

Iowa's Dairy Story Cow's Digestive System Lesson

Objectives:

1. Learn the parts of the cow's digestive system.
2. Learn how much a dairy cow eats and drinks in a day.
3. Understand the ruminant digestion along with chemical and physical processes that occur.
4. Explore the types of food dairy animals eat and understand where they come from.
5. Understand what cows do with the food they eat.

Iowa Core Curriculum Met:

Mathematics Standards

- Content Standard 1: Students can understand and apply a variety of math concepts.
- Content Standard 3: Students can solve a variety of math problems.

Science Standards

- Content Standard 1: Students can understand and apply skills used in scientific inquiry.
- Content Standard 2: Students can understand concepts and relationships in life science.

Literacy Standards

- Content Standard 1: Students can comprehend what they read in a variety of literary and informational texts.

Duration: 20-25 minutes

Supplies Needed:

Watch the Dairy Cow Digestive System video or use the following materials to teach the lesson in your classroom. *Optional* Contact us to get a cow feed sample.

Digestive System labels	¼ cup vinegar	Potato
Bubble Gum	Balloons	Iodine
2 feet of 1 inch hose	Baking Soda	4-6ft tubing
Ball	Sponge	2 ft accordion tubing
Pop Bottles	Pail or wastebasket	5 gallon bucket

Lesson Preparation:

1. Gather the materials listed above. Materials include: Pop bottle, digestive system labels (Mouth, Esophagus, Rumen, Reticulum, Abomasum, Omasum, Small Intestine, Large Intestine), 2 feet of 1 inch hose, sponge and pail, small iodine bottle, long piece of small tubing, wide accordion piece of tubing.
2. Fill the 5 gallon bucket with water to cover the sponge inside.
3. Cut potato in half or quarters.
4. Put $\frac{1}{4}$ cup of vinegar in the pop bottle and use the funnel to put 2 teaspoons of baking soda inside the balloon. Place balloon end securely on top of pop bottle, but make sure balloon end that is holding the baking soda is hanging to the side so baking soda doesn't interact with vinegar yet.

Teaching the Lesson:

1. Ruminant Animals

Cows are ruminant animals. Does anyone know what that means? (It means they have four parts or compartments to their stomach which allows them to eat a variety of grasses and corn.) Who can tell me some other animals that might be ruminant? Hint: Think about animals that are similar to cows. Example of similar animals.

Alpacas	Camels	Giraffes	Reindeer	Yaks
Antelope	Caribou	Goats	Sheep	
Beef Cows	Deer	Llamas	Water Buffalo	
Bison	Gazelle	Moose	Wildebeest	

All Ruminants have cloven hoofs, which means they have two pieces to their hoofs. Show the cow's hoof that is on display. The only animal that is a ruminant that does not have a cloven hoof is a camel and the only animal that has cloven hoofs but is not a ruminant is a pig.

2. Parts of the Cow's Digestive System

To help you understand the parts of the digestive system and what each does I am going to have you help by demonstrating what each part of the digestive system is doing for the animal. A few of you will get a label to help us demonstrate what each of the part of the stomach does. (*Hang the labels around the neck of the youth to help them remember what each part is called. Point out the part of the stomach on the model cow as each part is discussed.*)

- A. **Mouth**—is for chewing the food. A cow chews about 18 hours a day. (*Give the youth a piece of gum to chew; they need to keep doing this throughout this activity. If someone has a second hand watch, have someone time the number of chews the child does in one minute. Try to get one student involved in counting to include more of the youth. (most have 54-60 chews) This is very similar to a cow.*)

In the Reticulum the cow creates a ball of feed called a “bolus” which they regurgitate back to the cow’s mouth for further chewing. A cow will chew a piece of cud for about 45-50 chews then swallow and regurgitate another piece of cud. In one day a cow will regurgitate and rechew about 60 pounds of food.

- B. **Esophagus**—is used for swallowing and passing feed. The esophagus in a cow allows food to be swallowed as well as bring food back up for the cow to chew. *(Give the youth a hose about 1 inch in diameter and 2 feet long) Have the student move the hose up and down to show the movement of food up and down the esophagus.*
- C. **Rumen**—the main job of the rumen is to break down the food. Here food is fermented and the feed is further broken down. In a day a cow will produce 50–80 quarts of saliva which is added to the rumen. **Who can tell me about how many gallons of saliva that is? How many quarts are in a gallon?** (answer: 12.5-20 gal. That is 3-4 five gallon pails of saliva show pail.)

The food is constantly moving and churning. The rumen can hold up to 25 gallons of materials. That is 5 of these buckets. *(to represent the fermentation process give the child a pop bottle with ¼ cup of vinegar in it, place the balloon that is filled with 2 teaspoons of baking soda inside. Place the balloon over the lip of the bottle and when ready have the youth tip the balloon up so that the baking soda falls into the vinegar.)* Ask the students what is being made. *(Help them understand that it is a gas.)*

- D. **Reticulum**—is for holding, agitating and digesting. The Reticulum is like a honeycomb with a network of tissue. It holds back large particles of feed so that bacteria can digest it further. This is the area of the stomach that catches any hardware such as nails and wire that a cow may eat. The cow needs to be given a magnet first which will catch the metal. This is where the bolus or the cud is created. *(Give the “reticulum” youth the ball and have them throw the ball to the “mouth” youth.)*
- E. **Omasum**—Here the water is removed from the feed. *(Give the youth a sponge that they squeeze the water out of into the wastebasket)*
- F. **Abomasum**—often called the true stomach. Here enzymes and acids are secreted and produced to break down the feed. *(Give the youth a potato and apply small strip or design of iodine.)* Let’s pass the potato so everyone can see

what it looks like and then we will look at it again when we get to see the chemical reaction that is happening in this compartment of the stomach.

- G. **Small Intestine**—here additional digestion takes place and nutrients are absorbed. The small intestine is about twenty times the length of the cow or the length of 3 buses head to tail. *(Give a youth a piece of the smaller diameter tubing to represent the intestine.)*
- H. **Large Intestine**—this is the last portion and can hold about 40 quarts. **How many gallons is 40 quarts?** (10 Gallons) Its main function is to absorb water. *(Give the youth a piece of the larger diameter tubing to represent the intestine.)*

3. What Cows Eat - *OPTIONAL*

There are samples of alfalfa hay, alfalfa silage, corn silage, cotton seed, ground corn, mineral, protein pellets, and Dried Distillers Grain to pass around for the youth to see.

- A. Alfalfa Hay- How is it made? Cut down in the field and left to dry for a few days and then baled.
- B. Alfalfa Silage or Haylage- How is it made? Cut down in the field, chopped into small pieces by a machine and put into wagons, when it is wet, then stored to keep in fresh in a silo, bunker or silage bag. *(Tell them they will get to see each of those during the tour)*
- C. Corn Silage- How is it made? Chopped into small pieces right out of the field by a machine and put into wagons also stored like haylage.
- D. Cottonseed- Has anyone seen cottonseed before? *Show picture of cottonseed in container, explain the seeds are inside the white ball.*
- E. Ground Corn- this is dry corn that is ground up into small pieces, it makes it easier for the cows to digest and they get more nutrients from the corn.
- F. Mineral- How many of you took your vitamins this morning? These are the vitamins and minerals that we give our cows.
- G. Protein Pellets- How do we get our Protein? By eating meat. This is protein for the animals and it is made from other plants.
- H. Dried Distillers Grain- What does distillers grain come from? It is a byproduct of Ethanol. Does anyone know what ethanol is? It is a gas that we use in our vehicles. Ethanol is made from corn and the distillers grain is the left over pieces of the corn that are not used in making ethanol.

A cow weighing about 1,350 pounds will eat about 90 pounds of feed plus 40 -50 gallons of water each day. The cow will also make about 125 pounds of manure from all that food they eat.

Typical daily diet: (use wall chart and feed chart to show kinds and amounts)

Water	30 gallons (240 pounds)
Alfalfa Hay	6 pounds
Alfalfa Silage	17.78 pounds
Corn Silage	22 pounds
Cotton Seed	7 pounds
Corn	19.85 pounds
Soybean Meal	8 pounds
Limestone	.3 pounds
Dicalcium Phosphate	.2 pounds
Magnesium	.14 pounds
Baking Soda	.25 pounds
Salt	.09 pounds
Selenium	.027 pounds
A, D & E	.06 pounds
Total	81.7 pounds

This amount of feed is needed for a cow to produce 110 pounds of milk in a day. A cow that produces 110 pounds of milk each day gives about 12 gallons of milk a day. That milk can make about 192, 8 ounce glasses of milk, 5 pounds of butter, 16 pounds of cottage cheese, 10 pounds of cheese or 8 ½ gallons of ice cream.

4. Reflect

- How does the cow's digestive system differ from ours? (We only have one stomach.)
- What was the main function of the digestive system? (To digest and absorb the nutrients from the feed.)
- Why can cows digest large quantities of fiber? (Because of a cow's digestive system with four compartments they can breakdown foods high in fiber. These are food that our stomachs would not be able to digest.)

5. Apply

- What are some other animals you may own that it would be important to know how their stomachs and digestive system works? (Dogs, Cats, a variety of answers here)
- Why would knowing this information be helpful? (Know what kinds of feed you can give them, you don't want them to get sick.)
- If you didn't know what an animal should eat and how much, who would you call? (Extension Office, Veterinarian, Co-op, teacher)