GOT GUTS?

LESSON PLAN

Grade Level(s)

6 - 8

Estimated Time

Two 50-minute sessions

Purpose

In this lesson students will investigate the different digestive systems of livestock and learn how animals have unique nutritional needs based on these structures. Students will also discover the responsibilities of an animal nutritionist.

Materials

For the teacher:

- Document or overhead projector
- Transparency film (optional)
- *Animal Appetites* handout
- *Got Guts? Teacher Review*

For the class:

- *Got Guts? Pig Descriptions*
- *Got Guts? Cow Descriptions*

For each group:

- *Got Guts? Pig Labels* or *Cow Labels*
- *Pig* or *Cow Digestive Tract* handout

- Foam board
- Modeling materials: balloons, tubing, hoses, straws, string, rope, empty soft drink bottles, chenille stems, milk jugs, or food containers
- Scissors
- Tape or glue

For each student:

- Sticky note

Suggested Companion Resources

- An Agricultural Interview (Activity)
- Sprout 2 - Careers (Activity)
- Career Trek Game (Kit)
- Careers in Agriculture Videos (Multimedia)
- Living Science Career Cards (posters or mini-posters) (Poster)

Vocabulary

cud: partially digested food from a ruminant animal which is regurgitated to the mouth for further chewing

graze: to feed on grass

ruminant: an animal with a multi-chambered stomach

monogastric: a simple single-chambered stomach

digestive system: the system which physically and chemically breaks down food to provide the body with absorbable nutrients

browse: to feed on leaves, twigs, or other high-growing vegetation

diet: the types of food that an animal habitually eats

Interest Approach or Motivator

1. Write the questions: "What do cattle eat?" and "What do pigs eat?" on the board.
2. Have students write their ideas on a sticky note and place their sticky note under the corresponding question. Review student ideas as a class, rearranging sticky notes to group, sort, and identify themes or ideas. Help students understand that animals eat different things due to their nutritional needs, preferences, and their unique digestive tracts.

3. Inform students that they will:
    - investigate the different digestive systems of livestock;
    - learn how animals have unique nutritional needs; and
    - discover the responsibilities of an animal nutritionist.

Background Agricultural Connections

This lesson is one in a series of 5 related lessons to promote the development of STEM abilities and critical thinking skills, while fostering an appreciation for the people involved in livestock production. For more information about what STEM is, why it's important, and how it can be implemented in your classroom, watch the video, *What is STEM?* The curriculum includes real-life challenges for students to investigate, inquiry-based labs, and opportunities to plan and construct models. Featured careers include:

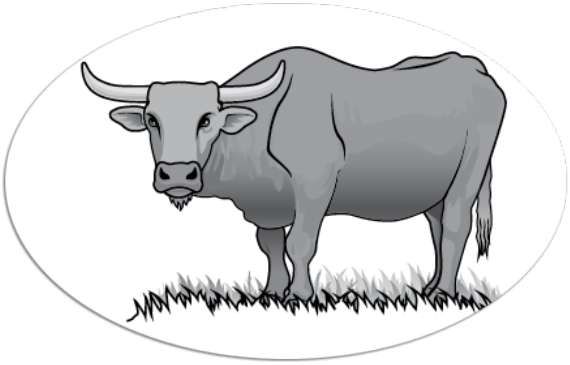
- Animal Physiologist: *Significant Surroundings*
- Agricultural Engineer: *Build it Better*
- Animal Geneticist: *Roll of the Genes*
- Animal Nutritionist: *Got Guts?*
- Range Manager: *Homes on the Range*

There are two basic digestive systems, monogastric and ruminant. Although both systems break down food into smaller components so it is easily absorbed into the blood stream, they have significant differences.

A monogastric organism has a simple single-chambered stomach. Humans have a monogastric digestive system. Examples of other monogastric organisms include omnivores such as rats and pigs, carnivores such as dogs and cats, and herbivores such as horses and rabbits.

A ruminant is a grazing or browsing animal that chews cud. There are many different species of ruminant animals, including cattle, sheep, goats, buffalo, deer, and elk. These animals all have a similar digestive system. Plant-based foods, such as grasses, herbs, and twigs, initially enter the first stomach,

known as the rumen, where they are broken down by bacteria. Next, they regurgitate the partially digested food and chew it again in the form of cud. The word "ruminant" means "to chew over again."



Most ruminant animals have no upper front teeth. In place of teeth, they have a hardened gum, which they use to crush food. Ruminants eat rapidly and do not chew their food completely before swallowing it, but can chew their cud for hours. Dairy cows spend almost eight hours a day chewing their cud.

Ruminants have four different chambers in their stomach, and these chambers have specific functions. In a large dairy cow, the rumen has the capacity to store and process up to 50 gallons of food at a time.

Food remains in the rumen until it has been broken down and can proceed to the next chamber. Good bacteria in the rumen help the cow digest her food and provide her with protein and energy. This is where cud comes from. The reticulum works with the rumen to mix and bring the undigested feed back up the esophagus in the form of cud, to be rechewed. The cud chewing physically breaks down the fibrous material and increases the surface area of the feed. When the cud is swallowed, the increased surface area provides space for bacteria to attach and continue the digestion process. Once the particle size is reduced sufficiently, the undigested feed particles leave the rumen with liquid and flow into the omasum. The omasum has many folds which regulate flow of partially digested food to the fourth stomach compartment, the abomasum. The abomasum is similar to a human stomach, where the pH is approximately two—very acidic. This acidic environment prepares the nutrients that are present for absorption in the small intestine. See the Cow Digestive Tract handout on page 52 for more information.

Many of the plants that grow on earth cannot be used directly by humans as food. More than 50 percent of the plant matter in cereal crops is inedible to humans. Because of the microorganisms in the rumen, ruminants can convert otherwise unusable plant materials into nutritious food (e.g., milk and meat) and fiber (e.g., wool).

In this lesson, students will investigate the digestive process and use household materials to construct models of both monogastric and ruminant digestive systems.

Refer to the *Answers to Commonly Asked Questions* for more background information.

Procedures

1. Prior to the lesson, replicate the *Animal Appetites* handout included with this lesson onto an overhead transparency (optional) or project it on a screen. Cut out one set of the *Got Guts? Descriptions* for the cow and pig. Draw a large outline of either a cow or a pig on each group's piece of foam board.

2. Read the story attached story, *Animal Appetites*. After reading the story out loud, solicit student responses to the included questions. Tell students that today they are going to act as animal nutritionists. Animal nutritionists must have an extensive knowledge of how animals digest food. They use their knowledge to formulate diets for animals. The diets they create must be nutritionally sound, good-tasting, and economical for the ages and types of animals that will use them.

3. Introduce the term "digestive tract." Briefly review the human digestive system, and the roles of teeth and the mouth, esophagus, stomach, small intestine, large intestine, and colon in the function of digesting food. Allow students to identify the parts they know, and if possible, the related function. Highlight the following features:

    - Digestion begins in the mouth. As the teeth tear and chop food, saliva moistens it for easy swallowing.
    - From the throat, food travels down a muscular tube in the chest called the esophagus. Waves of muscle contractions force food down through the esophagus to the stomach.
    - The stomach muscles churn and mix the food with acids and enzymes, breaking it into smaller, more digestible pieces.
    - Digestion continues in the small intestine, a tube-like structure that absorbs nutrients into the bloodstream.
    - The large intestine's main function is to remove water and minerals from the undigested matter and form solid waste that can be excreted.
    - The colon is part of the large intestine. Bacteria in the colon help to digest the remaining food products.

4. Tell students that today they will use household materials to construct models of both monogastric and ruminant digestive systems. Divide the class into groups of five students. Assign each group a cow or pig digestive tract. Give each group the *Pig Digestive Tract* or *Cow Digestive Tract* handout. Distribute foam board, modeling materials (including balloons, tubes, hoses, straws, string, rope, and empty soft drink bottles, chenille stems, milk jugs, and food containers), and corresponding *Got Guts? Labels* for the cow and pig. Instruct students to research their assigned animal, using classroom and Web resources, and then create a model of the animal's digestive tract on the foam board using the labels and materials provided.

5. Once students have completed their models, display them around the room. Gather students in a location where both cow and pig digestive tracts are visible. Distribute the Got Guts? Descriptions (both pig and cow) to students. Lead students in a review of each digestive tract,

using the *Got Guts? Teacher Review* as needed. Throughout the review, have students place the correct description of each organ on the correct model.

6. Summarize student learning with a classroom discussion.

- Monogastric and ruminant digestive systems are different. Monogastric systems have one true stomach, while ruminants have a multi-chambered stomach.
- Animals prefer foods that can be easily digested and used by their body. Cattle have ruminant digestive tracts with large microbial populations that allow them to eat complex plant materials. Pigs and humans have monogastric digestive tracts.
- Animal nutritionists use their knowledge about animals and their digestive tracts to formulate diets that are nutritionally sound, good-tasting, and economical.
- The proper nutrition of livestock animals is a key component of a successful production system. Just like humans, animals that consume the nutrients they need will stay healthy and grow stronger.

Concept Elaboration and Evaluation

After conducting these activities, review and summarize the following key concepts:

- Animal nutritionists help farmers and ranchers provide the proper nutrition in order for animals to grow and be healthy.
- Animals with a single-chamber stomach are considered *monogastrics*. Animals with a multi-chamber stomach are called *ruminants*.
- Ruminant animals such as cattle, sheep, and goats can obtain nutrients from food that humans and other monograstrics cannot.

Variations

- During the *Interest Approach/Motivator*, solicit student responses using a text message poll such as Poll Everywhere or SMSPoll. Summarize student responses by creating a Wordle.

- Have students choose a livestock animal to research and design a digestive model. Compare the digestive systems of a variety of animals including llamas, sheep, goats, cattle, horses, and pigs.

ELL Adaptations

- Students create a diagram of the selected digestive system before working on model. Graphic organizers are a means of introducing and assessing concepts in a manner that encourages meaningful learning.
- The activities in this lesson employ group work and cooperative learning. These activities provide opportunities for students to exchange, write, and present ideas. Students use a variety of skills that work together to increase understanding and retention.

Essential Files (maps, charts, pictures, or documents)

- Pig and Cow Digestive Tract handouts
- Got Guts? Teacher Review
- Got Guts? Pig Descriptions
- Got Guts? Cow Labels
- Got Guts? Cow Descriptions
- Animal Appetites handout
- Got Guts? Pig Labels

Did you know? (Ag Facts)

- An animal nutritionist most often works with agricultural animals on farms, but they might also work at a zoo with wild or exotic animals.[1]
- Most animal nutritionists have a Masters or Doctorate degree.[1]
- Ruminants do not have top teeth in the front of their mouth (incisors). Instead their gums are very thick and known as a *dental pad.*[2]

Enriching Activities

- Compare the teeth of different animals and discuss how they are designed to break down specific foods. Introduce the terms carnivore, herbivore, and omnivore. Sort the teeth based on the animal's primary food sources and observe similar characteristics.
- Use diagrams to compare the human, cow, and pig digestive systems. Challenge students to consider which animal humans are most similar to and form an expository response.

- Research the length of animal intestines. Use rope to model and compare the different lengths. Discuss why these differences might exist.
- Students research the educational background and skills required to be an animal nutritionist.

Sources/Credits

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Sources:

1. http://study.com/articles/Animal_Nutritionist_Job_Description_Duties_and_Salary.html
2. http://www.animalfacts.net/ruminants-cows-goats-sheep/index.html

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Organization Affiliation

California Foundation for Agricultural Education

- Agricultural Literacy Outcomes
- Education Content Standards
- Common Core Connections

Agricultural Literacy Outcomes

Science, Technology, Engineering & Math

- Describe how biological processes influence and are leveraged in agricultural production and processing (e.g., photosynthesis, fermentation, cell division, heredity/genetics, nitrogen fixation)
- Identify science careers related to both producers and consumers of agricultural products

Food, Health, and Lifestyle

- Identify the careers in food production, processing, and nutrition that are essential for a healthy food supply