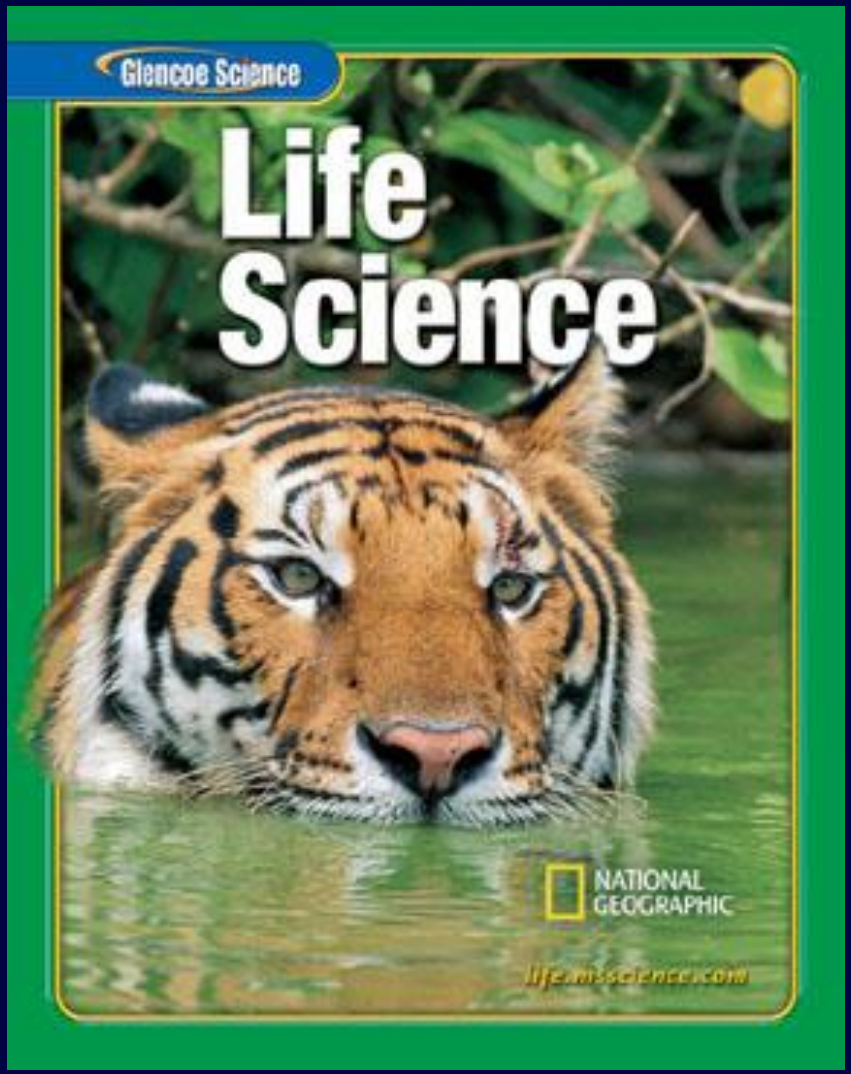
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Chapter: Nutrients and Digestion

Section 1: Nutrition

Section 2: The Digestive System

1

Why do you eat?—Energy Needs

- **Nutrients** (NEW tree unts) are substances in foods that provide energy and materials for cell development, growth, and repair.
- Your body needs energy for every activity that it performs.
- How much energy you need depends on several factors, such as body mass, age, and activity level.
- This energy comes from the foods you eat.

1

Why do you eat?—Energy Needs

- The amount of energy available in food is measured in Calories.
- A Calorie (Cal) is the amount of heat necessary to raise the temperature of 1 kg of water 1°C.
- The number of Calories varies due to the kinds of nutrients a food provides.

1

Classes of Nutrients

- Six kinds of nutrients are available in food—proteins, carbohydrates, fats, vitamins, minerals, and water.
- Proteins, carbohydrates, vitamins, and fats all contain carbon and are called organic nutrients.

1

Classes of Nutrients

- Inorganic nutrients, such as water and minerals, do not contain carbon.
- Foods containing carbohydrates, fats, and proteins need to be digested or broken down before your body can use them.
- Water, vitamins, and minerals don't require digestion and are absorbed directly into your bloodstream.

1

Proteins

- Your body uses proteins for replacement and repair of body cells and for growth.
- **Proteins** are large molecules that contain carbon, hydrogen, oxygen, nitrogen and sometimes sulfur.
- A molecule of protein is made up of a large number of smaller units, or building blocks, called **amino acids**.

1

Proteins

- Your body needs only 20 amino acids in various combinations to make the thousands of proteins used in your cells.
- Most of these amino acids can be made in your body's cells, but eight of them cannot.
- These eight are called essential amino acids.

1

Proteins

- Complete proteins provide all of the essential amino acids.
- Incomplete proteins are missing one or more of the essential amino acids.
- Vegetarians get all of the essential amino acids by eating a wide variety of protein-rich vegetables, fruits, and grains.

1

Carbohydrates

- **Carbohydrates** (kar boh HI drayts) usually are the main sources of energy for your body. 
- Each carbohydrate molecule is made of carbon, hydrogen, and oxygen atoms.
- Energy holds the atoms together.
- When carbohydrates are broken down in the presence of oxygen in your cells, this energy is released for use by your body.

1

Carbohydrates

- Three types of carbohydrates are sugar, starch, and fiber.
- Sugars are called *simple carbohydrates*.
- Your cells break down glucose, a simple sugar.

1

Carbohydrates

- The other two types of carbohydrates—starch and fiber—are called *complex carbohydrates*.
- Starch is found in potatoes and foods made from grains such as pasta.
- Starches are made up of many simple sugars in long chains.

1

Carbohydrates

- Fiber, such as cellulose, is found in the cell walls of plant cells.
- Foods like whole-grain breads and cereals, beans, peas, and other vegetables and fruits are good sources of fibers.
- You cannot digest fiber, but it is needed to keep your digestive system running smoothly.

1

Carbohydrates

- Nutritious snacks can help your body get the nutrients it needs, especially when you are growing rapidly and are physically active.

- Choose smacks that provide nutrients such as complex carbohydrates, proteins, and vitamins, as well as fiber.

1

Fats

- **Fats**, also called lipids, are necessary because they provide energy and help your body absorb vitamins.
- Fat tissue cushions your internal organs.
- A major part of every cell membrane is made up of fat.
- A gram of fat can release more than twice as much energy as a gram of carbohydrate can.

1

Fats

- During the digestion process, fat is broken down into smaller molecules called fatty acids and glycerol (GLIH suh rawl).

- Because fat is a good storage unit for energy, excess energy from the foods you eat is converted to fat and stored for later use.

1

Fats

- Fats are classified as unsaturated or saturated based on their chemical structure.
- Unsaturated fats are usually liquid at room temperature.
- Vegetable oils as well as fats found in seeds are unsaturated fats.

1

Fats

- Saturated fats are found in meats, animal products, and some plants and are usually solid at room temperature.
- Saturated fats have been associated with high levels of blood cholesterol.
- This can lead to heart disease and strokes.

1

Vitamins

- Organic nutrients needed in small quantities for growth, regulating body functions, and preventing some diseases are called **vitamins**.
- Your bone cells need vitamin D to use calcium, and your blood needs vitamin K in order to clot.
- Most foods supply some vitamins, but no food has them all.

1

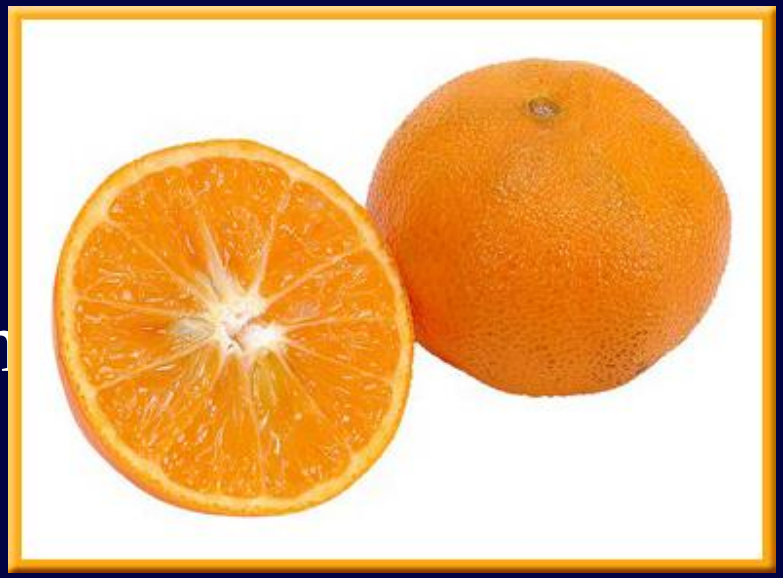
Vitamins

- Vitamins are classified into two groups.
- Some dissolve easily in water and are called water-soluble vitamins.
- They are not stored by your body so you have to take them daily.

1

Vitamins

- Other vitamins dissolve only in fat and are called fat-soluble vitamins.
- These vitamins are stored by your body.
- Although you eat or drink most vitamins, some are made by your body.
- Vitamin D is made when your skin is exposed to sunlight.



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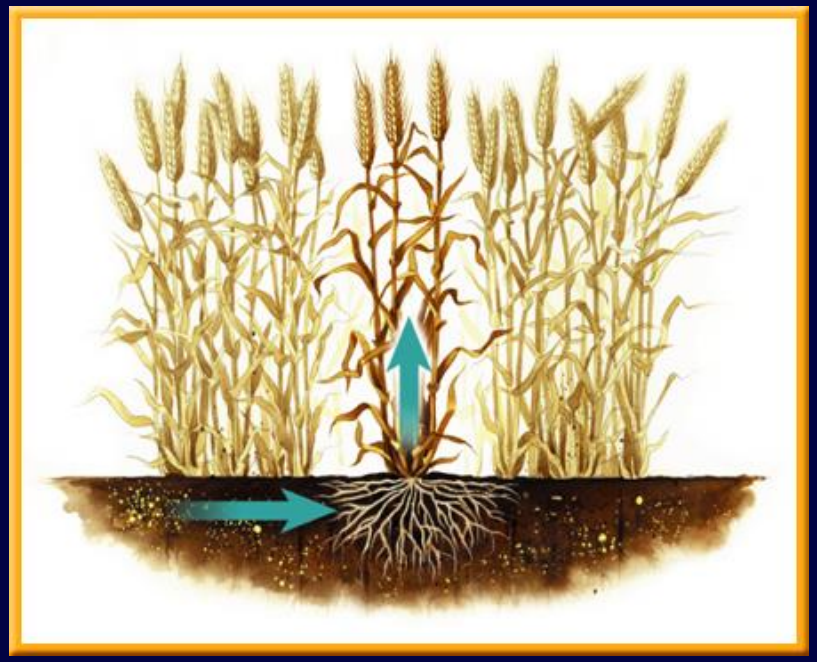
Minerals

- Inorganic nutrients—nutrients that lack carbon and regulate many chemical reactions in your body—are called **minerals**.
- Your body uses about 14 minerals.
- Minerals build cells, take part in chemical reactions in cells, send nerve impulses throughout your body, and carry oxygen to body cells.

1

Minerals

- Of the 14 minerals, calcium and phosphorus are used in the largest amounts for a variety of body functions.
- Some minerals, called trace minerals, are required only in small amounts.



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Minerals

- This table lists several minerals, what they do, and some food sources for them.

Minerals

Mineral	Health Effect	Food Sources
Calcium	strong bones and teeth, blood clotting, muscle and nerve activity	dairy products, eggs, green leafy vegetables, soy
Phosphorus	strong bones and teeth, muscle contraction, stores energy	cheese, meat, cereal
Potassium	balance of water in cells, nerve impulse conduction, muscle contraction	bananas, potatoes, nuts, meat, oranges
Sodium	fluid balance in tissues, nerve impulse conduction	meat, milk, cheese, salt, beets, carrots, nearly all foods
Iron	oxygen is transported in hemoglobin by red blood cells	red meat, raisins, beans, spinach, eggs
Iodine (trace)	thyroid activity, metabolic stimulation	seafood, iodized salt

1

Water

- Next to oxygen, water is the most important factor for survival.
- Different organisms need different amounts of water to survive.
- You could live for a few weeks without food but only for a few days without water because your cells need water to carry out their work.
- Most of the nutrients have to be dissolved in water.
- In cells, chemical reactions take place in solutions.

1

Water

- The human body is about 60 percent water by weight.
- About two thirds of your body water is located in your body cells.
- Water also is found around cells and in body fluids such as blood.

1

Water

- Your body loses water as perspiration.
- When you exhale, water leaves your body as water vapor.
- Water also is lost every day when your body gets rid of wastes.
- To replace water lost each day, you need to drink about 2 L of liquids.

Water Loss

Method of Loss	Amount (mL/day)
Exhaled air	350
Feces	150
Skin (mostly as sweat)	500
Urine	1,500

1

Why do you get thirsty?

- When your body needs to replace lost water, messages are sent to your brain that result in a feeling of thirst.
- Drinking water satisfies your thirst and usually restores the body's homeostasis (hoh mee oh STAY sus).
- Homeostasis is the regulation of the body's internal environment.

1

Food Groups

- Nutritionists have developed a simple system, called the food pyramid, to help people select foods that supply all the nutrients needed for energy and growth.

1

Food Groups

- Foods that contain the same type of nutrient belong to a **food group**. 
- Foods have been divided into five groups—bread and cereal, vegetable, fruit, milk, and meat.
- The recommended daily amount for each food group will supply your body with the nutrients it needs for good health.

1

Daily Servings

- Each day you should eat:
  - six to eleven servings from the bread and cereal group
  - three to five servings from the vegetable group
  - two to four servings from the fruit group
  - two to three servings from the milk group
  - two to three servings from the meat group
- Only small amounts of fats, oils, and sweets should be consumed.

1

Daily Servings

- The size of a serving is different for different foods:
  - a slice of bread or one ounce of ready-to-eat cereal for bread-and-cereal
  - one cup of raw leafy vegetables or one-half cup of cooked or chopped raw vegetables for vegetables
  - one medium apple, banana, or orange for fruit
  - one cup of milk or yogurt for milk
  - two ounces of cooked lean meat or one egg for meat

1

Food Labels

- The nutritional facts found on all packaged foods can help you plan meals that supply the daily recommended amounts of nutrients and meet special dietary requirements (for example, a low-fat diet).

1

Question 1

A _____ is the amount of heat necessary to raise the temperature of 1 kg of water 1 degree Celsius.

Answer

The answer is Calorie. The amount of energy available in food is measured in Calories.

1

Question 2

The foods in this illustration are rich in _____.

A. carbohydrates
B. fat
C. minerals
D. protein

1

Answer

The answer is D. Your body uses proteins for replacement and repair of body cells.

1

Question 3

Organic nutrients needed in small quantities for growth, regulating body functions, and preventing some diseases are called _____.

A. carbohydrates
B. fats
C. minerals
D. vitamins

1

Answer

The answer is D. Taking extra vitamins or eating a well- balanced diet helps give your body all the vitamins it needs.

2

Functions of the Digestive System

- Food is processed in your body in four stages—ingestion, digestion, absorption, and elimination.

- As soon as food enters your mouth, or is ingested, breakdown begins.

2

Functions of the Digestive System

- **Digestion** is the process that breaks down food into small molecules so that they can be absorbed and moved into the blood.
- From the blood, food molecules are transported across the cell membrane to be used by the cell.
- Unused molecules pass out of your body as wastes.
- Digestion is mechanical and chemical.

2

Functions of the Digestive System

- **Mechanical digestion** takes place when food is chewed, mixed, and churned.

- **Chemical digestion** occurs when chemical reactions occur that break down large molecules of food into smaller ones.

2

Enzymes

- An **enzyme** is a type of protein that speeds up the rate of a chemical reaction in your body.
- One way this happens is by reducing the amount of energy necessary for a chemical reaction to begin.
- Enzymes work without being changed or used up.

2

Enzymes

Click image to view movie.

2

Enzymes in Digestion

- Many enzymes help you digest carbohydrates, proteins, and fats.
- Amylase (AM uh lays) is an enzyme produced by glands near the mouth.
- This enzyme helps speed up the breakdown of complex carbohydrates, such as starch, into simpler carbohydrates—sugars.

2

Enzymes in Digestion

- In your stomach, the enzyme pepsin aids the chemical reactions that break down complex proteins into less complex proteins.
- In your small intestine, a number of other enzymes continue to speed up the breakdown of proteins into amino acids.

2

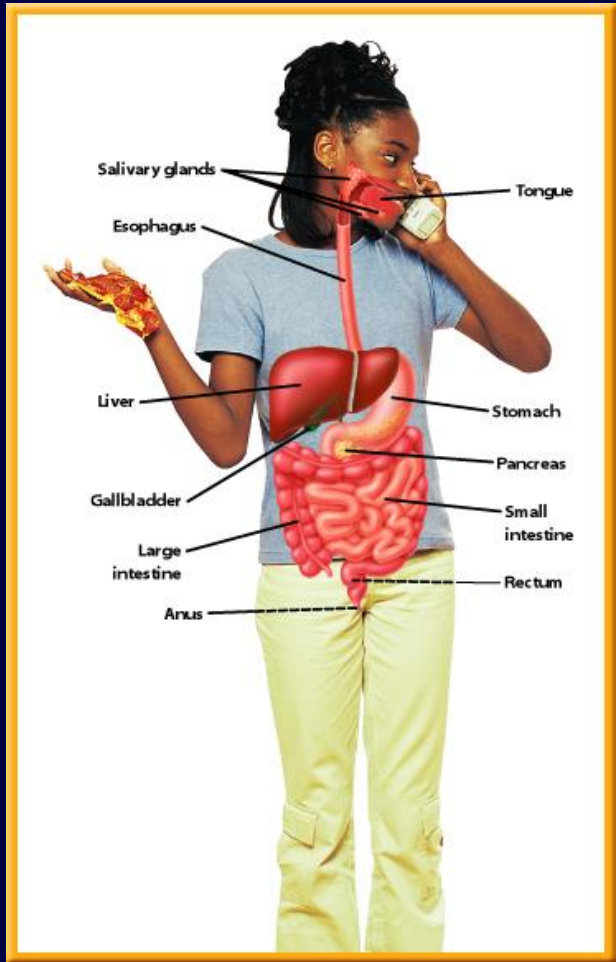
Enzymes in Digestion

- The pancreas, an organ on the back side of the stomach releases several enzymes through a tube into the small intestine.
- The resulting sugars are turned into glucose and are used by your body's cells.
- Different enzymes from the pancreas are involved in the breakdown of fats into fatty acids.

2

Organs of the Digestive System

- Your digestive system has two parts—the digestive tract and the accessory organs.
- The major organs of your digestive tract are the mouth, esophagus (is SAH fuh guhs), stomach, small intestine, large intestine, rectum, and anus.



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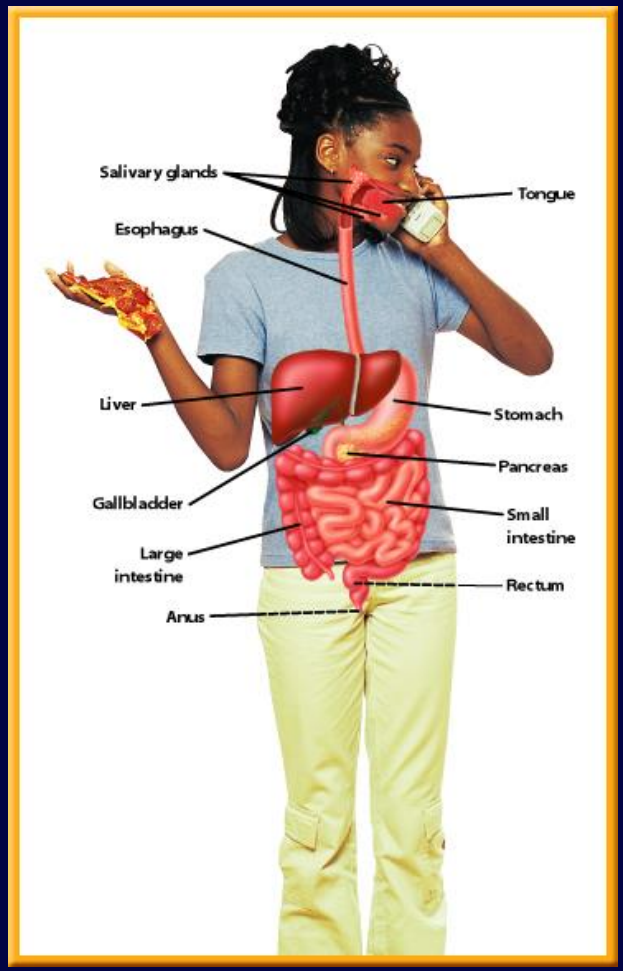
Organs of the Digestive System

- The tongue, teeth, salivary glands, liver, gallbladder, and pancreas are the accessory organs.

- They are important in mechanical and chemical digestion.



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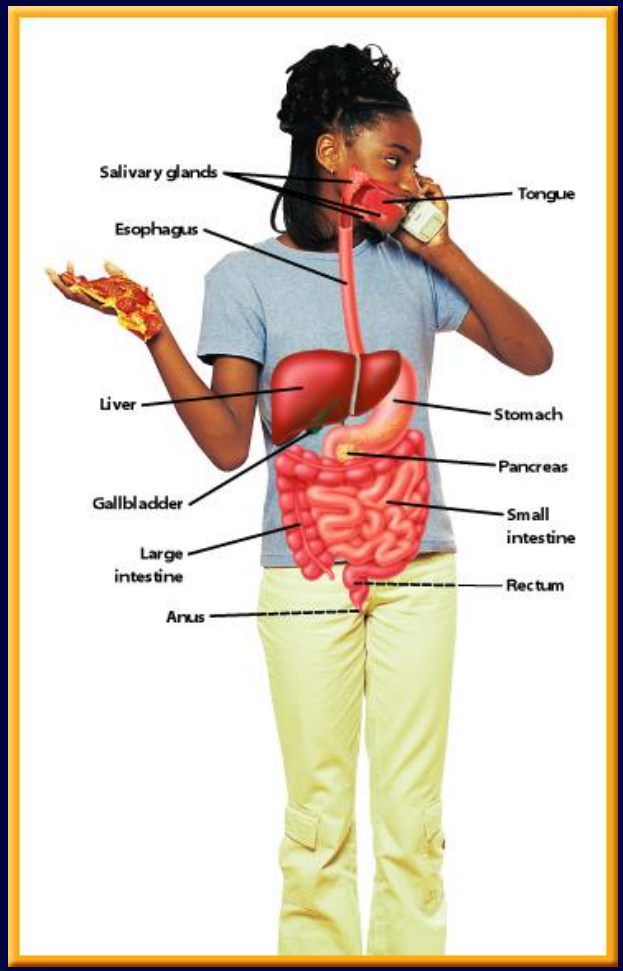
Organs of the Digestive System

- Your liver, gallbladder, and pancreas produce or store enzymes and chemicals that help break down food.



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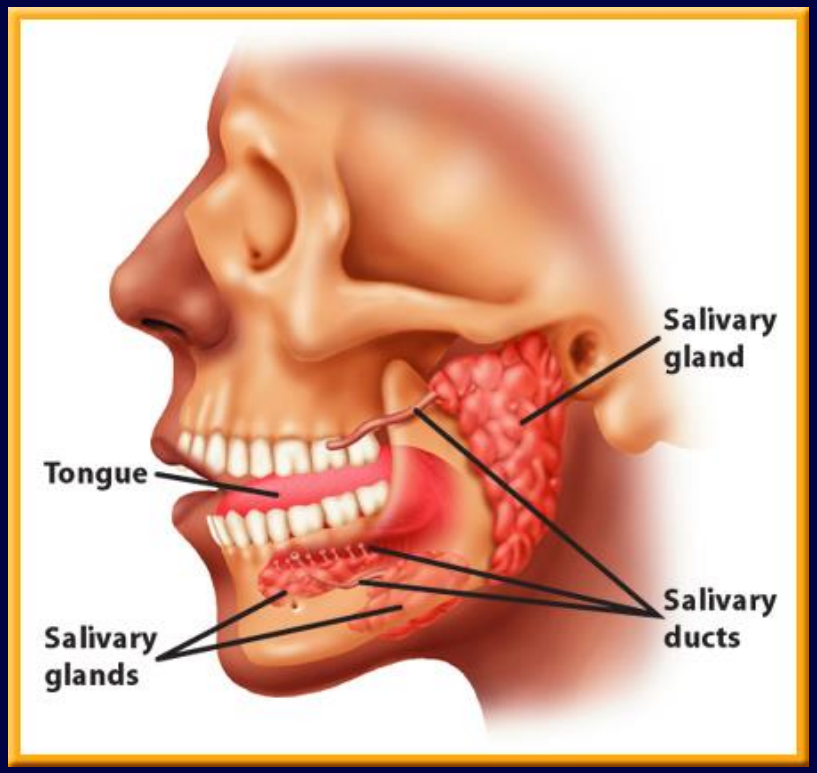
The Mouth

- Mechanical and chemical digestion begin in your mouth.
- Mechanical digestion happens when you chew your food with your teeth and mix it with your tongue.
- Chemical digestion begins with the addition of a watery substance called saliva (suh LI vuh).

2

The Mouth

- As you chew, your tongue moves food around and mixes it with saliva.
- Saliva is produced by three sets of glands near your mouth.



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The Mouth

- Although saliva is mostly water, it also contains mucus and an enzyme that aids in the breakdown of starch into sugar.
- Food mixed with saliva becomes a soft mass and is moved to the back of your mouth by your tongue.
- It is swallowed and passes into your esophagus.

2

The Esophagus

- Food moving into the esophagus passes over the epiglottis (ep uh GLAH tus).
- This structure automatically covers the opening to the windpipe to prevent food from entering it, otherwise you would choke.
- Your esophagus is a muscular tube about 25 cm long.
- It takes about 4 s to 10 s for food to move down the esophagus to the stomach.

2

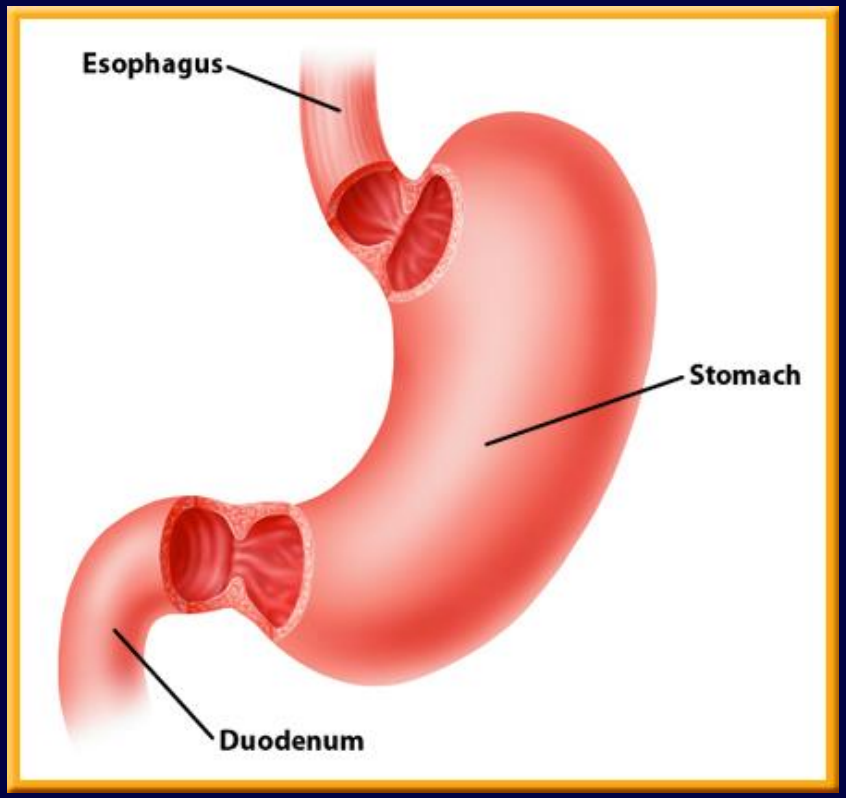
The Esophagus

- No digestion takes place in the esophagus.
- Mucous glands in the wall of the esophagus keep the food moist.
- Smooth muscles in the wall move food downward with a squeezing action.
- These waves of muscle contractions, called **peristalsis** (per uh STAHL sus), move food through the entire digestive tract.

2

The Stomach

- The stomach is a muscular bag.
- When empty, it is somewhat sausage shaped with folds on the inside.
- As food enters from the esophagus, the stomach expands and the folds smooth out.



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The Stomach

- Mechanical and chemical digestion take place in the stomach.
- Mechanically, food is mixed in the stomach by peristalsis.
- Chemically, food is mixed with enzymes and strong digestive solutions, such as hydrochloric acid solution, to help break it down.

2

The Stomach

- Specialized cells in the walls of the stomach release about 2 L of hydrochloric acid solution each day.

- The acidic solution works with the enzyme pepsin to digest protein.

2

The Stomach

- It also destroys bacteria that are present in the food.
- The stomach also produces mucus, which makes food more slippery and protects the stomach from the strong, digestive solutions.
- Food moves through your stomach in 2 hours to 4 hours and is changed into a thin, watery liquid called **chime** (KIME).
- Little by little, chime moves out of your stomach and into your small intestine.

2

The Small Intestine

- Your small intestine is small in diameter, but it measures 4 m to 7 m in length.
- As chime leaves your stomach, it enters the first part of your small intestine, called the duodenum (doo AH duh num) where most digestion takes place.
- Here, a greenish fluid from the liver, called bile, is added to break up large fat particles.

2

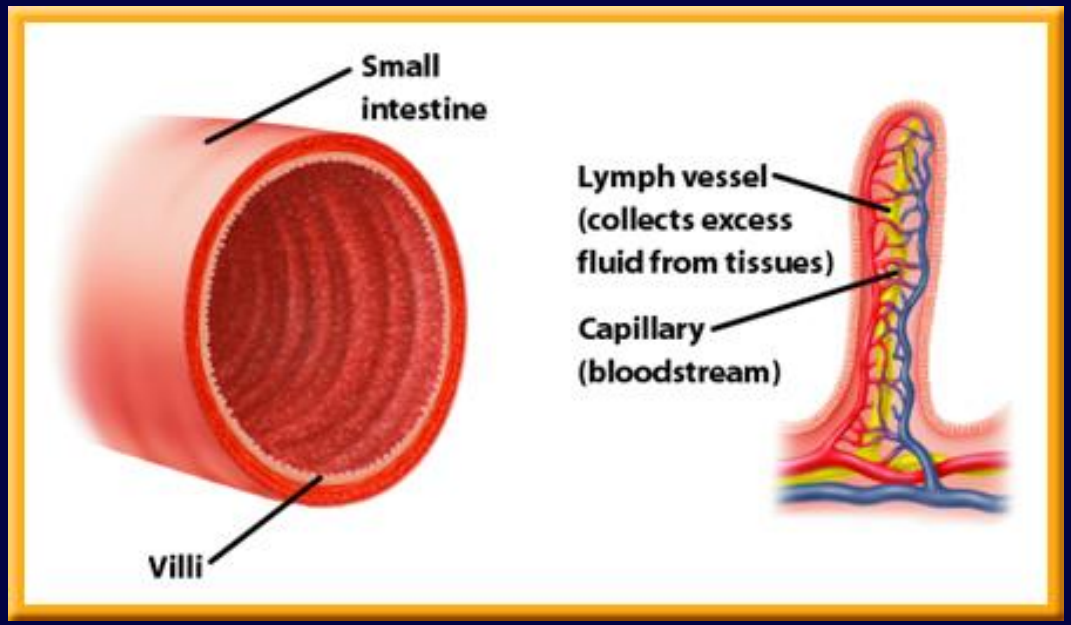
The Small Intestine

- Chemical digestion of carbohydrates, proteins, and fats occurs when a digestive solution of bicarbonate ions and enzymes from the pancreas is mixed in.
- The solution helps neutralize the stomach acid.
- Your pancreas also makes insulin, a hormone that allows glucose to pass from the bloodstream into your cells.

2

The Small Intestine

- Absorption of food takes place in the small intestine.
- The wall has many ridges and folds that are covered with fingerlike projections called **villi** (VIH li).



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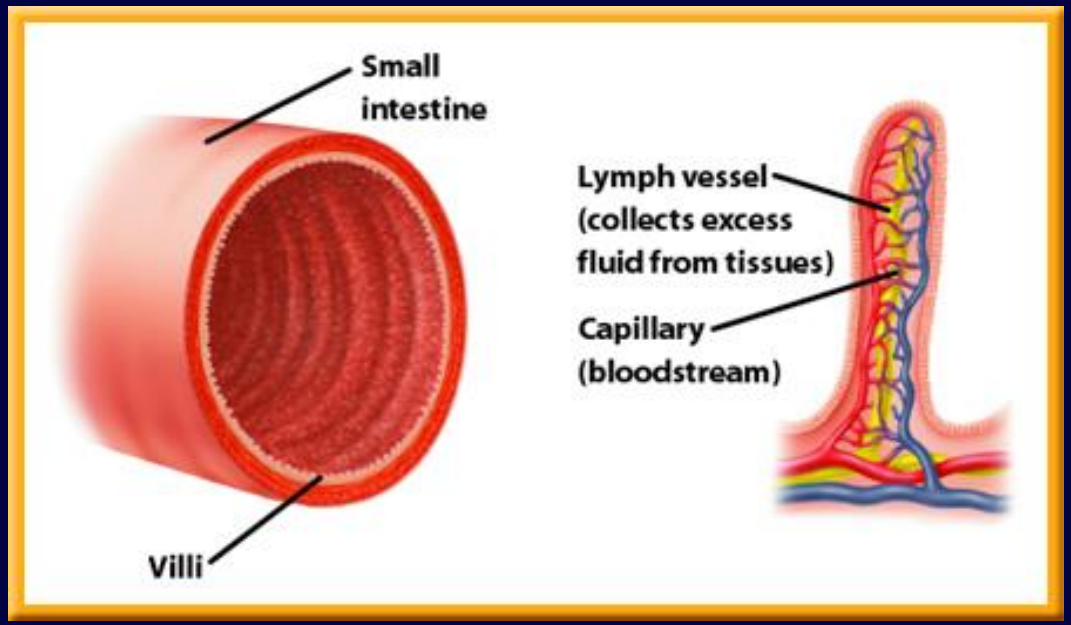
The Small Intestine

- Villi increase the surface area of the small intestine so that nutrients in the chime have more places to be absorbed.



2

The Small Intestine

- Peristalsis continues to move and mix the chime.
- The villi move and are bathed in the soupy liquid.
- Nutrients move into blood vessels within the villi.

2

The Small Intestine

- From here, blood transports the nutrients to all cells of your body.
- Peristalsis continues to force the remaining undigested and unabsorbed materials slowly into the large intestine.

2

The Large Intestine

- When the chime enters the large intestine, it is still a thin, watery mixture.
- The main job of the large intestine is to absorb water from the undigested mass.

2

The Large Intestine

- After the excess water is absorbed, the remaining undigested materials become more solid.
- Muscles in the rectum, which is the last section of the large intestine, and the anus control the release of semisolid wastes from the body in the form of feces (FEE seez).

2

Bacteria Are Important

- Bacteria live in many of the organs of your digestive tract including your mouth and large intestine.
- The bacteria in our large intestine feed on undigested material like cellulose. In turn, bacteria make vitamins you need—vitamin K and two B vitamins.
- Bacterial action also converts bile pigments into new compounds.

2

Question 1

This illustration represents _____.

A. absorption
B. digestion
C. elimination
D. ingestion

2

Answer

The answer is D. Ingestion occurs as food enters your mouth.

2

Question 2

_____ are a type of protein that speeds up the rate of a chemical reaction in your body.

Answer

The answer is enzymes. Enzymes reduce the amount of energy necessary for a chemical reaction to begin.

2

Question 3

Which is a major organ in your digestive tract?

A. esophagus
B. gallbladder
C. pancreas
D. salivary glands

2

Answer

The answer is A. The major organs of the digestive tract are mouth, esophagus, stomach, small intestine, large intestine, rectum, and anus. Food passes through all of these organs.

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