Elementary

LESSON 1

Hilleman & Vaccines

Lesson 1

What Are Germs?

Hilleman & Vaccines

LESSON INSTRUCTIONS
Lesson 1: What Are Germs?

ESSENTIAL QUESTION
How do we stay healthy?

OVERVIEW & PURPOSE
Students may know that germs lead to disease, but most students may not realize that there are many different kinds of germs that cause different kinds of diseases. In this lesson, students learn about the two main different kinds of germs. The main differences between these two causes of disease include (1) viruses are much smaller than bacteria, (2) viruses require a host cell's machinery to reproduce and (3) we consider viruses to be non-living (partly because of their inability to reproduce without living cells).

EDUCATION STANDARDS
3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

3-LS1.B Growth and Development of Organisms – Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

CCS.ELA.RI.3.9 Compare and contrast the most important points and key details presented in two texts on the same topic.

CCS.ELA.RI.3.4 Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 3 topic or subject area

OBJECTIVES
Students will identify

1. Examples of microorganisms.
2. The difference between bacteria and virus.
3. Some of the ways diseases are spread and how bacteria can be either healthy or unhealthy.

LESSON INSTRUCTIONS
Lesson 1: What Are Germs?

MATERIALS

- Vocabulary Match student worksheet page (page 59)
- Bowl, glitter, hand cream (lotion), soap, paper towels
- "Virus or Bacteria?" Student worksheet page (pages 63-64)
- "Virus" and "Bacteria" fact sheets (pages 66-69) (optional for 4th-6th graders)

PREPARATION

- Make copies of the student pages, one per student
- Preview and load the video: Do Not Lick this Book (11:40) https://youtu.be/mGsCuXONF04 for use later in class. The book is available in any major US bookstore if YouTube is unavailable to you.

VOCABULARY

- **Antibiotic:** a medicine which destroys bacteria
- **Bacteria:** tiny organisms (microorganism or living thing) which can be found everywhere. Some of them are harmless, some of them are helpful, and some of them can cause diseases
- **Contagious:** illness able to be passed from person to person
- **Germ:** a microorganism that causes disease
- **Infection:** an illness that has been caused by germs
- **Organism:** a living being, a form of life
- **Transmit:** to send, spread, or pass on
- **Virus:** a tiny germ which causes disease and can only live in the body of another living thing

VERIFICATION

Use these questions to facilitate a discussion at the end of the lesson to check for student understanding:

1. What is a virus?
2. What is bacteria?
3. What is the difference between virus and bacteria?
4. What is a simple way to keep ourselves healthy?

ACTIVITY INSTRUCTIONS
Lesson 1: What Are Germs?

ENGAGEMENT

Use the following dialogue example to introduce the lesson through a class discussion:

(Choose a student's name) isn't feeling very well. They have a high temperature and a sore throat. Their mom takes (student's name) temperature and says, "I'm afraid you've caught a bug!" What do you think we mean when we say someone has "caught a bug"?

Today we are going to be talking about very, very, very small organisms. They are so small that 1 million could fit on the tip of the pin.

Fill out a Know, Want to Know and Learned (KWL) chart to help students organize information they will gather during this lesson. Keep track of answers using a three column chart on a whiteboard or chalkboard. Use these questions to guide discussion:

1. What do you know about bacteria?
2. What do you know about viruses?
3. What do you know about diseases?
4. How do you get sick?

We are going to be hearing a lot of words today that you might not have heard of before. Pass out vocabulary worksheet.

I am going to set the timer for three minutes and, with your partner, see how many of the words you can match with their definitions. (Go over the definitions with the class)

We are going to watch/read a quick book by Iden Bek-Barak and Julian Frost titled *Do Not Lick this Book.*

Vocabulary

Match each word in Column A with its definition in Column B.

Column A	Column B
_____**Antibiotic**	A. an illness that has been caused by germs
_____**Bacteria**	B. to send, spread, or pass on
_____**Contagious**	C. tiny organisms (microorganism or living thing) which can be found everywhere. Some of them are harmless, some of them are helpful, and some of them can cause diseases
_____**Germ**	D. a medicine which destroys bacteria
_____**Infection**	E. a tiny germ which causes disease and can only live in the body of another living thing
_____**Organism**	F. illness able to be passed from person to person
_____**Transmit**	G. a living being, a form of life
_____**Virus**	H. a microorganism that causes disease

GLITTER GERMS

EXPLORATION

Now we are going to see it in action. How can you see things being spread when you can't actually see them? We are going to use glitter to represent germs!

MATERIALS

- Glitter
- Hand cream
- Water & Soap
- Paper towel

INSTRUCTIONS

1. Split the children into groups of two and ask one child from each pair to rub a small amount of hand lotion onto their hands.

2. Sprinkle a dime-sized amount of glitter onto the hand with hand lotion and ask the children to shake hands. They should see that they both now have glitter on their hands.

3. Ask both children to try to remove the glitter using just a paper towel. Does it work?

4. Next try washing with just water, followed by water and soap to see which method of hand washing is most effective.

5. Next, put glitter in your hand and then touch the children's hands, shoulders, hair, etc. to show them how the glitter was transferred. Emphasize how germs are spread. You can put glitter in the palm of your hand and then simulate a sneeze to illustrate how germs are passed through the air and can infect people. Explain how germs are also transferred in this way.

EXPLANATION

Play the video "How do soap and water make us clean?" (3:26) https://youtu.be/XntinCBEC9U
Discuss and relate back to the Glitter Germs activity.

Play the video "Viruses vs. Bacteria" (5:33). https://youtu.be/mQZDyLtCu5E

Use the following questions to facilitate a class discussion in order to evaluate comprehension. Choose from the examples below or make up your own.

Germs are sometimes called microbes, because they can only be seen under a what? (microscope)
Inside the germ is a chemical called nucleic ____? (acid)

What is the name of the chemical inside of the germ?
How do germs make people sick?
Why shouldn't bacteria be called germs even though some of them are bad for you?

What can kill viruses?
What are three ways to avoid getting ill from bacteria?

6-8th grade students should also read the information sheets "Understanding Bacteria" and "Understanding Viruses," and complete the comprehension questions. The cell and virus drawings are simplified drawings meant to highlight the parts that all cells have in common, and the differences between the different types of cells. Help students walk through those drawings to compare the major types of cells. Then, have students look at the viral capsids and the cell to virus comparison. This should help students understand why viruses are not considered living like other cells, and that viruses are far smaller than cells and do not have a cell membrane. The 3-D view of the cell is to help students visualize how the phospholipid bilayer covers a cell.

Note: If you are unable to access YouTube in your classroom, you can embed the videos in a slideshow prior to class or visit https://vaccinemakers.org/resources/videos-animations for other resources

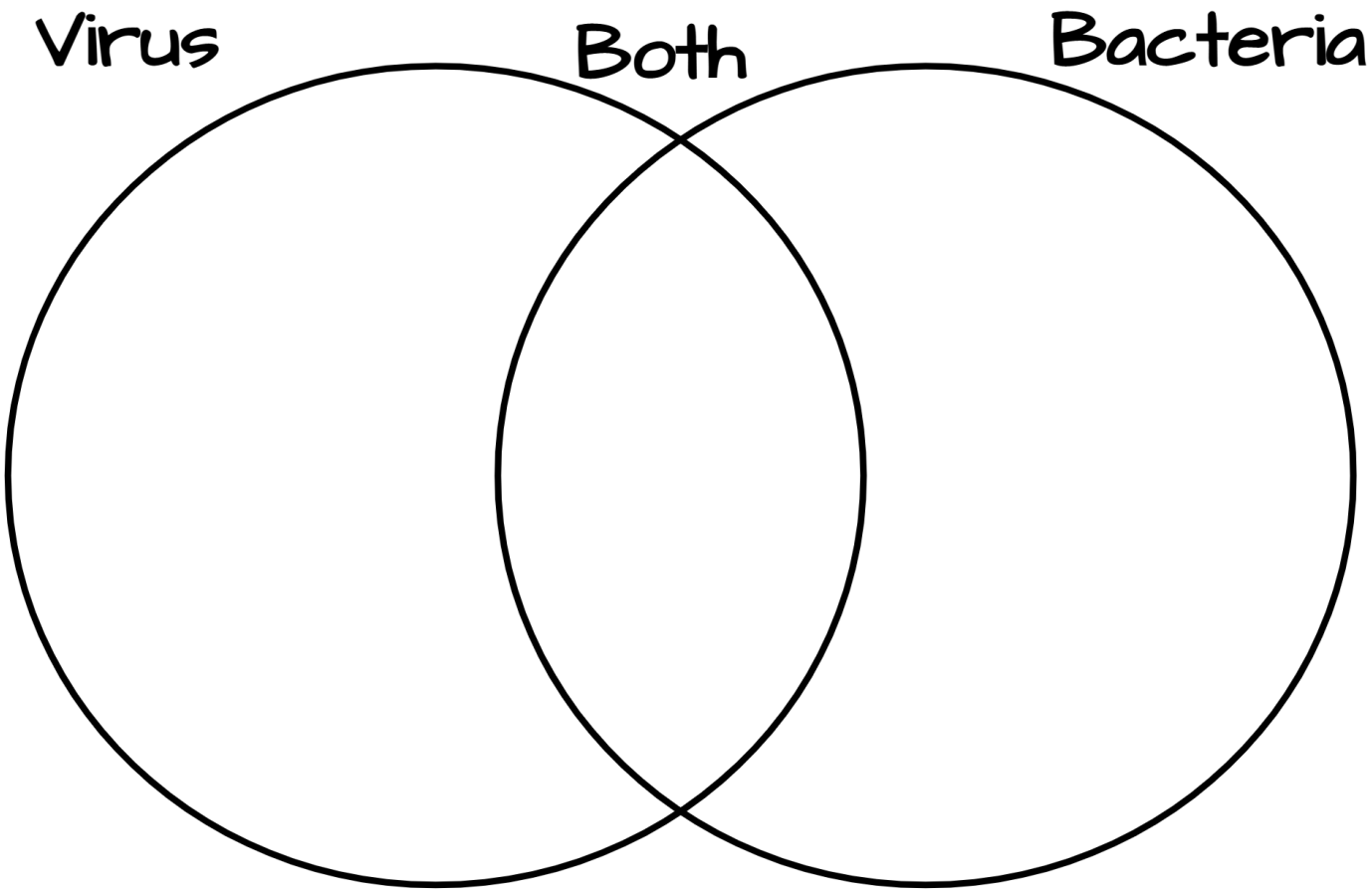
ELABORATION

Have students complete the Venn diagram. Print the student page if you would like the students to complete the Venn diagram independently or with a partner. Alternatively, the whole class can fill it out together.

EVALUATION

Have students complete the "Virus or Bacteria" sort activity to compare and contrast bacteria and viruses.

Name: _____ **Date:** _____



Name: _____ **Date:** _____

Virus or Bacteria?

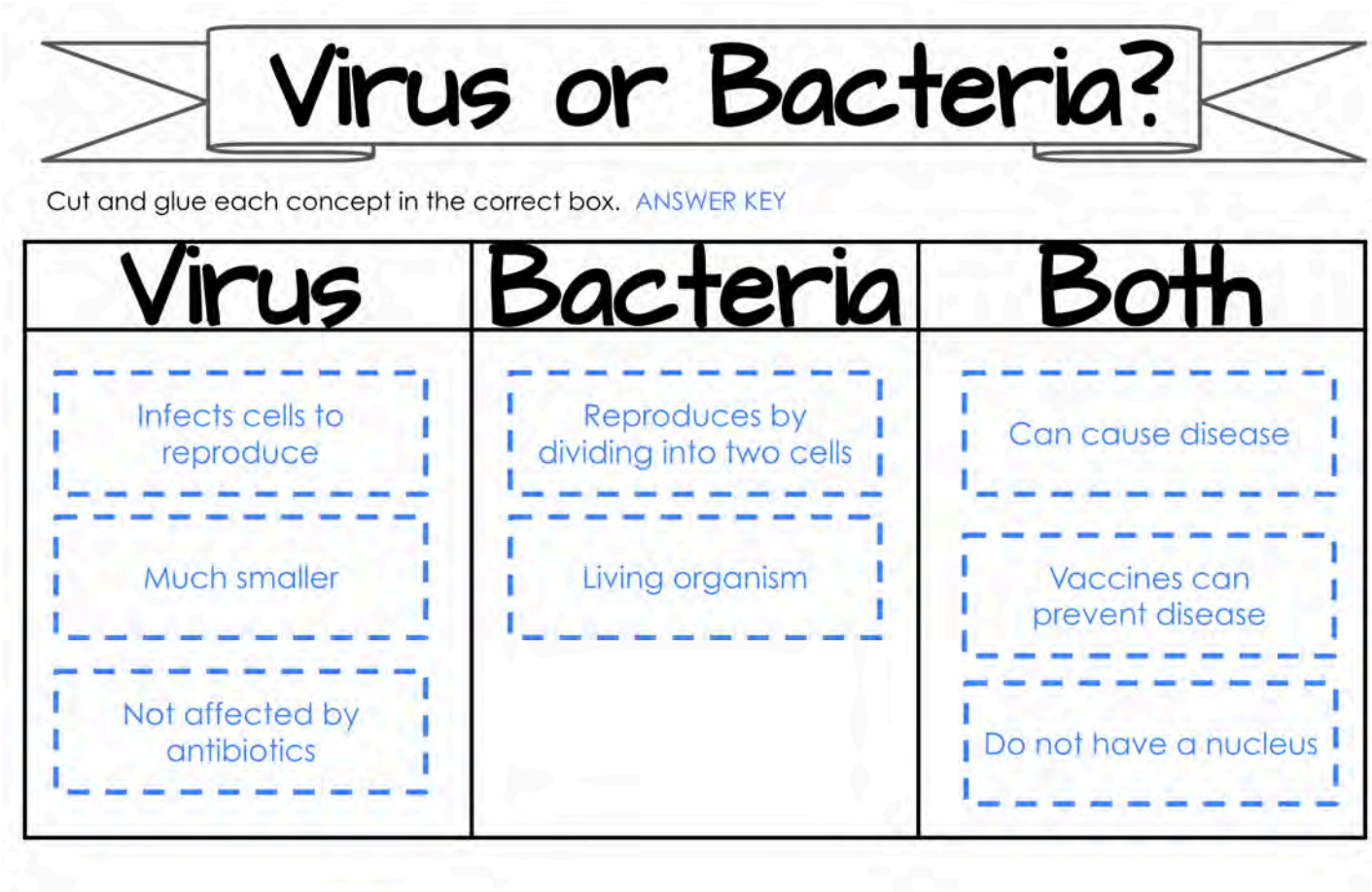
Cut and glue each concept in the correct box.

Virus	Bacteria	Both

✂

Reproduces by dividing into two cells	Infects cells to reproduce	Can cause disease	Vaccines can prevent disease
Living organism	Much smaller	Not affected by antibiotics	Do not have a nucleus

SORTING ANSWER KEY



Name _____

UNDERSTANDING VIRUSES

Within the world of germs, there is one kind of germ called a virus. The virus is different from bacteria and protists (algae and amoebas), because it does not have a cell membrane, nor is it a cell at all. Viruses have a protein coat called a capsid to surround them and they only have DNA or RNA on the inside of the protein coat. The DNA or RNA carries all of the information needed to make more of the virus.

Because viruses lack three of the requirements to be considered life, scientists consider them to be nonliving. Viruses do not require energy (they do not take in food or use sunlight to make food), viruses are not cellular (made of one or more cells), and viruses do not reproduce on their own. In order to reproduce, viruses must use cell parts from an actual organism (host) to make their virus pieces.

By attaching themselves to cells, in organisms like plants, animals, and bacteria, viruses can inject their DNA or RNA into the cells. Then, the cell's organelles do all of the work to make copies of the viral DNA or RNA and to make new protein coats. Diseases occur in the organisms when the viruses are reproduced so much that the cells rupture (burst open), become entirely dysfunctional, or the virus causes problems around the cells. For example, human immunodeficiency virus (HIV) ruptures white blood cells until the host has no immune system left. The chickenpox virus settles near the skin's surface and makes sores filled with more of the virus. For viruses that cause pneumonia, they can cause fluid to build up where it should not, like in the lungs.

The chickenpox virus is then spread when the skin sores begin to leak and the virus comes in contact with more humans. Viruses move and spread to new hosts by organisms touching each other, ingesting virus-contaminated foods or liquids, or through bodily fluids like mucus (snot), or respiratory droplets from your mouth and lungs (coughing or sneezing). Viruses can also be spread to humans from animals like when humans catch rabies from a bite, scratch, or contaminated piece of food, or West Nile virus from mosquito bites. Viruses can be easily spread and difficult to detect because they are much smaller than bacteria.

Name _____

VIRUS FOLLOW-UP QUESTIONS

1. Describe viruses:

2. What is the protein coat of a virus called and what is found inside the protein coat?

3. Give three reasons why viruses are considered nonliving.
   1.
   2.
   3.

4. Explain two ways that viruses can cause diseases.
   1.
   2.

5. List three ways that viruses can spread between hosts.
   1.
   2.
   3.

Name _____

UNDERSTANDING BACTERIA

Bacteria are single-celled organisms, meaning that each cell lives mostly alone. They have a cell membrane and a cell wall on the outside, but they do not have organelles with membranes around them, like the nucleus or mitochondria that plants and animals have. Their DNA is in a circular shape and they do have ribosomes for making proteins like plants and animals. Bacterial cells are about ten times smaller than typical plant and animal cells.

Bacteria can have many shapes like rods, spheres, and spirals, and they can form chains or clusters with each other. These properties and their types of cell walls help us classify bacteria. For example, streptococcus are chains of round bacteria. Strepto- means chains and -coccus means round. Under a microscope, a staph infection would be recognized by the bacteria clumped together in clusters like grapes.

Although you typically think of strep as being bad, some bacteria are good and some cause disease. Skin contains a natural layer of bacteria that protects the body from incoming diseases and keeps the skin at a steady pH level (acidic or basic). If the bacteria on the skin die off, the skin becomes more basic and fungi can grow (yeast or athletes' foot). The stomach and digestive system also have bacteria that keep them healthy and functioning well. Cows have special bacteria that release the sugars from plant cellulose. This is how they can get so much energy from grass, but we cannot. Other bacteria help recycle or add nutrients to the soil. Decomposers break down dead plants and animals and cause the rotting scents. Truly, plants and animals cannot live without bacteria.

The dangerous bacteria are the ones that can make us sick. In that case, we call them pathogens. For instance, there is a kind that causes strep throat and one that causes salmonella. Bacteria can also cause pneumonia or tetanus, but unlike viruses, bacteria can be killed with antibiotics. Antibiotics are medications capable of killing cells by disrupting the cell membranes. In other words, these diseases are treatable, but we do not want to kill all bacteria so we have to be careful.

Name _____

BACTERIA FOLLOW-UP QUESTIONS

1. Describe bacteria:

2. Name two diseases caused by bacteria.
   1.
   2.

3. List three things that bacteria are good for.
   1.
   2.
   3.

4. What is an antibiotic and what can't they be used on?

5. What kind of bacteria break down dead things and return nutrients to soil?

VIRUS QUIZ ANSWERS

=

1. Describe viruses:

A: A virus is a germ that only has a protein coat and DNA or RNA on the inside of it.

2.What is the protein coat of a virus called and what is found inside the protein coat?

A: The protein coat is called a capsid and has DNA or RNA on the inside.

3. Give three reasons why viruses are considered nonliving.

A: Viruses are not typically considered living because they are not made of one or more cells, they cannot reproduce on their own, and they do not require any kind of energy or food.

4. Explain two ways that viruses can cause diseases.

A: Viruses can cause disease by rupturing cells, causing cells to no longer function, or causing sores or fluid build-up.

5. List three ways that viruses can spread between hosts.

A: Viruses can spread through mucus, respiratory droplets, people touching each other, the air, ingesting contaminated food or water, or from animals.

ANSWER KEY (6TH - 8TH GRADE)

Lesson 1: What are germs?

BACTERIA QUIZ ANSWERS

=

1. Describe bacteria:

A: Bacteria are single-celled organisms with a cell wall, no organelles, and circular DNA.

2. Name two diseases caused by bacteria.

A: Diseases caused by bacteria could be strep throat, tetanus, salmonella, staph infections, and pneumonia. Students can list any two.

3. List three things that bacteria are good for.

A: Bacteria can be good for recycling nutrients to soil, breaking down dead organisms, keeping the skin and digestive system healthy, and breaking down food to give more nutrients to animals.

4. What is an antibiotic and what can't they be used on?

A: Antibiotics are medicines that kill cells but cannot kill viruses.

5. What kind of bacteria break down dead things and return nutrients to soil?

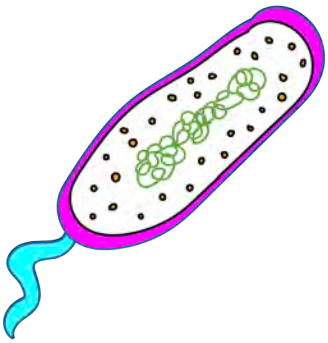
A; Decomposers break down dead organisms.

STUDENT PAGE (6TH - 8TH GRADE)

Lesson 1: What are germs?

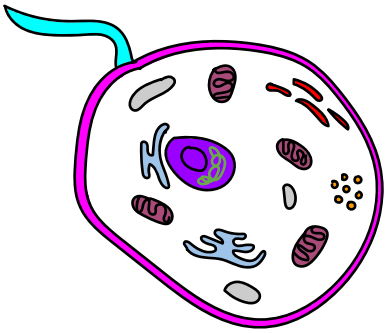
Name: _____ **Date:** _____

Below are three different types of cells. The word banks below the images list the cell parts, which correspond to a specific color in the image. Look at the images then answer the questions at the bottom of the page.



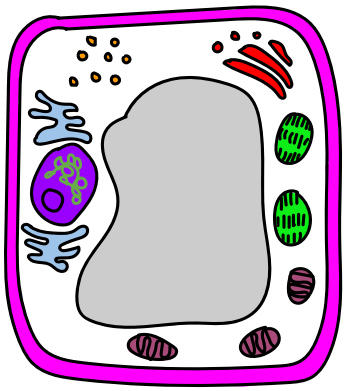
Bacteria Cell

Cell wall
Cell membrane
Flagella
Circular DNA
Ribosomes



Animal Cell

Cell membrane
Flagella
Golgi apparatus
Mitochondria
Nucleus
DNA
Ribosomes
Vacuole
Endoplasmic reticulum



Plant Cell

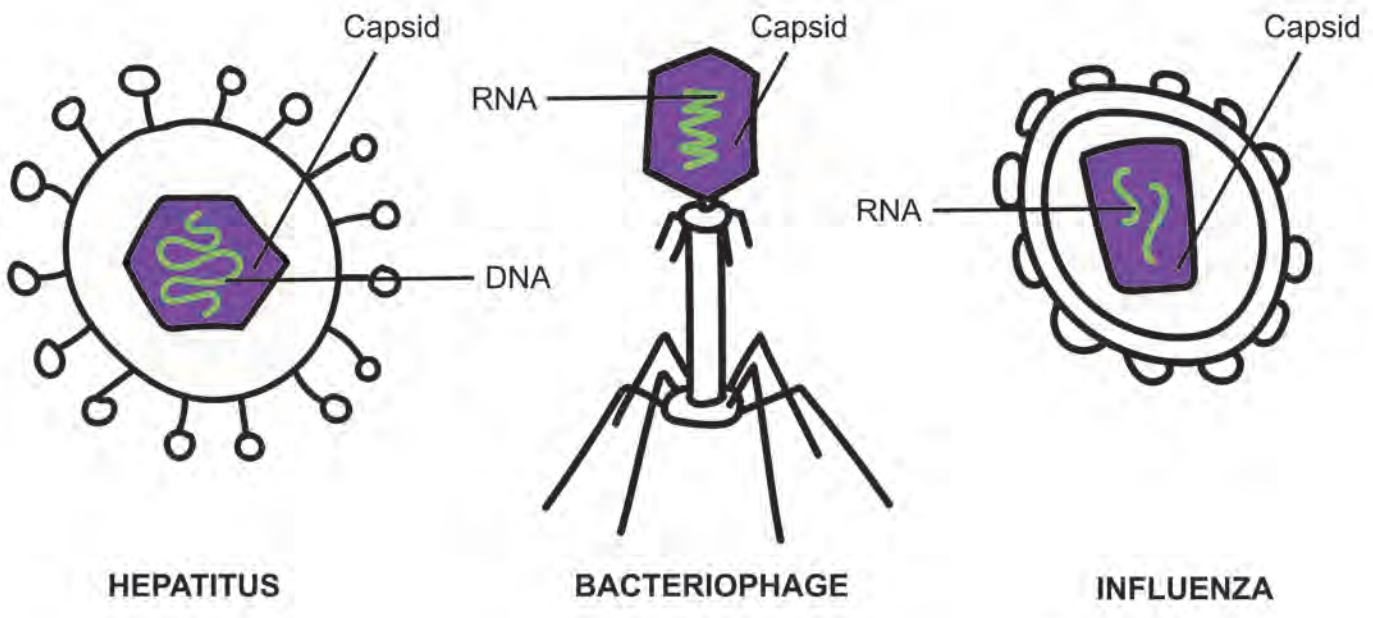
Cell wall
Cell membrane
Flagella
Golgi apparatus
Mitochondria
Nucleus
DNA
Ribosomes
Vacuole
Endoplasmic Reticulum
Chloroplasts

1.What parts do all cells have in common?

2.What are the differences?

Name: _____ **Date:** _____

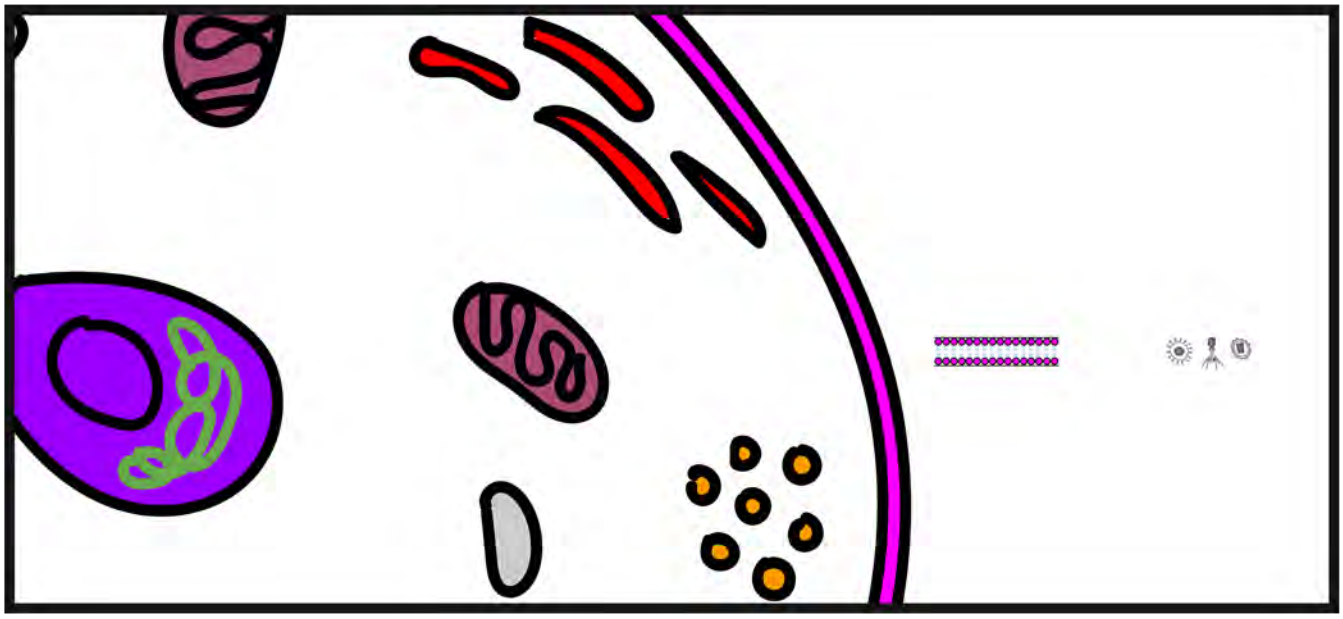
Below are three different types of viral capsids. Look at the images and compare them to the cells on the previous page. What are some differences? Similarities?



Viral Capsids

Notes:

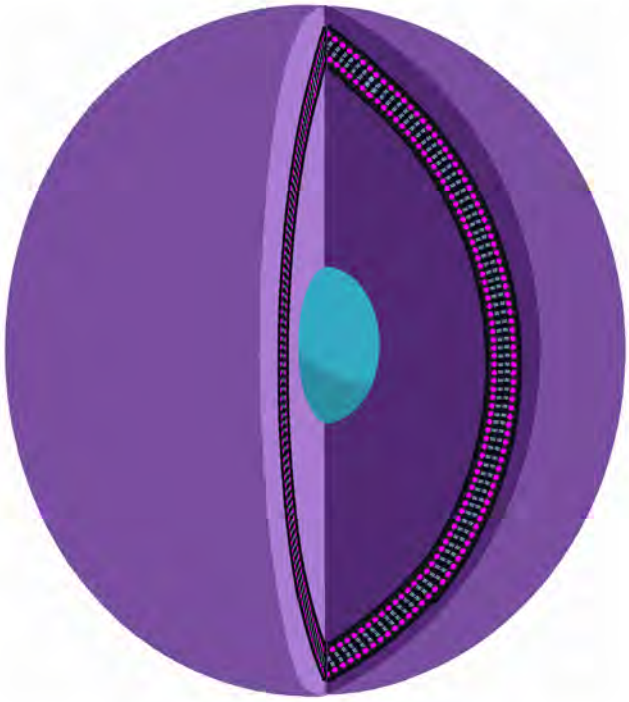
Name: _____ **Date:** _____

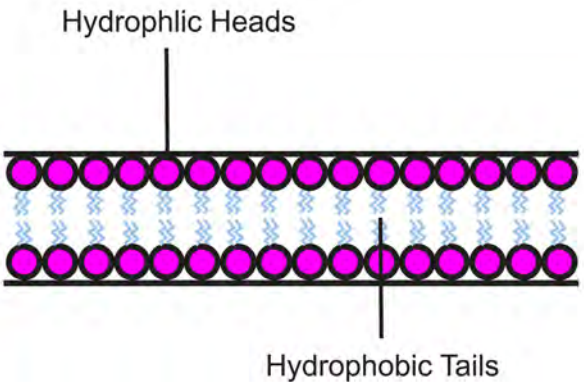


Above is a size comparison of cells and viruses. What differences do you notice?

Name: _____ **Date:** _____

PHOSPHOLIPID BILAYER





Notes:

ANSWER KEY (6TH - 8TH GRADE)

Lesson 1: What are germs?

Name _____

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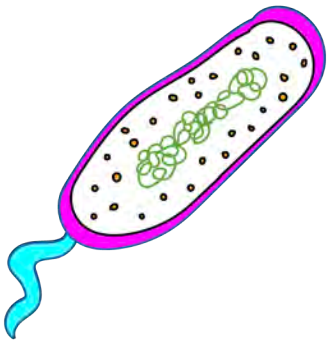
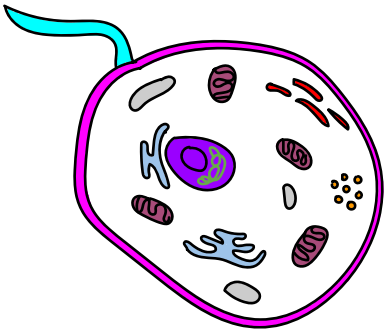


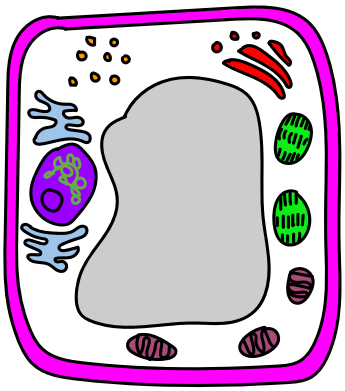
Bacteria Cell

Cell wall
Cell membrane
Flagella
Circular DNA
Ribosomes



Animal Cell

Cell membrane
Flagella
Golgi apparatus
Mitochondria
Nucleus
DNA
Ribosomes
Vacuole
Endoplasmic reticulum



Plant Cell

Cell wall
Cell membrane
Flagella
Golgi apparatus
Mitochondria
Nucleus
DNA
Ribosomes
Vacuole
Endoplasmic Reticulum
Chloroplasts

1.What parts do all cells have in common?

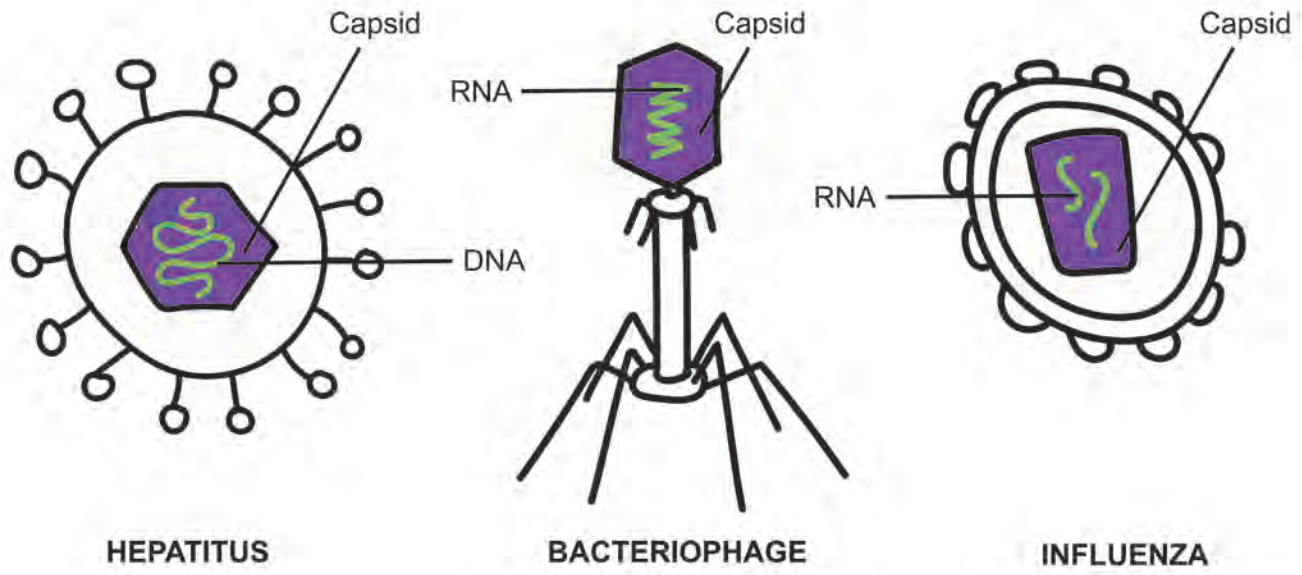
All cells have a cell membrane, DNA, flagella, and ribosomes

2.What are the differences?

Bacteria cells and plant cells have a cell wall (quite different from each other), and bacteria cells do not have a nucleus or any kind of organelle that is surrounded by a membrane like the vacuoles or mitochondria. Bacteria cells are much smaller, too. Plants contain chloroplasts.

Name: _____ **Date:** _____

Below are three different types of viral capsids. Look at the images and compare them to the cells on the previous page. What are some differences? Similarities?



Viral Capsids

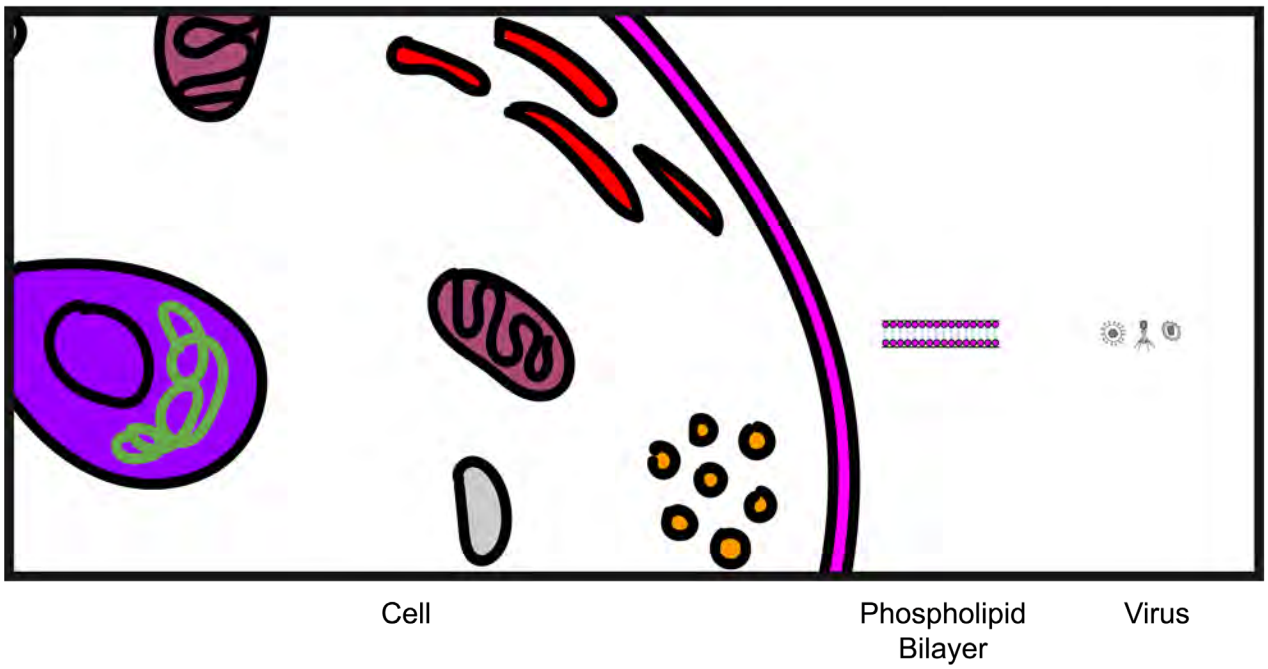
Notes:

The cell and virus drawings are simplified drawings meant to highlight the parts that all cells have in common, and the differences between the different types of cells. Help students walk through those drawings to compare the major types of cells. Then, have students look at the viral capsids and the cell to virus comparison (next pages).

ANSWER KEY (6TH - 8TH GRADE)

Lesson 1: What are germs?

Name: _____ **Date:** _____



Above is a size comparison of cells and viruses. What differences do you notice?

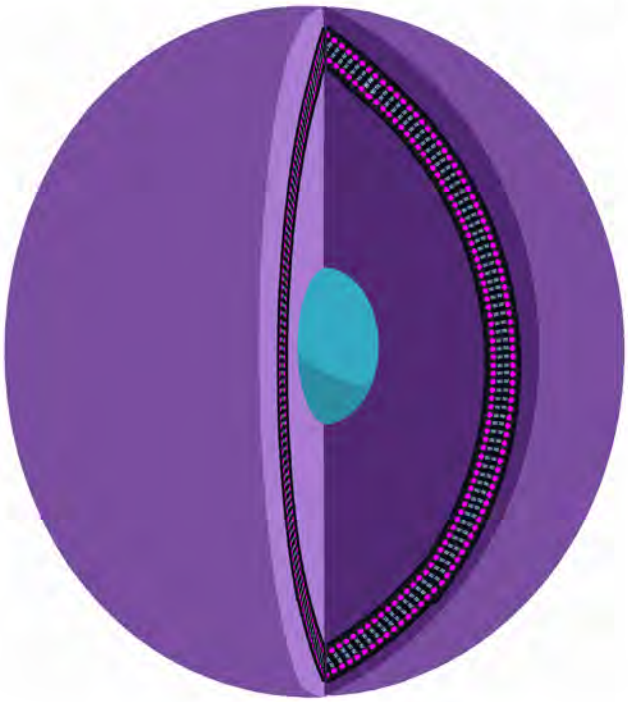
Have students look at the viral capsids and the cell to virus comparison. This should help students understand why viruses are not considered living like other cells, and that viruses are far smaller than cells and do not have a cell membrane.

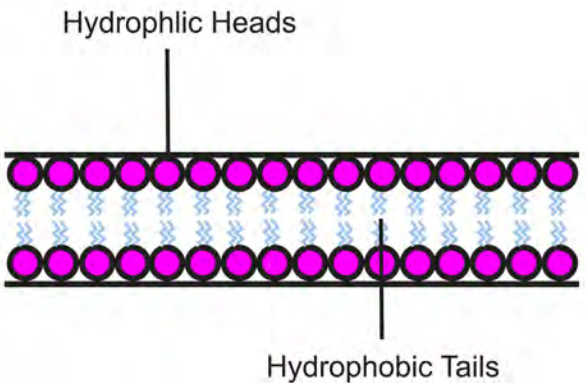
ANSWER KEY (6TH - 8TH GRADE)

Lesson 1: What are germs?

Name: _____ **Date:** _____

PHOSPHOLIPID BILAYER





Notes:

The 3-D view of the cell is to help students visualize how the phospholipid bilayer covers a cell.