38–2 The Process of Digestion

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What are the organs of the digestive system?

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The digestive system includes the mouth, pharynx, esophagus, stomach, small intestine, and large intestine.

Other structures add secretions to the digestive system, and aid in digestion. These include the salivary glands, pancreas, and liver.

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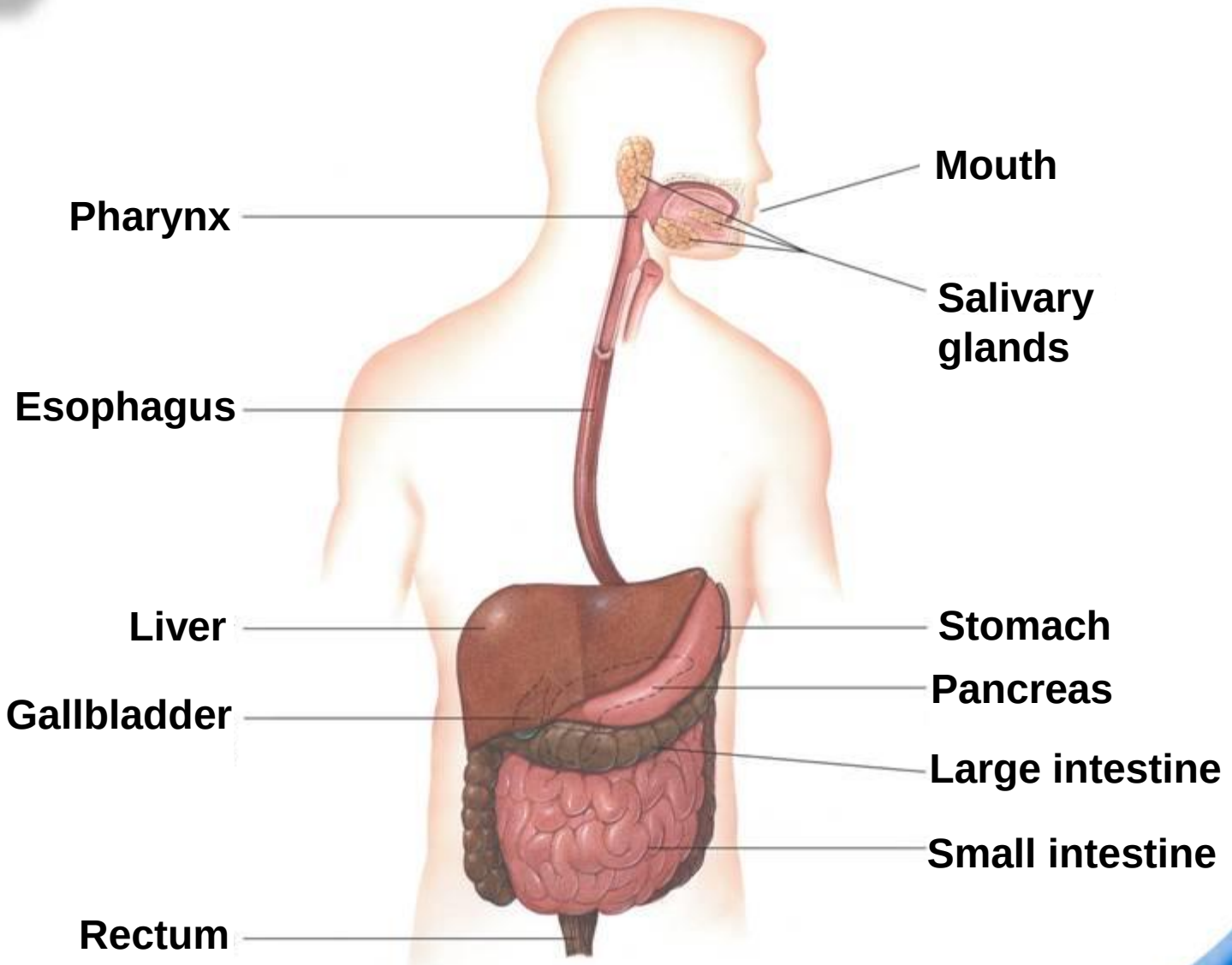
The Digestive System



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What is the function of the digestive system?

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The function of the digestive system is to help convert foods into simpler molecules that can be absorbed and used by the cells of the body.

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The Mouth

Chewing begins mechanical digestion, which is the physical breakdown of large pieces of food into smaller pieces.

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The teeth cut, tear, and crush food into small fragments.

As the teeth cut and grind the food, salivary glands secrete saliva, which moistens food and makes it easier to chew.

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Saliva helps ease the passage of food through the digestive system and also begins the process of chemical digestion.

Saliva contains **amylase**, an enzyme that breaks the chemical bonds in starches and releases sugars.

Saliva also contains lysozyme, an enzyme that fights infection.

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The Esophagus

From the throat, the chewed food passes through the **esophagus**, or food tube, into the stomach.

Food is moved along by contractions of smooth muscle.

These contractions, known as **peristalsis**, squeeze the food through the esophagus into the stomach.

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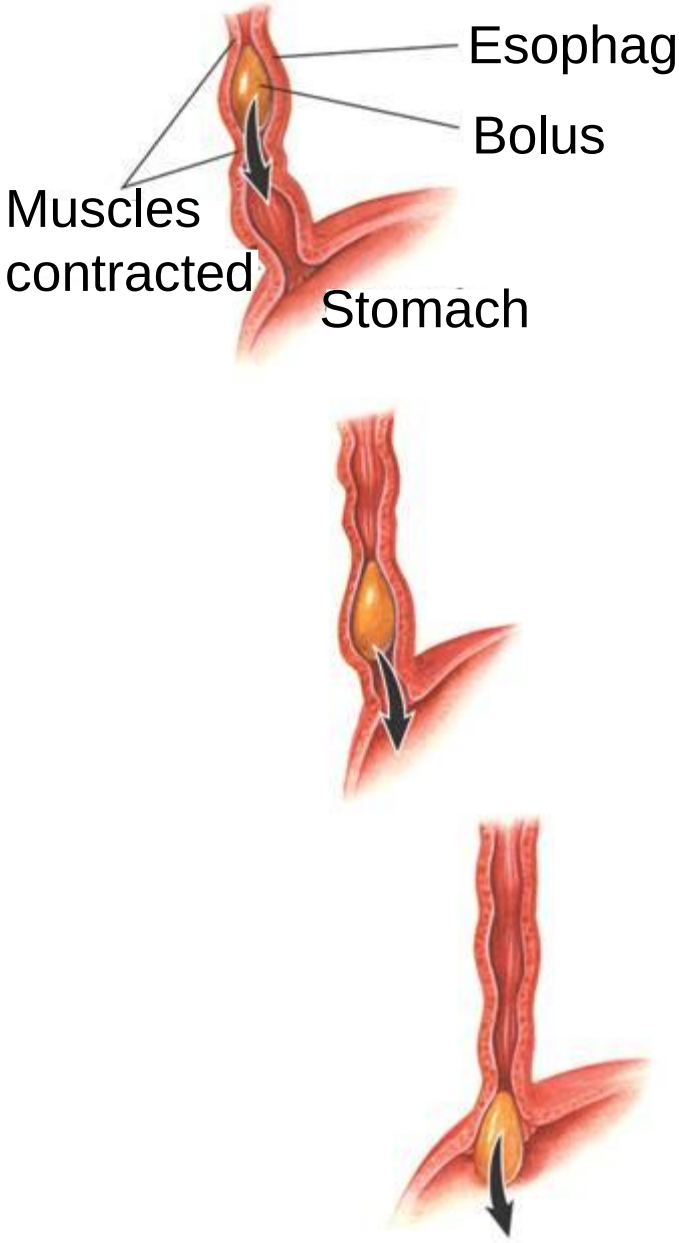
Peristalsis



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The cardiac sphincter closes the esophagus after food has passed into the stomach.

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The Stomach

Food from the esophagus empties into the **stomach**.

The stomach continues mechanical and chemical digestion.

Alternating contractions of three smooth muscle layers churn food.

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Chemical Digestion

The stomach lining has millions of gastric glands that release substances into the stomach.

- Some glands produce mucus, which lubricates and protects the stomach wall.
- Other glands produce hydrochloric acid, which makes the stomach contents very acidic.
- Other glands produce pepsin, an enzyme that digests protein.

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Pepsin and hydrochloric acid begin protein digestion.

Pepsin breaks proteins into smaller polypeptide fragments.

Other enzymes are denatured by stomach acid.

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Effects of Digestive Enzymes		
Active Site	**Enzyme**	**Effect on Food**
Mouth	Salivary amylase	Breaks down starches into disaccharides
Stomach	Pepsin	Breaks down proteins into large peptides
Small intestine (from pancreas)	Amylase	Continues the breakdown of starch
	Trypsin	Continues the breakdown of protein
	Lipase	Breaks down fat
Small intestine	Maltase, sucrase, lactase	Breaks down remaining disaccharides into monosaccharides
	Peptidase	Breaks down dipeptides into amino acids

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Mechanical Digestion

The stomach contracts to churn fluids and food, gradually producing a mixture known as **chyme**.

After 1–2 hours, the pyloric valve between the stomach and small intestine opens and chyme flows into the small intestine.

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The Small Intestine

As chyme is pushed through the pyloric valve, it enters the duodenum.

The duodenum is the first of three parts of the **small intestine**, and is where most digestive enzymes enter the intestine.

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Most chemical digestion and absorption of food occurs in the small intestine.

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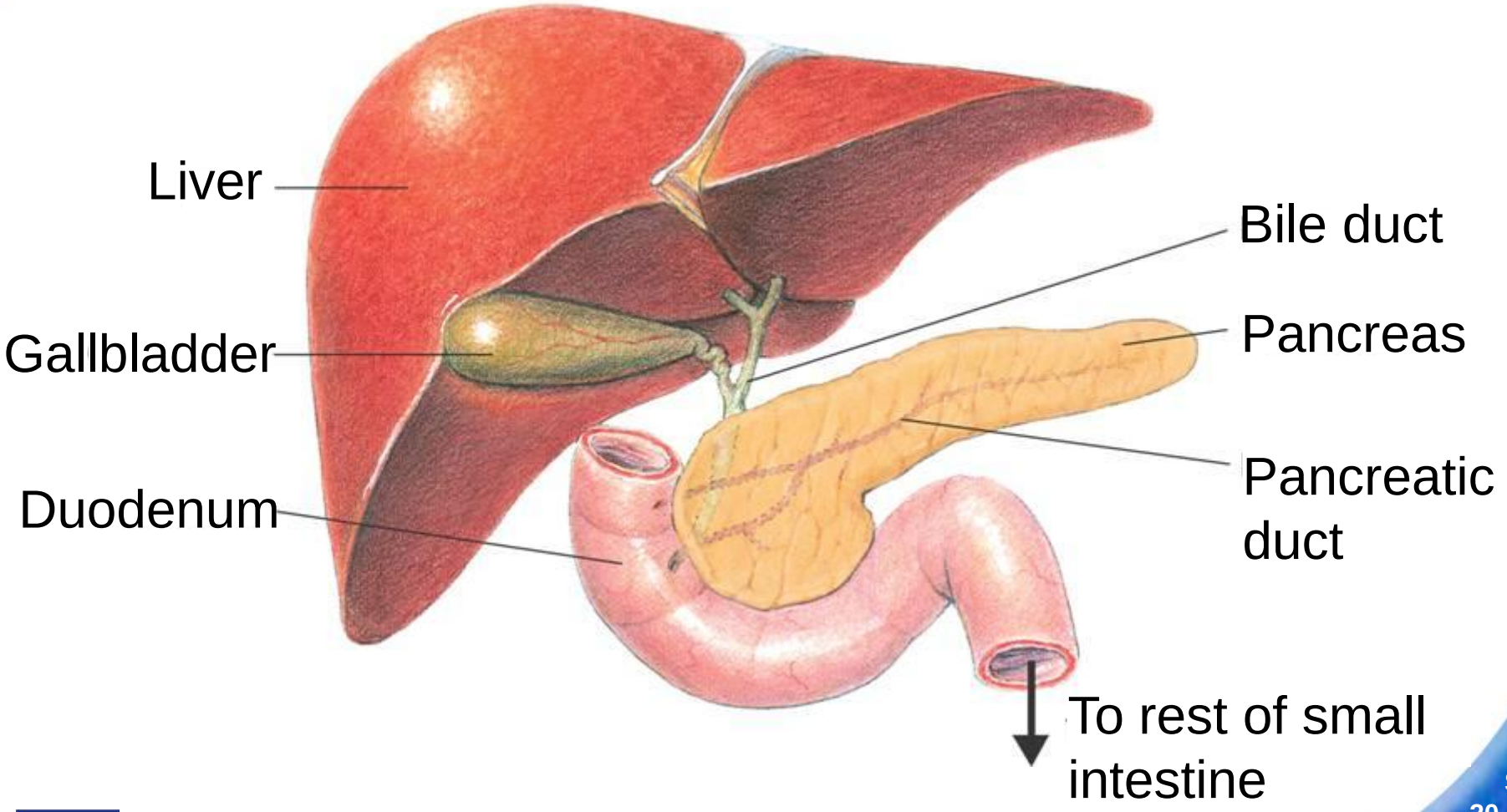
Accessory Structures of Digestion



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Accessory Structures of Digestion

Just behind the stomach is the **pancreas**.

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During digestion, the pancreas:

- produces enzymes that break down carbohydrates, proteins, lipids, and nucleic acids.
- produces sodium bicarbonate, a base that neutralizes stomach acid so that these enzymes can be effective.

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Assisting the pancreas is the **liver**, which produces bile.

Bile dissolves and disperses droplets of fat in fatty foods. This enables enzymes to break down smaller fat molecules.

Bile is stored in the gallbladder.

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Absorption in the Small Intestine

The small intestine is adapted for the absorption of nutrients.

The folded surfaces of the small intestine are covered with fingerlike projections called **villi**.

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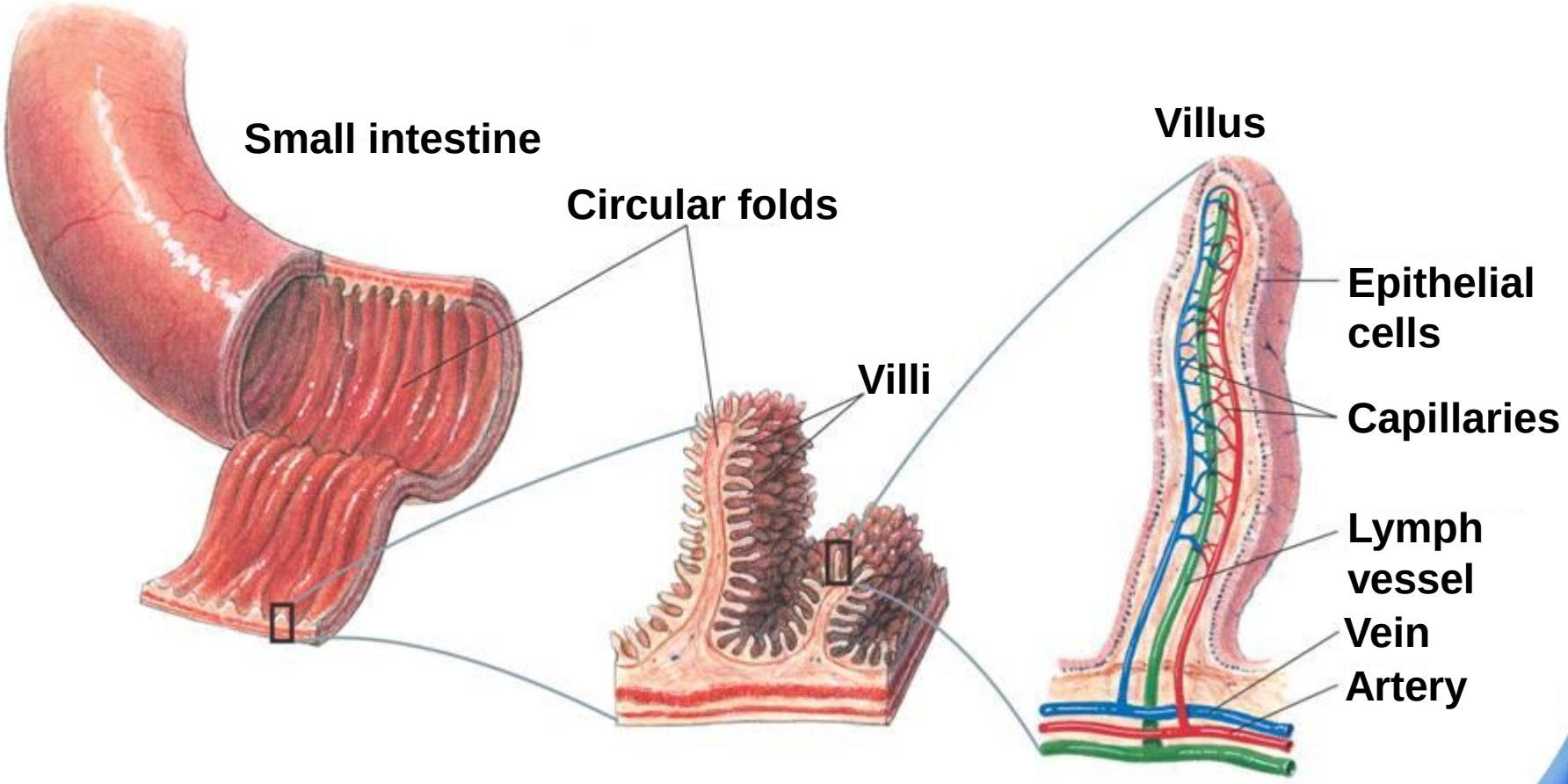
The Small Intestine



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Cell surfaces of villi have more projections called microvilli.

These provide an enormous surface area for the absorption of nutrient molecules.

Slow, wavelike contractions of smooth muscles move the chyme along this surface.

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Nutrient molecules are absorbed into the cells lining the small intestine.

Most products of carbohydrate and protein digestion are absorbed into the capillaries in the villi.

Molecules of undigested fat are absorbed by lymph vessels.

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The Large Intestine

When the chyme leaves the small intestine, it enters the large intestine, or colon.

The large intestine removes water from the chyme.

Water is absorbed quickly, leaving undigested materials behind.

Concentrated waste material passes through the rectum and is eliminated from the body.

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Digestive System Disorders

Stomach acids sometimes damage the organ's own lining, producing a hole in the stomach wall known as a peptic ulcer. Most peptic ulcers are caused by the bacterium *H. pylori*.

Other digestive disorders include diarrhea and constipation.

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38–2 Section QUIZ

1 Food is moved through the esophagus into the stomach by

a. air pressure.

A b. muscle contractions.

c. gravity.

d. swallowing.

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2 A gland that has both endocrine and exocrine functions is the

a. liver.

b. spleen.

A c. pancreas.

d. gallbladder.

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3 The enzyme in saliva that begins the digestion of starch is

A a. amylase.

b. pepsin.

c. lysozyme.

d. peptidase.

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4 Stomach muscles contract to churn and mix stomach fluids and food, producing a mixture known as

A a. chyme.

b. amylase.

c. bile.

d. acid.

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5 Absorption of vitamins, minerals, and digested food molecules takes place in the

a. stomach.

A b. small intestine.

c. large intestine.

d. duodenum.

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END OF SECTION