



Major Parts of the Digestive System

Unit: Animal Science and the Industry

Problem Area: Nutritional Needs of Animals

Lesson: Major Parts of the Digestive System

- **Student Learning Objectives.** Instruction in this lesson should result in students achieving the following objectives:

- 1 Describe the functions of the mouth, salivary glands, and esophagus.**
- 2 Determine the age of animals through teeth examination and discuss how age and teeth wear can affect animal well-being.**
- 3 Describe the functions of the stomach and examine the functions of substances and enzymes present in the stomach.**
- 4 Describe the functions of each of the three segments of the small intestine and examine the functions of the three digestive juices that are mixed with chyme.**
- 5 Describe the functions of the cecum.**
- 6 Describe the functions of the large intestine.**

- **List of Resources.** The following resources may be useful in teaching this lesson:

Corresponding E-unit(s). Danville, IL: CAERT, Inc. www.mycart.com

- **List of Equipment, Tools, Supplies, and Facilities**

- ✓ Copies of sample test
- ✓ Visuals from accompanying masters

■ **Terms.** The following terms are presented in this lesson (shown in bold italics):

- ▶ amylase
- ▶ bile
- ▶ chyme
- ▶ duodenum
- ▶ electrolyte
- ▶ enzyme
- ▶ feces
- ▶ Galvayne's groove
- ▶ gastric lipase
- ▶ hydrochloric acid
- ▶ ileum
- ▶ jejunum
- ▶ lactase
- ▶ lipase
- ▶ maltase
- ▶ mastication
- ▶ pepsin
- ▶ peptidase
- ▶ peristalsis
- ▶ rennin
- ▶ salivary amylase
- ▶ salivary maltase
- ▶ sucrase
- ▶ trypsin
- ▶ villi

■ **Interest Approach.** Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situation. A possible approach is included here.

Bring a box of saltine crackers to class. Ask students if they know where digestion begins. Give each student a cracker and tell the student to take one or more bites of the cracker but not to swallow. Let the student chew and hold the cracker in his or her mouth for approximately five minutes. The cracker should begin to taste sweet. Ask why this has occurred. The response should be that the starch in the cracker has been changed by the saliva in the mouth to sugar. Note that the sweet taste will be subtle, but it will exist. Most students will be able to taste the change from starch to sugar.

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Describe the functions of the mouth, salivary glands, and esophagus.

Anticipated Problem: What are the functions of the mouth, salivary glands, and esophagus?

- I. Digestion begins when food is ingested. The mouth, salivary glands, and esophagus are involved in the first stages of digestion.
 - A. Food enters the digestive system through the mouth, where **mastication**, or chewing, occurs and it is formed into a bolus by the tongue.
 - B. The salivary glands secrete saliva, which moistens food to make it easier to swallow and begins to break down simple carbohydrates. Saliva contains two

enzymes. An **enzyme** is an organic catalyst that speeds up a chemical reaction in the body.

1. **Salivary amylase** changes starch to maltose, or malt sugar.
 2. **Salivary maltase** changes maltose to glucose.
- C. The esophagus connects the mouth and the stomach. Food moves through the esophagus by involuntary smooth-muscle contractions called **peristalsis**.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content. Use VM-A, VM-B, VM-C, and VM-D to reinforce the content of this objective.

Objective 2: Determine the age of animals through teeth examination and discuss how age and teeth wear can affect animal well-being.

Anticipated Problem: How can the age of animals be determined through teeth examination, and how do age and teeth wear affect animal well-being?

- II. The art of determining the age of animals by teeth examination is very old and requires skill and experience. The degree of growth and the ratio of baby teeth to permanent teeth are useful when determining the age of a young animal. Once an animal reaches adulthood and has all its permanent teeth, the degree of wear to the teeth should be used to determine age. This is not always an accurate process. Error increases with age. Also, stabled animals tend to appear younger than they are, whereas those grazing sandy areas appear relatively old because of more wear on the teeth from soil particles. Age is determined by observing the front teeth, or incisors. The easiest method of restraint is holding the animal's tongue out and to the side.
 - A. Aging by teeth wear is most commonly used with horses. One way of determining the age of a horse up to age five is by observing the occurrence of permanent teeth. All permanent teeth usually appear by age five and make up a "full mouth."
 - B. In a horse, as permanent teeth age, the cups (deep indentations in the center of teeth surfaces) disappear. Theoretically, all cups will disappear by age 11, and the animal will have a "smooth mouth." Some livestock producers will cut cups into animals' teeth to make the animals appear younger.
 - C. **Galvayne's groove** is a mark on each of a horse's upper corner incisors that appears and disappears in a predictable pattern as the horse ages. It usually appears by age 10, is halfway down by age 15, and extends the full length of the tooth by age 20. Then, the groove begins to recede. It is usually halfway gone by age 25 and completely gone around age 30.
 - D. When a horse's mouth is viewed from the side, the angle of incidence (the angle formed by the meeting of the upper and lower incisor teeth) can be used to determine approximate age. As a horse ages, this angle decreases and can become less than a right angle in an older horse.

- E. Tooth shape can also be used to determine an animal's age. As an animal ages, teeth become more triangular, longer, and narrower.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content.

Objective 3: Describe the functions of the stomach and examine the functions of substances and enzymes present in the stomach.

Anticipated Problem: What are the functions of the stomach and of the substances and enzymes present in the stomach?

- III. The stomach is a muscle that stores food and secretes fluids and enzymes that function to break down food. To aid in digestion, the stomach secretes a fluid called gastric juice, which contains hydrochloric acid, pepsin, rennin, and gastric lipase. It also acts mechanically by using muscle contractions to mix food. The gray, pulpy mass that results from digestion in the stomach is called **chyme** and is passed on to the small intestine.
- A. **Hydrochloric acid** is a digestive fluid that breaks proteins down into shorter chains of amino acids. It also lowers the pH in the stomach, killing any bacteria ingested with feed.
- B. **Pepsin** is an enzyme that breaks down proteins into polypeptides and coagulates milk in animals that lack rennin.
- C. **Rennin** is an enzyme that breaks down proteins and curdles milk. It is found only in the fourth stomach of ruminant animals.
- D. **Gastric lipase** is an enzyme that splits emulsified fats into glycerol and fatty acids.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content. Use VM-A, VM-B, VM-C, and VM-D to reinforce the content of this objective.

Objective 4: Describe the functions of each of the three segments of the small intestine and examine the functions of the three digestive juices that are mixed with chyme.

Anticipated Problem: What are the functions of each of the three segments of the small intestine and of the three digestive juices that are mixed with chyme?

- IV. Most absorption occurs in the small intestine. It is the longest organ of the digestive system. The small intestine consists of three segments: the duodenum, the jejunum,

and the ileum. The small intestine is also where chyme is mixed with three digestive juices: pancreatic juice, bile, and intestinal juice.

A. The three segments of the small intestine

1. The **duodenum** is the first segment of the small intestine and is where most digestion occurs in a monogastric animal.
2. The **jejunum** is the second segment of the small intestine and is where nutrient absorption begins.
3. The **ileum** is the third segment of the small intestine and is where most nutrient absorption occurs. Millions of small fingerlike projections called **villi** line the wall of the small intestine and increase the absorption area. Most of the villi are in the ileum.

B. Three digestive juices in the small intestine

1. Pancreatic juice is produced by the pancreas and secreted into the duodenum. It includes the enzymes trypsin, amylase, and lipase.
 - a. **Trypsin** breaks down proteins and polypeptides to reduce them to small peptides. The peptides are then broken down by chymotrypsin to produce amino acids.
 - b. **Amylase** changes starch into disaccharides. The disaccharides are maltose, lactose, and sucrose.
 - c. **Lipase**, along with bile, breaks up fat molecules into a form that can be absorbed. Lipase changes fat molecules into fatty acids and glycerol.
2. **Bile**, a yellowish-green, alkaline, bitter liquid, is produced by the liver and stored in the gallbladder in most animals. Bile helps digest fats and fatty acids.
3. Intestinal juice is secreted from the walls of the small intestine and contains peptidase, maltase, lactase, and sucrase, which are all enzymes used in digestion. Maltase, lactase, and sucrase break down disaccharides into monosaccharides, or simple sugars. The monosaccharides are glucose, galactose, and fructose.
 - a. **Peptidase** breaks down peptides into amino acids.
 - b. **Maltase** converts maltose into two molecules of glucose.
 - c. **Lactase** converts lactose into one molecule of glucose and one molecule of galactose.
 - d. **Sucrase** converts sucrose into one molecule of glucose and one molecule of fructose.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content. Use VM-A, VM-B, VM-C, and VM-D to reinforce the content of this objective.

Objective 5: Describe the functions of the cecum.

Anticipated Problem: What are the functions of the cecum?

- V. The cecum, or “blind gut,” is found where the small intestine joins the large intestine. Herbivores and omnivores have larger cecums that are used to digest the cellulose found in plants they eat. Carnivores have either smaller cecums or no cecums at all.
 - A. In a pseudo-ruminant, such as a horse, feed is fermented and digested by bacterial action in the cecum.
 - B. Nutrient absorption also occurs in the cecum.
 - C. In a nonruminant animal, the cecum is extremely large and provides areas for microbial digestion of fiber.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content. Use VM–A, VM–B, VM–C, and VM–D to reinforce the content of this objective.

Objective 6: Describe the functions of the large intestine.

Anticipated Problem: What are the functions of the large intestine?

- VI. The large intestine is shorter than the small intestine but larger in diameter.
 - A. The main function of the large intestine is to absorb water and electrolytes. An **electrolyte** is a substance, such as a salt, that takes on an electrical charge in a solution.
 - B. The second function of the large intestine is to store indigestible food until it is ready to be expelled from the body.
 - C. The third function of the large intestine is to form **feces**, or waste matter composed of food materials not digested or absorbed. The feces then pass through the rectum and exit the body through the anus.

Many techniques can be used to help students master this objective. Question students about the content as presented and use the corresponding E-unit(s) to reinforce the content. Use VM–A, VM–B, VM–C, and VM–D to reinforce the content of this objective.

- **Review/Summary.** Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. The anticipated problems in this lesson and “Checking Your Knowledge” in the corresponding E-unit(s) may also be used in the review/summary.

■ **Application.** Use the included visual masters to apply the information presented in the lesson.

■ **Evaluation.** Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. The sample written test can also be used.

■ **Answers to Sample Test:**

Part One: Matching

1. b
2. d
3. e
4. a
5. c

Part Two: Short Answer

1. Food moves through the esophagus by involuntary smooth-muscle contractions called peristalsis.
2. a. Break down proteins into shorter chains of amino acids
b. Lower the pH in the stomach to kill any bacteria ingested with feed
3. The main function of the large intestine is to absorb water and electrolytes.

Part Three: Completion

1. feces
2. chyme
3. electrolyte
4. Galvayne's groove
5. bile

Part Four: Multiple Choice

1. d
2. b
3. b

Major Parts of the Digestive System

► Part One: Matching

Instructions: Match the term with the correct definition.

- | | |
|----------------|----------------|
| a. villi | d. peristalsis |
| b. mastication | e. chyme |
| c. feces | |

- ____ 1. The action of chewing food
- ____ 2. Involuntary smooth-muscle contractions that move food through the digestive system
- ____ 3. The gray, pulpy mass that results from digestion in the stomach
- ____ 4. Small fingerlike projections that line the wall of the small intestine and absorb food
- ____ 5. A mass of undigested or unabsorbed feed that forms in the large intestine

► Part Two: Short Answer

Instructions: Complete the following.

1. How does food move through the esophagus?

2. What are the two functions of hydrochloric acid?

3. What is the main function of the large intestine?

► Part Three: Completion

Instructions: Provide the word or words to complete the following statements.

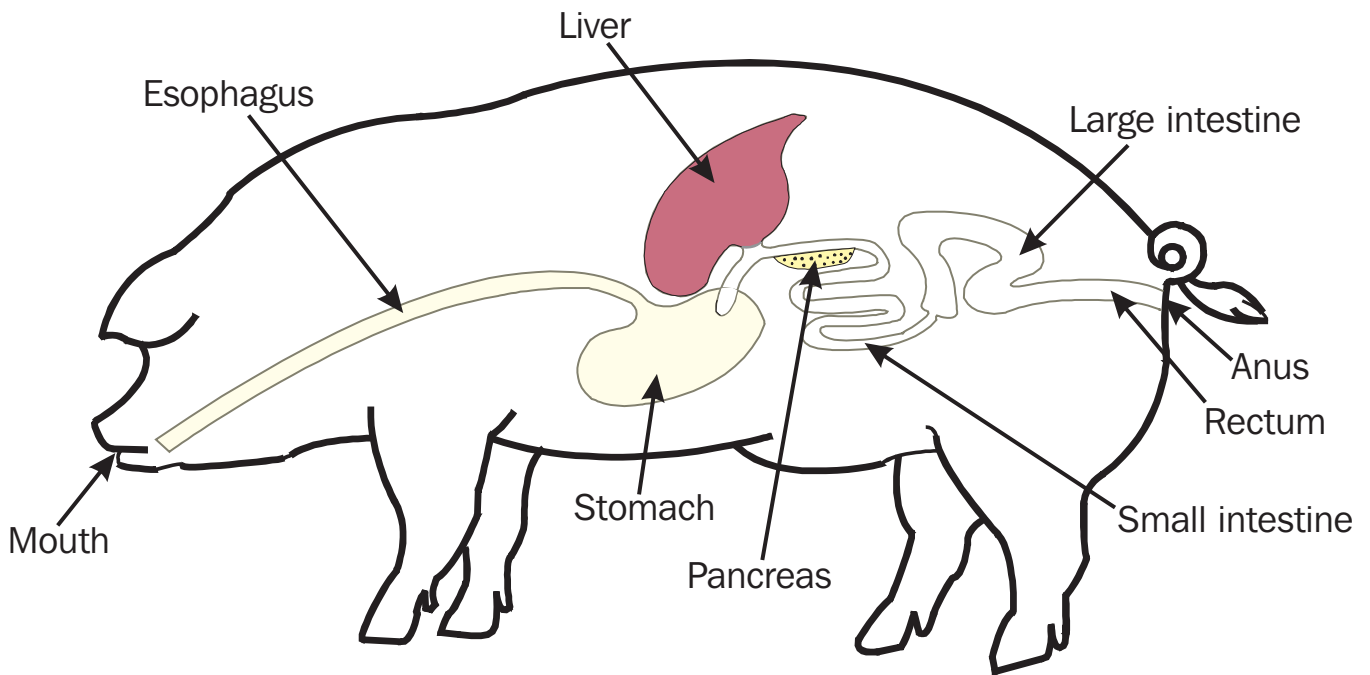
1. The large intestine forms _____, or waste matter composed of food materials not digested or absorbed.
2. The gray, pulpy mass that results from digestion in the stomach and passes to the small intestine is called _____.
3. A substance, such as a salt, that takes on an electrical charge in a solution is called an _____.
4. _____ is a mark on each of a horse's upper corner incisors that appears and disappears in a predictable pattern as the horse ages.
5. A yellowish-green, alkaline, bitter liquid, called _____, is produced by the liver and stored in the gallbladder in most animals.

► Part Four: Multiple Choice

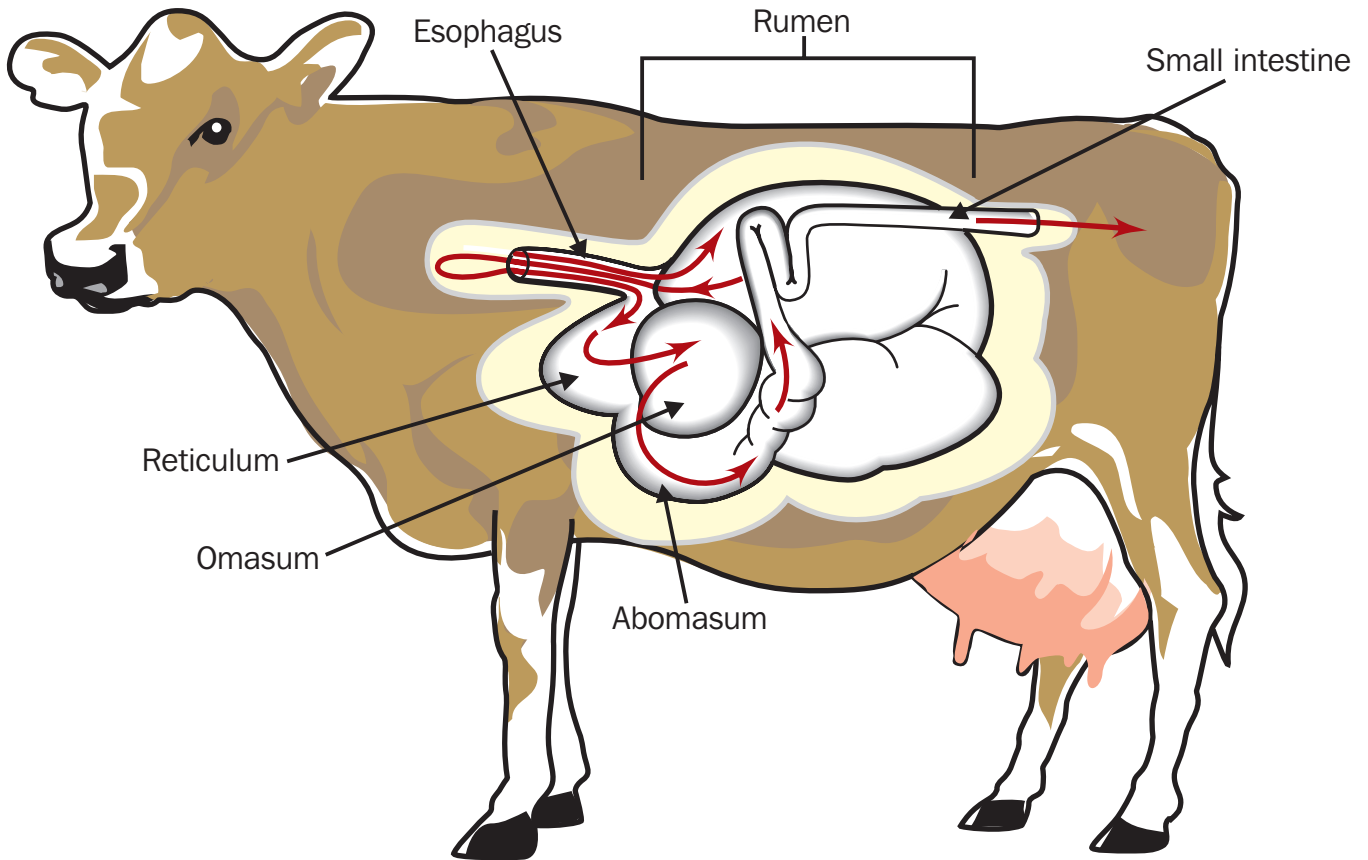
Instructions: Write the letter of the correct answer.

- _____ 1. Which of the following enzymes breaks down proteins into polypeptides and coagulates milk in animals that lack rennin?
 - a. lactase
 - b. peptidase
 - c. sucrase
 - d. pepsin
- _____ 2. Which of the following enzymes converts sucrose into one molecule of glucose and one molecule of fructose?
 - a. maltase
 - b. sucrase
 - c. gastric lipase
 - d. fructose
- _____ 3. Which of the following enzymes breaks down proteins, curdles milk, and is found only in the fourth stomach of ruminant animals?
 - a. lactase
 - b. rennin
 - c. gastric lipase
 - d. pepsin

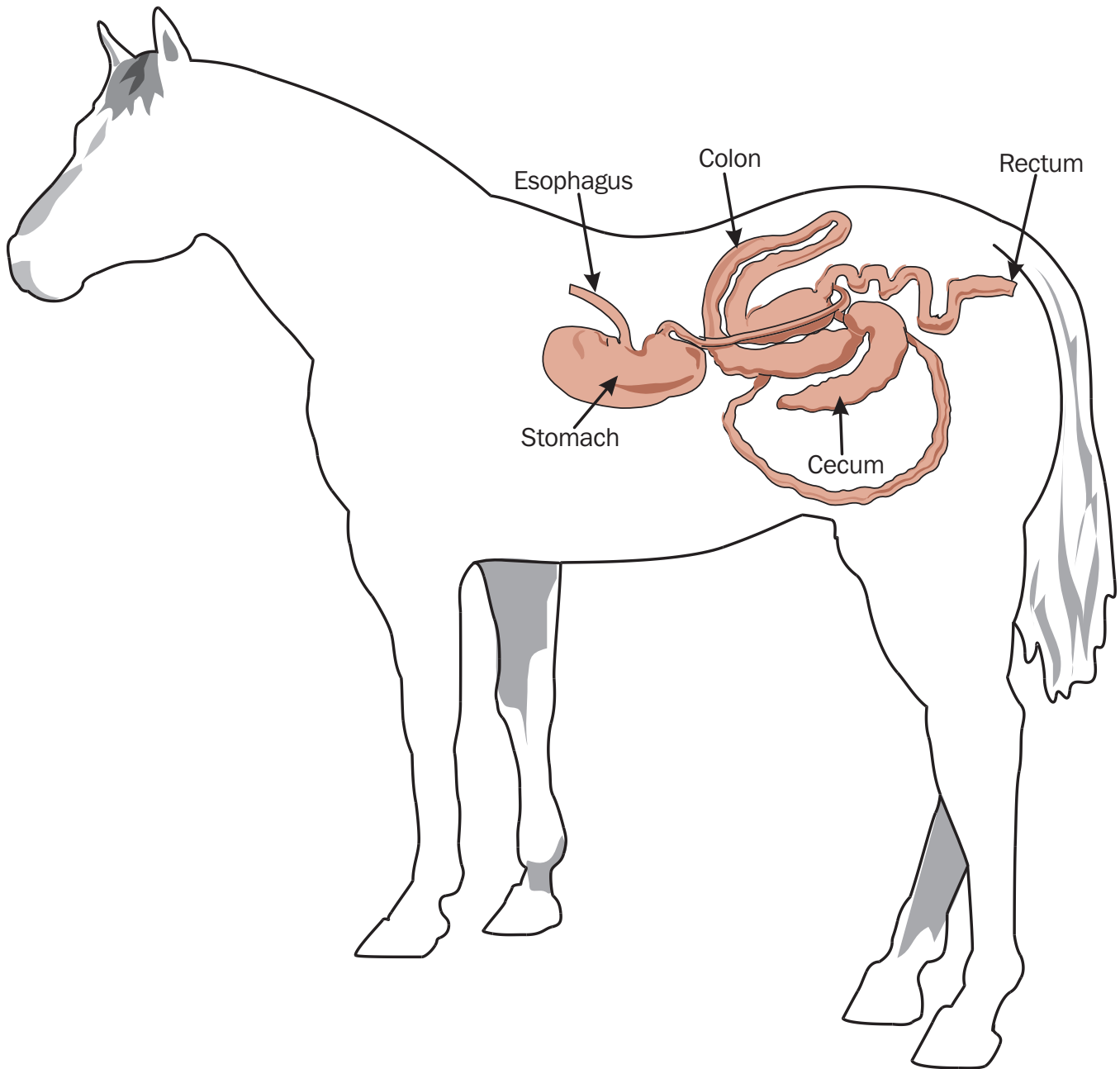
SCHEMATIC DIAGRAM OF SWINE DIGESTIVE SYSTEM



SCHEMATIC DIAGRAM OF COW DIGESTIVE SYSTEM



SCHEMATIC DIAGRAM OF HORSE DIGESTIVE SYSTEM



SCHEMATIC DIAGRAM OF CHICKEN DIGESTIVE SYSTEM

