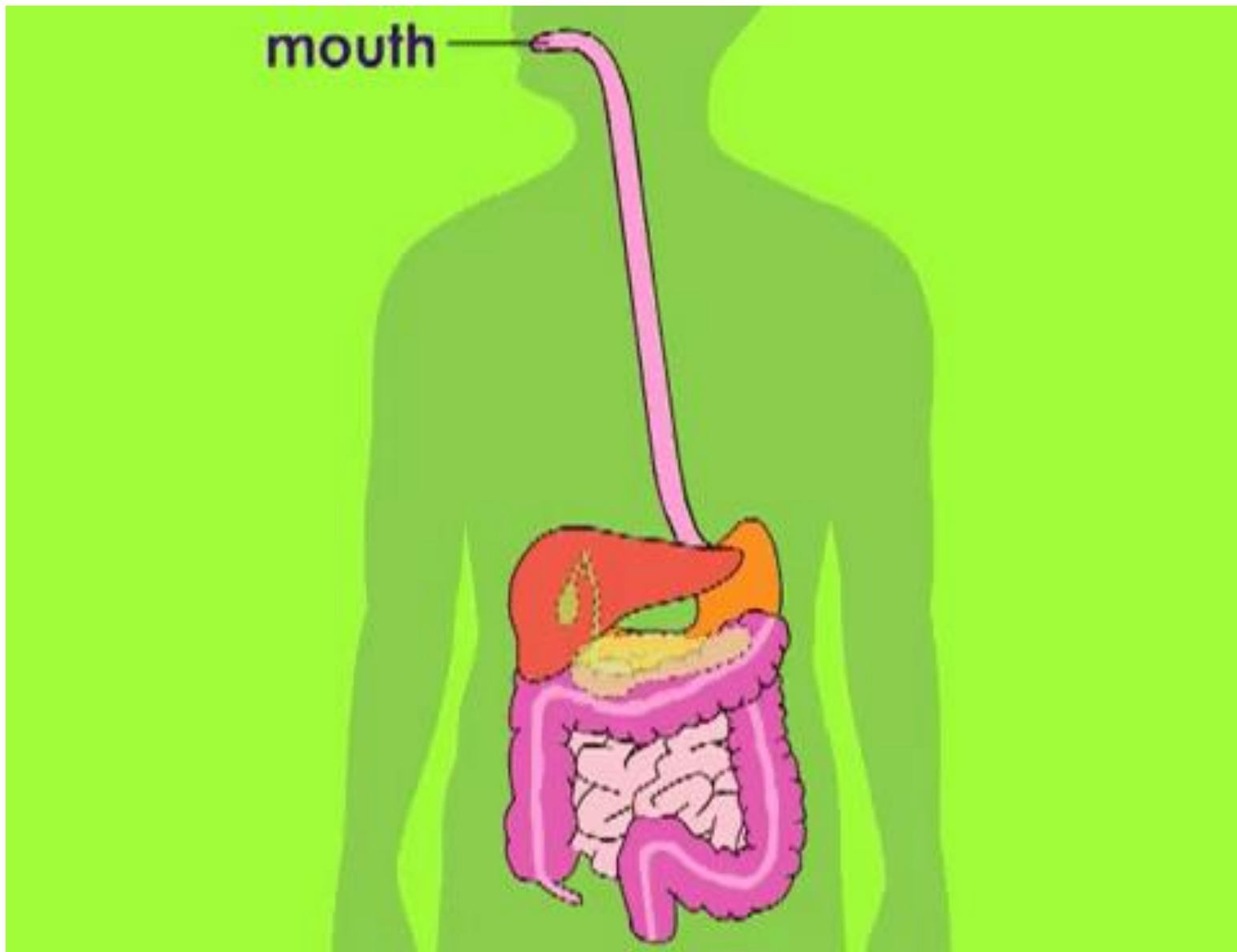


Digestive system

mouth

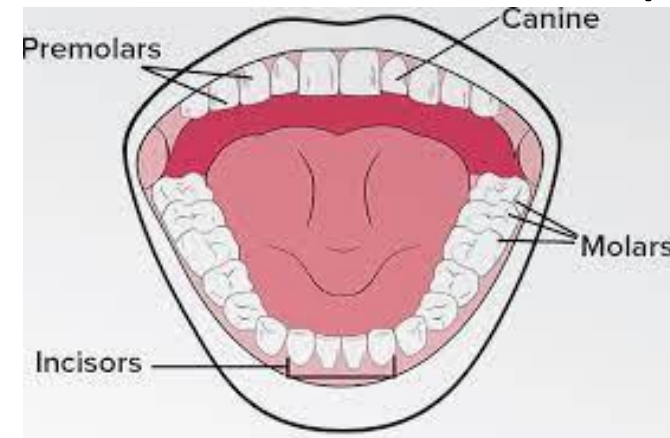


<b>Food Tube</b>	<b>Accessory Organs and Glands</b>
Mouth Cavity	Salivary Glands
Pharynx	Liver
Esophagus	Gallbladder
Stomach	Pancreas
Small Intestine	
Large Intestine	

# Mechanical Phase of Digestion

- - involves the breaking up of food into smaller pieces, pushing food down the food tube, mixing it with digestive juices
- Starts in the mouth where four kinds of teeth tear the food to pieces

Teeth	Function
Thin-edged incisors	Cutting food
Pointed canines	Tearing meat
Molars and premolars	Crushing food



- Canines are well-developed meat eaters, some carnivores have fangs
- Molars are well-developed in grass eaters

# Mechanical Phase of Digestion

- Wavelike contraction of the food tube

## → Peristalsis

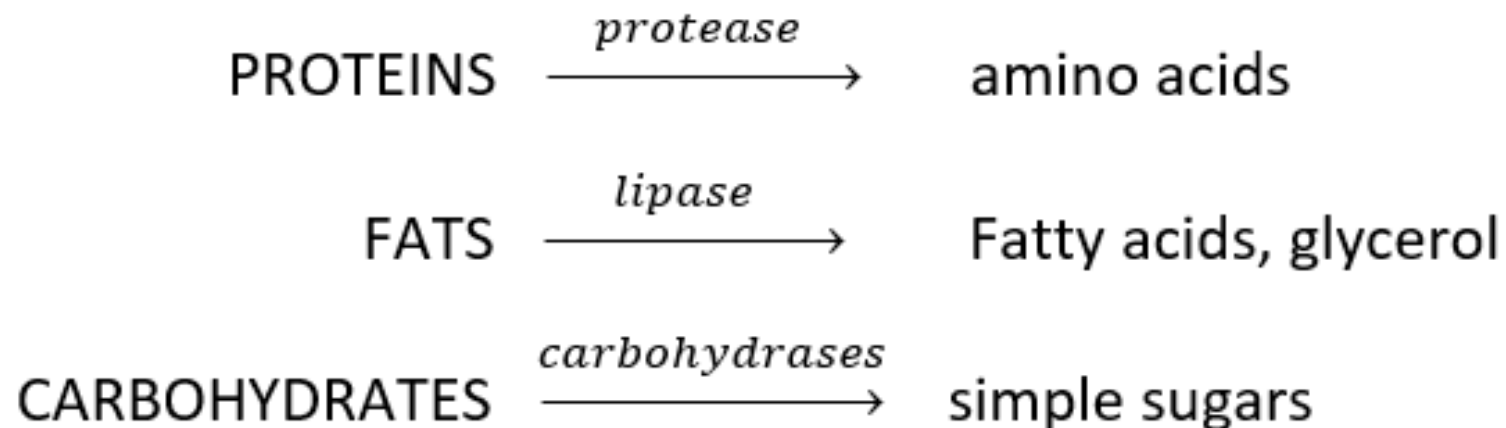
→ Beginning from the esophagus downward, pushes the soft mass of chewed food (called bolus) down the esophagus and mixes it with the digestive juices.

## Anti-peristalsis

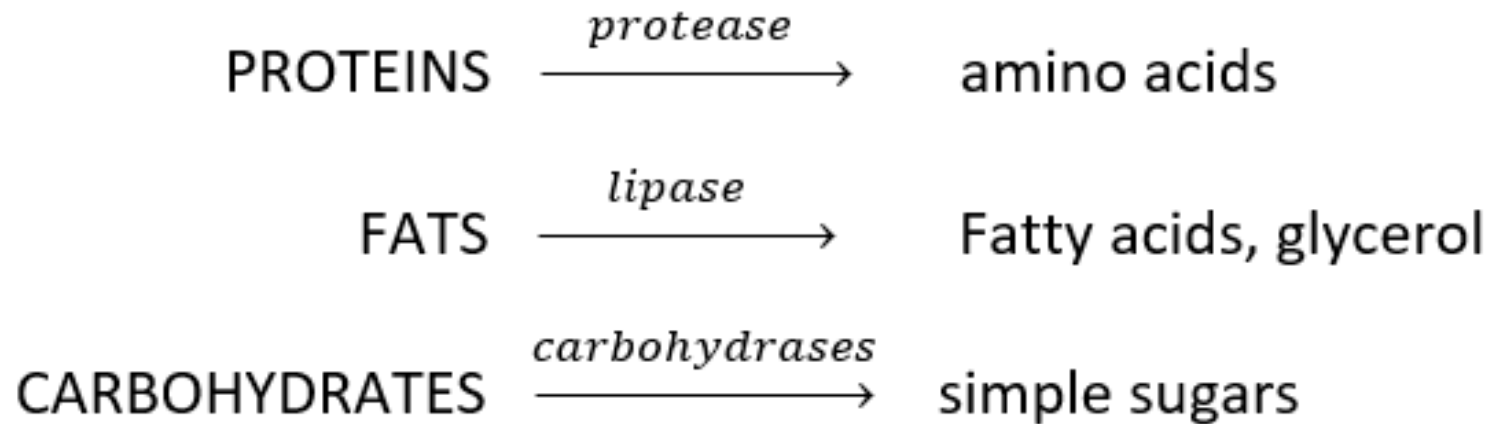
-reverse movement, results in vomiting, protects the body from harmful substance that have been taken in, or ingested

# Chemical Phase of Digestion

- Involves the further breaking up of the larger molecules of food (which cannot pass through the plasma membrane of the body cells) into simpler molecules  
by the action of digestive enzymes.



## Chemical Digestion of Complex Molecules



- FATS also called lipids
- Carbohydrates (such as starches, double sugars) and other carbohydrates
- Notice:
- The name of groups of enzymes consist of two parts:
  - The substance which they act on (called substrate)
  - And the suffix *-ase*

# CARBOHYDRATES


I. STARCH  
(or amyllum/amylose)

salivary amylase or  
ptyalin

**maltose**  
(a double sugar)

## II. MALTOSE

*maltase*

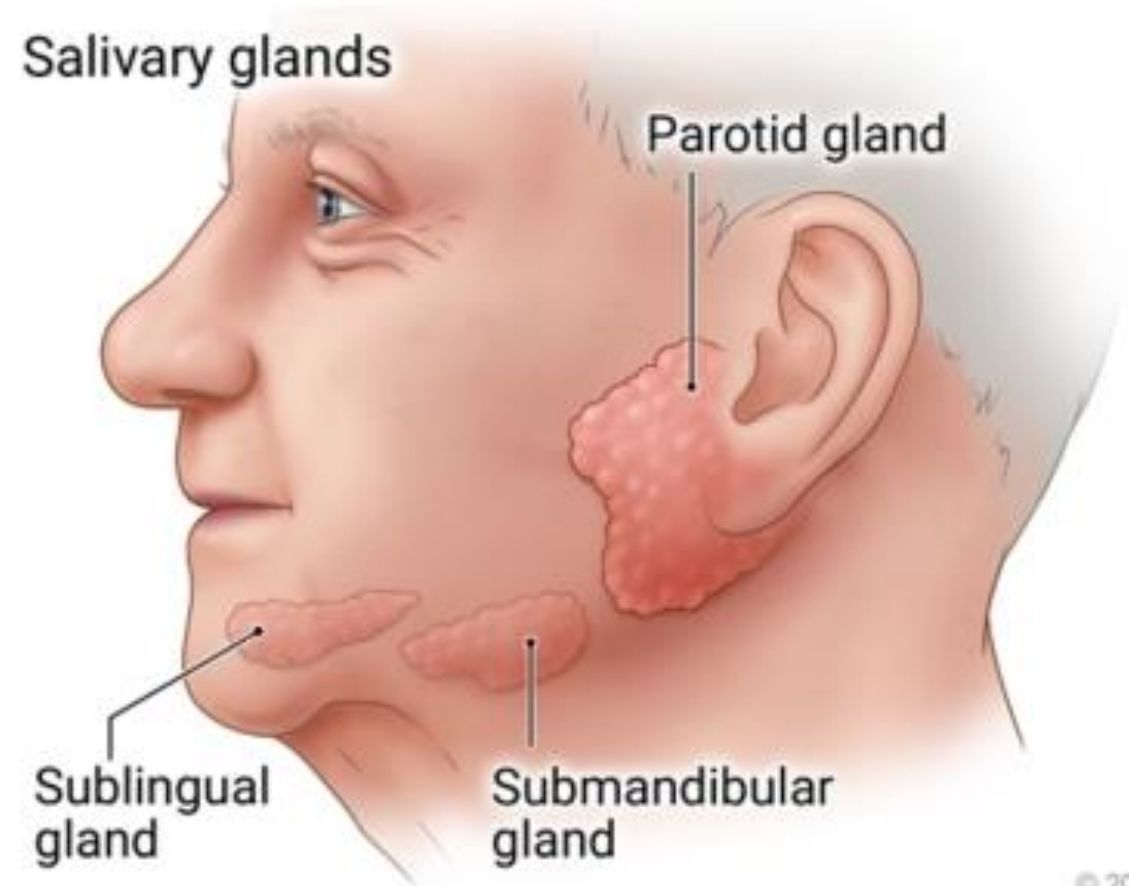


**glucose**  
(a simple sugar)



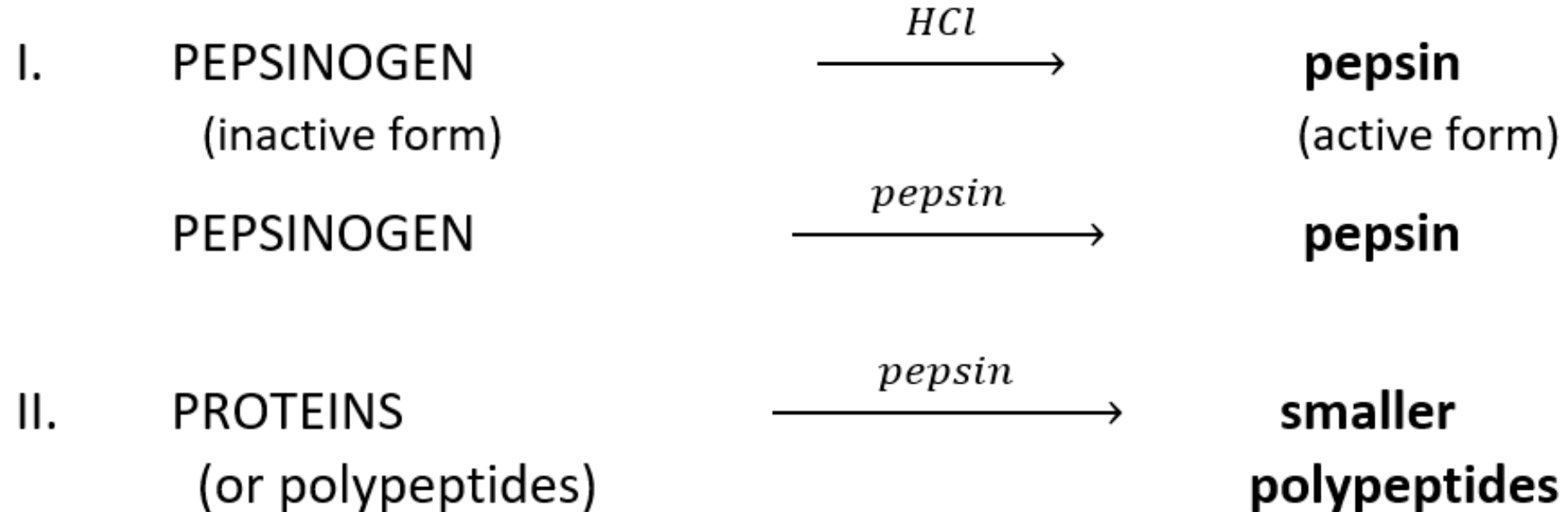
- Chemical digestion in man starts in the mouth
  - where starch-digesting enzyme of saliva acts on starchy foods

Salivary Glands	Location
Parotid glands	In front of the ear
Submaxillary glands (submandibular glands)	Under the lower jaw
Sublingual glands	Under the tongue



# Chemical digestion in the stomach

## PROTEINS

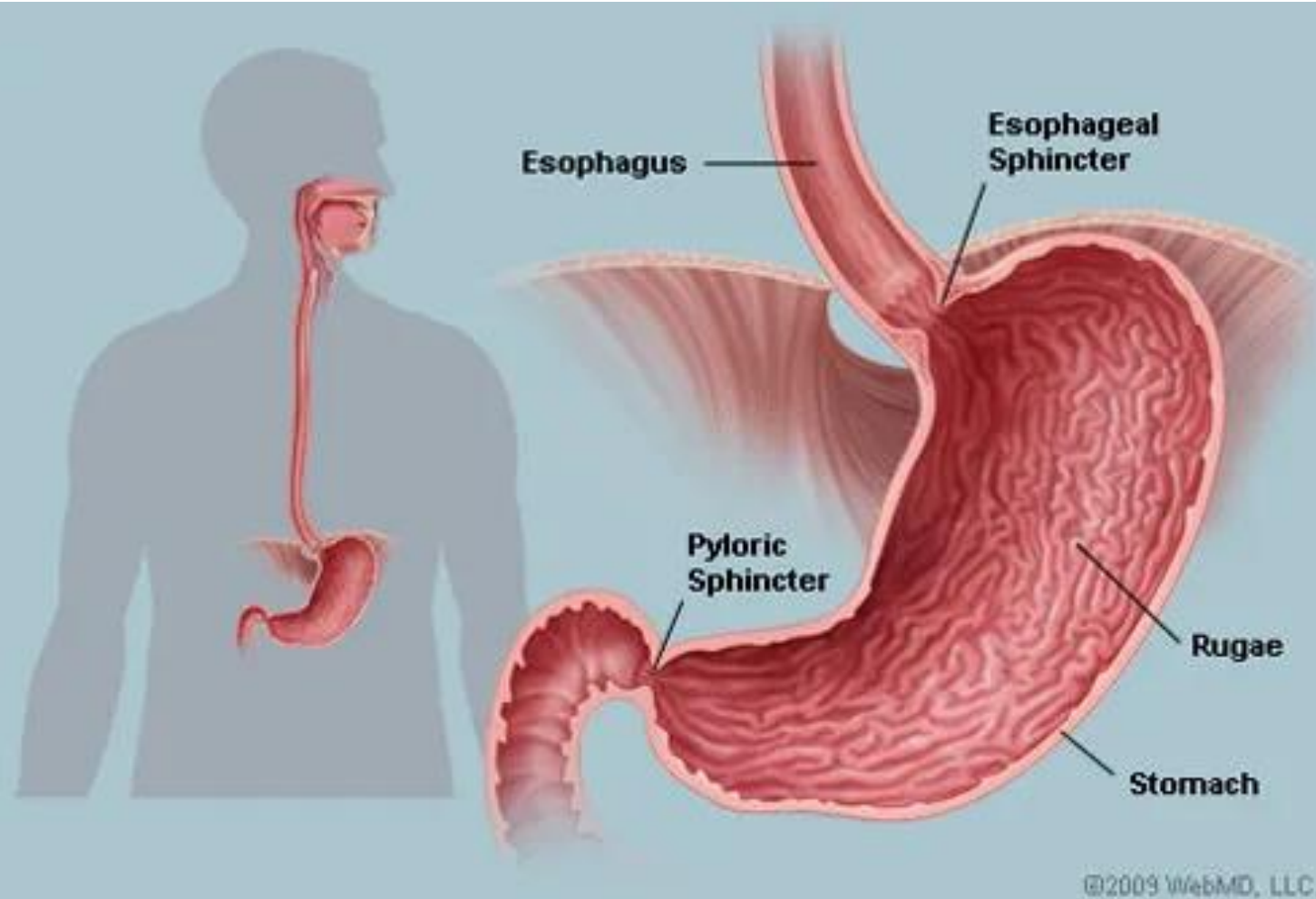


# Digestive juices in the stomach

- -inner wall of stomach is highly folded and contain numerous glands.
- There are three types of cells that secrete different gastric juices

Type of cell	Secretion	Function of the Secretion
Mucous cells	Mucus	Lubricates and protects the cells from lining the stomach

# Chemical digestion in the stomach

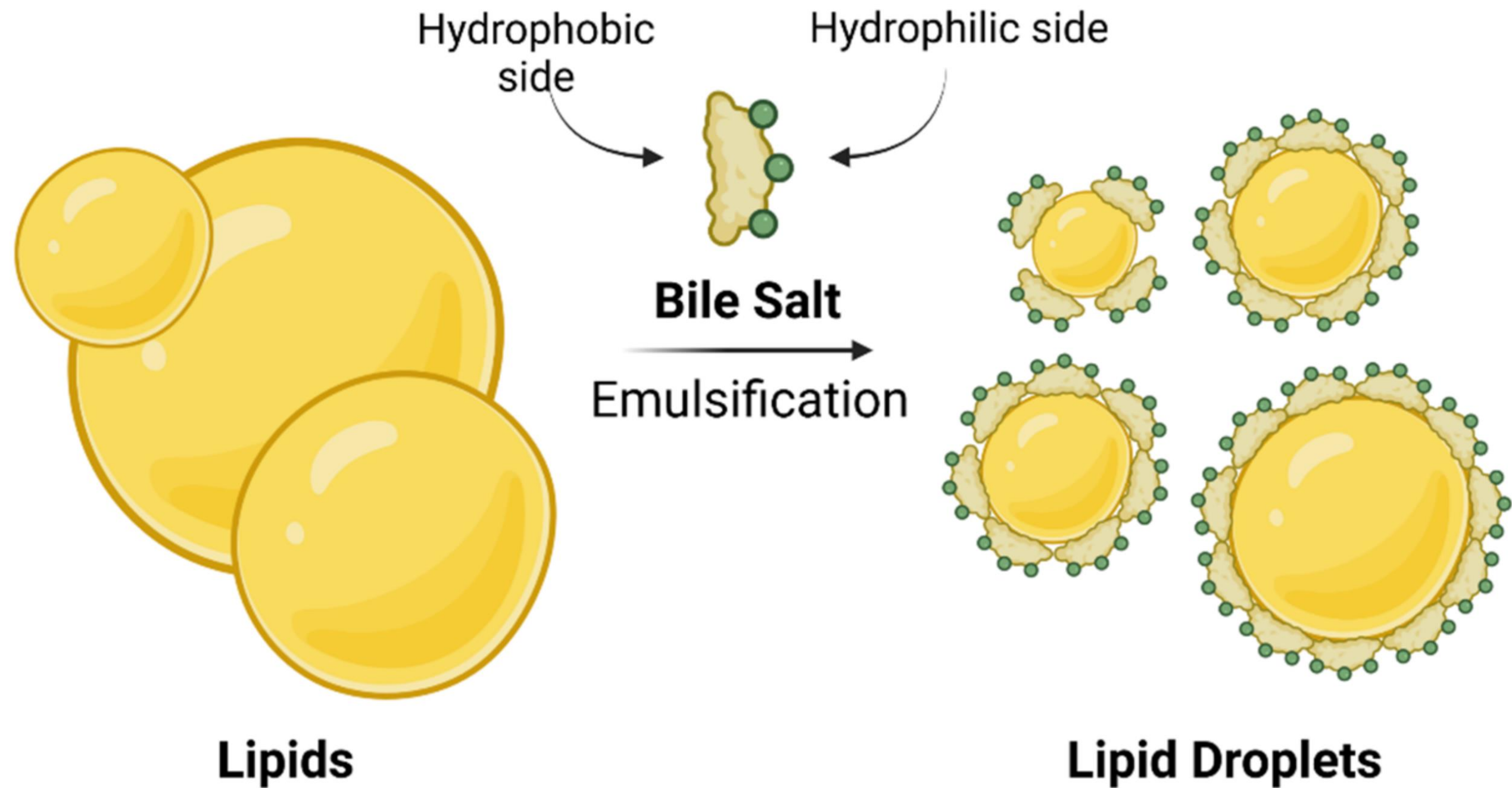


- Cardiac sphincter or esophageal sphincter – controls the passage of food called bolus
- Pyloric sphincter – close for temporary storage of food in the stomach
- The food mass becomes semifluid (chyme) and gradually leaves the stomach after two hours

### → DID YOU KNOW?

- a. Gastric juice is highly acidic and can digest the stomach itself. What conditions protect the stomach?
- First, mucus protects the inner lining of the stomach.
  - Second, the enzyme is secreted in its inactive form, pepsinogen. It is converted into pepsin only in the presence of HCl.
  - Third, the glands do not secrete gastric juice continuously. It is secreted only when food is expected in the stomach, that is, during mealtime.
- b. It takes 2-6 hours (after a meal) for the stomach to empty its contents into the small intestine.





# Chemical digestion in the small intestine

## CARBOHYDRATES

- I. Starch (a polysaccharide)  $\xrightarrow{\text{pancreatic amylase}}$  maltose (a disaccharide or double sugar)
- II. Maltose (malt sugar)  $\xrightarrow{\text{maltase}}$  glucose
- Sucrose (cane sugar or beet sugar)  $\xrightarrow{\text{sucrase}}$  glucose and fructose
- Lactose (milk sugar)  $\xrightarrow{\text{lactase}}$  glucose and galactose (monosaccharides or simple sugars)

## PROTEINS

- I. Trypsinogen (inactive form)  $\xrightarrow{\text{enterokinase}}$  trypsin (active form)
- II. Proteins or polypeptides  $\xrightarrow{\text{trypsin and chymotrypsin}}$  smaller polypeptides
- III. Smaller polypeptides and dipeptides  $\xrightarrow{\text{carboxypeptidase, aminopeptidase and dipeptidase}}$  amino acids

## FATS

- I. Fats  $\xrightarrow{\text{bile salts}}$  small fat droplets (emulsion)
- II. Fat droplets  $\xrightarrow{\text{lipase}}$  fatty acids and glycerol

- Pancreatic juice and intestinal juice contain other enzymes aside from lipase. Those enzymes complete the digestion of carbohydrates (which started in the mouth) and proteins (which started in the stomach)



# Absorption of digested food and some other substances

- Absorption – the process by which nutrients in the food tube diffuse into the cells of the wall until they reach the circulating fluids ( blood and lymph)

# Summary of enzymes

**Table1: Major digestive enzymes**

<b>Enzyme</b>	<b>Digestive organ</b>	<b>Function</b>
Salivary amylase	Mouth	Breaks down starches into simpler sugars
Pepsin	Stomach	Breaks down proteins
Maltase, lactase, sucrase	Small intestine	Breaks down sugars into simpler molecules
Peptidase		Breaks down proteins into amino acids
Trypsin and Chymotrypsin	Small intestine, pancreas	Continue the breakdown of proteins
Amylase		Continues the breakdown of starches
Lipase		Aids in breaking down fats

# Key concepts

- 1. Living things need food to (a.) Build new tissues for growth and repair of burnout tissues; (b) Regulate body processes.; (c) Provide energy for the activities of the cells, organs and organ system. Food also maintains the body temperature at  $37^{\circ}\text{C}$  at which enzymes in the body function best.
- 2. Like other hydrographic organisms, man has to take in preformed food.

# Key concepts

- 3. Food (particularly carbohydrates, proteins and fats are made up of complex molecules that cannot pass through the membrane of the body cells. They have to undergo digestion until they are converted into simple molecules that can pass through the cell membrane.
- 4. The structure of the body organs involved in food getting, digestion and absorption permits them to perform the corresponding functions. This is an example of complementarity of structure and function.

# Key concepts

- 5. The mechanism by which nutrients are submerged to the body and the mechanism by which undigested food and waste products are removed from the body before they reach toxic levels of concentration illustrates **homeostasis** or the tendency of the body to maintain internal balance.

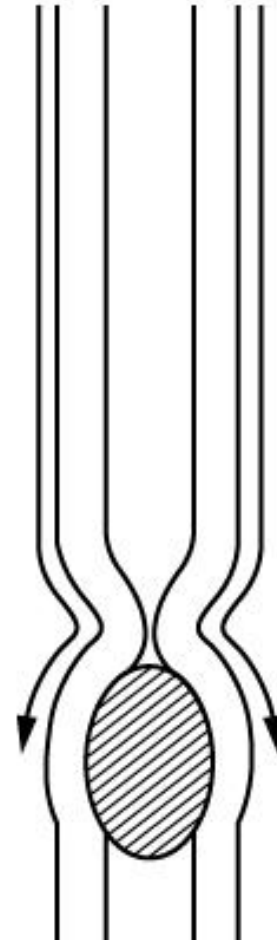
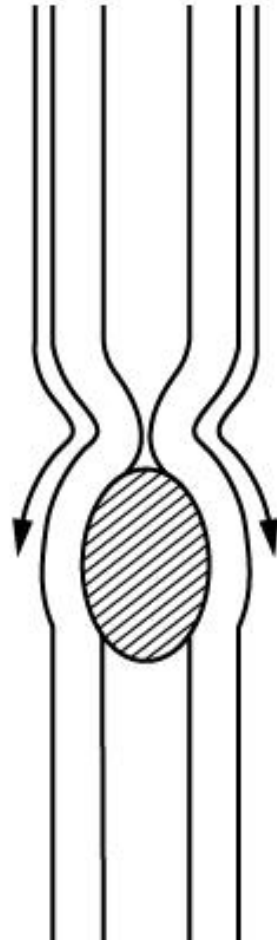
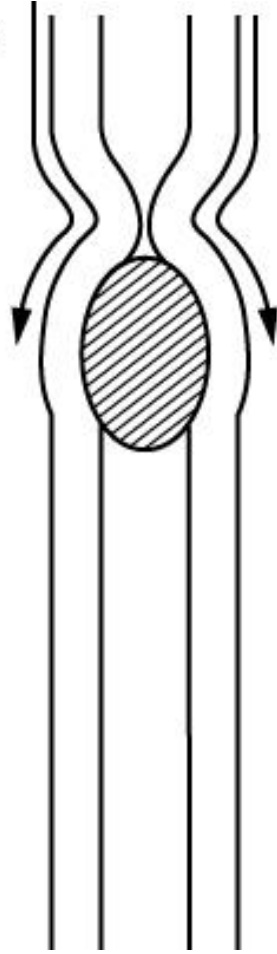
- Make notes in orange notebook  
(handwritten or  
printed)
- Thursday : no phones , answer within the  
time

# Chemical digestion

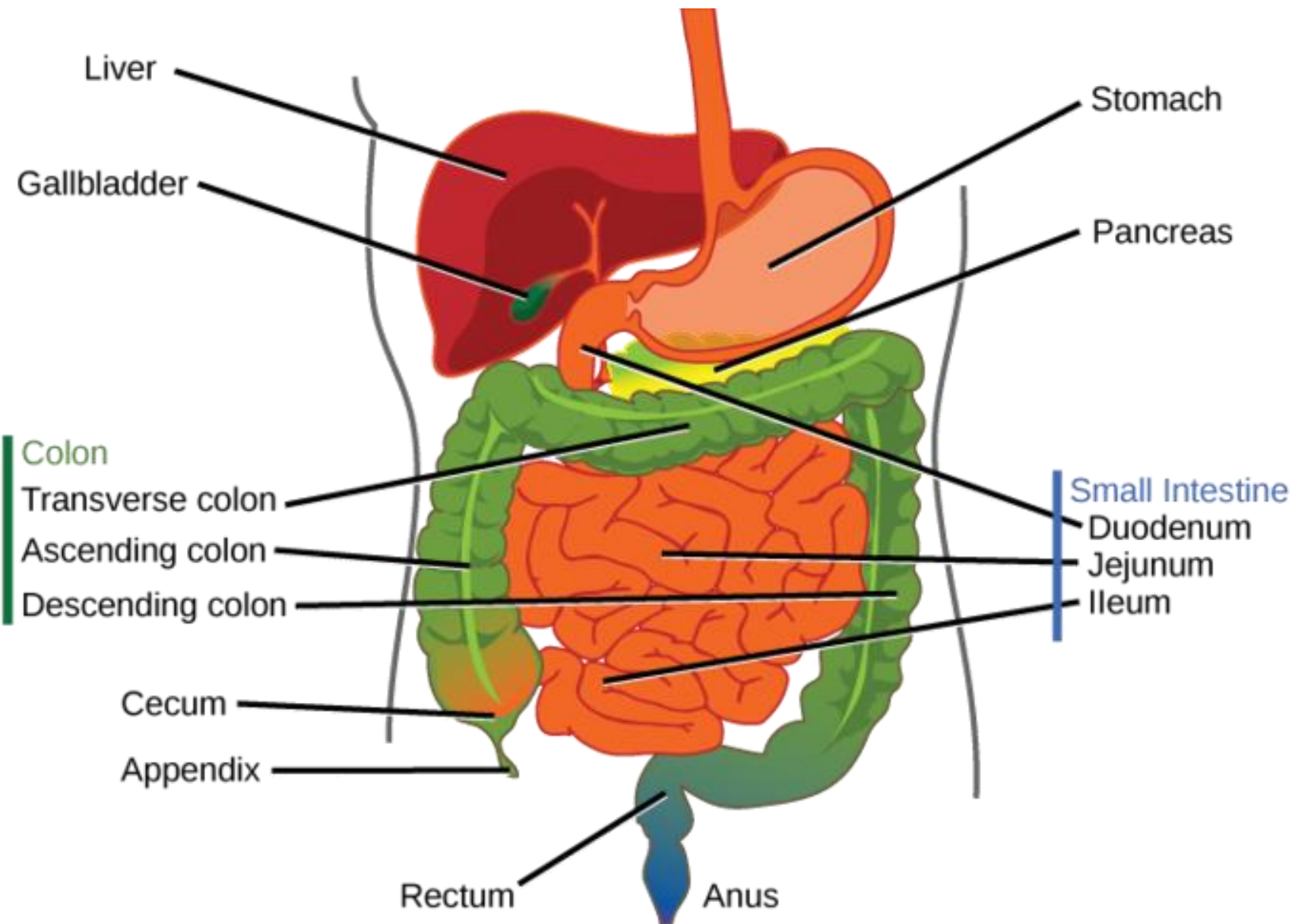
- Mouth

- Breaking of carbohydrates(starches) into maltose , by salivary amylase
- Lingual lipase produced by tongue also starts breaking triglycerides , start break down fats in food
- The chewing and wetting action provided by the teeth and saliva shape the food into a mass called the bolus for swallowing.
- Then persistalsis in the esophagus , involuntary muscle movement

Direction  
of food







# Chemical digestion in stomach

- major site for protein digestion in animals other than ruminants.
- Protein digestion is mediated in the stomach chamber by an enzyme called pepsin, which is secreted by the chief cells in the stomach in an inactive form called pepsinogen.
- Another cell type, parietal cells, secrete hydrogen and chloride ions, which combine in the lumen to form hydrochloric acid, the primary acidic component of the stomach juices.
- Hydrochloric acid helps to convert the inactive pepsinogen to pepsin.
- The highly-acidic environment also kills many microorganisms in the food and, combined with the action of the enzyme pepsin, results in the hydrolysis of protein in the food.

# Chemical digestion in the stomach

- Chemical digestion is facilitated by the churning action of the stomach. Contraction and relaxation of smooth muscles mixes the stomach contents about every 20 minutes.
- The partially-digested food and gastric juice mixture is called chyme.
- Chyme passes from the stomach to the small intestine. Further protein digestion takes place in the small intestine.
- Gastric emptying occurs within two to six hours after a meal. Only a small amount of chyme is released into the small intestine at a time.
- The movement of chyme from the stomach into the small intestine is regulated by the pyloric sphincter.

# Key Points

- Mechanical and chemical digestion begin in the mouth with the chewing of food and the release of saliva, which starts carbohydrate digestion.
- The epiglottis covers the trachea so the bolus (ball of chewed food) does not go down into the trachea or lungs, but rather into the esophagus.
- The tongue positions the bolus for swallowing and then peristalsis pushes the bolus down the esophagus into the stomach.
- In the stomach, acids and enzymes are secreted to break down food into its nutrient components.
- The churning of the stomach helps to mix the digestive juices with the food, turning it into a substance called chyme.