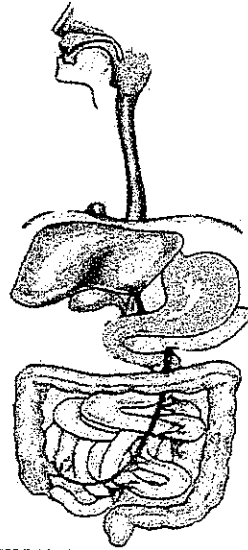
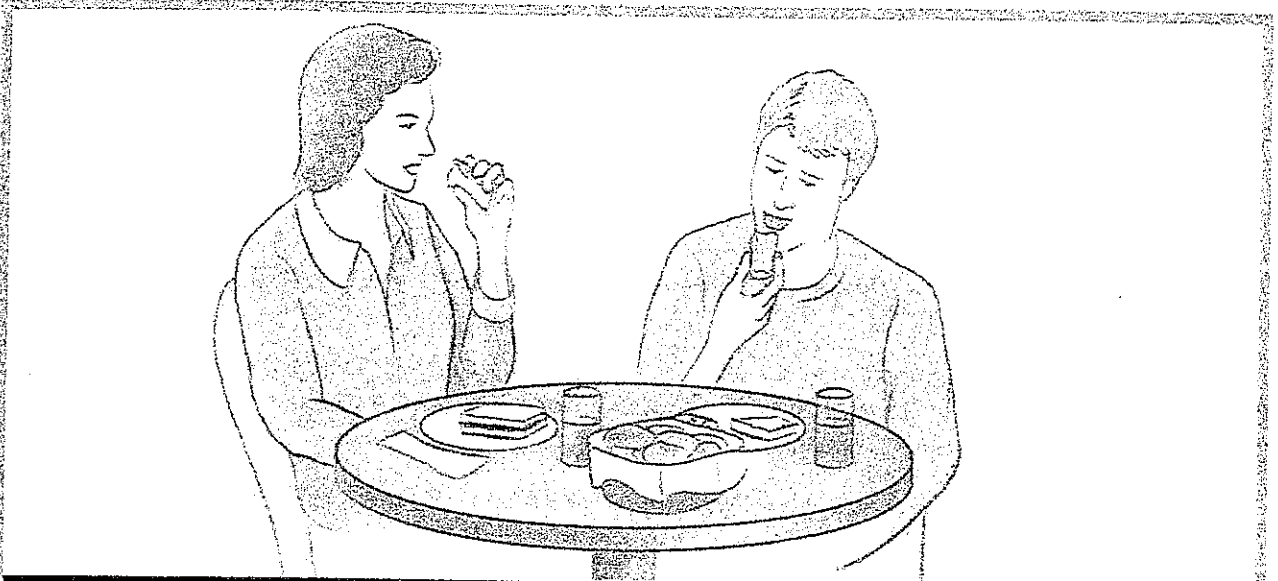


How is food digested?



KEY TERMS

digestion: process by which foods are changed into forms the body can use

esophagus: tube that connects the mouth to the stomach

peristalsis: wavelike movement that moves food through the digestive tract

LESSON

How is food digested?

9

People, like all living things, need food. Food gives us the nutrients our bodies need. It also gives us energy. Energy is needed to carry out the life processes.

Our bodies cannot use the nutrients or energy in food unless the food is changed. The changing of food into a form the body can use is called **digestion** [dy-JES-chun].

What does digestion do? Digestion breaks down large pieces of food into smaller pieces. Digestion also changes the chemicals of food. It changes large, complex food molecules into smaller, simpler ones.

Where does digestion take place? Digestion takes place in the digestive tract. The digestive tract is a long, curving tube in your body. If stretched out, the digestive tract would be more than 9 meters (30 feet) long.

What are the parts of the digestive tract? The parts of the digestive tract are: the mouth, the **esophagus** [i-SAF-uh-gus], the stomach, the small intestine, and the large intestine.

There are many glands and organs along the digestive tracts, such as the liver and the pancreas. These organs are not part of the digestive tract, but they help in digestion. The digestive tract and the other digestive organs make up your digestive system.

Food enters the body through the mouth. Waste materials (undigested food) leave the body through the **anus** [AY-nus]. The anus is at the end of the large intestine.

Digestion is a step-by-step process. It does not take place quickly. It takes food from one to two days to pass through the entire digestive tract.

WHAT THE PARTS OF THE DIGESTIVE TRACT DO

Read the descriptions below to find out what happens as food moves through the digestive tract.

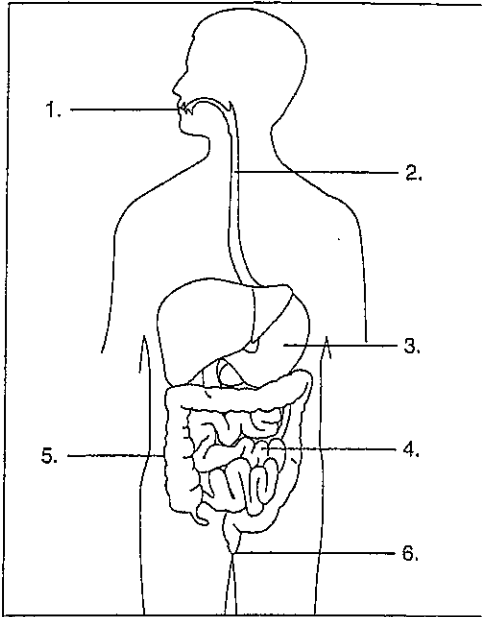


Figure A

1. Food enters the body through the mouth. Digestion begins here.
 - The teeth break food into smaller pieces.
 - Saliva moistens the food.
 - Saliva also begins the chemical breakdown of starch.
2. When you swallow, food passes into the esophagus.
 - Food passes through the esophagus and into the stomach.
3. What happens to food in the stomach?
 - The stomach churns food and breaks it into even smaller pieces.
 - The chemical digestion of protein begins.
 - Partially digested food then moves to the small intestine.
4. Most digestion takes place in the small intestine.
 - The small intestine is also where all digestion is completed.
 - Undigested food (waste) then passes into the large intestine.
5. Undigested food (waste) is not used by the body.
 - The large intestine stores and eliminates undigested food as solid waste.
6. Solid waste is passed out of the body through the anus.
 - NOTE: The anus is not a digestive organ.

FOLLOWING THE PATH OF FOOD

Figure B shows the organs of the digestive system. Study the drawing, then see if you can answer the questions below.

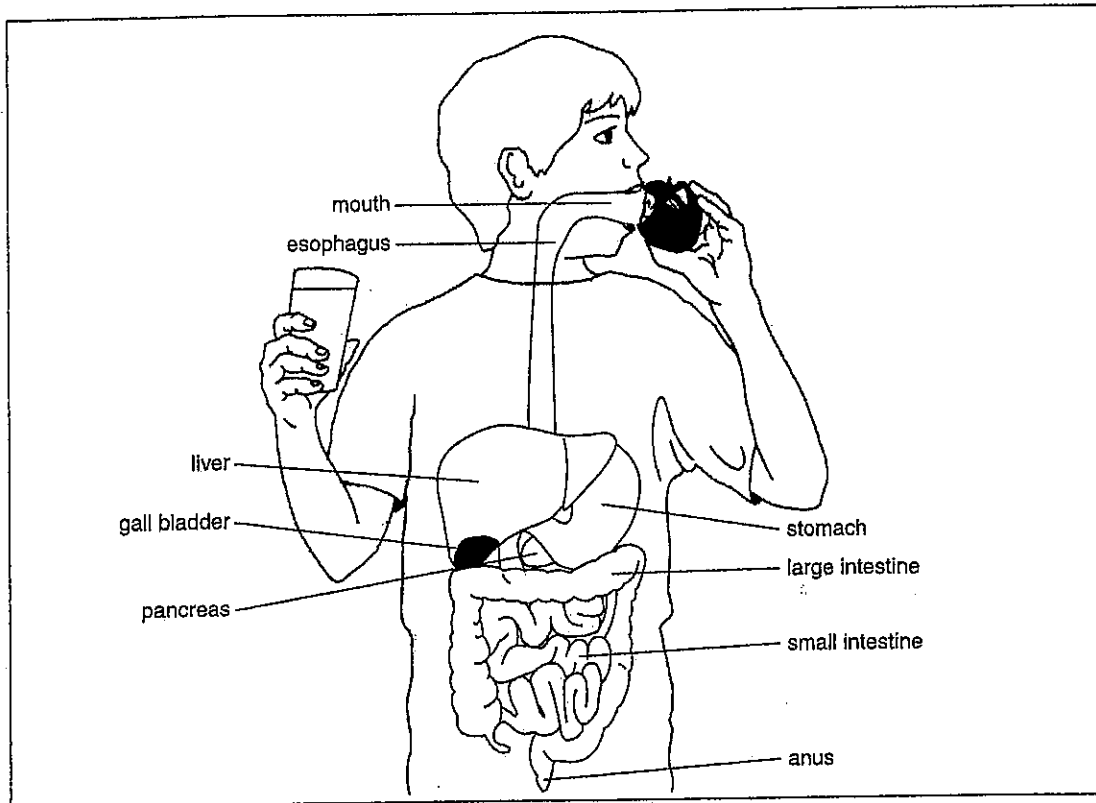


Figure B

1. Name the parts of the digestive tract that food passes through in order. (Do not include the anus.) _____, _____, _____, _____, and _____.
2. The digestive tract has two openings to the outside of the body.
 - a) Food enters the body through the _____.
 - b) Waste materials leave the body through the _____.
3.
 - a) Where does chemical digestion start? _____
 - b) Where does most chemical digestion take place? _____
4. What are two organs that are part of your digestive system, but not part of the digestive tract? _____ and _____

FILL IN THE BLANK

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided. Some words may be used more than once.

esophagus
completed
digestive tract
large intestine
liver

stomach
simpler
teeth
mouth
pancreas

smaller
small intestine
saliva
digestion

1. The changing of food to a form the body can use is called _____.
2. Digestion breaks down large pieces of food into _____ pieces.
Digestion also makes food molecules _____.
3. Digestion takes place in a body tube called the _____.
4. The parts of the digestive tract (in order) through which food passes are the _____, the _____, the _____, the _____, and the _____.
5. In the mouth, food is broken into smaller pieces by the _____.
6. Food in the mouth is moistened by _____.
7. Starch digestion starts in the _____.
8. Protein digestion starts in the _____.
9. Most digestion takes place in the _____. This is also where all digestion is _____.
10. Organs such as the _____ and _____ help in digestion, but are outside the digestive tract.

HOW FOOD MOVES ALONG THE DIGESTIVE TRACT

Food in the digestive tract does not move by itself. Food is squeezed along the digestive tract by wavelike movements of muscles. These muscles work by themselves. We do not have to think about moving food. It is an involuntary action. The wavelike movement is called **peristalsis** [per-uh-STAWL-sis]. Peristalsis starts in the esophagus right after you swallow. It continues along the entire digestive tract. Peristalsis works in only one direction—except when we are ill. For sample, reverse peristalsis in the stomach or esophagus causes us to “throw up.” Throwing up, or vomiting, is one way the body gets rid of things that can harm us.

TRY THIS!

Get a rubber tube. Wet the inside.

Put in a marble that just fits in the tube.

Pinch it forward.

This will give you an idea of how peristalsis moves food through the digestive tract.



Figure C

IDENTIFY THE PARTS

Identify the parts of the digestive tract by writing the letter from Figure D next to the name of the part.

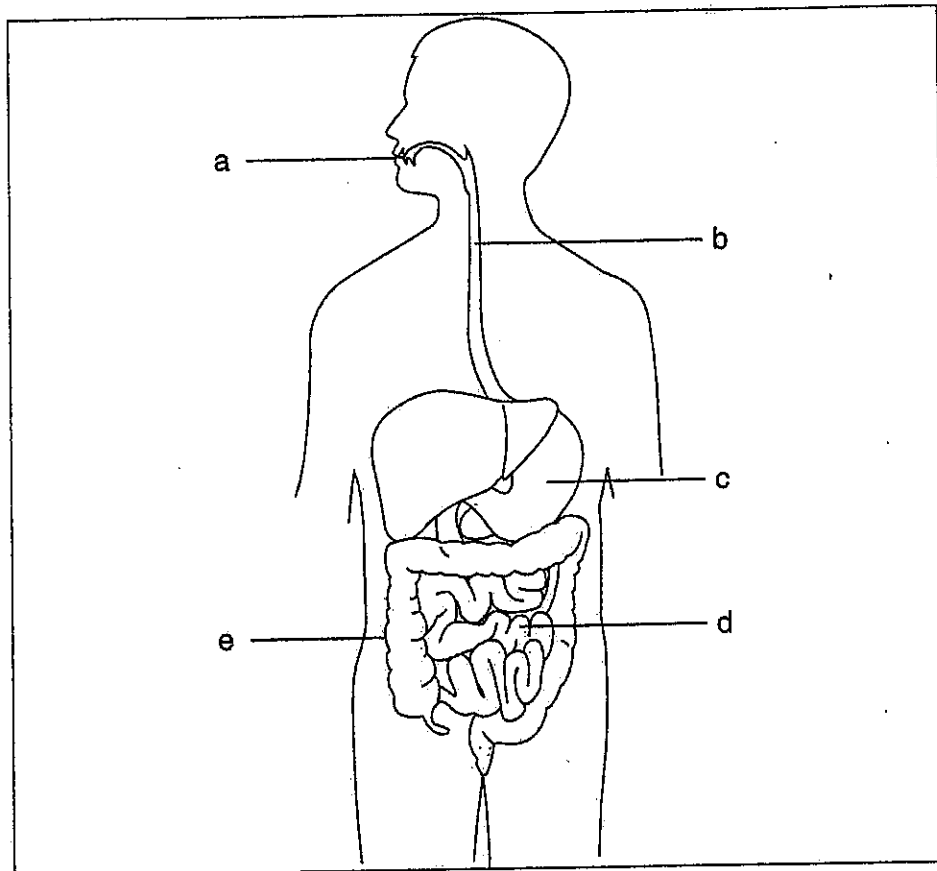
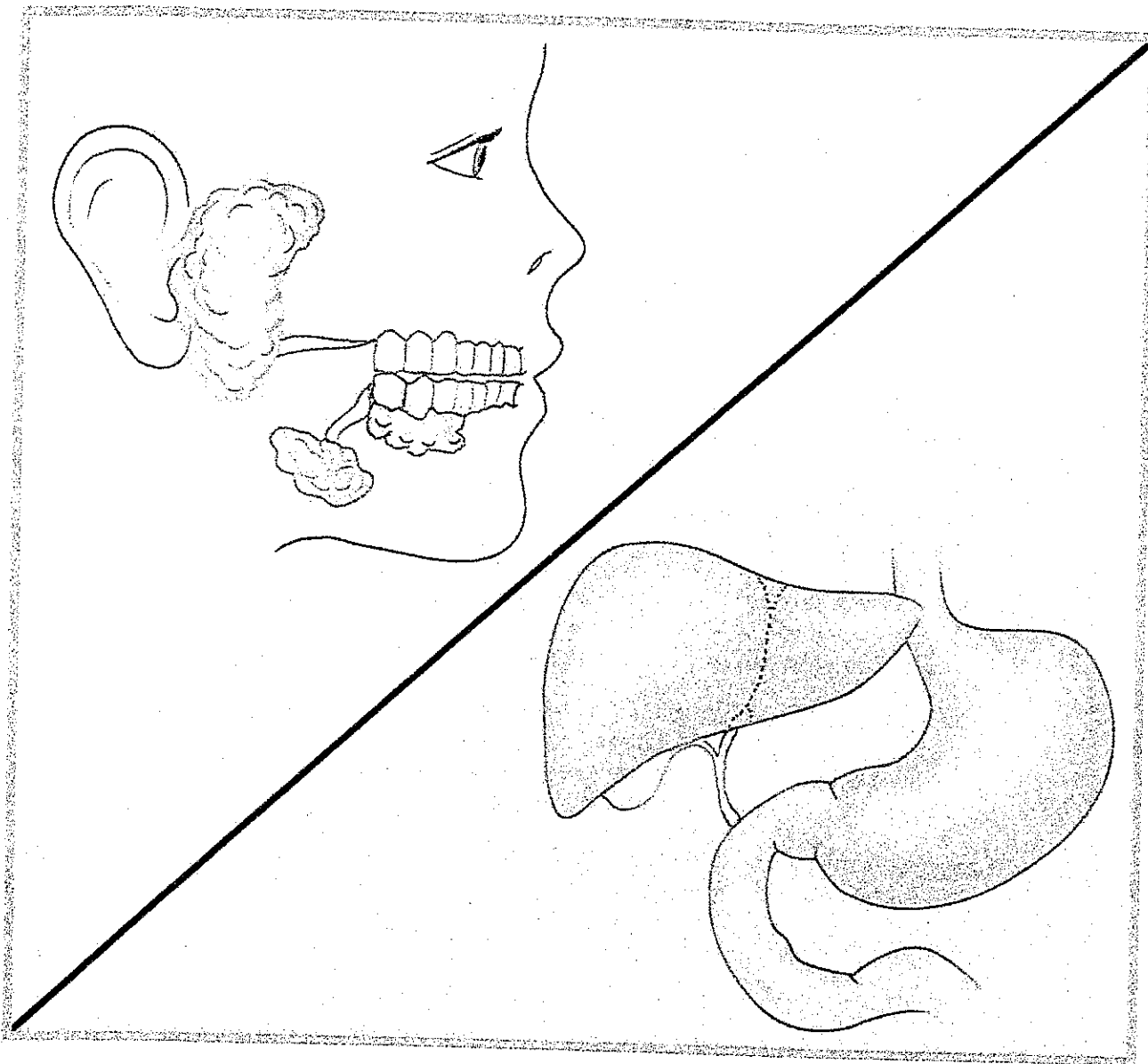


Figure D

- | | | |
|--------------------------|--------------------------|--------------------|
| 1. small intestine _____ | 3. mouth _____ | 5. esophagus _____ |
| 2. stomach _____ | 4. large intestine _____ | |

How do enzymes help digestion?



KEY TERMS

enzyme: protein that controls chemical activities

bile: green liquid that breaks down fats and oils

LESSON

10

How do enzymes help digestion?

Your body is like a chemical factory. It makes many kinds of chemicals.

Some of the chemicals your body makes are called **enzymes** [EN-zymz]. Enzymes are useful to your body in many ways. You cannot live without them.

Some enzymes help digest food. They are called digestive enzymes. Digestive enzymes are made by special groups of cells called glands.

Many tiny digestive glands are found inside the digestive tract. They are within the walls of the stomach and small intestine. These glands empty right into the stomach and small intestine.

Some kinds of digestive glands are found outside the digestive tract. They are the **salivary** [SAL-uh-ver-ee] glands, and the **pancreas** [PAN-kree-us]. The pancreas is found near the stomach. The three pair of salivary glands are near the mouth.

Enzymes from these glands enter the digestive tract through small tubes. These glands help in digestion although no food passes through them.

The digestive tract along with its helping glands make up the digestive system.

HOW GLANDS HELP DIGEST FOOD

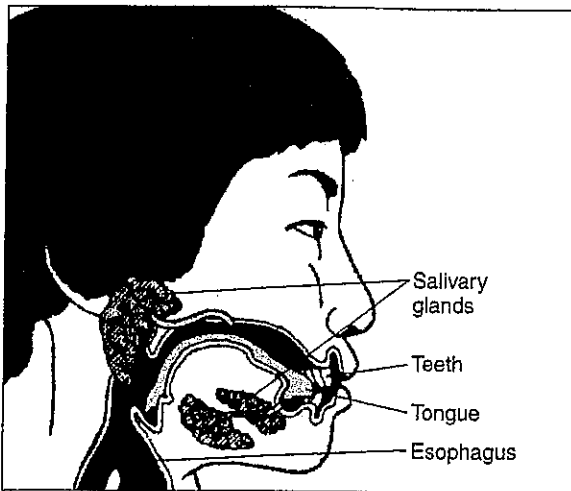


Figure A *The salivary glands*

THE SALIVARY GLANDS

The salivary glands produce saliva. Saliva is mostly water. It also contains an enzyme called **ptyalin** [TY-uh-lin].

Water in saliva moistens food. This makes the food easier to swallow.

Ptyalin starts changing starch to simple sugars.

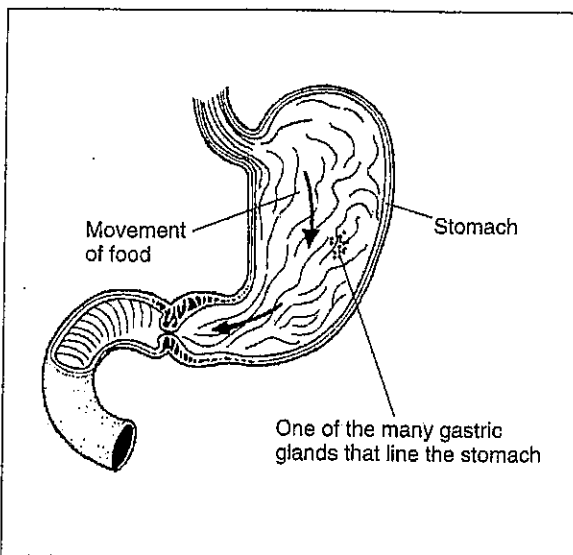


Figure B *The gastric glands are located in the walls of the stomach.*

THE STOMACH

The digestive glands of the stomach are called gastric glands. These glands secrete (give off) a liquid called gastric juice.

Gastric juice contains the enzymes **pepsin** [PEP-sin] and **rennin**. It also contains **hydrochloric** [hy-druh-KLAWR-ik] acid and **mucus**.

- Pepsin starts protein digestion.
- Rennin "curdles" milk. It changes liquid milk protein to a "cheeselike" substance. This keeps the protein from passing through the digestive tract too quickly. It gives protein-digesting enzymes time to digest the protein.
- Hydrochloric acid. Pepsin can digest protein properly only in an acid environment. Hydrochloric acid, in the stomach, provides this environment. The mucus in gastric juice helps protect the stomach lining from the acid.

THE PANCREAS AND SMALL INTESTINE

The pancreas and the small intestine produce enzymes. These enzymes complete the digestion of all nutrients.

Look at Figure C carefully. Then complete the sentences below.

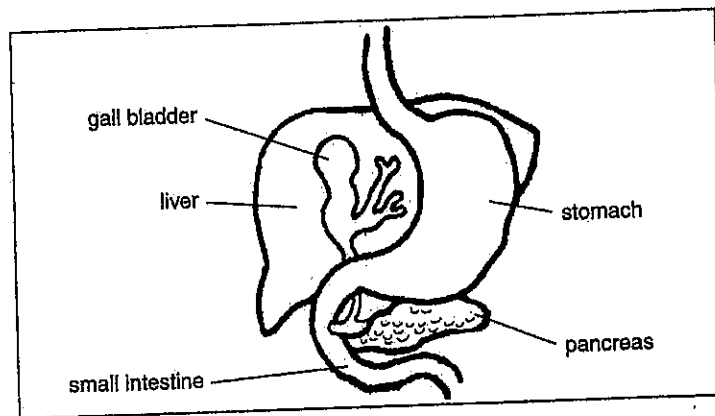


Figure C

1. Enzymes from the pancreas empty into the _____.
2. The pancreas lies just below the _____.

THE LIVER

The liver is one of the largest organs in the human body. It also helps in digestion. The liver provides a liquid called **bile**. Bile is not an enzyme. But it is very important in fat digestion. Bile breaks fat into tiny pieces. It "prepares" the fat for fat-digesting enzymes.

Bile does not move directly from the liver to the small intestine. It is stored in the gall bladder. When you eat fat, the gall bladder squeezes. Some bile is forced out of the gall bladder. It goes into the small intestine. Bile mixes with the food in the small intestine.

The chart below tells the story of how digestion in the small intestine changes the chemicals of food:

STARTING PRODUCT		END PRODUCT
starches and double sugars	→ change to	simple sugars
proteins	→ change to	amino acids
fats	→ change to	simpler fatty substances

MATCHING

Match each term in Column A with its description in Column B. Write the correct letter in the space provided.

	Column A	Column B
_____	1. liver	a) chemicals made by the body
_____	2. enzymes	b) starting point of digestion
_____	3. glands	c) make body chemicals
_____	4. digestive system	d) one of the largest organs
_____	5. mouth	e) digestive tract and other digestive organs

LABEL THE DIAGRAM

Find each part of the digestive system and write its letter in the blank.

1. stomach _____
2. large intestine _____
3. mouth _____
4. pancreas _____
5. small intestine _____
6. esophagus _____

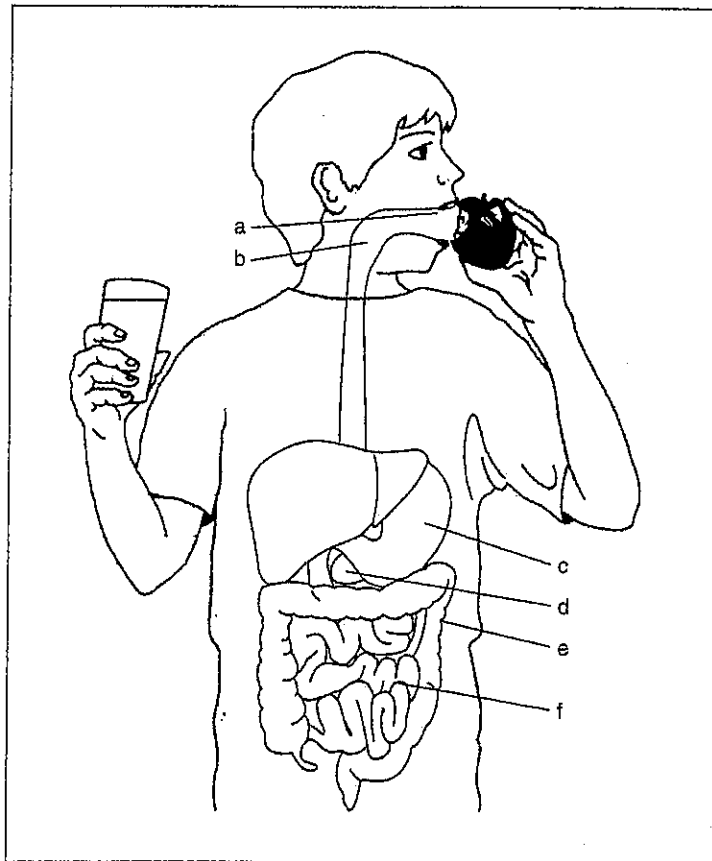


Figure D

FILL IN THE BLANK

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided.

simple sugars
small intestine
outside
salivary glands
digestive enzymes

ptyalin
fats
smaller molecules
glands
pancreas

liver
gall bladder
large molecules
starch
stomach

1. Any chemical digestion changes _____ to _____.
2. Enzymes are produced by groups of cells and tissues called _____.
3. Chemicals that help digest food are called _____.
4. Digestive glands are found both within and _____ the digestive tract.
5. Digestive glands within the digestive tract are found in the walls of the _____ and the _____.
6. Two digestive glands that are found outside the digestive tract are the _____ and the _____.
7. The enzyme found in saliva is _____.
8. Ptyalin starts to change _____ to _____.
9. Bile is produced by the _____. It is stored in the _____.
10. Bile breaks up _____.

END PRODUCTS, PLEASE

Fill in the correct answers.

1. The end product of fat digestion is _____.
2. The end product of starch digestion is _____.
3. The end product of double sugar digestion is _____.
4. The end product of protein digestion is _____.