



# Making a Rumen

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## *Build a Model of a Working Rumen*

**Skill Level**  
Beginner

**Learner Outcomes**

*The learner will be able to:*

- Recognize the function of the rumen
- Apply what was learned from the model to the real functions of the rumen

**Educational Standard(s) Supported**

4.LS2.2

4.ETS2.1

5.PS1.4

**Success Indicator**

*Learners will be successful if they:*

- Participate in the activities
- Think critically about the components of the model and how they apply to a real rumen.

**Time Needed**

15-20 Minutes; can be adjusted as needed

**Materials List**

For each group:

- Empty, approximately 20-oz water/soft drink bottle with cap
- 8 packets or 3 tablespoons of white granulated sugar
- Packet of active dry yeast or dry quick rise yeast
- Warm tap water
- 9-inch latex balloon
- Pencil and animal outlines

### **Introduction to Content**

This lesson focuses on the function and importance of the rumen in ruminant animals. Students will build a model of the rumen to get a hands-on visual and understanding of the ruminant process.

### **Introduction to Methodology**

Students work in groups to build a model of a rumen to understand the components and functions of the rumen. Students will be given the opportunity to process the activity by considering the components of the experiment and how changes to those components would affect the outcome.

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## Terms and Concepts Introduction

**Rumen:** the large fermentation vat that host micro-organisms and is responsible for the breakdown of feed.

**Parts of the ruminant stomach:** Rumen, Reticulum, Abomasum and Omasum

**Fermentation:** the chemical breakdown of a substance by bacteria, protozoa, or other microorganisms

## Tips for Engagement

As students are working in groups, rotate around the room to make sure each student is being given the opportunity to participate in the building of the model.

## Setting the Stage and Opening Questions

Ask students, “**Why do people need a stomach? Why do animals need a stomach?**”

Tell students the following information: “**Certain animals such as cattle, sheep and goats are considered ruminant animals. This means that they have a stomach with four different parts, which includes the Rumen, Reticulum, Abomasum and Omasum.**

**Each part has an important function for the animal. The Rumen is the home of many micro-organisms such as bacteria and protozoa. These ‘bugs’ use fermentation to break down the fiber from plants and turn them into energy for the animal. Without this fermentation, these animals would not get any nutrients from the grass and hay that they eat. This fermentation also produces gasses such as methane and carbon dioxide.”**

## Experience

1. Pass out the animal outlines and ask the students to draw the rumen for the animal. After they have completed this (approximately 5-7 minutes), show them the animal diagrams so they can see how the rumen fits into the digestive system with the other parts.
2. Pass out the supplies to each group of 1-2 students who will be making a rumen.
3. Add yeast and sugar to the bottle.
4. Fill the bottle half full with tap water that is very warm to the touch. Replace cap and shake the bottle to mix the yeast and sugar.
5. Remove the cap and place a balloon over the open top of the bottle and observe what happens. It will take a few minutes for the yeast to start eating the sugar in order to build up enough gas to inflate the balloon. The longer the model is left, more gas will develop and the balloon will inflate more (shown in Picture 1 below).

## Share

Review the parts of the “mock” rumen and what they represent.

- Water bottle = Rumen
- Sugar = Plants that the animals eat
- Yeast = Micro-organisms or “bugs” (shown in Picture 2 below)
- Gas in balloon = Methane and carbon dioxide

## Process

Ask students the following questions:

- Did you know that cows, sheep and goats had “bugs” in their stomach?
- What do you think would happen without these bugs?
- How did the size of the water bottle affect the gas production?
- What do you think would have happened if you doubled the amount of sugar?

## Generalize

Ask students, “Why do ruminant animals need four different parts for their stomach? How is this similar to and different from the human stomach?”

## Apply

Ask students the following questions:

- Have you ever fed a cow, a sheep or a goat? How is their diet different than a pig? How similar is their diet to yours?
- Do you have bugs in your stomach like a cow does? Why?
- Specialized feeding systems have been developed to deliver the exact nutrients that an animal needs depending on their stage of life. Why is this important for animals?
- Some farms use automatic feeders with computers/robots. How could you build a robot to feed your sheep?

### Life Skill(s)

Gather relevant information for decision-making 4<sup>th</sup> – Hands

Communicate information learned from a specific project area to the larger 4-H club 5<sup>th</sup> – Head

As part of a group, identify and agree on a common task (set a goal) 5<sup>th</sup> – Hands

## ***Supplemental Information***

### ***Educational Standards Met***

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**4.LS2.2** Develop models of terrestrial and aquatic food chains to describe the movement of energy among producers, herbivores, carnivores, omnivores, and decomposers.

**4.ETS2.1** Use appropriate tools and measurements to build a model.

**5.PS1.4** Evaluate the results of an experiment to determine whether the mixing of two or more substances result in a change of properties.

This activity was adapted from the 2009 National Youth Science Day Experiment, Biofuel Blast.

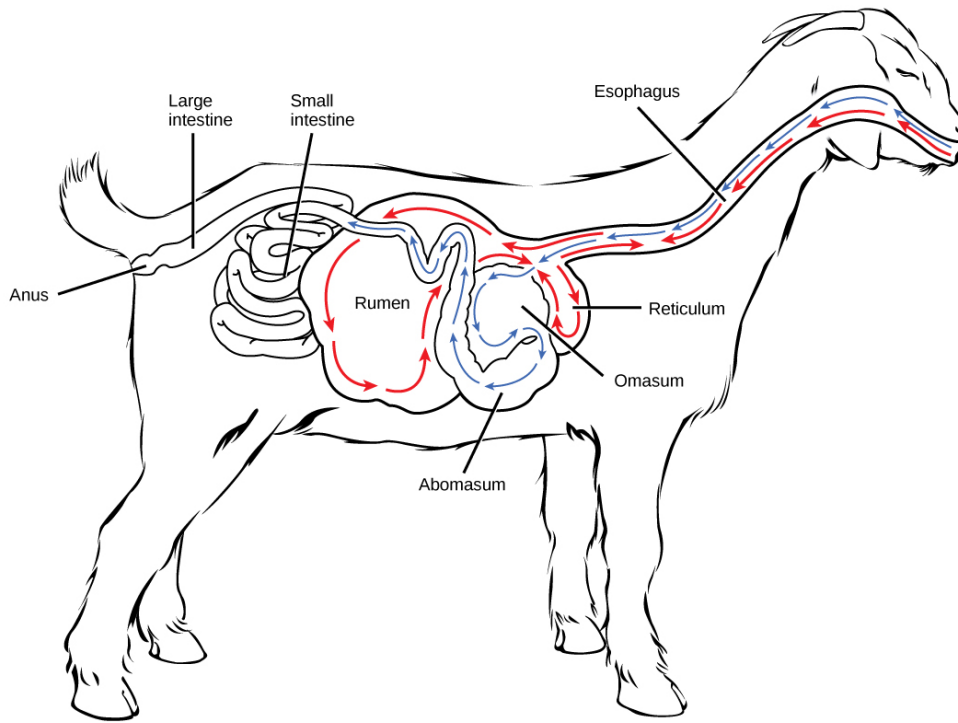


Picture 1: Finished rumen model.

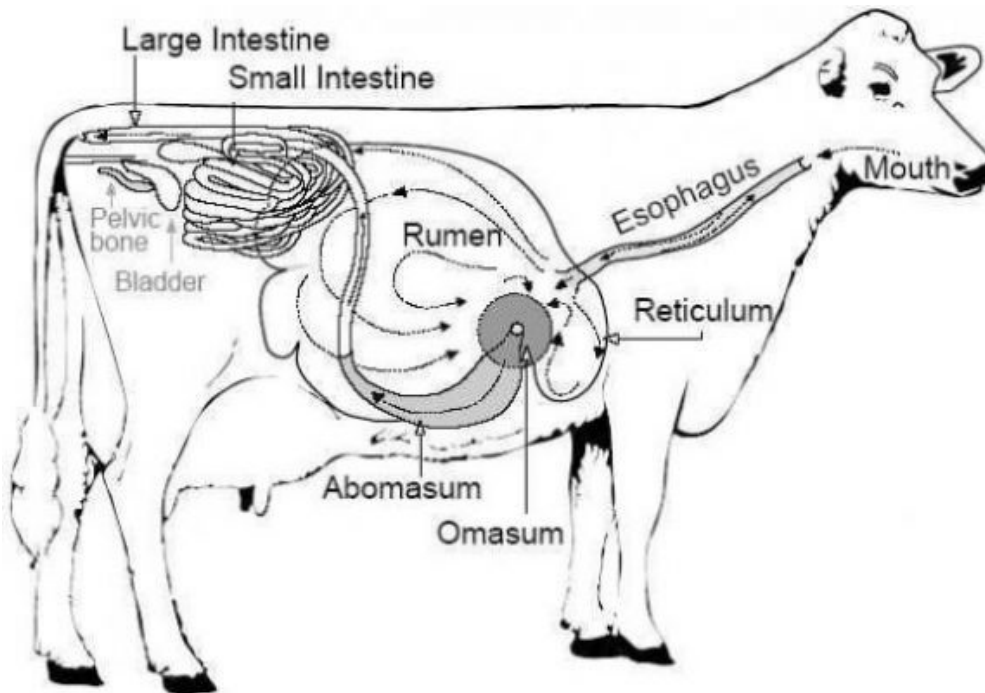


Picture 2: Microscopic view of rumen micro-organisms or "bugs."

**Animal Diagrams**

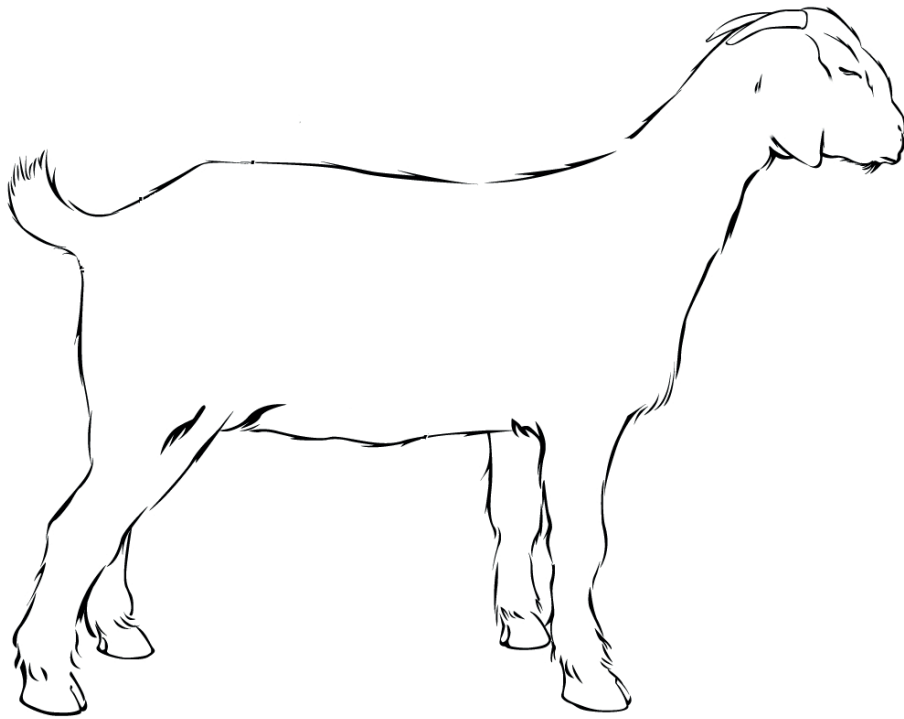


**Goat Diagram**

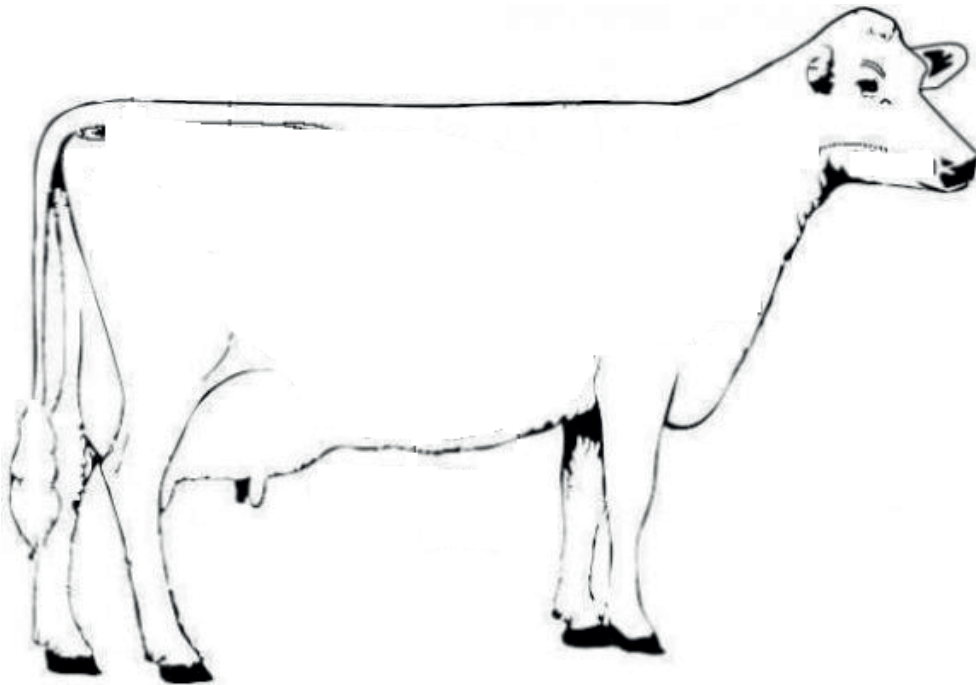


**Cow Diagram**

**Animal Outlines**



**Goat Outline**



**Cow Outline**



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