MASSACHUSETTS AGRICULTURE IN THE CLASSROOM

WHO MADE MY MILK?

Dairy cows change grass and grain into milk, producing 90 percent of the world's milk. In the United States dairy goats are also raised for milk, although they supply only a small percentage of the milk we drink. In addition to cows and goats, water buffalo, camels, sheep, horses and reindeer are also milked in other parts of the world.

Meet the Dairy Cow

All dairy cows are **female.** In order to produce milk, the cow must have been pregnant and have given birth to a **calf.** The birth of a calf begins the milking cycle, since the mother cow produces milk to feed her calf. Improvements in breeding, feeding and care of dairy cows have provided extra milk, which is used for human consumption. The cow gives milk for ten months of the year, then rests for two months before giving birth again.

The average Holstein calf weighs from 90 to 100 pounds at birth. The newborn calf is fed **colostrum** milk from its own mother for the first three days of life. Colostrum is special because it gives the calf extra nutrients and antibodies from the mother to help the calf get off to a healthy start. Calves are usually fed milk or milk replacer starting at 3 days of age. They are also fed a calf starter grain, beginning at 7 to 10 days of age. They are 4 to 8 weeks old when they are weaned from milk.

By the time the **heifer** (young female cow that has not yet had a calf) has reached a year, she may weigh as much as 700 pounds. She still has much growing to do before she enters the milking herd in a year. The yearling heifer will be bred so that her second birthday, she will give birth to her first calf. There is a nine month gestation between the time the cow is bred and the young calf is born. She is bred between 60 and 100 days after her calf is born. The first calf-heifer may weight 1,200 pounds and still has more growing to do before reaching her full size of 1,500 pounds when she is five years old. A mature cow produces about 25 percent more milk than a first calf heifer.

The dairy cow is a **ruminant**, an animal with four compartments to her stomach. The dairy cow spends up to eight hours a day eating. The cow eats grass, hay, silage and grains. Silage is fermented corn, wheat or hay with stalk and leaves. On average, a cow will eat 50 pounds of silage as well as 40 pounds of feed and hay each day. Dairy cows are particularly dependent on water, since milk is 87 percent water. A cow can drink a bathtub-full (25 to 50 gallons) of water in a day.

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Dairy Breeds

In the United States, common breeds of milking cows include **Holstein (both Black and White and Red and White), Jersey, Guernsey, Brown Swiss, Ayrshire** and **Milking Shorthorn.** Each breed varies in appearance size and the amount and richness of milk produced.

Holstein

Holsteins are the most popular breed of dairy cow in the United States because of their outstanding milk production and adaptability to a wide variety of environments. The Holstein cow originated in Central Europe and the development of the breed is associated with the Netherlands, where they were bred to become high-producing dairy cows. The first Holstein in the United States was brought to Massachusetts in 1852, where the breed was further improved. Of the more than nine million dairy cows in the United States today, approximately 90% are of Holstein descent. They are found coast to coast.

Holstein cows are the easily recognizable black and white cows found in pastures and dairy barns around the state. Some Holstein may also be red and white, due to a recessive gene. These large cows reach 1,500 pound in weight and stand 58 inches tall at the shoulder, making them the largest of the U.S. Dairy breeds. Holstein cows give more milk than any other dairy breed in the United States.

The average Holstein cow produces around 23,000 pounds of milk (2,674 gallons) of milk each year. With a standard lactation lasting ten months (305 days), that comes out to seventy five pounds, or almost nine gallons of milk per cow per day.

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Jersey

The Jersey is the smallest breed of dairy cows in the United States, weighing an average of 900-1,000 pounds. This breed originated on the Island of Jersey, a small British Island in the English Channel off the coast of France. It is a very old breed that has been reported for more than 600 years. The Jersey cow arrived in the United States in the 1850s.

While once fawn in color, due to modern breeding, Jersey cows may now be of a wide range in color, from a very light gray or mouse color to a very dark fawn or even a shade that is almost black. They are usually darker at the hips, head and shoulders than on the body.

The Jersey cow is regarded favorably because of the production of rich milk, with high protein and butterfat content. The Jersey cow produces more pounds of milk per pound of body weight than any other breed, far in excess of 13 times her body weight.

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Guernsey

The Guernsey cow originated on The Isle of Guernsey, a tiny island in the English Channel off the coast of France, around 960 A.D. The first Guernsey was brought to the United States around 1840 to New York. The Guernsey dairy cow of today has been improved through breeding.

The coat of the Guernsey cow varies in color from golden fawn to reddish-brown with white patches on the face and body.

The Guernsey is an excellent grazer, well adapted to pasture-based milk production. The Guernsey cow is known for producing high-butterfat, high-protein milk with a high concentration of betacarotene. Due to their intermediate size they can produce their high quality milk while consuming 20 to 30 % less feed per pound of milk. This makes them an economically desirable breed.

Guernseys also have a gentle disposition. They are adapted to warmer climates and lack any undesirable genetic recessive genes.

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Brown Swiss

Brown Swiss cattle originated in the valleys and mountain slopes of Switzerland as long ago as 4,000 B.C. They were originally raised for cheese production. The herds would graze on the pastures in the mountainous areas during the summer months and return to the lowlands for the cold snowy winters. The breed only became associated with milk production about 100 years ago with the improved availability to feed the cattle with grains and other feed.

The first Brown Swiss brought to the United States came to Belmont, Massachusetts in 1869. Today they are found around the world, where the population is approximately 7 million, making it one of the most popular dairy breeds world-wide.

Brown Swiss cattle can be grey, dark brown, tan or even almost white in color. Their hooves, muzzle and switch are usually black. They are often noted for their big floppy ears, docile temperament and quiet nature. They are very large with good resistance to extremes of both hot and cold. They are also long lived. On average, Brown Swiss cows weigh about 1,300 to 1,400 pounds.

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Ayrshire

The Ayrshire breed originated in the County of Ayr in Scotland, prior to 1800. Its characteristics gradually became well enough established to consider it a distinct breed, and in 1786, the first Ayrshire show was sponsored by the Highland Agricultural Society. The Ayrshire was well suited for the land and climate.

The first importations of Ayrshires to the United States was believed to have been to Windsor, Connecticut, around 1822. Farmers in New England needed a dairy cow that would graze the pastures of their rough, rocky farms and tolerate the cold, inhospitable winters. In many ways, the environment in New England was very similar to the Ayrshire's native Scotland. Ayrshire herds are now located in every part of the United States, including the Deep South.

The coat of the Ayrshire is reddish-brown mahogany and white in color. The reddish brown varies in shade from very light to very dark. The color markings vary from nearly all red to nearly all white. The spots are usually very jagged at the edges and often small and scattered over the entire body of the cow. Usually, the spots are distinct, with a break between the red and the white.

Ayrshires are medium-sized cattle, weighing over 1200 pounds at maturity. They are strong, rugged cattle that adapt to all management systems and are especially efficient grazers. These traits make Ayrshires outstanding commercial dairy cattle. They are also efficient milk producers. The composition of the milk is moderate in butterfat breed and relatively high protein breed. The actual average of all Ayrshires on official ABA programs in 2002 is 17,230 pounds of milk with 665 pounds of fat and 542 pounds of protein. Top producing Ayrshires regularly exceed 20,000 pounds of milk in their annual lactations.

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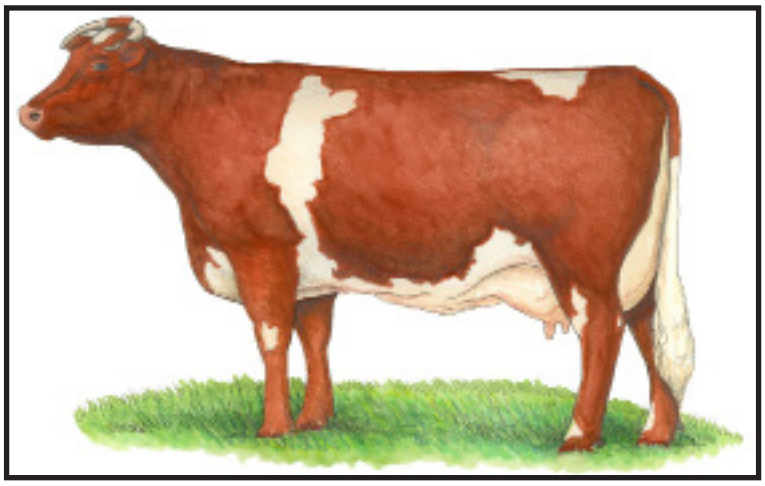
Milking Shorthorn



One of the oldest recognized breeds in the world, Shorthorn cattle originated in Northeastern England in the Valley of the Tees River. Much of the early improvement work took place in the counties of Northumberland, Durham and York. The first importation of Shorthorns to the United States was in 1783 to Virginia.

The hardiness of this breed along with the wide range of adaptation and efficiency of production providing milk, meat, transportation, and power, made them favorites for early pioneer families.

The Shorthorn coat can be red, red and white, white or roan. Roan is a very close mixture of red and white, and found in no other breed of cattle.

The Milking Shorthorn breed is the most versatile of all breeds and this is one of its greatest attributes. These docile cows efficiently produce large volumes of nutritious milk each lactation and are large enough to have a high salvage value when their long productive lives finally come to an end. In addition, they are easy to manage, and excellent grazers. Their healthy calves born each year on regular calving intervals are spunky at birth and grow rapidly. They can be kept for breeding stock and herd replacement or for meat.

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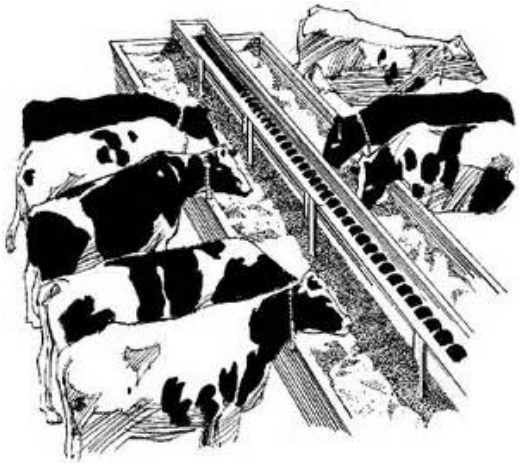
WHO MADE MY MILK LESSON



Grade Level: Grades 1 - 4

Lesson/Activity Description
In this lesson, students will learn about dairy cows. They will learn about the different types, the stomach of a cow, and the products that are produced from elements of the cow.

Guiding Question
What do we know and what can we learn about cows? Why can ruminant animals eat only green leafy plant materials and live healthy lives as opposed to humans that cannot?

Big Idea
There are many different breeds of dairy cows, each with different characteristics. Having 4 chambers in the stomach allows for a different digestive system from humans. This allows the cow to survive on only plant matter. Cows help to produce many different products.

Learning Objectives
- To understand the importance of the cows stomach to milk production, the different breeds of dairy cow, and the products that come from cows.

Materials
- White paper
- Construction paper
- Markers/colored pencils

Preparation
Review Background material above

Introducing the Lesson
Show the students the pictures of the different breeds of dairy cows. Explain that you will be learning more about dairy cows and how milk is produced.

Activate prior knowledge
Ask students what they know about cows. Have them draw a picture of a cow and share what they know about cows.

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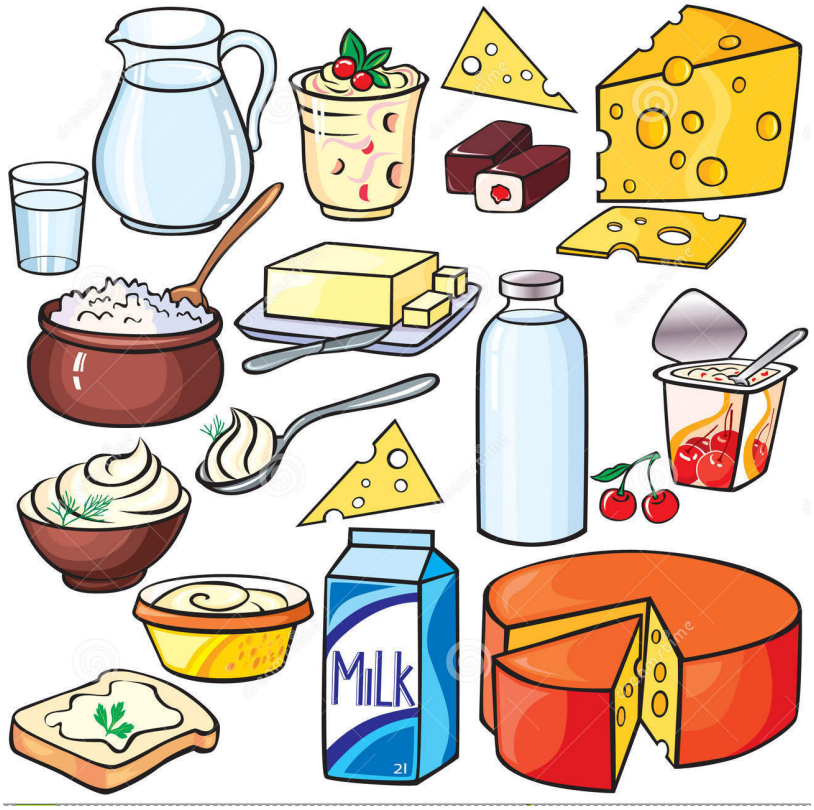
Engage Student Interest:
Now discuss common products that come from a cow. There are many common products that come from a cow. Ask students to look through their kitchen and home and read the ingredient lists on products found there. Then make a list of all the things that come from a cow. Show the students the pictures of the examples of the products from a cow.



Dairy foods: dairy cows are raised mainly for their milk. Dairy products include milk (including low-fat and flavored milks), cream, cheese, butter yogurt and ice cream. Milk and milk solids may be found in other foods.

Meat: Beef cows are raised for meat, but dairy cows eventually end up as meat too. Meat from cows includes, steak, hamburger, hot dogs, sausage, roasts and even beef jerky. Beef or beef broth appear in other products.

Leather: Cow's hides, or their skins, are treated to become leather.

Manure: Farmers spread manure on the fields to improve the soil.

Procedure
Total time approximately. 1 hour

1. Watch the following video from the Massachusetts Dairy Promotion Board. (http://www.youtube.com/watch?v=_GQlERrgbhQ#t=266).

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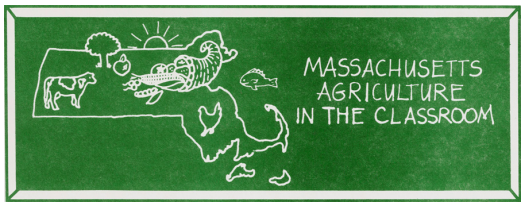

2. Write a poem to describe a cow and products from a cow. Ask students to come up with a list of words to describe a cow. Write the words on the board. Add any additional words that express a color, shape, texture, scent, sound, feeling or action. Work with the students to write a poem from these words. Give the poem a one word title. This will be the first line of the poem. Continue filling in the outline below (15 minutes)

Line 1 _____
One word to give title

Line 2 _____
Two words to describe the title

Line 3 _____
Three action words about the title

Line 4 _____
Four words that express the feeling about the title

Line 5 _____
One word that renames the title

3. Have students share their poems about cows and put them together with the picture of the cow.

4. Discuss the following information about the stomach of a cow

A Four Chambered Stomach

Cows are **ruminant** animals. They have a **four-chambered stomach** that allows them to change grass, hay and grains into milk. As the cow eats, the food passes from the mouth through the esophagus into the rumen - the first chamber of the stomach. Ruminants do not have any upper front teeth. They eat by wrapping their tongues around their food and pulling it into their mouths.

The **rumen** is a very large organ that can hold up to 25 gallons of food. In the rumen, food is partially digested by colonies of microscopic organisms that break up the plant fibers, while the stomach muscles churn and blend the food. Partially digested and fermented food is then passed along to the second chamber or reticulum.

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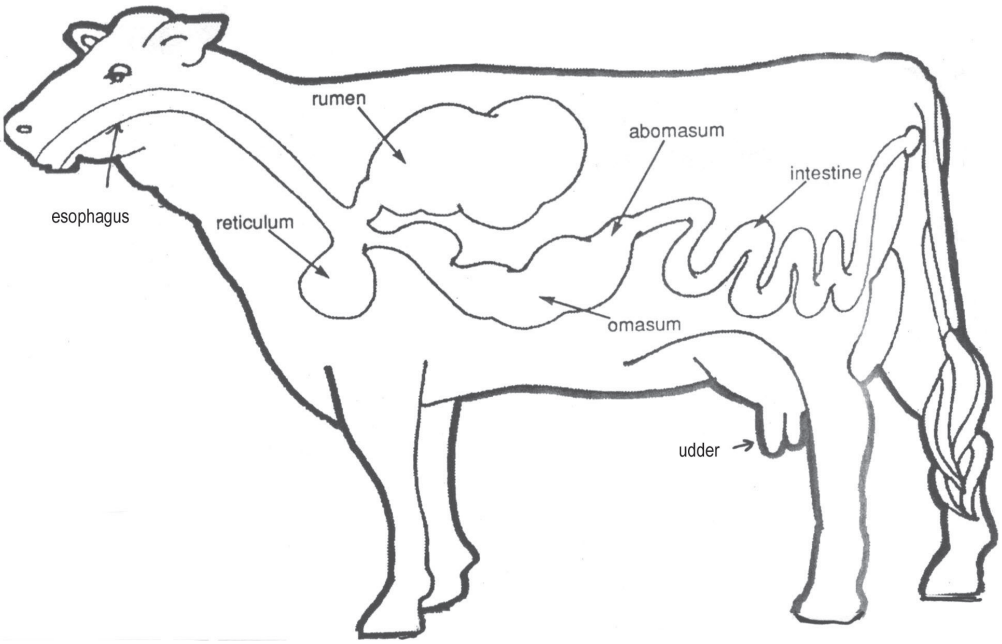

The **reticulum** is a membrane with "honeycombed" ridges that break the food into smaller pieces. The smallest pieces pass on to the third chamber or omasum, while large clumps (cud) are regurgitated back to the mouth to be rechewed. The cow uses the big upper and lower teeth at the back of her jaw to grind the partially digested food, mixing it with saliva, which acts to buffer the stomach acid. Cows can spend up to eight hours a day chewing their cud or "ruminating."

The **omasum** has a narrow opening that allows only small particles of food to enter. This food is further mixed and softened. Water is absorbed from the food through the stomach walls and passes into the blood stream. The rest of the food passes on to the fourth chamber - the abomasum.

In the **abomasum** digestion is completed. Enzymes and acids break down the food, so that nutrients can be absorbed through the stomach walls and passed on to the blood stream. Once the food is completely digested, it moves to the small intestines.

In the **small intestines**, amino acids, fats, minerals and water are absorbed through the intestine walls into the blood stream. The walls expand and contract to move the leftovers along to the large intestines. The undigested and unuseable food that remains becomes manure, which fertilizes the grass and corn fields, completing the cycle.

Meanwhile, all of the nutrients that have been collected from the digested foods are transported throughout the body by the bloodstream. In a mother cow, nutrients are delivered to the udder where they are used to form milk for the new calf. It takes 50-70 hours for a cow to turn green grass into white milk. The milk is stored in the udder until it is needed.

(Adapted from Utah Agriculture in the Classroom and Project Seasons)

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5. Explain how cows can thrive on corn, grass, and hay because of the extra chambers of their stomachs that allow them to digest carbohydrates. The cows stomach is like a organic material recycler.

6. After discussing the material on the cows stomach, asks students name other animals that are feed nearly entirely by grazing? (Such as horses, zebra, giraffe, deer, goats, sheep, etc). Do all of these animals produce milk? Who milks them?

7. Then discuss the diet of a cow. What specifically do cows eat? (Cows like to eat coarse, fibrous foods. They eat a lot of grass and hay. They also like to eat feeds that have ingredients such as soybean meal, cottonseed hulls, citrus pulp, and cracked corn. Cows even eat baked goods and candy every once in awhile.)

8. Are there things your list that people like to eat? Can people survive just on grass or hay? Why not? Explain that this is what makes the cow's stomachs special, it breaks down food that human stomachs cannot break down.

9. Now break the students up into groups. Task each group with coming up with a menu for a restaurant that caters only to cows. Include appetizers, main courses, and desserts.

10. Have the students make a menu for their restaurant, using the poem they wrote and the pictures they drew as the front cover.

Wrap up
Have the students share their menus. What parts of their menu would people actually like to eat?

Assessing Student Knowledge
For homework, have the students explore their own food choices. Would a cow like to eat their meals? Would they be able to digest them well?

Extensions
Have the students explore the different breeds of dairy cow and the difference between the breeds in milk production.

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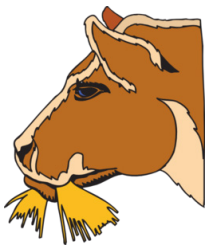
*** Some of the Massachusetts Department of Education Standards in this lesson ***



Speaking and Listening:
1. Participate in collaborative conversations with diverse partners about appropriate topics and texts with peers and adults in small and larger groups.

Life Sciences
Grades 1-2:
1. Recognize that animals (including humans) and plants are living things that grow, reproduce, and need food, air, and water.

Writing Standard
7. Participate in shared research writing projects

Language Standard
5. Vocabulary acquisition and use: demonstrate understanding of word relationships

Resources

Massachusetts Dairy Promotion Board
http://massdairy.com

The American Jersey Cattle Association
http://www.usjersey.com/

American Guernsey Association
http://www.usguernsey.com/

American Milking Shorthorn Society
http://www.milkingshorthorn.com/

Brown Swiss Cattle Breeders Association of US
http://www.brownswissusa.com

Holstein Association
http://www.holsteinusa.com/

Brown Swiss Cattle Breeders Association of US
http://www.brownswissusa.com

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US Ayrshire Breeders Association
http://www.usayrshire.com

Oklahoma State: Cattle Breeds:
http://www.ansi.okstate.edu/breeds/cattle

Oklahoma Agriculture in the Classroom
http://www.clover.okstate.edu/fourh/aitc/

Project Seasons
Deborah Parrella, Shelburne Farms, VT, 1995.

MooMilk: Adventure into the Dairy Industry
www.moomilk.com

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Dairy Cow Cards

Holstein Dairy Cow

Guernsey Dairy Cow

Jersey Dairy Cow

Brown Swiss Dairy Cow

Milking Shorthorn Dairy Cow

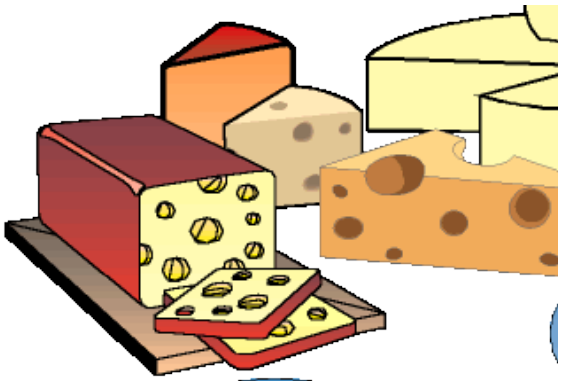
Ayrshire Dairy Cow

It Comes From A Cow

Milk

Flavored Milk

Yogurt



Cheese

Ice Cream

Cottage Cheese

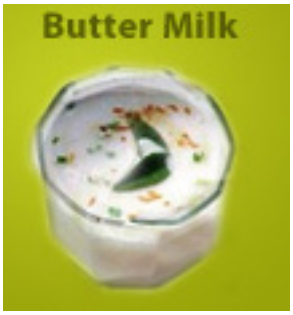
Butter

Powdered Milk

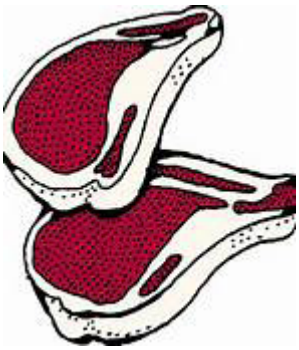
Canned Milk

Sour Cream

Cream



Buttermilk



Beef

Veal

Leather

Cow Manure