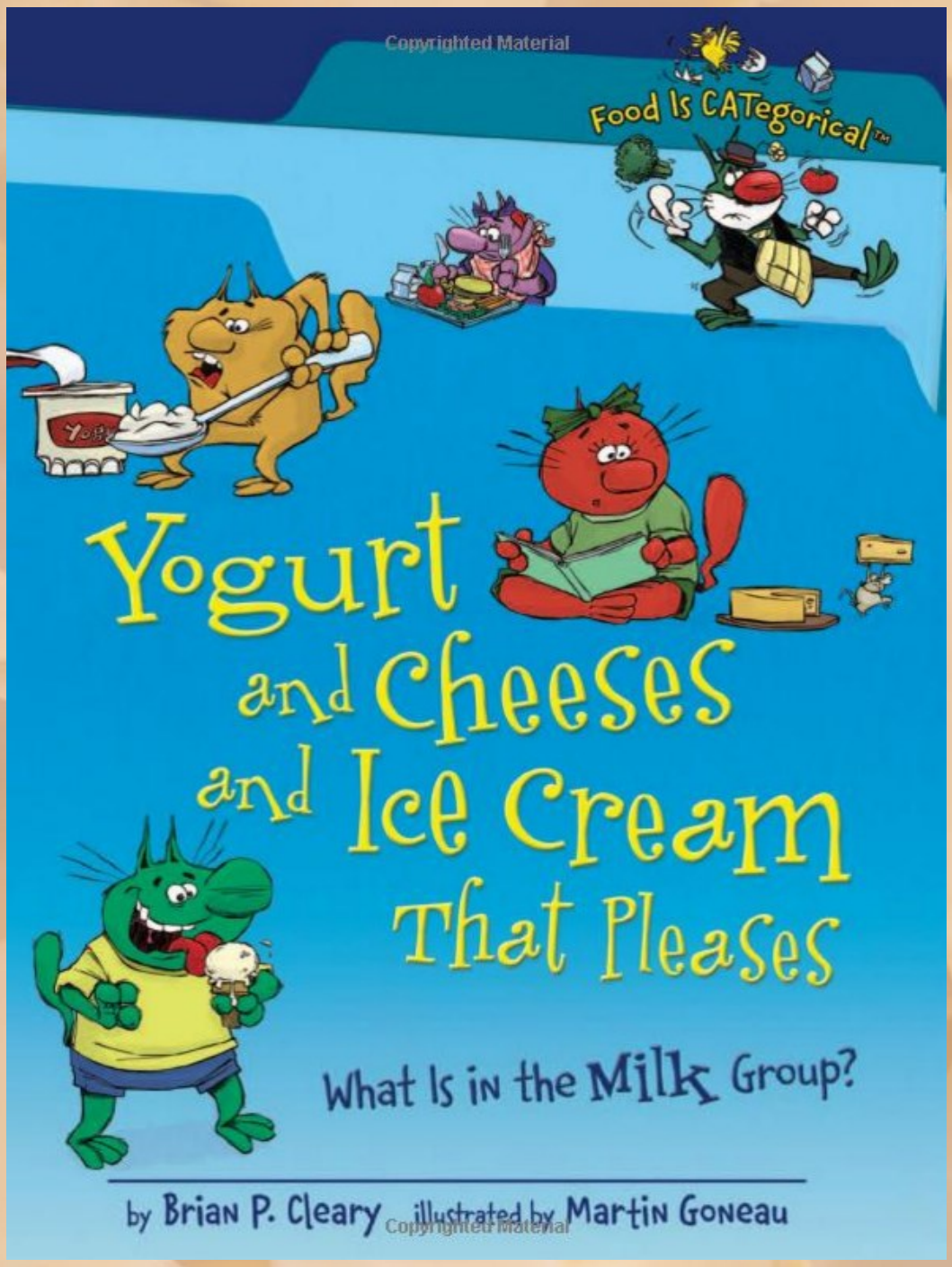
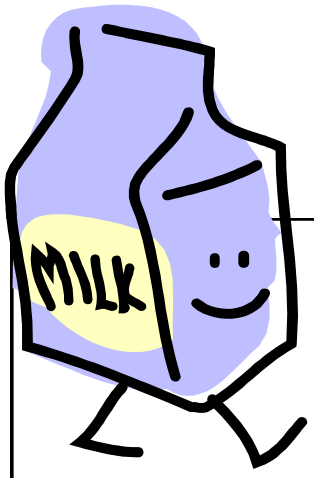
An Illinois Ag in the Classroom companion guide to

Yogurt and Cheeses and Ice Cream that Pleases

By Brian P. Cleary and illustrated by Martin Goneau





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Dairy Websites

Midwest Dairy
www.midwestdairy.com
Prairie Farms Dairy
www.prairiefarms.com
Moo Milk
www.moomilk.com

Dairy Fun Facts

The average cow produces enough milk each day to fill six one-gallon jugs, about 55 pounds of milk.

It takes more than 21 pounds of whole milk to make one pound of butter.

The fastest growing variety of cheese produced in the U.S. is Hispanic-style soft cheese.

All 50 states in the United States have dairy farms.

The natural yellow color of butter comes mainly from the beta -carotene found in the grass cows eat.

A typical dairy cow weighs 1,400 pounds and consumes about 50 pounds of dry matter each day.

Most dairy cows are milked two to three times per day. On average, a cow will produce up to 10 gallons of milk each day.

Cheddar cheese is the most popular natural cheese in the U.S.

It takes 12 pounds of whole milk to make one gallon of ice cream.

The average cow drinks 30-50 gallons of water each day – about a bathtub's worth.

Large ice cream producing states include California, Indiana, Texas, Pennsylvania, Illinois, and Minnesota.

Cows have an acute sense of smell, and can smell something up to six miles away.

Nearly 75% of the milk produced in Illinois is marketed through five farmer-owned dairy cooperatives: Dairy Farmers of America; Mid-West Dairymen's Company; Prairie Farms Dairy, Inc.; Swiss Valley Farms Co.; Foremost Farms USA.

In Illinois, the average dairy herd size is 93 cows.

Illinois ranks 20th in milk production in the United States.

USDA statistics show U.S. dairy farmers are producing almost three times more milk with about half the number of cows compared to 1960, thereby reducing the total amount of feed, water and space needed, and resulting in less manure.

Ice Cream in a Bag

Ice cream freezes at -6 degrees C (21 degrees F). Ice cream can be made in the classroom with the understanding that the freezing point of water is actually lowered by adding salt to the ice between the bag walls. Heat energy is transferred easily from the milk through the plastic bag to the salty ice water causing the ice to melt. As it does so, the water in the milk freezes, resulting in ice cream.

Next Generation Science Standards:
Motion and Stability: K-PS2
Waves and their applications: 1-PS4-1

Materials:

- 1/4 Cup sugar
- 1/2 Teaspoon vanilla extract
- 1 Cup milk
- Duct tape
- Bath towel
- 1 Cup whipping cream, half & half or Milnot
- Crushed ice (1 bag of ice will freeze 3 bags of ice cream)
- 1 Cup rock salt (approximately 8 cups per 5 lbs.)
- 1 Quart and 1 gallon size Ziploc freezer bags (Ziplocs are usually stronger & work best)

Directions

1. Put the milk, whipping cream, sugar, and vanilla in a 1 quart freezer bag and seal. For security, fold a piece of duct tape over the seal.
2. Place the bag with the ingredients inside a gallon freezer bag.
3. Pack the larger bag with crushed ice around the smaller bag. Pour ¾ to 1 cup of salt evenly over the ice.
4. Wrap in a bath towel and shake for 10 minutes. Open the outer bag and remove the inner bag with the ingredients. Wipe off the bag to be sure salt water doesn't get into the ice cream.
5. Cut the top off and spoon into cups.
6. Makes about 3 cups. (1 bag will serve approximately 4 students)
7. Serve plain or top with nuts, coconut or fruit. ENJOY!

Milk vs. Coke

There are so many good things in milk, including vitamins, fats, and proteins that our bodies need to function. This experiment uses the acid in cola to separate all the proteins and other particles in the milk.

Next Generation Science Standards:
Engineering and Design: K-2-ETS1
Matter and Its Interactions: 2-PS1

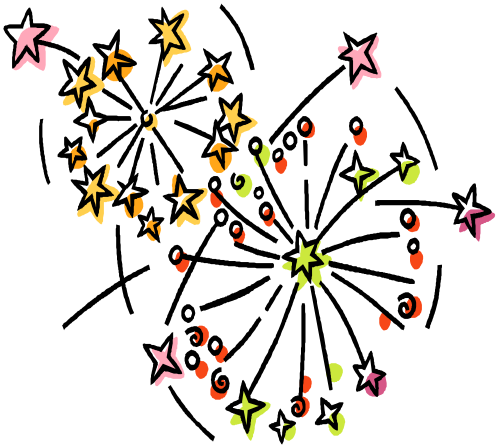
Materials:
- New bottle of Coke
- 2% milk
- A few hours

Directions:
1. After removing the label, open a new bottle of brown cola.
2. Pour 2% milk into the cola until the bottle is completely full.
3. Replace the cap to the cola and wait.
4. Regularly observe the contents of the bottle without disturbing the contents.
5. After several hours, you should observe the color and other materials have separated and sunk to the bottom of the bottle leaving a clear liquid on top.
6. In journals or on a piece of paper, answer the question: *Where did all the stuff at the bottom of the bottle come from?*

Summary:
The proteins and fats in the milk attached to the acid in the cola. This demonstration shows that even though milk looks like one smooth substance, it is actually made up of many parts, too small and too well mixed to usually be seen.

Milk... An Explosion of Color!

When you add soap to milk, the weak chemical bonds that hold the proteins in the solution are altered. It becomes a free-for-all! The molecules of protein and fat bend, roll, twist and contort in all directions. The food coloring molecules are bumped and shoved everywhere, providing an easy way to observe all the invisible activity.



At the same time, soap molecules combine to form a *micelle*, or cluster of soap molecules. These micelles distribute the fat in the milk. This rapidly mixing fat and soap causes swirling and churning where a micelle meets a fat droplet.

Milk is mostly water, and has surface tension like water. The drops of food coloring floating on the surface tend to stay put. Liquid soap wrecks the surface tension by breaking the cohesive bonds between water molecules and allowing the colors to zing throughout the milk. What a party!

Common Core State Standards:
Language Arts: CCSS.ELA-Literacy. W.K.1; SL.K.1
Next Generation Science Standards:
Engineering Design: K-2-ETS1
Matter and Its Interactions: 2-PS1

Milk... An Explosion of Color

Materials:
Milk (whole or 2%)
Dinner plate
Cotton swabs
Food coloring (red, yellow, green, blue)
Dish-washing soap (Dawn brand works well)

Directions:
1. Pour enough milk in the dinner plate to completely cover the bottom. Allow the milk to settle. There should be no ripples in the milk before starting this activity.
2. Add one drop of each of the four colors of food coloring - red, yellow, blue, and green - to the milk. Keep the drops close together in the center of the plate of milk.
3. Find a clean cotton swab for the next part of the experiment. Predict what will happen when you touch the tip of the cotton swab to the center of the milk. It's important not to stir the mix. Just touch it with the tip of the cotton swab.
4. Now place a drop of liquid dish soap on the other end of the cotton swab. Place the soapy end of the cotton swab back in the middle of the milk and hold it there for 10 to 15 seconds.
5. Add another drop of soap to the tip of the cotton swab and try it again. Experiment with placing the cotton swab at different places in the milk.

Review
1. Describe how the milk reacted when you first added the food coloring drops (step number 2).
2. What did you predict would happen when you touched the cotton swab to the center of the milk, why (step number 3)? Explain what actually happened.
3. Explain what happened when the soapy cotton swab was held on the surface of the milk.
4. What happened when you placed the soapy cotton swab in different locations of the plate? Would this work with the plain cotton swab, why or why not?
5. What makes the food coloring in the milk move?
6. Explain why this activity would or would not work with regular tap water.

Exercise adapted from Kitchen Chemistry:
www.stevespanglerscience.com

What Makes NesQuik™ Quick?

Common Core State Standards:
Language Arts: W.K.1; SL.K.1; SL.K.6

Next Generation Science Standards:
Motion and Stability: K-PS2-1; K-PS2-2

Materials:

- 2 empty plastic cups
- Milk
- 1/2 tsp baking cocoa
- 1/2 tsp NesQuik™

Directions:

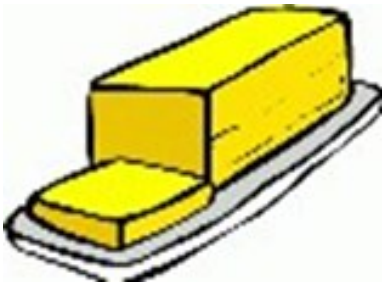
1. Turn over the empty plastic cups.
2. Place one large drop of milk on the bottom of one cup.
3. Sprinkle a small amount of cocoa on the drop.
4. Observe and record what happens.
5. Discuss your observations with a partner.
6. Now place one large drop of milk on the second cup.
7. Sprinkle a small amount of NesQuik™ on the second drop.
8. Observe and record what happens.
9. Discuss your observations with a partner. *What is the difference between how the cocoa looked and how the NesQuik™ looked?*

Summary:
The liquid milk has a natural surface tension that naturally holds the lightweight powders on top of it. NesQuik™ uses a soy ingredient (soy lecithin) to break apart the fat in the milk, much like dish soap on a dirty pan, and disrupt the surface tension. Gravity then pulls the NesQuik™ down into the milk The cocoa doesn't have this special ingredient, so it stays on top of the milk's surface, because gravity's force on the cocoa is not strong enough to break the tension by itself.

Butter Races

Common Core State Standards:
Language Arts: W.K.1; SL.K.1
Next Generation Science Standards:
Engineering Design: K-2-ETS1
Motion and Stability: K-PS2

Additional Reading Materials
The Butter Battle Book by Dr. Seuss,
ISBN 978-0-39496-580-2



Materials:
- 2 bowls
- Empty, clean, baby food jars and lids
- 1-2 quarts heavy whipping cream
- 1/2 gallon 2% Milk

Directions:
1. Begin reading *The Butter Battle Book* to introduce the conflict of fighting over butter.
2. Pour a sample of 2% and heavy whipping cream into separate bowls and leave the container next to each bowl.
3. Have the students compare the whipping cream and the 2% percent milk, identifying and noting differences.
4. Explain to the students they are going to compete to make butter, but they only get to choose one of the dairy products.
5. Have the students write a short paragraph explaining their choice (hypothesis) for making butter, including evidence and a concluding statement.
6. Separate the kids into groups based on the dairy product they wish to use and provide each group with one or more baby food jars 2/3 full of the dairy item chosen. **Close lids tightly.
7. Have the children shake the jars vigorously as you finish reading *The Butter Battle Book*, passing the jar each time you turn a page.
8. Compare the butter made from the whipping cream with the jar of milk, explaining how the fat used to make butter was taken out to make the 2% milk.
9. Share the butter with the whole class on crackers and discuss the similarities and differences between the butter battle in the story and the class butter battle.

Curds and Whey

Common Core State Standards:
Language Arts: W.K.1; SL.K.1
Next Generation Science Standards:
Engineering Design: K-2-ETS1
Motion and Stability: K-PS2

Materials:

- Hot plate or cooking surface
- Saucepan
- 2 cups milk
- 4 tsp. Vinegar/lemon juice
- Cheesecloth
- Colander
- Bowl for draining whey
- String

Directions:

1. In the saucepan, bring 2 cups of milk to a boil slowly. Stir constantly.
2. When the milk is just about to boil (look for bubbles at the edge of the milk's surface), turn off the heat.
3. Stir in vinegar or lemon juice, one teaspoon at a time. Notice any changes.
4. Slowly continue to stir as the milk begins to curdle.
5. Line the colander with cheesecloth and set it in a sink or separate bowl.
6. Carefully pour the warm milk through the colander, catching the curds in the cheese-cloth.
7. Gather the corners of the cheesecloth around the curds and tie the corners with string. Let the curds sit and drain for about an hour.
8. Divide the curds into small cups and have students make observations comparing the curds to the whey and to the milk.

When you are done with the experiment, add a pinch of salt or some seasonings and enjoy your creation with some crackers!

Dairy Farm Charm

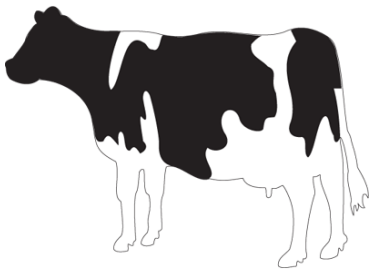
Illinois has about 114,000 dairy cows that produce more than two million pounds of milk a year. On average, each cow produces enough milk per day to fill 90 glasses. That's over five gallons per day!

Common Core Standards: L.K.4; L.K.5

Directions:
In a small, plastic jewelry bag, combine the following materials to symbolize everything that goes into providing the world with milk.

Cow confetti: Cows give us milk.
Green Crinkle paper: Grass that cows eat while in the pasture.
Soybeans & Corn: Cows eat hay, silage, grains and a feed made of soybeans and corn.
Blue bead: Water--one cow drinks 40 gallons of water a day.
Red or Green Bead: Tractor--the farmer uses a tractor for many different functions on the dairy farm.
Real seal: The seal is put on natural dairy products.
Day & night symbol: The farmer has to milk the cows 2 times a day-once in the morning and once at night.
Heart confetti: Veterinarians help the farmer keep the cows healthy and producing safe milk.
Soap shavings: Cleanliness of the dairy farm keeps the milk supply safe.

Finally, punch a hole above the baggie's seal. Then, loop a string through the hole and tie it off. Now, you have a dairy charm to wear around your neck. Be sure to share everything you know about DAIRY!



Moo! Masks

Objective: Students will demonstrate an ability to identify types of cattle based on markings.

Suggested Reading Material:
Clarabelle by Cris Peterson, ISBN-10: 1620915901
Click, Clack, Moo by Doreen Cronin & Betsy Lewin, ISBN-10: 1442433701
Dairy Ag Mag available at www.agintheclassroom.org

Materials:
- 1 Large paper dinner plate
- 2 Small paper dessert plates
- Scissors
- String or yarn
- Glue or staples
- Crayons, markers, or colored pencils

Directions:
1. Have the students cut one dessert plate in half.
2. Have the students staple or glue the other dessert plate behind the large dinner plate.
3. They should draw eyes on, or cut eyes out of the dessert plate and draw a mouth and nostrils on the dinner plate.
4. Next, use the dessert plate that was cut in half to make two ears that are glued or stapled to the top of the dessert plate with the eyes.
5. Have the students use the writing utensils to color the cow to match their favorite breed.
6. Attach string to the side of the mask to allow it to wrap around their heads.

Moo! Masks

Once your moo masks are complete, the students can use math to create their own custom ear tags to identify their cows.

Common Core State Standards:
Mathematics: K.OA.A.1; K.OA.A.2; K.OA.A.3; K.OA.A.5; K.MD.B.3

Materials:
- Moo Mask
- Colored Construction Paper
- Marker
- Scissors

Directions:

1. Have the students write out their first and last names.

2. With their names in front of them, have each student write the number of letters in both their first and last names.

3. Then have the students add the number of letters in their first name to the number of letters in their last name.

*It may be helpful to provide the students with a guide like this:

_____ + _____ = _____
(# in first name) (# in last name) (Total)

4. When the student correctly adds the numbers in her name, have her write the numbers on the cow tag. Then attach it to the ear of her moo mask.

Michelle + Brown = 13
(8) + (5)

Illinois AGRICULTURE in the Classroom℠

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