



# ***HUMAN MILK CURRICULUM FOR 4TH GRADE STUDENTS***

***HUMAN MILK IS A LIVING FLUID  
MOTHER NATURE LOVES HUMAN MILK***

***CREATED BY THE DC BREASTFEEDING COALITION***



**DC BREASTFEEDING  
COALITION**

## The Human Milk Curriculum

**This curriculum is a project of the DC Breastfeeding Coalition.**



**DC BREASTFEEDING  
COALITION**

### **Our Mission**

The DC Breastfeeding Coalition was established to increase the breastfeeding rates of all infants living in the District of Columbia. Working in partnership with maternal and child health professionals, community health organizations, and mother-to-mother support groups, the DC Breastfeeding Coalition seeks to promote, protect and support culturally sensitive programs and activities that build awareness and understanding of the preventive health benefits of breastfeeding. Through its breastfeeding research, advocacy and educational activities, the Coalition seeks to reduce health disparities—particularly among racialized families living in DC communities with less resources.

### **Breastfeeding Modules**

As part of the DC Breastfeeding Coalition's work, we have created a set of teaching and learning modules that we are happy to make freely available to educational and non-profit organizations. In addition to this module designed for 4<sup>th</sup> grade students, there is also one for high school students and one for kindergarten students. These can be found at [www.dcbfc.org](http://www.dcbfc.org).

**This curriculum was developed by the DC Breastfeeding Coalition**

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**If you use this curriculum, we would appreciate your feedback.** Please send all comments to [curriculum@dcbfc.org](mailto:curriculum@dcbfc.org)

## Module 1: Human Milk is a Living Fluid

NGSS: 4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Subjects: life sciences, mammals, breastfeeding, biology, immunology

Skills: critical thinking, inference, identifying, constructing an argument based on evidence

Materials: paper and pencils (if students are writing their true/false answers down)

### BACKGROUND



Almost all the food you eat used to be alive, but no longer is. When you bake bread, the yeast that helps it rise is killed by the heat. Milk comes out of the cow with living **microbes**, but **pasteurization** kills them all.

There are, however, a few foods that are still alive when you eat them. Yogurt can be filled with multiple types of live **bacteria**. The blue stripes in stinky blue cheese are made from penicillium, which is a living **mold**. Some **fermented** foods, like sauerkraut and soy sauce, can contain live bacteria and **enzymes** that help you digest **proteins** and **carbohydrates**.

Guess what food is also alive? **Human milk**. Human milk is teeming with living cells and important **nutrients** that play a special role in helping babies grow, fight off disease, and develop a strong **immune system**. Unlike infant formula, which is a **sterile** fluid, human milk is a “living fluid.”

There are different types of bacteria. There are bacteria that are usually harmful and cause diseases like ear infections and there are bacteria that are usually **beneficial**. Your intestines contain more than 100,000,000,000,000 (100 trillion) beneficial bacteria. Your intestines contain ten thousand times more bacteria than there are people living on the earth! These bacteria help break down food, make nutrients available to the body and even make **vitamins**. These beneficial bacteria (part of the **intestinal biome**) also protect the **intestines** from the harmful bacteria.

Science has shown that human milk contains the right combination of sugars to help the beneficial bacteria thrive in the intestines to create a healthy biome and protect against infections. We are learning more about how important the intestinal biome is every day.

Human milk also contains **antibodies**. Antibodies recognize specific types of viruses and harmful bacteria and attack them so that they cannot spread and cause disease. Because the antibodies fight off infections, babies who are NOT breastfed are more likely to get ear infections, diarrhea, and **pneumonia**.



## Human Milk is a Living Fluid: ACTIVITY ONE

1. Go over the background information with students. Have they ever thought about food as being “alive” when they eat it? Why or why not?
2. Go through the True-False questions with students by reading the questions out loud. Students can either answer as a class by raising their hands or getting in partners and writing their answers down.
3. As you go over the answers with students, instruct them to think about why they initially selected “True” or “False” for the questions.

## DISCUSSION

*Most food you eat is not living when you eat it.*

*Why is it important that human milk is alive when babies drink it?*

*How does human milk, as a living fluid, keep a baby healthy?*



### Breastfeeding True or False Activity

1. **In general, babies who are fed formula are more likely to get sick and may not be as healthy as infants who are fed human milk.**

**True.** Human milk contains antibodies and other factors that keep babies healthy. Infants who are breastfed are less likely to get ear infections, diarrhea illness, lung infections and are less likely to be obese, have asthma and diabetes.

2. **Both formula and human milk provides the baby with the same amount of protein, fat, calories, and sugar throughout the day.**

**False.** Human milk changes during feeding and throughout the day, and that is one of the things that makes it so extraordinary! The milk at the end of feeding has more fat and calories, and the milk during the night contains hormones that help a baby sleep. Human milk changes as the baby grows to perfectly meet the baby's nutritional needs.

3. **Human milk contains different nutrients if a baby is born early (prematurely).**

**True.** Moms who give birth to their babies prematurely produce human milk that contains a different amount of nutrients than moms who deliver their infants at 9 months (full term). The milk produced for a premature baby will contain more fat, **calcium**, and **proteins** to help the baby grow. Since premature babies are behind in growth, they really need extra nutrients to help them catch up.

4. **Moms who are sick with a cold or the flu should stop breastfeeding until they feel better.**

**False.** Moms should not stop breastfeeding while they are sick because their bodies are actively working to make antibodies against the **viruses** that cause the illness. The antibodies that are produced during this time will pass to their babies through human milk and protect them from getting these illnesses.

5. **Breastfeeding helps a baby stay healthy but does not help a mother stay healthy.**

**False.** In fact, breastfeeding is also good for the mom, protecting her from a variety of illnesses when the baby is young and for the rest of her life. Moms who breastfeed are less likely to get diabetes, high blood pressure heart disease and breast cancer!

**6. Moms who breastfeed must pay careful attention to what they eat.**

**False.** Since the nutrients from mom's food are passed to the baby through breastfeeding, moms should always make sure that they are eating a diet with plenty of fruits, vegetables, and foods that support milk production. Moms should also make sure that they are getting enough calories, as breastfeeding uses a lot of energy. Even though everyone wins if moms eat healthy, balanced foods, the body knows what it needs to do to protect the baby. Even moms who are not eating healthy food produce rich human milk designed to nourish the baby.

**7. Moms who breastfeed are less at risk for heart disease, and breast cancer.**

**True.** Moms who breastfeed are less at risk for both heart disease and breast cancer! Breastfeeding protects a mother from developing diabetes, which is one of the major causes of heart disease. So, breastfeeding is not only good for the baby, but it also is good for the mom, protecting her for a variety of illnesses for the rest of her life.



## Human Milk is a Living Fluid: ACTIVITY TWO

1. Make sure to review all the terms with the students before beginning so that they have the maximum opportunity to succeed in the game.
2. Group the students into pairs, two students per group. Distribute a set of term cards to each student. Instruct the students to not look at the cards. Have the students place the cards face down in between them.
3. Choose one student from each pair to go first. On your signal, the student going first will lift a card without looking at it and hold it up in front of their forehead. The other student will try to describe the term without using the term in any way or form. They may also not use rhymes such as “rhymes with filk (milk).” If the student who is going first guesses the term correctly, it is placed in a pile. Each card earns a point. If they cannot get it, they can say “pass” and place it into a discard pile.
4. After about 3 minutes the second student takes a turn and roles reverse. After each has had a turn, they may write down their points. Students can play again with the same partner or rotate partners. Groups of term cards may also be rotated so that partners get a set of new terms each round. Students may collect points as a team and compete against other teams for the most points, or they may keep points individually and compete for the most points as individuals.
5. At the end of the lesson count the number of total points for the entire class and celebrate by doing that many jumping jacks! Example: the entire class earned 100 points, so we all do 100 jumping jacks! Or 100 high fives.



## DISCUSSION

Encourage the students to analyze the game: what words helped our partner and what words did not?

What was the most challenging part of the game and what was the least challenging?

Which terms were harder to guess than others?

### *Vocabulary words to choose*

*Intestinal Biome*

*Bacteria*

*Antibodies*

*Pneumonia*

*Immune System*

*Nutrient*



## Human Milk is a Living Fluid: ACTIVITY THREE

Read the background information on page one to your students.

1. Have students divide into groups of 2 or 3 and compare the pictures on page eight taken under a microscope of formula vs. human milk.
2. Ask them the following questions (answers in red) once they have had time to analyze the images.

- Which picture (1 or 2) taken under a microscope is of human milk?

*Picture 2 is of human milk.*

- Why do you think this is a picture of human milk?

*Picture 2 is a picture of human milk because it contains living cells (white blood cells) and other nutrients while picture 1 is a picture of formula because it is homogeneous and sterile.*

- Picture 2 contains fat globules and white blood cells. How do you think these help a baby grow and stay healthy?

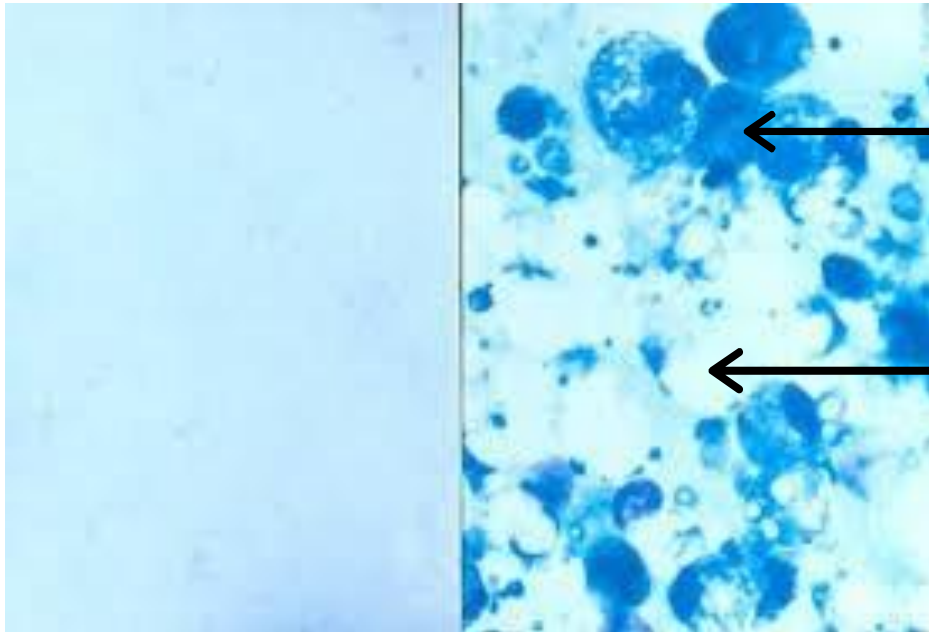
*Fat globules are needed for brain and eye development and white blood cells help fight off infections.*

3. Instead of having a group discussion, you can ask your students to fill out the worksheet on the next page. The answers are the same as above.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Pictures taken under a *microscope*.



White blood cells

Fat globules

Picture 1

Picture 2

**Questions:**

1. Which picture (1 or 2) taken under a microscope is of human milk?

\_\_\_\_\_

2. Why do you think this is a picture of human milk?

\_\_\_\_\_

\_\_\_\_\_

3. Picture 2 contains fat globules and white blood cells. How do you think these help a baby grow and stay healthy?

\_\_\_\_\_

\_\_\_\_\_

## GLOSSARY

<i>Antibody</i>	An antibody is produced by the body's immune system to fight off harmful substances such as bacteria and viruses.
<i>Bacteria</i>	Bacteria are tiny living organisms that you need a microscope to see. They are only one cell big. They live nearly everywhere including the soil, ocean, and inside human intestines.
<i>Beneficial</i>	Causes good results; helpful. Example: It is beneficial to your body to eat vegetables.
<i>Calcium</i>	Calcium is a mineral that your body uses to build strong bones and keep your nerves, muscles, and heart healthy.
<i>Carbohydrates</i>	Carbohydrates are mainly sugars and starches (like pasta and bread) that the body breaks down into a simple sugar that the body can use to feed its cells.
<i>Diarrhea</i>	Loose, watery stools (poops).
<i>Enzymes</i>	Enzymes speed up chemical reactions in the body.
<i>Fat globule</i>	Tiny piece of fat inside a cell.
<i>Fermentation</i>	Fermentation is a process where yeast or other microorganisms break down a substance. An example of fermentation is when bacteria break down milk into yogurt.
<i>Hormone</i>	Hormones are special chemicals that are made in one part of the body and travel in the blood to other parts of the body to help the body. For example, if you eat candy, your body makes the hormone insulin to keep the sugar level in your body under control.
<i>Immune System</i>	The immune system is made up of cells, tissues, organs, and the substances they make (such as antibodies and white blood cells) that help the body fight infections and other diseases.
<i>Intestinal Biome</i>	The intestinal biome is also known as the gut biome and is made up of the microorganisms that live in your intestines.

<i>Microbe</i>	Microbes are also known as microorganisms. They are tiny living things that are found all around us and need to be seen with a microscope. They live in water, soil, and in the air.
<i>Microscope</i>	An instrument used to see tiny objects like cells.
<i>Mold</i>	Mold is a simple, tiny living organism (a fungi) that likes to grow in damp, warm places. An example is mold that grows on damp bread or in the shower.
<i>Nutrient</i>	A nutrient is a substance that help organisms grow. Nutrients include water, vitamins, carbohydrates, proteins, fats and minerals.
<i>Pasteurization</i>	Pasteurization is a process of heating and then cooling a liquid or a food to kill bacteria and make the food safe to eat. Most cow's milk is pasteurized.
<i>Pneumonia</i>	Pneumonia is an infection in the lungs. The "P" is silent, so it is pronounced "nuh-mow-nyuh."
<i>Premature</i>	Premature means that something happens or arrives before the usual time. For example, a baby is born prematurely if it is born before the usual 9 months of pregnancy.
<i>Protein</i>	A protein is a large molecule that includes hormones, enzymes and antibodies. It is also the nutrient found in meat, chicken, tofu and beans.
<i>Sterile</i>	Something is sterile if it does not have any living germs or microbes.
<i>Vitamin</i>	Vitamins are nutrients your body needs to stay healthy.
<i>White Blood Cells</i>	White blood cells are cells that help fight infection. They are part of the immune system.

## Module 2: Mother Nature Loves Human Milk

### NGSS:

*4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.*

*4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.*

Subjects: *life sciences, mammals, breastfeeding, biology, environmental conservation*

Skills: *critical thinking, inference, collaboration, identifying, sorting*

Materials: *activity worksheets*

## BACKGROUND

When it comes to taking care of Mother Nature, human milk can't be beat. Human milk may look white, but actually it is as "green" as can be. It is one of the few foods produced and delivered to the **consumer** without any **pollution**, unnecessary packaging, or waste. In fact, human milk has been called the most environmentally friendly food available. It produces almost zero waste, **greenhouse gases**, and **water footprint**.

Some people talk about the environmental effects of cloth versus disposable diapers, but the environmental impact of formula-feeding may be even greater. Cow's milk is needed to make infant formula, and cow's need water and food to make milk. Farmers grow plants for the cows to eat and put **pesticides** and **fertilizers** on the plants to help them grow faster.



*Cows in a pasture*

Once the plants are done growing, the farmer can harvest the food to feed the cows. The cows are milked, and the milk is **processed** into infant formula. The packaging materials, bottles, and nipples are then made, which requires a lot of resources. These materials end up in **landfills** and sometimes the ocean.



*Plastic pollution covering the ocean floor*

## Mother Nature Loves Human Milk: ACTIVITY ONE

1. Go over the background information with students. Ask for volunteers to tell you about a few different environmental issues with which they are familiar. Do these environmental issues have to do with the air? The water? How might some of them be connected to the production of baby formula?
2. Divide students into pairs and hand each of them slips of paper with the different steps involved in producing baby formula on them. Have students work together to put the steps in the correct order.

Go over the answers with students. With each answer you go over, provide the following facts to students:

- Substituting cow's milk (the primary ingredient in infant formula) for human milk pollutes the water, land, and air. Raising cattle and growing soy requires large amounts of fertilizer and **irrigation**. Sewage and fertilizers pollute rivers and groundwater. Additionally, pesticides and antibiotics used in farming contaminate the soil and water.
- Producing artificial baby milk contributes to air pollution. Methane gas is released when the cow passes gas and is second behind **carbon dioxide** in contributing to the greenhouse effect and global warming; cow gas and stool (poop) account for 20 percent, or 100 million tons, of the total annual global methane emissions.
- Processing artificial baby milk consumes a huge amount of energy. Cows must be milked, and the milk must then be skimmed, processed, pasteurized, **homogenized**, dried, and packaged. Manufacturing the bottles and nipples uses large amounts of energy in addition to plastic, rubber, **silicon**, glass, packaging, and paper.
- Producing the packaging for infant formula creates toxins and uses paper, plastic, and tin. For every three million bottle-fed babies, 450 million tins of formula are consumed. The 550 million cans of infant formula sold each year to feed US babies alone uses 86,000 tons of tin and 364,000 tons of paper.
- Producing powdered formula uses a lot of water. More than 4000 liters (16,907 cups) of water are needed to produce just one kg (2.2 pounds) of formula powder.



## DISCUSSION

As it turns out, the production of infant formula leads to a lot of harmful environmental effects, many of which students are only familiar with on a surface level. Ask students to think back on the environmental issues they talked about at the beginning of class.

Are any of the steps involved in producing infant formula contributing to these environmental issues? How so? Instruct students to brainstorm on what would be different in the environment (land, water, air) if more babies breastfed.

What positive changes would take place? The goal is for students to begin thinking about baby formula as one of the milk-related farm products that seriously damage the environment.

Explain to the students that some babies can't get all their nutrition from human milk and need to be fed formula. Ask the students if they can think of circumstances in which a baby may not be able to get all their nutrition from human milk. Some examples include birth parents not producing enough milk (occurs rarely), birth parents having illnesses or taking drugs that make their human milk not healthy for babies, babies being adopted or having two dads.



Why would a new mom choose to buy formula instead of using a food that is free and designed by nature for her baby? Do you think women breastfeeding in public ever receive negative reactions? Does working outside the home make it difficult for a woman to provide human milk for her baby?

To breastfeed the natural way, babies should feed whenever they are hungry. This means that babies and moms should spend most of their time together. In your community, are moms and babies always together? Why or why not?

If families knew the environmental cost of using infant formula instead of human milk, do you think they would make different choices? How can teaching families more about the environment change parenting decisions?

**Cut strips of paper and have students assemble in this order.**

Farmers grow soy plants so that their cows have enough food to grow strong and produce milk.

Farmers put pesticides and fertilizers on their soy plants to help them grow faster.

Fertilizers seep into the surrounding rivers and groundwater, polluting them.

Cows consume large amounts of feed, producing an average of 65 pounds of poop per day!

Methane gas is released into the atmosphere. It is a greenhouse gas that absorbs the sun's heat and warms the atmosphere, contributing to global warming.

The cows are milked, and the milk must be processed.

Trees need to be cut down to provide the paper that is used in milk products. Trees are important to the environment because they give us oxygen and absorb carbon dioxide while they grow, slowing the rate of global warming.

Packaging must be created for the milk products, using up lots of tin, paper, and plastic.

Bottles and nipples need to be manufactured for baby formula. This uses up ton of plastic, rubber, silicon, paper, and other materials.

The plastic, tin, silicon, and other materials end up in landfills and the ocean every year, causing serious pollution problems. Wildlife may choke on them.

## Mother Nature Loves Human Milk: ACTIVITY TWO

1. Assign students to groups and give each group a worksheet, pencils, and a cup with three to five vocabulary storytelling sticks (see next page).
2. Tell each group they will create and write a story on how human milk and the use of infant formula impacts the environment. They must use all the vocabulary words in their stories, and they must underline those words as well.
3. You may choose to give each group the same sets of words and compare how each story differs, or you may choose to give each group a different set of vocabulary words. If you choose to give each group a different set, you can challenge them by exchanging vocabulary word sets and trying again. Encourage students to have a discussion with their group before they begin to write.

### Vocabulary words to include in the stories

Fertilizer

Environment

Artificial Food

Processed

Toxins

Natural

Greenhouse Gas

Water Footprint

Cow

Mammal

Milk

Formula

Pollution

Homogenized

Pasteurized

## DISCUSSION

Ask the students to compare their stories with their classmates. What was similar? What was different? Were there any themes?

Was the story about the positive impacts of mother's milk or the negative impact of infant formula on the environment? Why did they choose one over another?

If time allows, repeat with different vocabulary words, or have groups exchange groups of words and try again.



## GLOSSARY

<i>Carbon Dioxide</i>	Carbon dioxide is a gas. Burning fuel like coal, gasoline and oil makes carbon dioxide.
<i>Consumer</i>	A consumer is a person or thing who eats or uses something. A consumer is also a person who buys something for themselves.
<i>Fertilizer</i>	Fertilizer is a chemical or other substance (like manure) that is added to soil to help the plants grow.
<i>Global Warming</i>	Global warming is the unusually rapid increase in Earth's average surface temperature over the past century. It is mainly due to greenhouse gases released by people burning fossil fuels such as oils, coal and gasoline.
<i>Greenhouse gas</i>	Greenhouse gases are gases in earth's atmosphere that trap heat by allowing the sunlight to pass through the atmosphere but stops the sunlight's heat from leaving.
<i>Homogenize</i>	Homogenization of milk is a process that decreases the size of fat globules and mixes them evenly throughout the milk.
<i>Irrigation</i>	Irrigation is how water is supplied to farmland and crops.
<i>Landfill</i>	A landfill is a place where garbage is put and either buried or covered with soil.
<i>Methane</i>	Methane is a gas found in natural gas, waste decay and when animals pass gas.
<i>Over-population</i>	Overpopulation is when there are too many people living in an area to survive well.
<i>Pasteurize</i>	Pasteurization is a process of heating and then cooling a liquid or a food to kill bacteria and make the food safe to eat. Most cow's milk is pasteurized.



<i>Pesticides</i>	Pesticides are chemicals used to kill or prevent insects from damaging plants.
<i>Pollution</i>	Anything that makes the earth dirty and unhealthy.
<i>Silicon</i>	Silicon is a chemical used to make baby bottle nipples and pacifiers.
<i>Toxins</i>	Toxins are poisonous substances.
<i>Water footprint</i>	The amount of water used to make food, energy, and products.

### Image Sources

Cover Page and Pages 3, 4, 6, 8, 16 and 19: Property of the DC Breastfeeding Coalition

Page 2: *Plate of sandwiches*. Imagedepotpro; Unsplash Stock photo ID:1668300078| Credit: Getty Images

Page 13: *Cow*. Kamisoka; Unsplash Stock photo ID 906635620

Page 14: *Plastic*. Unsplash Stock photo ID: 1442904386

