



Marvelous Milk!



Students will explore the process involved in the production of milk by dairy cows and extend their knowledge of milk and milk products by making butter.

Subject Levels/ Suggested Grade

Physical and Health Education K-7

Science K, 1, 3, 4

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Overview & Curriculum Connections

In this lesson, students will learn about the process of digestion in the cow that converts the nutrients from grass and hay that they eat into milk. Students will also gain a deeper understanding of the nutritional value of milk and investigate various milk products. This lesson plan will provide students with the opportunity to learn about the old-fashioned way of churning butter by making a sample of butter.

Physical and Health Education

Grade	Big Ideas	Curricular Competencies
K-3	<p>Knowing about our bodies and making healthy choices helps us look after ourselves.</p> <p>Adopting healthy personal practices and safety strategies protects ourselves and others.</p>	<ul style="list-style-type: none">• Identify and explore a variety of foods and describe how they contribute to health• Identify opportunities to make choices that contribute to health and well-being
4-5	<p>Understanding ourselves and the various aspects of health helps us develop a balanced lifestyle.</p> <p>Personal choices and social and environmental factors influence our health and well-being.</p>	<ul style="list-style-type: none">• Explain the relationship of healthy eating to overall health and well-being• Identify and describe factors that influence healthy choices• Identify and apply strategies for pursuing healthy-living goals
6-7	<p>Healthy choices influence our physical, emotional and mental well-being.</p>	<ul style="list-style-type: none">• Investigate and analyze influences on eating habits• Identify factors that influence healthy choices and explain their potential health effects• Identify and apply strategies to pursue personal healthy-living goals

Science

Grade	Big Ideas	Curricular Competencies
K-3	<p>Plants and animals have observable features.</p> <p>Living things have features and behaviours that help them survive in their environment.</p> <p>Living things are diverse, can be grouped and interact in their ecosystems.</p>	<ul style="list-style-type: none">Demonstrate curiosity and a sense of wonder about the world
4	<p>All living things sense and respond to their environment.</p>	<ul style="list-style-type: none">Demonstrate a sustained curiosity about a scientific topic or problem of personal interest

Teacher Background

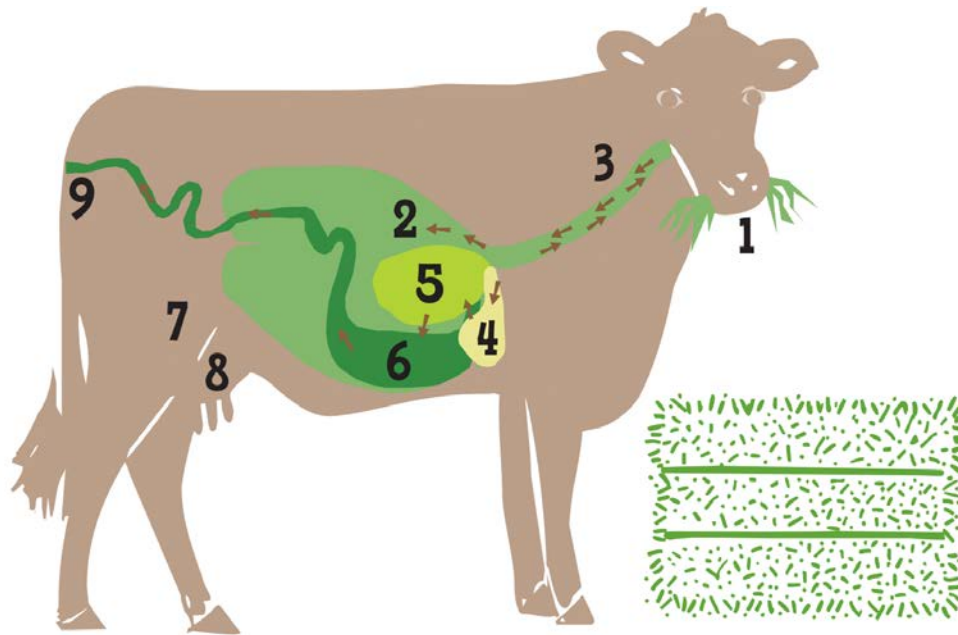
Where Does Milk Come From?

The milk we drink comes from dairy cows who produce milk to feed their young. Cows spend a majority of their day lying down, chewing cud & resting. **CUD** is partially digested food that the cow has already chewed once that is returned from the stomach to the mouth to be chewed again. Female cows turn the grass and hay that they have eaten into milk by chewing cud and allowing the food to move through their four different stomach chambers. Cows are called **RUMINANTS** because they have specialized stomachs to help digest tough grasses and hay. Each stomach chamber has its own job to do to help soften the cud. In between each chamber, the cow 'burps out the cud' to be chewed again.

Steps through the Cow's Digestive System

1. Cows eat grass and hay which moves down their throats and into their stomach.
2. The tough food is mixed with water in the first stomach chamber to soften it.
3. The cow "burps" out its food then re-swallows it.
4. In the second chamber, the food is squished to soften the cud.
5. The cud is "burped out, chewed again, then enters the third chamber.
6. The third chamber squeezes the water out then the re-swallowed cud and pushes it to the fourth chamber.
7. Nutrients from the fourth chamber of the stomach move into the cow's bloodstream.

8. The nutrients turn into milk which is released from the cow's udder. It can take up to two days for a cow's food to become milk.
9. The cow's waste is eliminated.



Dairy cows make a lot of milk: one dairy cow can make enough milk to fill more than 100 average glasses every day.

What is a Ruminant Animal?

Many different species of ruminant animals are found around the world. Ruminants include cattle, sheep, goats, buffalo, deer, elk, giraffes and camels. These animals all have a digestive system that is uniquely different from our own. Instead of one compartment to the stomach they have four. Of the four compartments the rumen is the largest section and the main digestive centre. The rumen is filled with billions of tiny microorganisms that are able to break down grass and other coarse vegetation that animals with one stomach (including humans, chickens and pigs) cannot digest.

Ruminant animals do not completely chew the grass or vegetation they eat. The partially chewed grass goes into the large rumen where it is stored and broken down into balls of "cud". When the animal has eaten its fill it will rest and "chew its cud". The cud is then swallowed once again where it will pass into the next three compartments—the reticulum, the omasum and the true stomach, the abomasum.

Dairy calves have a four-part stomach when they are born. However, they function primarily as a monogastric (simple-stomached) animal during the first part of their lives. At birth the first three compartments of a calf's stomach—rumen, reticulum, and omasum—are inactive and undeveloped. As the calf grows and begins to eat a variety of feeds, its stomach compartments also begin to grow and change.

Many of the plants that grow on earth cannot be used directly by humans as food. Over 50 percent of the energy in cereal crops that are grown for food is inedible to humans. Ruminants have the ability to convert these plants and residues into high quality protein in the form of meat and milk. In addition, they feed on the rejects and cutting from fruit and vegetable farming and the by-products from food processing plants.

What Foods Contain Milk?

Milk is a good source of many essential nutrients, including calcium, potassium and vitamin D. According to Canada's food guide (2019) milk, yogurt and cheese are recommended as healthy protein foods that are rich in calcium and other essential nutrients. Butter is another dairy food product. It is made by churning milk or cream to separate the fat globules from the buttermilk or heavy cream. Butter is a great source of fat-soluble vitamins like Vitamin A, D, E and K. These fats are essential for the assimilation of nutrients, especially water-soluble vitamins. Without fat, your body is unable to obtain many of the nutrients needed by the body. Butter is also a good source of healthy cholesterol and contains traces of vital minerals such as manganese, zinc, copper, selenium, Lauric acid and chromium.

Materials

- Student Handout: "Moving Milk From Cow to You"
- Small glass or plastic containers with lids (125 ml mason jars work well)
- Heavy cream or whipping cream (33% or higher MF)
- Salt

Procedure

Part 1

1. Provide students with the handout, "Moving Milk From Cow to You" and ask them to locate the image of the cow's digestive system.
2. Discuss with students how the digestive system of a cow differs from the digestive system of a human. Depending on the age level of students, introduce key vocabulary including the words RUMINANT and CUD.
3. Ask students to complete "Moving Milk From Cow to You" worksheet.

Part 2

1. Ask students to discuss with a partner what their favourite foods are containing milk.
2. Let students know that they will be creating their own milk products. Provide each student with a small plastic or glass jar or container with a lid that has been half filled with whipping cream or heavy cream.
3. Instruct students to ensure their lids are tightened and then ask them shake the containers well for several minutes.
4. After 5-7 minutes, students should notice the sloshing in their containers stop or at least slow down.
5. Have students open the jar to see if they have a semi-solid component. Tell students that this is called whipped cream and it is often eaten on desserts. Have them re-tighten the lid and shake their containers again.
6. After a few minutes, students should notice the butter and buttermilk separating. There will be a solid part (butter), and the liquid (buttermilk).
7. Have the students strain off the buttermilk (it can be saved for cooking), and then rise the butter in COLD water. It can be kneaded gently to remove all the buttermilk.
8. Add a pinch of salt, and then stir.
9. Remind students to store their butter in the fridge.

Extensions

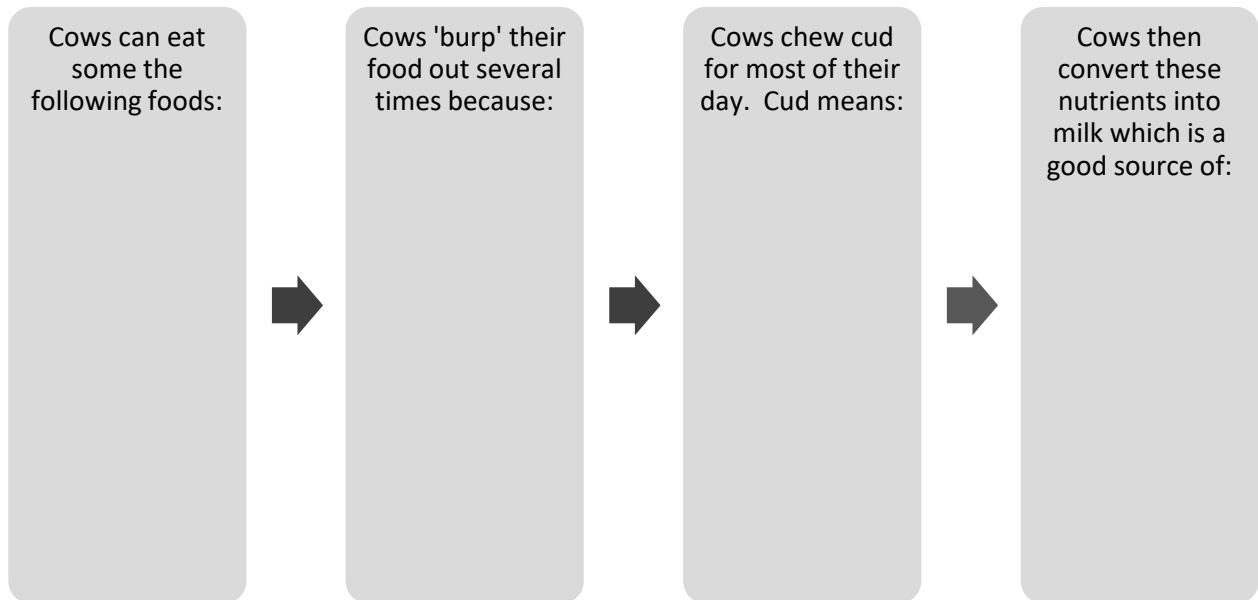
- Visit a local dairy farm with your class. To find a list of farms that offer tours, check out: <https://www.bcaitc.ca/index.php/farm-tours-field-trips>
- Try activities from Fresh Stories- Milk [Intermediate](#) or [Primary](#)
- Have participants compare the differences in diets between two animal species. Ask participants to explain why the two species might have similar or different diets.
- Have students try a milk recipe of their own choosing and share their creations with the class.
- Encourage students to try other milk recipes from <https://bcdairy.ca/milk/recipes>

Resources

- www.bcdairy.ca
- <https://proearthanimalhealth.com/how-does-the-digestive-system-work-in-a-cow-understanding-the-ruminant-digestive-system/>
- <https://www.progressivecattle.com/topics/feed-nutrition/a-cows-digestive-system-and-processes>
- <https://en.wikipedia.org/wiki/Butter>
- <https://nutritiondata.self.com/facts/dairy-and-egg-products/133/2>
- <https://www.webmd.com/diet/health-benefits-butter>
- [https://www.healthline.com/nutrition/foods/butter#:~:text=As%20it's%20mainly%20composed%20of,to%201%20medium%20sized%20banana.&text=Butter%20contains%20significant%20amounts%20of,1%20tablespoon%20\(14%20grams\).](https://www.healthline.com/nutrition/foods/butter#:~:text=As%20it's%20mainly%20composed%20of,to%201%20medium%20sized%20banana.&text=Butter%20contains%20significant%20amounts%20of,1%20tablespoon%20(14%20grams).)
- <https://thekidsmenunutritionandfitness.weebly.com/blog/the-fat-fact-butter-vs-margarine>

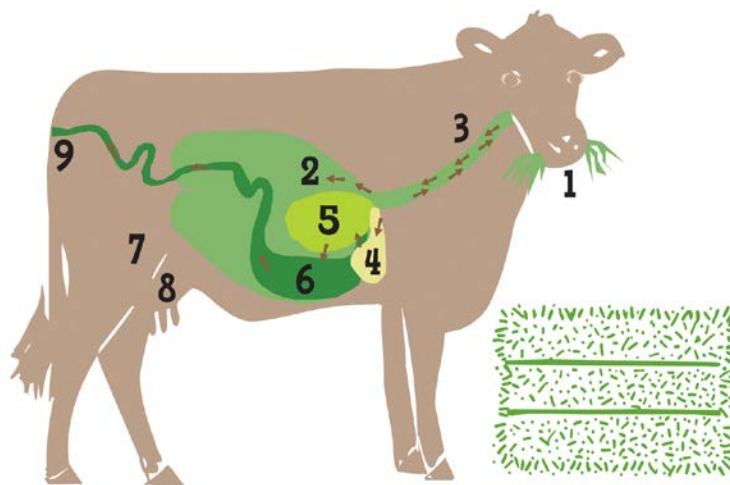
Moving Milk From Cow to You (Primary)

#1 - The milk we drink comes from dairy cows who produce milk to feed their young. Fill in the boxes below to complete the steps that happen in order for cows to produce milk.



#2 - **Label** the picture of dairy cow below using the following terms:

- Mouth: _____
- Udder: _____
- 4-chamber stomach: _____

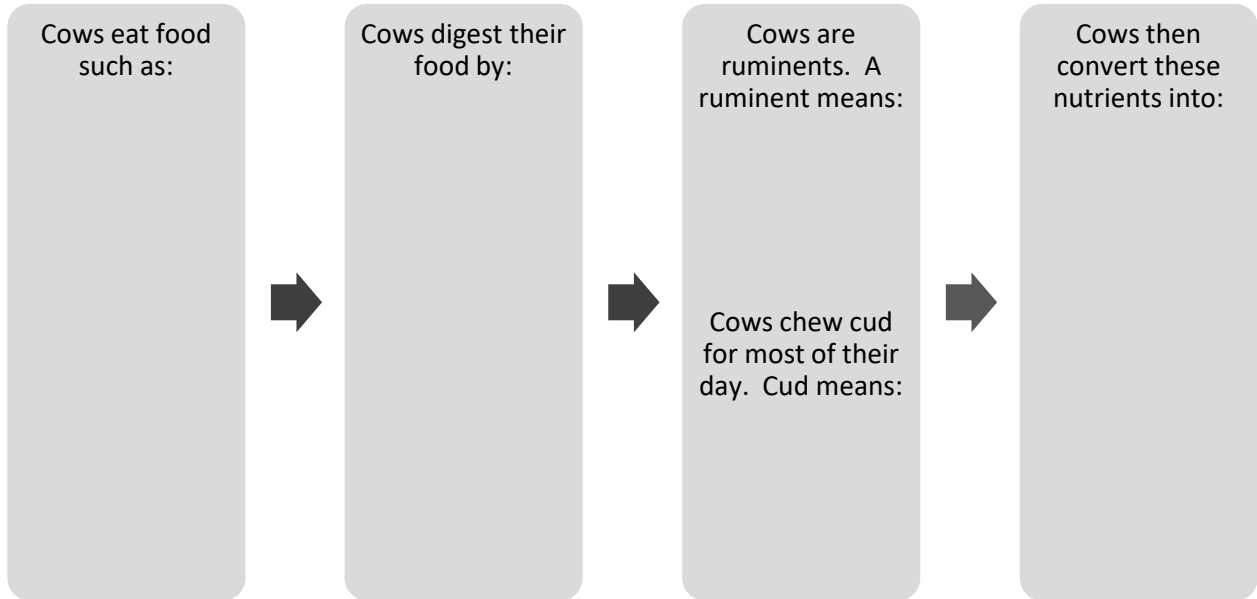


#3- **Draw** a picture of your favourite food item made from milk. Then make a list or draw some other dairy products that you know or use.

<p>My favourite food containing milk is:</p>	<p>Other dairy products include:</p>
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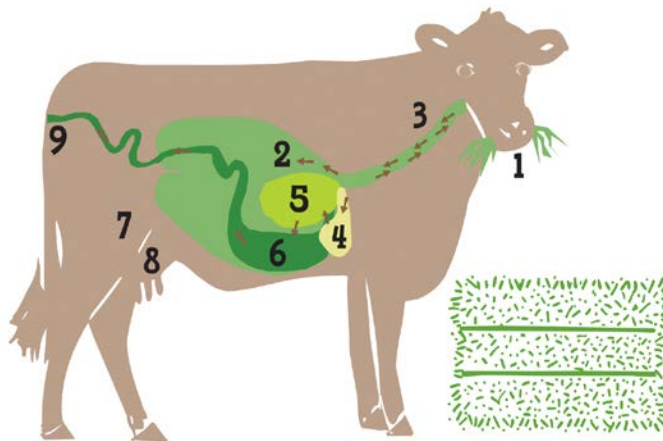
Moving Milk From Cow to You (Intermediate)

#1 - The milk we drink comes from dairy cows who produce milk to feed their young. Fill in the boxes below to complete the steps that happen in order for cows to produce milk.



#2 - **Label** the picture of a dairy cow and trace the process which food moves through its body. Be sure to include the following terms:

- Mouth: _____
- Esophagus: _____
- Udder: _____
- 4 chamber Stomach: _____



#3 - **Draw and label** a picture of your favourite food item made from milk and label it. Then make a list of other dairy products that you know or use.

My favourite food containing milk is:	Other dairy products:
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#4 - Number the following steps from 1-9 in the order that they occur in the cow's digestive system:

- ____. In the second chamber, the food is squished to soften the cud.
- ____. The cud is "burped out, chewed again, then enters the third chamber.
- ____. The cow's waste is eliminated.
- ____. The tough food is mixed with water in the first stomach chamber to soften it.
- ____. The third chamber squeezes the water out of the re-swallowed cud and pushes it to the fourth chamber.
- ____. Cows eat grass and hay which moves down their throats and into their stomach.
- ____. Nutrients from the fourth chamber of the stomach move into the cow's bloodstream.
- ____. The cow "burps" out its food from the first chamber then re-swallows it.
- ____. The nutrients turn into milk which is released from the cow's udder. It can take up to two days for a cow's food to become milk.

