

## UNIT 5: Structure and Function of Organisms, Part 2

### Lesson 1: Physical and Chemical Changes in Digestion

#### Engage



#### Eat a Cracker

1. Your teacher will give you two unsalted crackers.
2. Chew the crackers in your mouth for 2 minutes without swallowing.
3. Record your observations, including the initial taste of the crackers and their taste after 2 minutes.
  - Why do we chew our food before swallowing?

#### Explore



#### Procedure

1. Write a hypothesis of what will happen when pineapple is placed on gelatin. Record your hypothesis in your science notebook.
2. Place the small piece of pineapple in the middle of the Petri dish containing gelatin.
3. Over several minutes, record your observations.
4. Dispose of all materials according to your teacher's directions. Leave your area clean and organized.

#### Conclusion

1. Do your results support your hypothesis?
2. Did a chemical change occur? If yes, what evidence do you have?



## Lesson 1: Physical and Chemical Changes in Digestion

### Explain

#### Physical and Chemical Changes

Physical changes occur when a substance has a change in one of its physical properties, such as density, size, smell, or luster. Physical changes do not alter the chemical makeup of the substance. Examples of a physical change include tearing paper, adding food color to water, or chewing food to break it into smaller pieces.

If a substance has a change in its chemical properties, a chemical change occurs. New substances form during a chemical change. Examples of a chemical change include paper burning, organic material decomposing, and vinegar reacting with baking soda. Photosynthesis is an example of a chemical change that occurs in plants. Physical and chemical changes occur during digestion in humans.

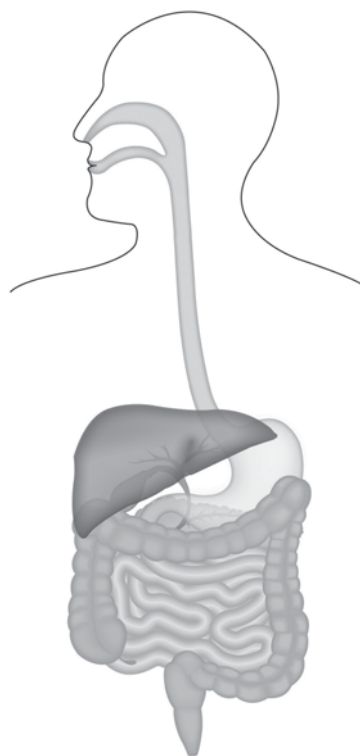
#### The Digestive System

Our cells need energy and nutrients from food to survive and grow. Food that we eat must be broken down into molecules that can be used by our cells. Large molecules of carbohydrates, proteins, and fat are broken down into even smaller molecules during digestion.

Digestion begins in the mouth. Chewing food physically breaks it into smaller pieces. The act of chewing also releases saliva from glands in the mouth. Saliva contains an enzyme that begins breaking down food molecules. Complex carbohydrates like starches are broken down into smaller simple sugars. The cracker tastes sweet because the complex starch is being broken down into glucose, a simple sugar.

The tongue moves the food particles around to shape it into a ball, called a bolus. The bolus is swallowed, moves down the esophagus by a squeezing action, and enters the stomach. The muscles of the stomach physically mix the bolus and gastric juices, which include hydrochloric acid and enzymes. The acid and enzymes continue to chemically break down the food into even smaller pieces to form a smooth paste called chyme.

Figure 5.1. The Digestive System



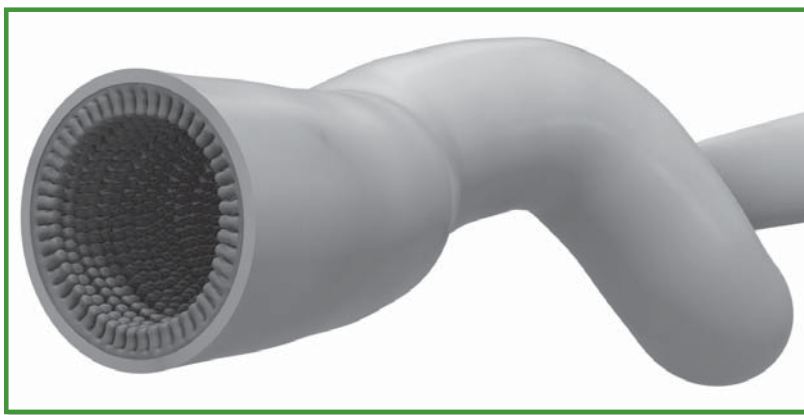
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#### DID YOU KNOW?

Hydrochloric acid breaks down food and also kills bacteria and viruses that are ingested with the food.

The chyme moves into the small intestine, and different digestive enzymes from the liver and pancreas continue breaking the molecules down. Approximately 6–8 hours after the food enters the mouth, it has been physically and chemically broken down into simple molecules that are easily absorbed into the blood through the small intestine's villi. The circulatory system then transports the digested food to the cells of the body.



Villi increase the surface area in the intestines for nutrient absorption.

Dangerous metabolic by-products such as hydrogen peroxide are chemically changed into less harmful substances by enzymes. Indigestible parts of chyme are moved along to the large intestine, where usable water and minerals are absorbed. Unusable waste material is expelled from the anus.



Create a table similar to the one below that describes whether physical changes, chemical changes, or both physical and chemical changes occur in each organ.

Organ	Physical, Chemical, or Physical and Chemical Changes
mouth	
esophagus	
stomach	
small intestine	
large intestine	

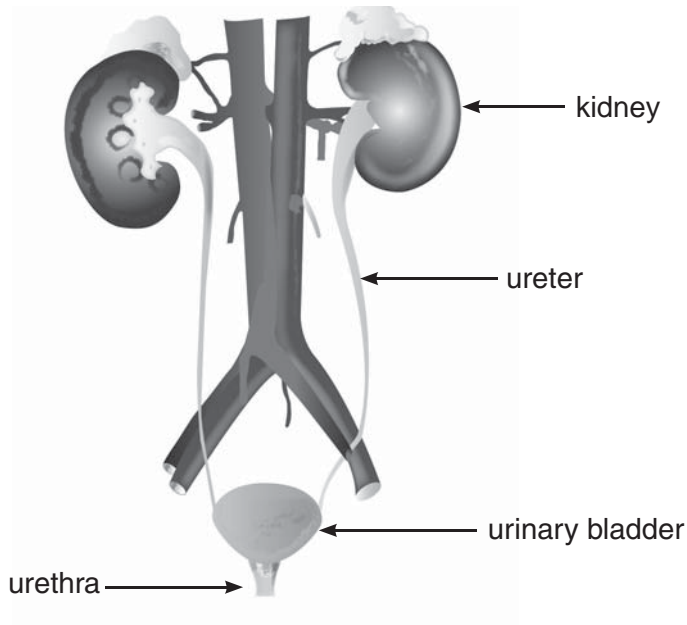


## Lesson 1: Physical and Chemical Changes in Digestion

### The Excretory System

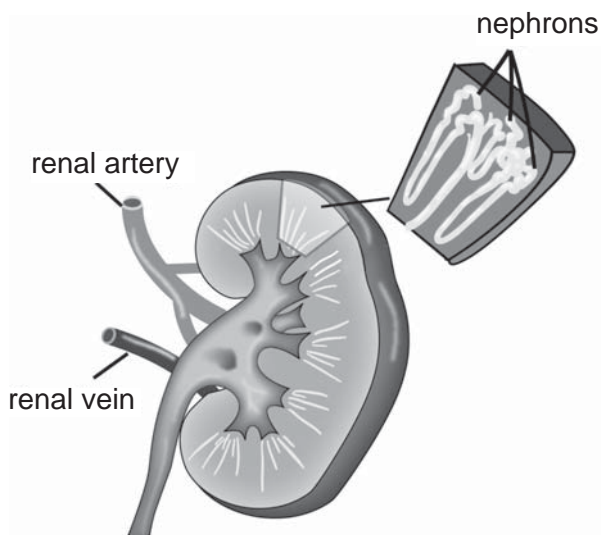
The daily activities of cells include chemical reactions that require energy from food. Chemical waste products are formed as a result of these activities and are moved out of the cells and into the blood. In order to maintain a balance in the body, the blood must be cleaned of these waste products. The kidneys are the main organs of the excretory system.

Figure 5.2. The Excretory System



The kidneys are bean-shaped organs that act as the main blood filters of the body. More than a quart of blood is cleaned every minute as blood passes through the filtering structures of the kidneys. Tiny tubelike structures called nephrons filter out waste materials and extra fluid from the blood. This liquid is sent to the bladder to be stored until it is released as urine.

Figure 5.3. The Kidney



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#### Human Body Book

Following your teacher's instructions, create a book about the functions of the human body.

- Title each diagram.
- Describe in your book the functions of the system.
- On the diagrams provided by your teacher, label and color the following:

mouth—red

esophagus—blue

stomach—orange

small intestine—brown

liver—green

large intestine—yellow

kidneys—brown

urinary bladder—yellow

#### Elaborate

Using the materials provided by your teacher, design a filter to model how kidneys filter waste from the blood. The “blood” to be cleaned is muddy water.

In your science notebook, draw and label the filter and describe the efficiency of the filter.

Keep a small amount of muddy water to use as a control for comparisons. Participate in a gallery walk to observe filters created by other groups.



#### Questions

1. Compare the water before and after filtering through each one of the filters. Which one cleaned the water most efficiently?
2. Which of the filters is most like the kidneys? Why?

The function of the kidneys is much more complex than your model. There is a delicate chemical balance that must be maintained in the body. The kidneys are “chemists” in that they measure amounts of chemicals your body needs, such as sodium, phosphorus, and potassium, and they make sure there is the correct amount in the blood for your body to function.



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## Lesson 1: Physical and Chemical Changes in Digestion

### Evaluate

#### Part 1

Create a concept map showing the chemical and physical changes that occur during digestion.

#### Part 2

Use your knowledge of physical and chemical changes in digestion to complete the assessment.