

Digestive Process Paired Text

PASSAGE 1

The Digestive Process Begins

1 In 1822, a man named Alexis St. Martin was wounded in the stomach. Dr. William Beaumont saved St. Martin's life. The wound, however, left an opening in St. Martin's stomach that never healed completely. Beaumont realized that by looking through the opening in St. Martin's abdomen, he could observe what was happening inside the stomach. Beaumont observed that food changed chemically inside the stomach. He hypothesized that chemical reactions in the stomach broke down foods into smaller particles. Beaumont removed liquid from St. Martin's stomach and analyzed it. The stomach liquid contained an acid that played a role in the breakdown of foods into simpler substances.

Functions of the Digestive System

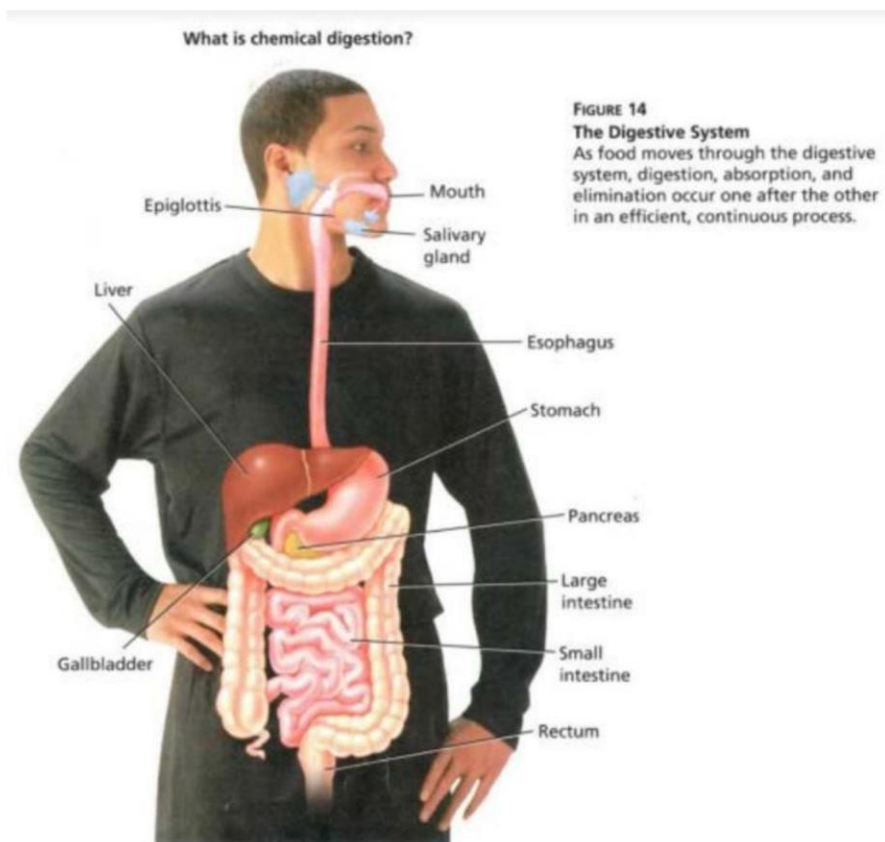
2 Beaumont's observations helped scientists understand the role of the stomach in the digestive system. The digestive system has three main functions. First, it breaks down food into molecules the body can use. Then, the molecules are absorbed into the blood and carried throughout the body. Finally, wastes are eliminated from the body. Figure 14 shows the organs of the digestive system, which is about 9 meters long from beginning to end.

Digestion

3 The process by which your body breaks down food into small nutrient molecules is called digestion. There are two kinds of digestion - mechanical and chemical. In mechanical digestion, foods are physically broken down into smaller pieces. Mechanical digestion occurs when you bite into a sandwich and chew it into small pieces. In chemical digestion, chemicals produced by the body break foods into their smaller chemical building blocks. For example, the starch in bread is broken down into individual sugar molecules.

Absorption and Elimination

4 After your food is digested, the molecules are ready to be transported throughout your body. Absorption (ab SAWRP shun) is the process by which nutrient molecules pass through the wall of your digestive system into your blood. Materials that are not absorbed, such as fiber, are eliminated from the body as wastes.



The Mouth

Have you ever walked past a bakery or restaurant and noticed your mouth watering? Smelling or even just thinking about food when you're hungry is enough to start your mouth watering. This response isn't accidental. When your mouth waters, your body is preparing for the delicious meal it expects. Both mechanical and chemical digestion begin in the mouth. The fluid released when your mouth waters is saliva (suh-LY-vuh). Saliva plays an important role in both kinds of digestion.

Mechanical Digestion in the Mouth

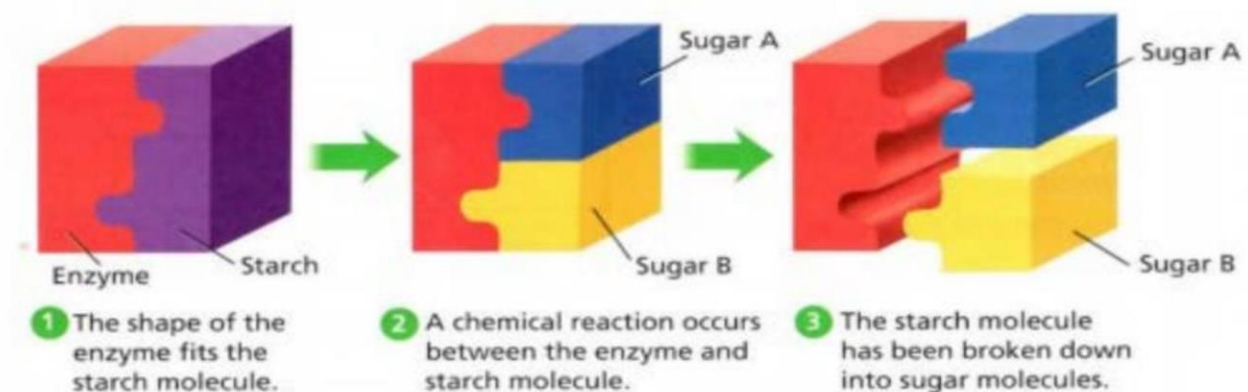
Your teeth carry out the first stage of mechanical digestion. Your center teeth, or incisors (in SY zurz), cut the food into bite-sized pieces. On either side of the incisors there are sharp, pointy teeth called canines (KAY nynz). These teeth tear and slash the food into smaller pieces. Behind the canines are the premolars and molars, which crush and grind the food. As the teeth do their work, saliva moistens the pieces of food into one slippery mass.

Chemical Digestion in the Mouth

As mechanical digestion begins, so does chemical digestion. If you take a bite of a cracker and suck on it, the cracker begins to taste sweet. It tastes sweet because a chemical in the saliva has broken down the starch molecules in the cracker into sugar molecules.

The chemical in saliva that digests starch is an enzyme. Enzymes are proteins that speed up chemical reactions in the body. Your body produces many different enzymes. Each enzyme has a specific chemical shape. Its shape enables it to take part in only one kind of chemical reaction. An example of enzyme action is shown in Figure 16.

FIGURE 16
How Enzymes Work
The shape of an enzyme molecule is specific to the shape of the food molecule it breaks down. Here, an enzyme breaks down a starch into sugars.



The Esophagus

If you've ever choked on food, your food may have "gone down the wrong way." That's because there are two openings at the back of your mouth. One opening leads to your windpipe, which carries air into your lungs. As you swallow, a flap of tissue called the epiglottis (ep uh GLAHT is) seals off your windpipe preventing the food from entering. The food goes into the esophagus (ih SAHF uh gus), a muscular tube that connects the mouth to the stomach. The esophagus is lined with mucus, a thick, slippery substance produced by the body. Mucus makes food easier to swallow and move along.

Food remains in the esophagus for only about 10 seconds. After food enters the esophagus, contractions of smooth muscles push the food toward the stomach. These involuntary waves of muscle contraction are called peristalsis (pehr ih STAWL sis). Peristalsis also occurs in the stomach and farther down the digestive system. These muscular waves keep food moving in one direction.

Using **PASSAGE 1**, answer the following questions on your own paper.

1. Why does food have to be broken down into smaller parts?
2. In your own words, explain the process of absorption.
3. Describe completely the events that occur when food enters the mouth.

4. PART A

According to *PASSAGE 1*, what are enzymes?

- A. acids that make food easier to swallow
- B. chemicals found in blood to help transport nutrients
- C. substances made by the body that increase the rate of chemical reactions
- D. proteins that carry nutrient molecules to organs throughout the body

PART B

The author of *PASSAGE 1* discusses enzymes in order to help the reader understand—

- A. how our bodies turn food into nutrients.
- B. how the liver performs more than one function.
- C. why the digestive process can take several hours.
- D. why a balanced diet contributes to efficient digestion.

5. Explain the diagram that is labeled *Figure 16*.

PASSAGE 2

Final Digestion and Absorption

1 Have you ever been part of a huge crowd attending a concert or sports event? Barriers and
passageways often guide people in the right direction. Ticket takers make sure that people enter in an
orderly fashion.

2 In some ways, the stomach can be thought of as the "ticket taker" of the digestive system. Once
the food has been changed into a thick liquid, the stomach releases a little of the liquid at a time into the
next part of the digestive system. This slow, smooth passage of food through the digestive system
ensures that digestion and absorption can take place efficiently.

The Small Intestine

3 After the thick liquid leaves the stomach, it enters the small intestine. The small intestine is the
part of the digestive system where most chemical digestion takes place. You may wonder how the
small intestine got its name. After all, at about 6 meters--longer than some full-sized cars-- it makes up
two thirds of the length of the digestive system. The small intestine was named for its small diameter. It
is from 2 to 3 centimeters wide, about half the diameter of the large intestine.

4 When food reaches the small intestine, it has already been mechanically digested into a thick
liquid. But chemical digestion has just begun. Starches and proteins have been partially broken down,
but fats haven't been digested at all. Almost all chemical digestion and absorption of nutrients takes
place in the small intestine. As the liquid moves into the small intestine it mixes with enzymes and
secretions that are produced by the small intestine, the liver, and the pancreas. The liver and the
pancreas deliver their substances to the small intestine through small tubes.

The Liver

5 As you can see in Figure 18, the liver is located in the upper right portion of the abdomen. It is
the largest organ inside the body. The liver is like an extremely busy chemical factory and plays a role
in many body processes. For example, it breaks down medicines, and it helps eliminate nitrogen from
the body. The role of the liver in the digestive system is to produce bile.

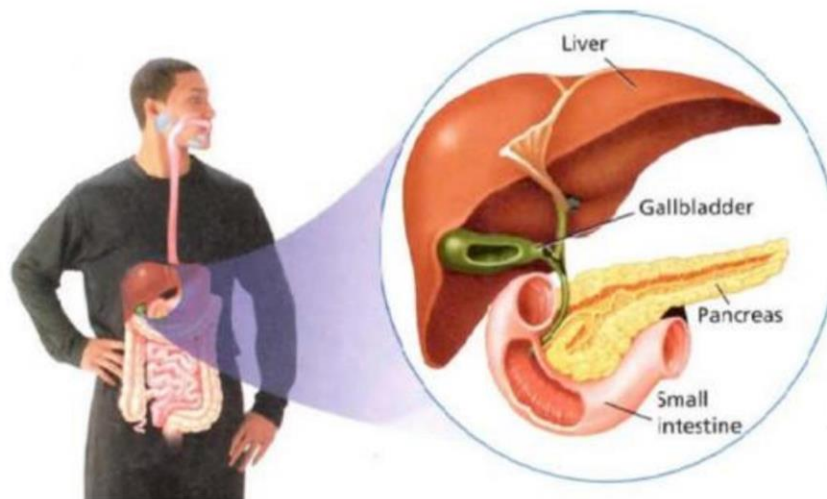


FIGURE 18
The Liver and Pancreas
Substances produced by the liver
and pancreas aid in digestion.

6 Bile is a substance that breaks up fat particles. Bile flows from the liver into the gallbladder, the
organ that stores bile. After you eat, bile passes through a tube from the gallbladder into the small
intestine.

7 Bile is not an enzyme. It does not chemically digest foods. It does, however, physically break up
large fat particles into smaller fat droplets. You can compare the action of bile on fats with the action of
soap on a greasy frying pan. Soap physically breaks up the grease into small droplets that can mix with

the soapy water and be washed away. Bile mixes with the fats in food to form small fat droplets. The droplets can then be chemically broken down by enzymes produced in the pancreas.

The Pancreas

The pancreas is a triangular organ that lies between the stomach and the first part of the small intestine. Like the liver, the pancreas plays a role in many body processes. As part of the digestive system, the pancreas produces enzymes that flow into the small intestine and help break down starches, protein, and fats.

Digestive enzymes do not break down all food substances. Recall that the fiber in food isn't broken down. Instead, fiber thickens the liquid material in the intestine. This thickening makes it easier for peristalsis to push the material forward.

Absorption in the Small Intestines

After chemical ingestion takes place, the small nutrient molecules are ready to be absorbed by the body. The structure of the small intestine makes it well suited for absorption. The inner surface, or lining, of the small intestine looks bumpy. Millions of tiny finger-shaped structures called villi (VIL eye) (singular villus) cover the surface. The villi absorb nutrient molecules. Notice in Figure 19 that tiny blood vessels run through the center of each villus. Nutrient molecules pass from cells on the surface of a villus into blood vessels. The blood carries the nutrients throughout the body for use by body cells.

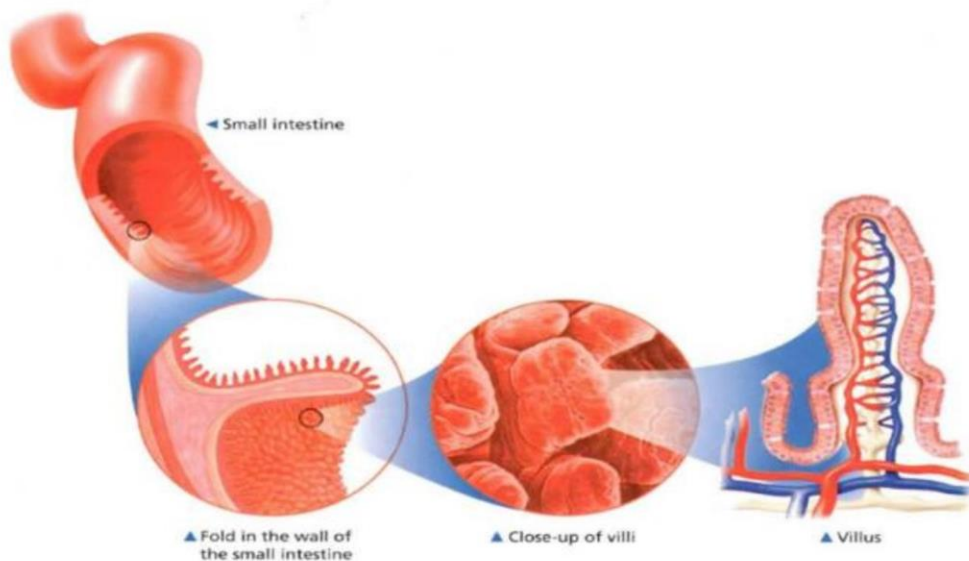


FIGURE 19
The Small Intestine
Tiny finger-shaped projections called villi line the inside of the small intestine. Blood vessels in the villi are covered by a single layer of cells.

Villi greatly increase the surface area of the small intestine. If all the villi were laid out flat, the total surface area of the small intestine would be about as large as a tennis court. This increased surface enables digested food to be absorbed much faster than if the walls of the small intestine were smooth.

The Large Intestine

By the time material reaches the end of the small intestine, most nutrients have been absorbed. The remaining material moves from the small intestine into the large intestine. The large intestine is the last section of the digestive system. It is about 1.5 meters long - about as long as the average bathtub. It runs up the right hand side of the abdomen, across the upper abdomen, and then down the left-hand side. The large intestine contains bacteria that feed on the material passing through. These bacteria normally do not cause disease. In fact, they are helpful because they make certain vitamins, including vitamin K.

- 13 The material entering the large intestine contains water and undigested food. As the material moves through the large intestine, water is absorbed into the bloodstream. The remaining material is readied for elimination from the body.
- 14 The large intestine ends in a short tube called the rectum. Here, waste material is compressed into a solid form. This waste material is eliminated from the body through the anus, a muscular opening at the end of the rectum.

Using **PASSAGE 2**, answer the following questions on your own paper.

6. According to the text, what is the role the stomach plays in digestion?
7. Explain what might happen if the stomach failed to work properly.
8. Describe what happens to food in the small intestine.
9. Why is the small intestine called “the small intestine”?
10. Describe what happens in the liver.
11. What are the different roles the liver performs?
12. Explain how the liver and the pancreas work together in digestion.
13. Carefully reread the section on the small intestine and the section titled *Absorption in the Small Intestines*. Explain how the structure or shape of the small intestine helps it perform its role in digestion.
14. Based on your answer to question 13, what might happen if much of the small intestine was damaged?
15. Explain what happens to food as it enters the large intestine.
16. Why might the large intestine have a greater diameter than the small intestine?

Using both passages, answer the following questions on your own paper.

17. PART A

Which statement best describes what happens to fat in the body as described in **PASSAGE 2**?

- A. In the small intestine, fat is broken down by special substances from the liver and pancreas.
- B. In the stomach, fat gets digested so it can be stored in the liver.
- C. In the small intestine, fat thickens waste material before it passes into the large intestine.
- D. In the mouth, fat works with enzymes in saliva to change food into a slippery mass.

Part B

Based on the answer to Part A, what can the reader conclude about fat?

- A. Fat is responsible for moving food through the body.
- B. Fat is mostly affected by mechanical digestion.
- C. Fat contains important nutrients.
- D. Fat is harder to digest than other types of food.

18. Write a sentence from **PASSAGE 2** that provides evidence that the late stages of digestion require several organs to work together at the same time.

19. Which idea discussed in **PASSAGE 2** is further emphasized by **Figure 19**?

- A. The small intestine is much longer than the large intestine but it is also more narrow.
- B. The small intestine produces enzymes that help break food down further.
- C. The small intestine allows digested nutrients to easily pass into the bloodstream.
- D. The small intestine compresses food into solid form in order to aid elimination.

20. Study the chart and the list of body parts to decide which part performs each of the roles described on the chart. Then complete numbers 1-5 by listing the names of the correct body parts. **NOTE: You will NOT use all the parts in the List of Body Parts. Also note that one part performs two main roles.**

BODY PART	MAIN ROLE IN DIGESTIVE PROCESS
1.	begins chemical and mechanical digestion
2.	starts peristalsis
3.	slowly releases liquid food
4.	• completes chemical digestion • absorbs nutrients into blood
5.	moves waste material

LIST OF BODY PARTS

stomach

gallbladder

small intestine

rectum

esophagus

large intestine

liver

mouth

pancreas

21. The author has mainly structured the two articles by—

- A. listing the body parts involved in the digestive process and describing the appearance of each.
- B. explaining the role that each organ plays in the sequential steps of the digestive process.
- C. comparing the three digestive functions and the organs that each depends on.
- D. describing how the digestive process results from the reactions shown in Figure 16.

22. The author defines digestion in paragraph 3 of “The Digestive Process Begins.” Based on this definition and other information from both articles, in which *three* organs does digestion mainly occur?
- A. esophagus
 - B. large intestine
 - C. mouth
 - D. liver
 - E. small intestine
 - F. gallbladder
 - G. pancreas
 - H. stomach