TEACHER'S GUIDE

Dairy Digestion

RUMINANTS AND DAIRY CATTLE NUTRITION LESSON

Learning Target: Determine components of a typical dairy cattle feed ration and identify parts of the ruminant digestive system.

Engagement Strategy: Would You Eat That?

To begin the lesson, **ask the class "*Where does chocolate milk come from?*"**

> They may think brown cows give chocolate milk. But in fact, all milk from cow is white. However…**some cows eat chocolate!** This doesn't affect the flavor of their milk though.

Use the**"Would You Eat That?" Teacher's Guide** to discuss what cows eat.

Show the class the **included pictures of cattle feed and by-products** used in cattle rations.

> For each one, ask "*Would you eat that?*" or "*Could you eat that?*". If they answer in the negative, you can reply with "*Cows do!*"

Learning Activity: Roll-a-Ruminant

Ask the class if they know **what a cow's superpower is**?

> After they have had a chance to guess, tell them it is turning plants and plant parts **that we can't eat**, into milk and milk products **that we can eat**.

Use the **"The Cow's Superpower" Teacher's Guide** to describe the unique parts of a ruminant digestive system. Older students can use this as a reading passage.

Questions you can have students answer include:

- *How many stomachs does a cow have? Answer:* ***one.*** *A cow's stomach does have four parts.*
- *Why are cow's stomachs different than ours? Answer:* ***So they can digest plant matter.***
- *What are cow's classified as? Answer:* ***ruminants***
- *What is unique about a cow's teeth? Answer:* ***They do not have incisors on top.***
- *What is the purpose of chewing their cud? Answer:* ***It allows them to eat a lot of grass in a short period of time and then re-chew it later which improves digestion.***
- *What part of the cow's stomach catches foreign objects so they do not move through the rest of the digestive system? Answer:* ***the reticulum***
- *What part of the cow's stomach functions much like monogastric (human) stomach? Answer:* ***the abomasum***

Next have students get into **groups of three to five** members and distribute **a single die** per group.

Handout the **"Roll-a-Ruminant" page** to each student, as well as at least one **crayon or colored pencil** to color in the parts of the digestive system. Or you can provide a set of colors to each group. (You can even assign a color for each digestive system part.)

Students will take turns **rolling the die and coloring in** their digestive system digram. The first one to **get all six parts completed** is the winner, but students should keep playing until they finish.

For older students, have them complete the digestive system **in the order that feed moves through** it for a more challenging game. In other words, they can't color a part unless it's the next in the order.

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Would You Eat That?

DAIRY CATTLE NUTRITION

Does chocolate milk come from brown cows?

Chocolate milk doesn't actually come from brown cows. They give white milk just like all cows. Chocolate milk is created by adding chocolate to the regular white milk. But some cows do eat chocolate.

Candy factories discard broken and misshapen product. Cattle nutrition specialists figured out that this leftover candy could be added to cattle feed to enhance their nutrition. This was a win-win arrangement. The waste chocolate product doesn't get thrown out and the dairy producers get a nutritious additive for their herd.

What DO cows eat?

Only 2.2% of what cows eat is made up of food that people could or would want to eat. So cows really don't eat food people could eat instead they put our unused resources to good use. Dairy cows have the special ability to transform parts of plants that we can't eat, even if we wanted to, into human food like milk, cheese, yogurt, and ice cream.

Grass: More than 50 percent of cow feed is actually grass (farmers call it hay and silage). While people often think dairy cows are fed a high-grain diet, in reality they eat the leaves and stems from corn, wheat and oats far more often than they are eating grain, like corn kernels.

Grain: Dairy cows do eat some grain, which usually makes up less than one-quarter of their diet. Some has been grown specifically for cows, and other types have been recycled after food or beverage production -- like barley that has been used first to brew beer.

By-Products: The rest of a cow's diet includes ingredients called by-products. These are the leftovers from food and fiber processing that were once thrown away. Now products like almond hulls, canola meal, citrus pulp, brewers' grains, cotton seed hulls, and even chicken litter are ground and added into feed in very specific amounts. Animal nutritionists work with dairy farmers to create feed plans to provide healthy diets so the energy and nutrients in these products don't go to waste.

NAME _____

Would You Eat That?

DAIRY CATTLE NUTRITION

GRASS/HAY

More than 50 percent of cow feed is actually grass (farmers call it hay and silage). Producers harvest the hay and keep it to feed all year.

GRAIN

Dairy cattle do eat some grain, which usually makes up less than one-quarter of their diet.

BY-PRODUCTS

Food and fiber processing creates a lot of leftovers that are not suitable for humans. Cattle can use them just fine however, like these cottonseed hulls.

TOTAL MIXED RATION

Dairy farmers work with a cattle nutritionist to formulate a complete feed that meets all the nutritional requirements of the cows. It is ground up and mixed together.

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The Cow's Superpower

THE RUMINANT DIGESTION SYSTEM

Cows have a superpower. They can take plants and plant parts that humans can't digest and easily convert them into energy, milk, and meat. All this is thanks to their unique (and more complex) digestive system which is very different from a person's.

Humans have stomachs with one compartment, so we are called **monogastrics**. Cows have stomachs with not one but four compartments that help them digest fibrous plant material (called roughage). Cattle also have a special process and bacteria in their digestive system to help them break down plants and other feed. This process includes fermentation which occurs in the rumen so cattle are classified as **ruminants**.

Cows Eat Twice

Another way cows are unique is that they have fewer teeth than other animals. In the front of the mouth, cows have teeth (known as incisors) only on the bottom jaw. Instead of teeth on the top, there is a hard leathery pad. So a cow must use its tongue to grasp a clump of grass and then bite it off.

To chew, cows then use their molars (the teeth in the back of the mouth) which they do have on the top and bottom jaws. Plant materials contain tough stems so they use their molars shred the grass into small pieces that are more easily digested. However cows chew the grass very little before it is swallowed…for the first time.

When cows eat, they fill up on a lot of grass and then go lie down to more thoroughly chew their food. Cattle are able to voluntarily regurgitate or "un-swallow" their food, chew it again, and finally re-swallow it. This is commonly known as "chewing the cud" and it enables cows to chew grass more completely, which improves digestion. Let's look at the parts of the cow's digestive system and how they work together to help a cow utilize her superpower.

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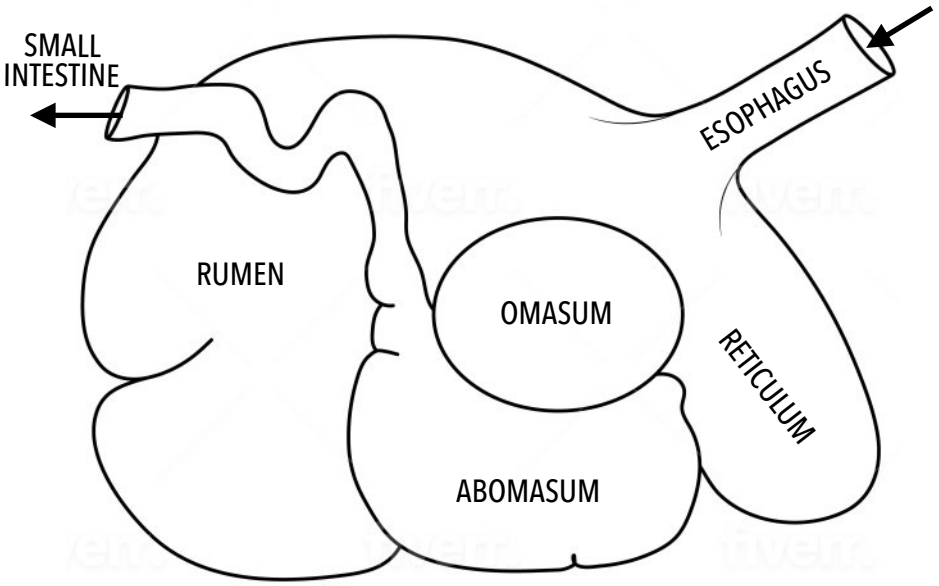
The Cow's Superpower

THE RUMINANT DIGESTION SYSTEM

esophagus: tube-like passage where food travels from the mouth to the rumen and from the rumen back up to the mouth; during chewing saliva is added which contains enzymes that aid digestion and help buffer the pH of the rumen



rumen: acts as a storage or holding vat for feed; the largest part of the cow' digestive system (can hold about 40 gallons!); contains millions of tiny organisms (mainly bacteria) that naturally live in the rumen and help by breaking down plant parts that cannot be digested otherwise through fermentation

reticulum: compartment attached to the rumen with honeycomb-like lining that acts as a spaghetti colander for large food particles and any foreign objects that might be accidentally eaten the animal

omasum: this compartment referred to as "the book" or "many plies" because of its many leaf-like folds of stomach tissue and is the gateway to the abomasum; it breaks down coarse particles within the folds and allows fine particles and fluid to pass to the abomasum

abomasum: known as the "true stomach", the abomasum functions much like the monogastric stomach; the only compartment lined with glands which releases stomach acid and enzymes to start protein digestion that will be absorbed in the small intestine

small intestine: the long, narrow tube that receives digested food from the stomach to start the absorption process; most food nutrients used by the cow are absorbed here

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Roll-a-Ruminant

PARTS OF THE DAIRY DIGESTION SYSTEM

The object of the game is to **be the first to completely color in** your ruminant digestion system.

1. Take turns rolling a single dice.
2. The **number you roll is the part** of the digestion system that you color in on the diagram. Colors are indicated below the name of the part.
3. If it is a number that you have previously rolled, you will <u>not</u> add anything new to your digestion system this turn, and play continues to the next player.
4. The winner is the first person to completely color in their digestion system by **rolling one of each** of the 6 numbers.

esophagus (yellow)

rumen (blue)

abomasum (red)

reticulum (green)

omasum (purple)

small intestine (orange)

THE RUMINANT DIGESTIVE SYSTEM