Course	Agricultural Science I
Unit	Introduction to Animal Nutrition
Lesson	Monogastric Digestive System
Estimated Time	50 minutes

Student Outcome

Identify the components and describe the functions of the monogastric animal digestive system.

Learning Objectives

1. Determine which domestic animals have monogastric digestive systems.
2. Identify the components of the monogastric digestive system.
3. Describe the functions that the components of the monogastric system play in digestion.
4. Explain the role of digestive juices and enzymes in the digestion of nutrients.

Grade Level Expectations

SC/LO/2/D/09-11/c SC/LO/2/F/09-11/a

SC/LO/2/D/09-11/d SC/LO/2/F/09-11/d

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slides
   - ☐ PPt 1 – Swine Digestive System
   - ☐ PPt 2 – Horse Digestive System
   - ☐ PPt 3 – Dog Digestive System
   - ☐ PPt 4 – Rabbit Digestive System
   - ☐ PPt 5 – Fowl Digestive System - Chicken
   - ☐ PPt 6 – Enzymes in the Monogastric Digestive System
2. Activity Sheets
   - AS 1 – Swine Digestive System
   - AS 2 – Dissection of the Monogastric Digestive System
3. *Introduction to Animal Nutrition (Student Reference)*. University of Missouri-Columbia: Instructional Materials Laboratory, 1996.
4. *Introduction to Animal Nutrition Curriculum Enhancement.* University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- ❑ A monogastric digestive system can be obtained from a local processing plant. The system should begin at the esophagus and end with the anus. It should be kept frozen until the dissection is performed.
- ❑ Six different colors of Play-Doh

Supplemental Information

1. Internet Sites
   - ❑ "Animal Nutrition and Digestion." Department of Animal Science. University of Vermont. Accessed May 10, 2007, from http://asci.uvm.edu/course/asci001/digest.html.
   - ❑ Animal Science Publications. MU Extension. University of Missouri-Columbia. Accessed April 12, 2007, from http://extension.missouri.edu/explore/agguides/ansci/.
   - ❑ "The Horse's Digestive System." Hygain. Accessed May 10, 2007, from http://www.hygain.com.au/articles/article_digestivesystem.htm.
   - ❑ Tech Information. Merrick's. Accessed May 10, 2007, from http://www.merricks.com/tech.html.
2. Print
   - ❑ Campbell, J. R., M. D. Kenealy, and K. L. Campbell. *Animal Sciences: The Biology, Care, and Production of Domestic Animals*. 4th ed. New York: McGraw-Hill Companies, 2003.
   - ❑ Frandson, R. D., W. L. Wilke, and A. D. Fails. *Anatomy and Physiology of Farm Animals*. 6th ed. Baltimore: Lippincott Williams and Wilkins, 2003.
   - ❑ Kellems, R. O., and D. C. Church. *Livestock Feeds and Feeding*. 5th ed. Upper Saddle River, NJ: Prentice Hall, 2002.
3. Electronic Media
   - ❑ *Animal Nutrition Interactive PowerPoints*. University of Missouri-Columbia: Instructional Materials Laboratory, 2006.

Interest Approach

Put students into small groups. Pass out six different colors of Play-Doh to each group. Instruct the students to "build" a monogastric digestive system using a different color for each major part.

Communicate the Learning Objectives

1. Determine which domestic animals have monogastric digestive systems.
2. Identify the components of the monogastric digestive system.
3. Describe the functions that the components of the monogastric system play in digestion.
4. Explain the role of digestive juices and enzymes in the digestion of nutrients.

Instructor Directions	Content Outline
Objective 1 *Animals have either a monogastric or a ruminant digestive system. The following domestic animals have a monogastric digestive system.*	**Determine which domestic animals have monogastric digestive systems.** 1. Swine 2. Horse 3. Dog 4. Rabbit 5. Fowl
Objective 2 *Ask students what a monogastric digestive system is and discuss their answers. Remind students that while the liver, gall bladder, and pancreas are not a part of the digestive system, they are related organs that play an important role in digestion. Hand out AS 1 and, using PPt 1, identify the parts along with the students. Use PPt 2, PPt 3, PPt 4, and PPt 5 to illustrate the digestive systems of other species.* AS 1 – Swine Digestive System PPt 1 – Swine Digestive System	**Identify the components of the monogastric digestive system.** Mammalian digestive system 1. Mouth 2. Esophagus 3. Stomach 4. Small intestine - duodenum, remainder of small intestine 5. Large intestine - cecum, colon, rectum 6. Anus Fowl digestive system 1. Beak 2. Gullet 3. Crop 4. Glandular stomach (or proventriculus) 5. Gizzard (or ventriculus) 6. Small intestine 7. Ceca 8. Large intestine 9. Cloaca 10. Vent

Instructor Directions	Content Outline
☐ PPt 2 – Horse Digestive System ☐ PPt 3 – Dog Digestive System ☐ PPt 4 – Rabbit Digestive System ☐ PPt 5 – Fowl Digestive System – Chicken	
Objective 3 *Each part of the monogastric digestive system has a specific function in the digestion process. Ask students if they know what each function is. When discussing the functions of the parts, use PPt 1 as an illustration.* ☐ PPt 1 – Swine Digestive System	**Describe the functions that the components of the monogastric system play in digestion.** Mammalian digestive system 1. Parts leading to the small intestine - reduce feed particle size 2. Mouth - teeth grind feed; tongue moves pieces to throat; begins digestion 3. Esophagus - carries pieces 4. Stomach - stores food; continues digestion 5. Small intestine a. Duodenum - continues digestion b. Remainder of small intestine - absorbs nutrients into the bloodstream 6. Large intestine - absorbs water and molds indigestible feed wastes into solid form a. Cecum - contains microorganisms; functions differently depending on the species, with the enlarged cecum in horses and rabbits allowing microorganisms to ferment roughage and break it down for absorption into the blood b. Colon - absorbs water and forms the feces 7. Parts allowing the exit of the feces a. Rectum - carries the feces to the anus b. Anus - passes solid wastes out of the body
☐ PPt 5 – Fowl Digestive System - Chicken	Fowl digestive system 1. Beak - breaks feed down for swallowing 2. Gullet - passes feed to crop 3. Crop - stores feed; softens feed for digestion 4. Glandular stomach - begins digestion 5. Gizzard - feed ground by muscular contractions

Instructor Directions	Content Outline
	6. Small intestine - digests and absorbs feed 7. Ceca - contain bacteria; little role in digestion 8. Large intestine - carries wastes to cloaca 9. Cloaca - junction of reproductive and digestive systems 10. Vent - allows wastes to exit the body
Objective 4	**Explain the role of digestive juices and enzymes in the digestion of nutrients.**
Ask students what digestion is. Describe the roles of enzymes and digestive juices in digestion. ☐ PPt 6 – Enzymes in the Monogastric Digestive System	Digestive juices - fluids secreted into the digestive system from glands or tissue; enzymes - substances in the digestive juices that speed up the chemical reactions of digestion Mammalian digestive system 1. Saliva - lubricates feed for passage into the digestive system; contains the enzyme amylase, which breaks down starches into sugars 2. Gastric juices a. Diluted hydrochloric acid (HCl) - stops the action of amylase b. Gastrin - stimulates the stomach to produce more gastric juices c. Pepsin - enzyme that begins digestion of proteins d. Rennin - enzyme that curdles a protein in milk e. Gastric lipase - enzyme that begins the breakdown of fats f. Mucus - protects the stomach lining from the acidic environment 3. Bile - helps to liquefy fats for absorption 4. Pancreatic juices a. Pancreatic lipase - breaks fats down further, aided by bile b. Trypsin - breaks down proteins c. Chymotrypsin - acts on proteins d. Amylase - continues to work on starch 5. Intestinal juices - contain the enzyme peptidase to break down proteins and the enzymes maltase, sucrase, and lactase to work on sugars and starches Fowl digestive system 1. Saliva - softens feed for digestion in conjunction with secretions from the crop wall

Instructor Directions	Content Outline
	2. Gastric juices - contain HCl and pepsin; pepsin begins digestion of proteins 3. Bile - liquefies fats 4. Pancreatic juices - include amylase, trypsin, and lipase; functions the same as the mammalian system 5. Intestinal juices - juices and enzymes function the same as the mammalian system
Application: AS 1 – Swine Digestive System AS 2 – Dissection of the Monogastric Digestive System	Answers to AS 1 1. Gall bladder 2. Colon 3. Stomach 4. Liver 5. Rectum 6. Anus 7. Mouth 8. Esophagus 9. Cecum 10. Pancreas 11. Small intestine 12. Duodenum Answers to "Key Questions" on AS 2 1. The monogastric digestive system is a simple digestive system in which the stomach has only one compartment. 2. Small intestine 3. Feed moves from the mouth to the stomach through the esophagus. From the stomach, it moves through the duodenum and the rest of the small intestine and then into the large intestine, through the cecum, colon, and rectum. Wastes exit the body through the anus.
Closure/Summary	The most distinctive part of the monogastric digestive system is that it has a simple stomach with only one compartment. Digestion is carried out by digestive juices that include enzymes to convert feed into usable nutrients. Swine, horses, dogs, and rabbits have a monogastric digestive system, as do fowl, although the digestive system found in fowl has some significant differences from the other species.

Instructor Directions	Content Outline
Evaluation: Quiz	Answers: 1. Stomach 2. Colon 3. Rectum 4. Mouth 5. Esophagus 6. Anus 7. Cecum 8. Small intestine 9. Duodenum 10. d 11. c 12. a 13. b 14. d 15. b 16. a 17. c 18. a 19. Once the feed enters the digestive system through the beak, it passes through the gullet to the crop. It then enters the glandular stomach, followed by the gizzard. From the gizzard it moves through the small intestine, passes by the ceca, and enters the large intestine. It passes out of the body through the cloaca and vent.