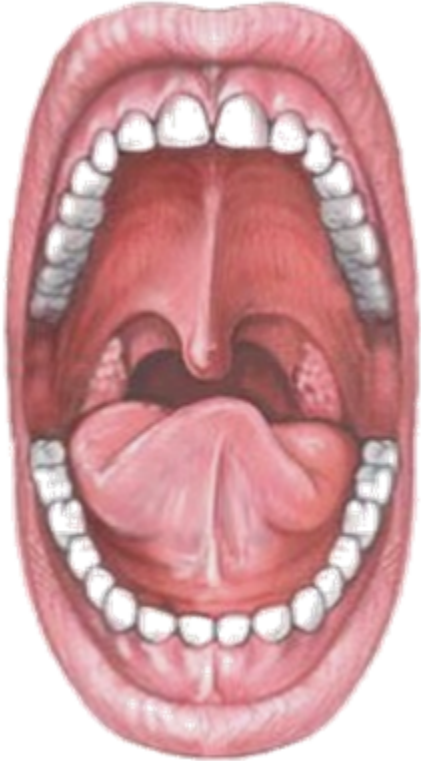


Where does digestion begin?



- The Mouth!
 - Chewing is a form of mechanical digestion that increases the surface area of food.
 - The tongue rolls food into a ball.
 - Once it is swallowed it is called a **bolus**.
 - Enzymes in saliva start the process of chemical digestion.

What enzyme starts digestion?

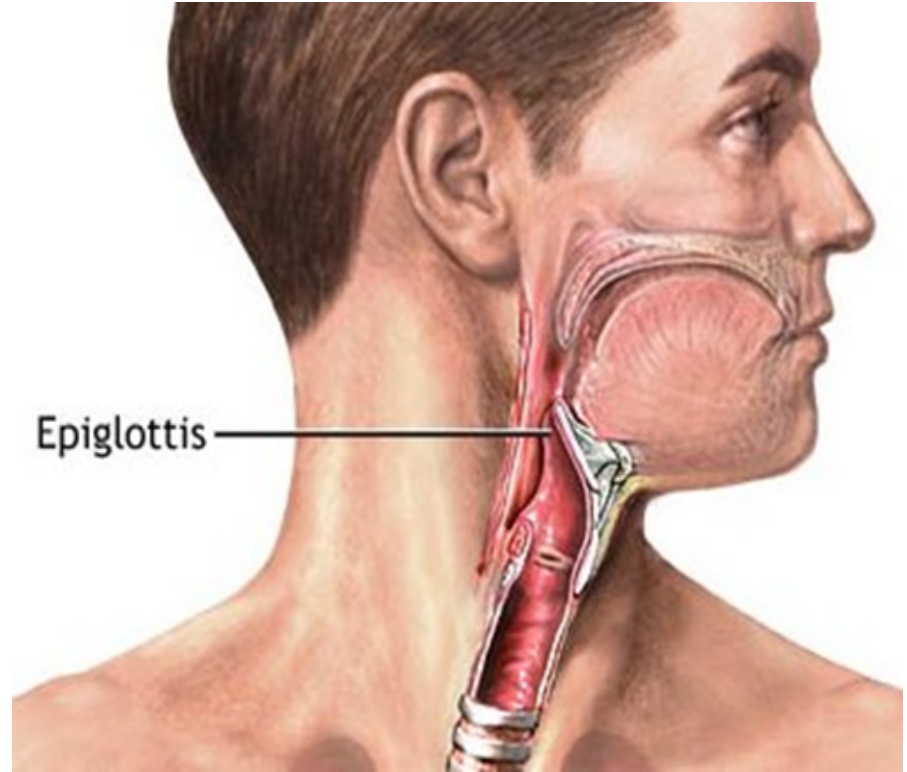


- Saliva contains amylase.
- Amylase works on
 - carbohydrate starches
 - breaks down simple sugars

Where does food go after the mouth?

- Epiglottis

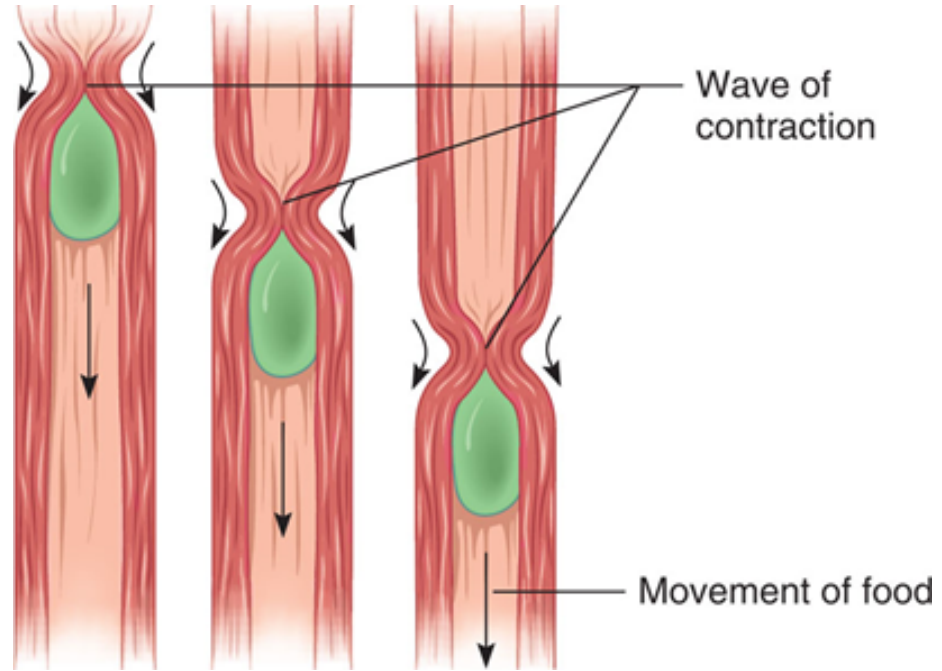
- Thin flap of tissue that prevents food from entering the airway (trachea) during swallowing.



How does food move through the digestive system?

- Esophagus

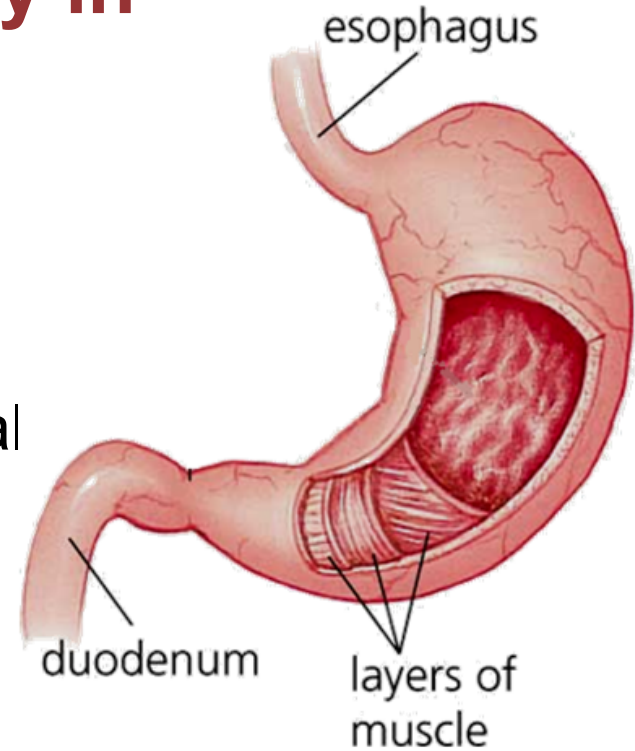
- Tube that attaches the throat to the stomach.
- Moves food using a wave like motion of involuntary muscle contractions called peristalsis.



What role does the stomach play in digestion?

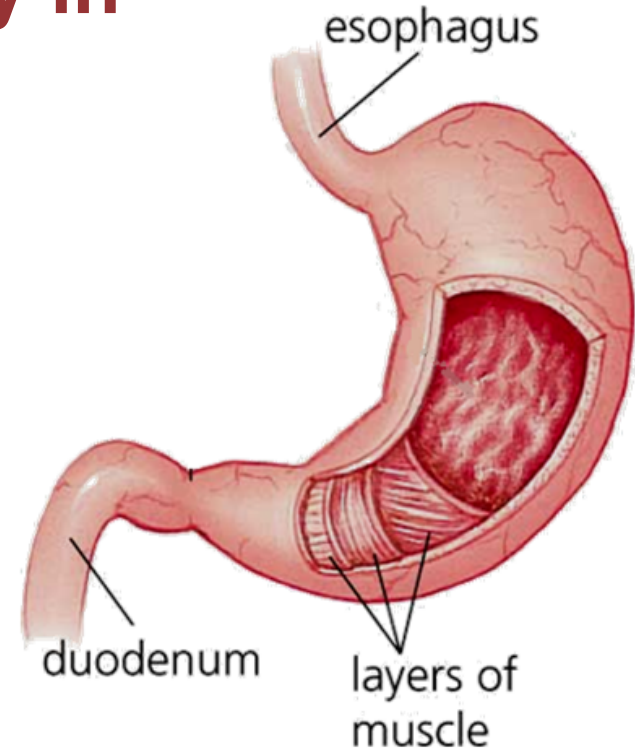
- Stomach

- Made of several layers of smooth muscle.
- Churns and mixes food (mechanical digestion) with enzymes (chemical digestion).
- Produces mucus to protect the stomach from digesting itself.



What role does the stomach play in digestion?

- Produces gastric juice
 - Hydrochloric acid (HCl) + pepsin
 - Pepsin = an enzyme that breaks down proteins into polypeptide strands.
- Pepsin needs an acidic environment.
 - Stomach acid provides acidic environments that allows powerful enzymes to do their work!
 - Enzymes digest food, not the stomach

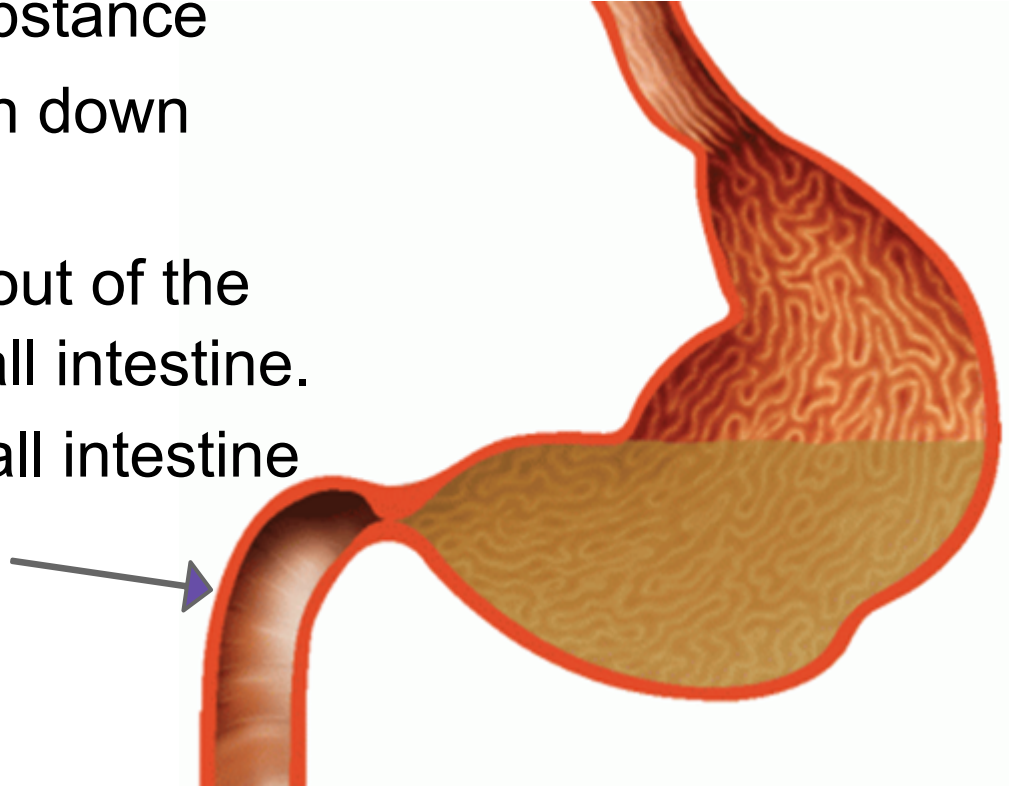


Stomach Fun Facts

- The stomach can be stretched to hold about 2 liters of food!
- Light meals can be emptied from stomach in 2 hours.
- Heavy meals can take up to 6 hours.
- Forensic pathologists will often examine the stomach contents of a deceased person in an attempt to pinpoint time of death.

What do we call food as it leaves the stomach?

- Chyme is a paste-like substance containing partially broken down food and gastric juice.
- Peristalsis forces chyme out of the stomach and into the small intestine.
- The first 25 cm of the small intestine is called the duodenum.



What role does the small intestine play in digestion?

- The small intestine is 2.5 cm wide and 6 m long!
- Peristalsis continues to squeeze food through.
- Most chemical digestion and all absorption of nutrients occurs here!
- Enzymes continue to break down polymers into monomers which are small enough to be absorbed into the bloodstream.



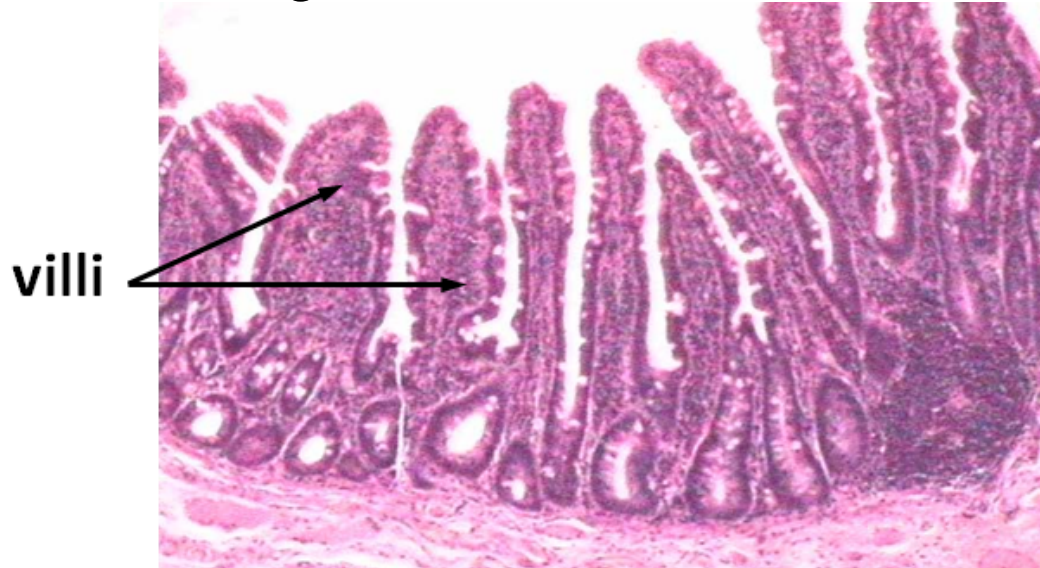
What role does the small intestine play in digestion?

- 4-8 hours in the small intestine.
- Most nutrients are absorbed in the small intestine and then carried by blood vessels to the liver, where any toxins are removed before nutrients are distributed through the rest of the body.



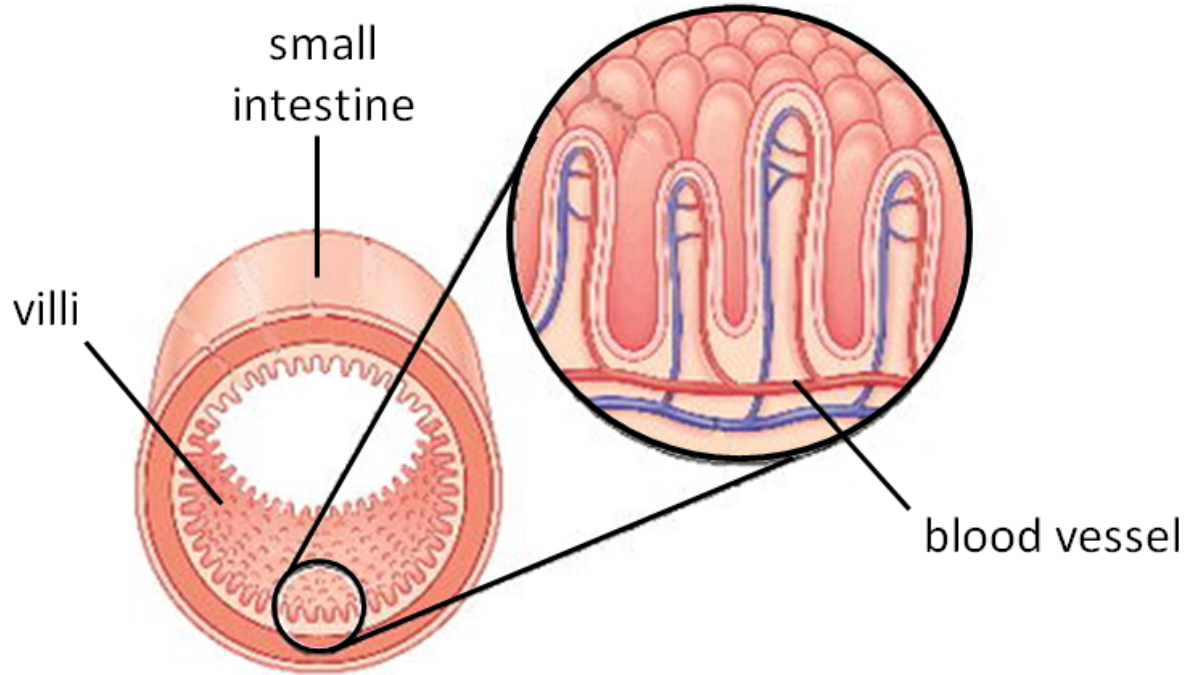
How does the small intestine absorb nutrients?

- The wall of the small intestine is covered with villi - small, finger-like structures that increase the surface area of the small intestine, along which nutrients are absorbed.



How does the small intestine absorb nutrients?

- The villi increase surface area of the small intestine

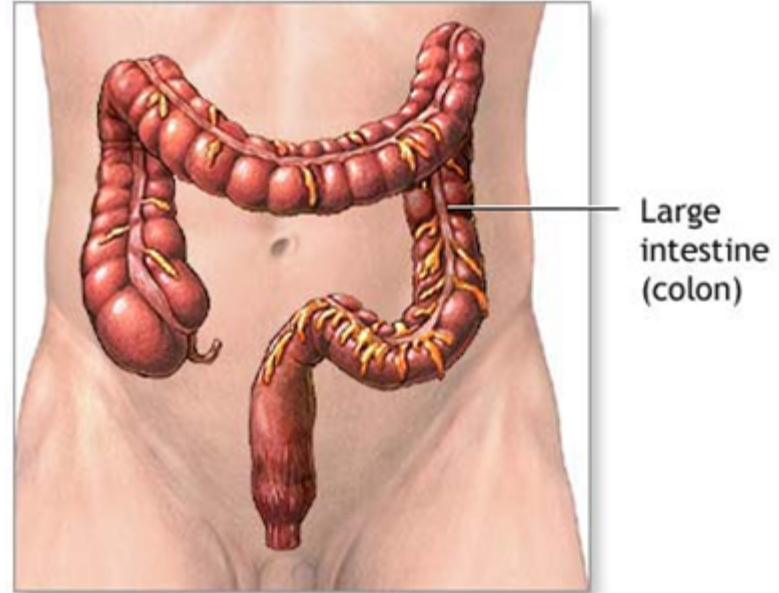


What happens to the monomers once they are absorbed into the bloodstream?

- The blood carries monomers to all body cells.
 - Monosaccharides
 - immediate energy
 - Glycerol & Fatty Acids
 - building cell membranes and energy storage
 - Amino Acids
 - building proteins

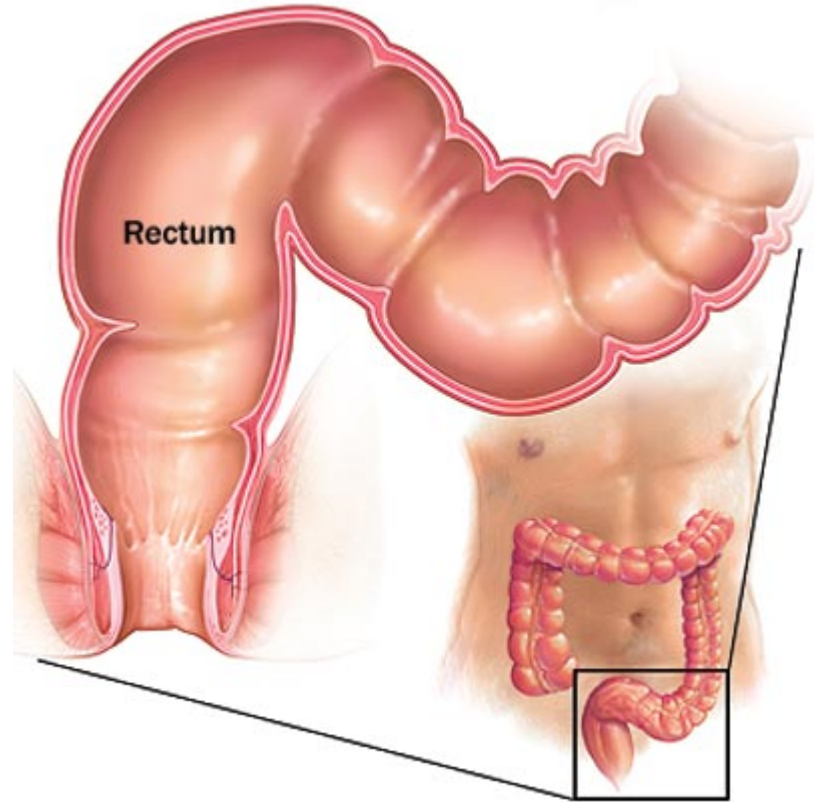
What role does the large intestine play in digestion?

- 6.5 cm wide and 1.5 m long
- Borders the small intestine
- Receives all indigestible matter from the small intestine
- **Absorbs water**, returning it to the bloodstream
- Solid waste is called feces



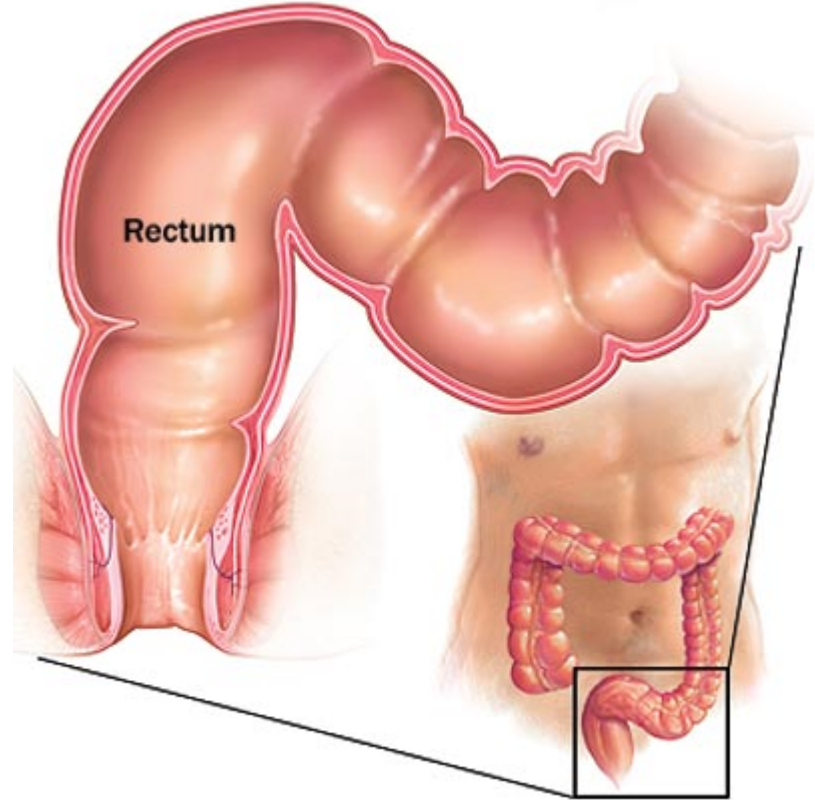
What role does the rectum and anus play in digestion?

- End of gastrointestinal tract, extending from the large intestine.
- Rectum stores feces until peristalsis eliminates it through the anus.



What role does the rectum and anus play in digestion?

- Up to half of the weight of feces can be bacteria- living or dead - and their waste products.
- Your body contains 3-5 pounds of bacteria
 - Most bacteria is found in the colon

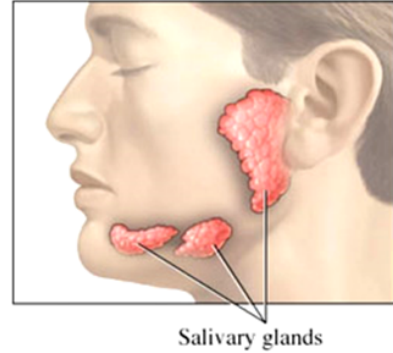


In what order does food travel through the digestive system?

1. Mouth
2. Esophagus
3. Stomach (2-4 hours)
4. Small Intestine (4 hours)
5. Large Intestine (18-24 hours)
6. Rectum
7. Anus

****Total digestion = 24-32 hours**

What role do accessory organs play in digestion?



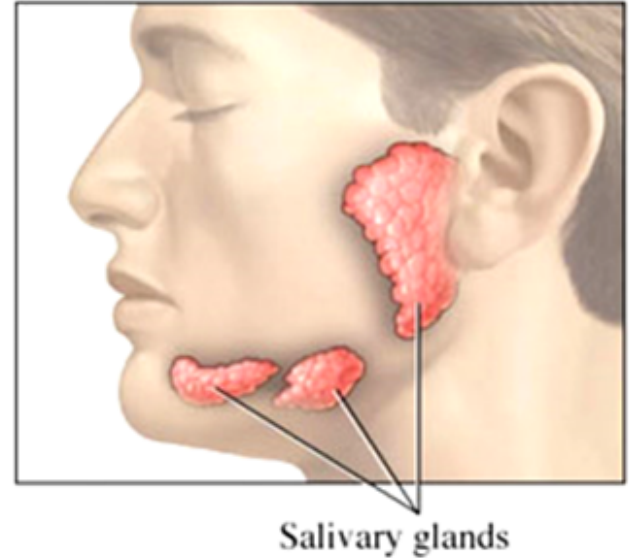
Salivary Glands

- Located under the tongue and lower jaw
- Produce and secrete saliva
 - Saliva = water + mucus + salivary amylase
 - Salivary amylase = enzyme that breaks down starch into monosaccharides

What role do accessory organs play in digestion?

Salivary Glands

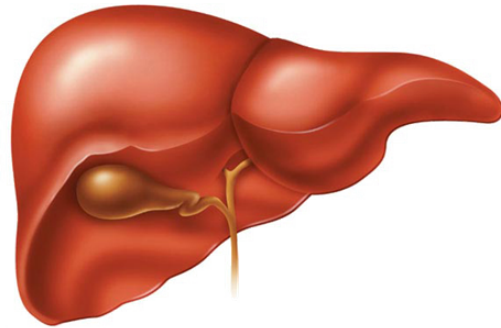
- Saliva also lubricates chewed food for passage into the esophagus, raises the pH of the mouth slightly to neutralize acidic secretions of bacteria that cause cavities.



What role do accessory organs play in digestion?

Liver

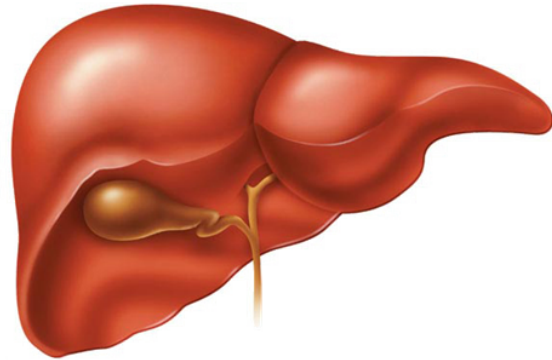
- Stores excess glucose as glycogen.
- Produces bile: a chemical that breaks down lipid globules into smaller droplets.
 - Bile also neutralizes stomach acid as it passes through the duodenum.



What role do accessory organs play in digestion?

Liver

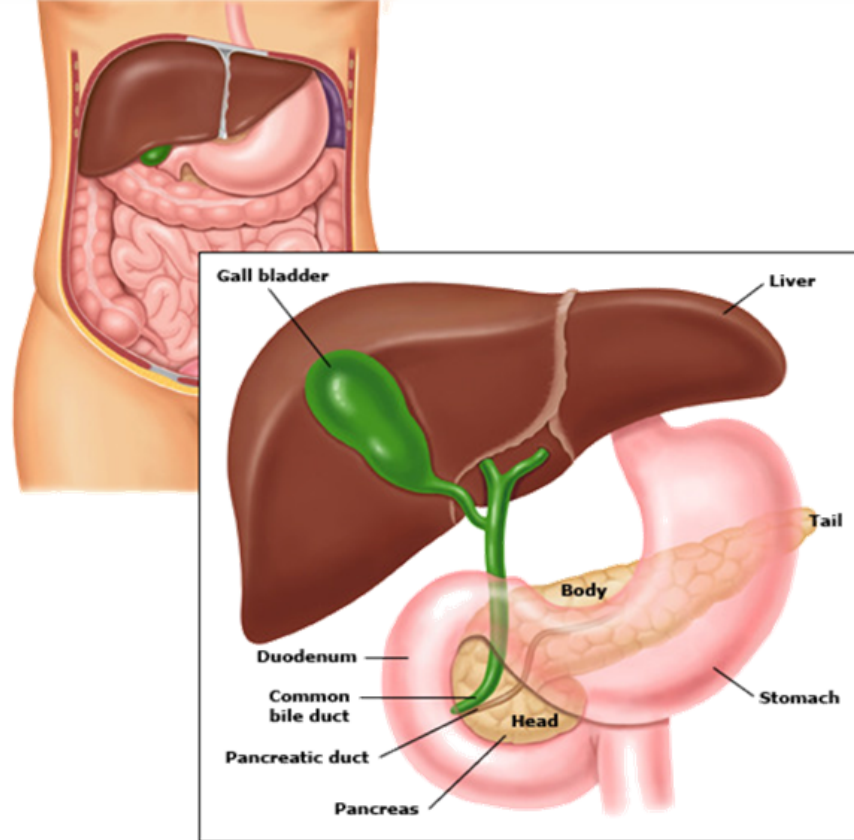
- Processes carbohydrates, lipids, and proteins.
- Stores glycogen, iron, vitamins
- Detoxifies toxins, inactivates drugs



What role do accessory organs play in digestion?

Gallbladder

- Bile produced in liver collects in gallbladder.
- Gallbladder delivers bile to the duodenum through a tube called the bile duct.



What role do accessory organs play in digestion?

Pancreas

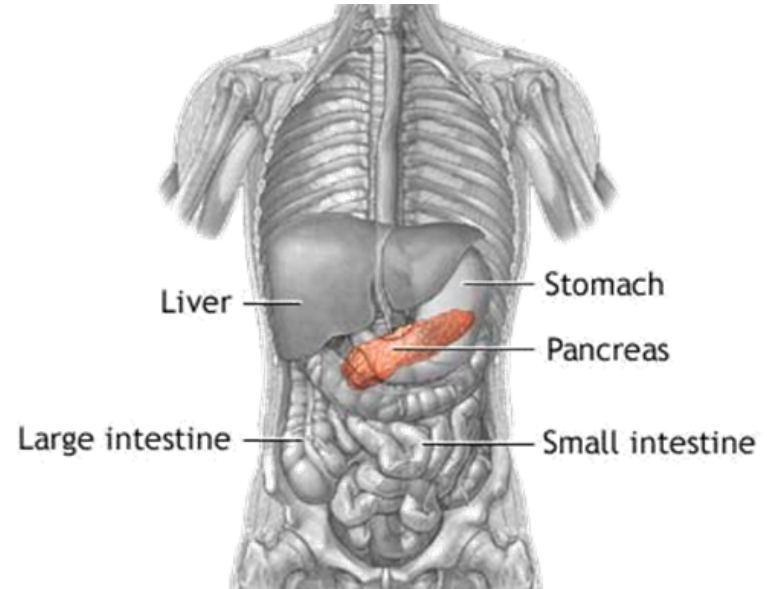
- Produces digestive enzymes that are released into the duodenum.
 - Pancreatic amylase (breakdown of carbs.)
 - Trypsin (breakdown of proteins)
 - Lipase (breakdown of lipids)



What role do accessory organs play in digestion?

Pancreas

- Pancreatic juice is basic to neutralize stomach acid.
- Produces insulin and glucagon to control blood sugar.



What role do accessory organs play in digestion?

Pancreas

- Blood sugar increases after a meal:
 - Pancreas release insulin
 - Insulin promotes glucose uptake in body cells
 - Insulin promotes storage of excess glucose in liver as glycogen
- Blood sugar decrease in between meals:
 - Pancreas release glucagon
 - Glucagon promotes release of glycogen from the liver into the blood.

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What is the difference between metabolism and digestion?

Digestion = Is the breakdown of food into smaller components that can be easily absorbed and used by the body.

Metabolism= The combination of chemical reactions through which an organism builds up or breaks down materials.

How do enzymes play a role in metabolism?

- Metabolic reactions can be divided into two main groups:
 - Anabolism
 - Involves the **synthesis** of complex molecules.
 - Catabolism
 - Involves the **breakdown** of complex molecules.