

# Virus Vs. Bacteria

Watch this video to learn about the Virus Vs. Bacteria activity: [https://youtu.be/emZM-eg\\_Huc](https://youtu.be/emZM-eg_Huc)

<b>Science Topic</b>	<i>We're going to learn about the differences between viruses and bacteria.</i>
<b>Ideal Age</b>	<i>2<sup>nd</sup>-3<sup>rd</sup> grade</i>
<b>Driving Question</b>	<i>What is the difference between a virus and a bacterium? How can this help us understand coronavirus?</i>
<b>Materials Needed</b>	<i>Play-Doh Toothpick or pieces of string Paper Pen/Pencil Scissors Beads (optional) DNA, ATP, and Antibiotics (printed from Materials sheet at end of document, or drawn on a piece of paper)</i>
<b>Science Content</b>	<p>Bacteria are single-celled living organisms that are present throughout the world, living on surfaces, in our food, and in our bodies. Bacteria are alive like humans are, meaning that they have DNA, are able to produce their own energy, and reproduce to create new generations. Bacteria often cause harmful infections in humans and other animals, such as strep throat, salmonella poisoning, and tuberculosis. To treat these infections, antibiotics were invented. Antibiotics find bacteria by targeting bacteria-specific structures: these are structures that bacteria possess, but human cells do not. The antibiotics then prevent bacteria from continuing to reproduce so that the population dies out, but they do not harm human cells.</p> <p>Viruses are small particles made mostly of DNA or RNA and proteins. Many scientists do not consider viruses to be 'alive' because they are unable to produce their own energy. Instead, they must hijack living cells and use cellular resources to make energy and to reproduce. A cell that a virus lives in is called a host cell. Viruses do not have any of the unique structures that bacteria have and therefore cannot be targeted by antibiotics, so antibiotics cannot treat viral infections like common colds or the flu. However, scientists are able to make vaccines that cause the body to build up a defense against a virus without actually being made sick by the vaccine. When a vaccinated person is later infected by the virus, the body is already prepared to fight it off.</p>
<b>Process of Science</b>	<p>This activity provides children with a hands-on way to learn the basics of viruses and bacteria. We know that coronavirus has raised a lot of questions for all of us about what viruses are, how to stay healthy, and how to treat a coronavirus infection. Asking questions is actually the first step of the process of science, so everyone is already off to a good start! Next, this activity incorporates the use of models, which are representations that are used to learn about a real-life concept.</p> <p>Participants will build physical models of bacteria and viruses and, by doing so, they will be able to physically see what makes a virus and a bacterium. After learning about viruses and bacteria from models, kids will be able to apply their knowledge to coronavirus. Children will additionally apply their knowledge by playing a fun game that asks them to identify viruses and bacteria. In short, this activity teaches some of the basic features of viruses and bacteria and allows kids to apply their knowledge to a fun quiz, but also to a real-world problem.</p>
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## Activity Instructions for Parents:

Follow the underlined instructions to help your child(ren) build a model of a bacterium and a model of a virus. To engage your child(ren) in the process, **read the bolded questions aloud** to them and *discuss the italicized answers*.

## Introduction:

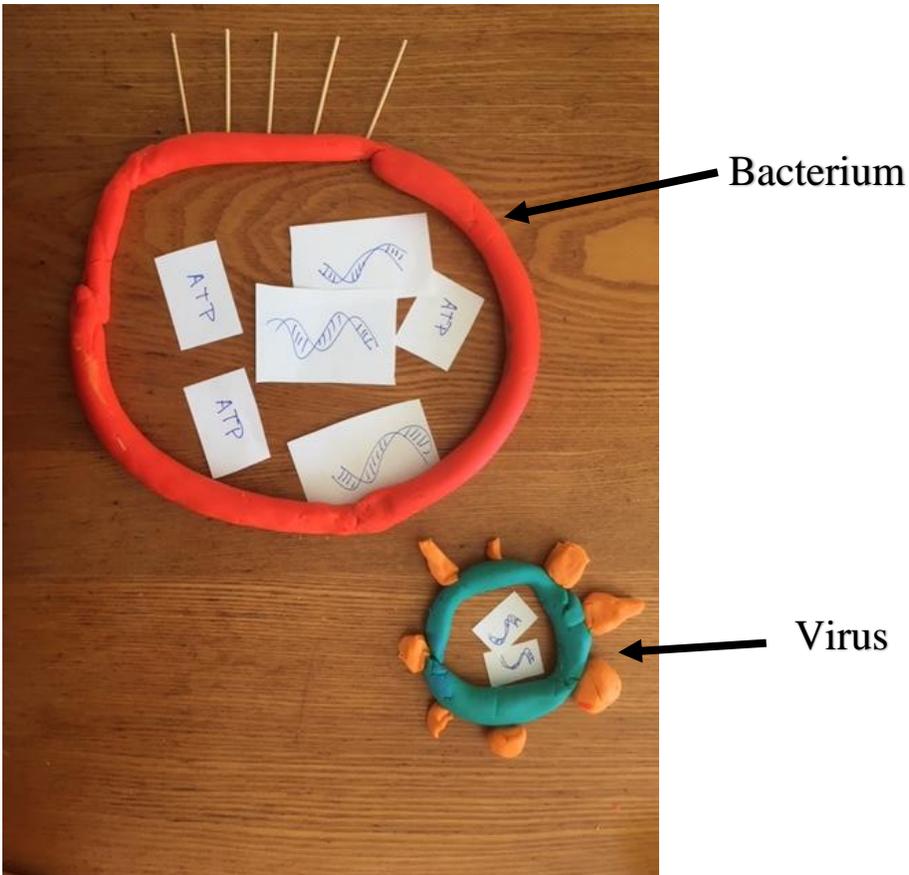
Ask your child the following questions to introduce the topic and get them thinking about viruses and bacteria!

- **Have you heard about viruses and bacteria before?**
  - Possible Answers:
    - Yes. (Move on to next question).
    - No. (Ask: Have you heard of Strep Throat? *This is caused by bacteria. Have you heard of E. coli?* *This is type of bacteria. Remember when you had a cold?* *That was caused by a virus.*)
- **What do viruses and bacteria do to people?**
  - Possible Answers:
    - Make them sick. (*This is correct. However, some viruses and bacteria are harmless, and some bacteria are even helpful to humans. For example, gut bacteria help us break down our food!*)
    - I don't know. (*Suggest common illnesses that are caused by bacteria or viruses that your child is familiar with.*)
- **Can you name a virus or bacteria (or associated illness) that you have heard about?**
  - Possible Answers:
    - E. Coli (*Bacteria*)
    - Salmonella (*Bacteria*)
    - Strep Throat (*Bacteria*)
    - Common Cold (*Virus*)
    - The Flu (*Virus*)
    - Chickenpox (*Virus*)
    - Coronavirus (*Virus*)

## Model Activity: Build a virus and a bacterium!

While building your models, you can refer to the pictures below for an example to follow!

1. Gather the materials you will need to build your model bacterium or virion.
  - a. Play-Doh (a few different colors is best)
  - b. paper
  - c. a pen, pencil, or other drawing instrument
  - d. scissors
  - e. beads (optional)
  - f. toothpicks or pieces of string.
  - g. You can print the “Materials” page, which includes some things you will need to help build your models, link DNA and ATP. Or you can use paper and pencils to draw these necessary materials.



2. First, build a bacterium.

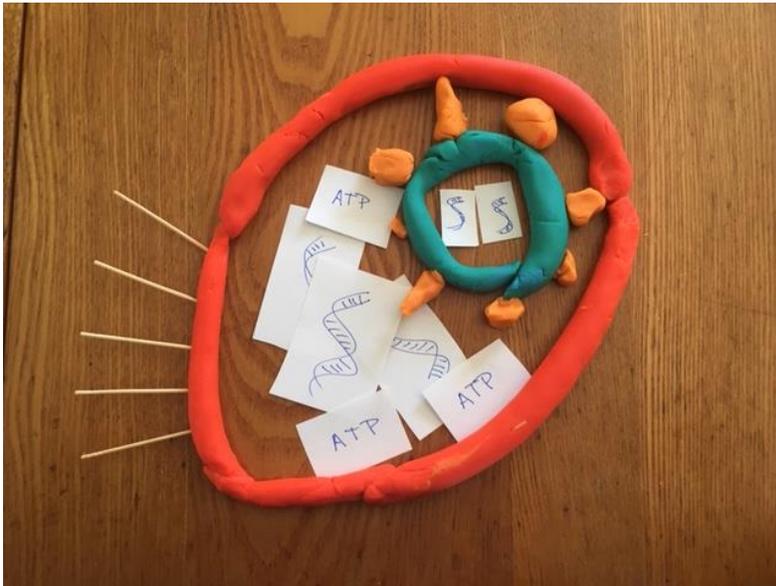
- a. *Just like people, bacteria need something that carries all the information to make a bacterium. **In people, what are genes made out of? DNA. Do you think bacteria also have DNA to carry information and genes? Yes!** Cut out one of the DNA strips that is provided below or make your own. This will be the DNA that goes into your bacterium.*
- b. **Are bacteria living creatures like people are? Yes, bacteria are alive!** *This means they need to make their own energy. The energy is called ATP! Cut out a few ATP molecules provided below or use paper and drawing materials to make your own. **What does the ATP do for the bacteria? It gives them energy.***
- c. *The DNA and ATP are stored inside of the bacterium. Mold your Play-Doh into a round shape around the DNA strip and the ATP molecules. This represents the bacterium's 'body' with the DNA and ATP inside.*
- d. *Your bacterium is almost ready to go! But what if it needs to move around somewhere? **What do you use to move around? People use their legs or feet to move. Do bacteria have legs or feet? No! One way that bacteria move is by having flagella, which are like little tails that help them swim around. Use a toothpick or a piece of string and attach it to your Play-Doh bacterium to represent a flagellum.***

3. Now, build a virion.

- a. **Do you think viruses have to have genes like people and bacteria do? Yes! What are genes made of? DNA! Viruses have DNA just like people and bacteria. Cut out a strip of DNA from the materials sheet or make your own DNA with paper and a pencil.**
- b. *Unlike bacteria, viruses can't make their own energy. **Since they can't make their own energy, should you put ATP molecules in your virus? No! The virus doesn't make ATP. It has to steal it from other organisms.***
- c. **Can you see viruses or bacteria with your naked eye? No, viruses and bacteria are both microscopic. This means that humans can't see them without using a microscope. But is one bigger than the other? Do you think viruses are bigger or smaller than bacteria? Viruses are tiny compared to bacteria! They have less DNA and they don't need to make ATP so there are fewer things inside of a virus. You should make your Play-Doh virus much smaller than your bacterium.**
- d. Mold your Play-Doh around your viral DNA into a spherical shape, being sure to make the virus smaller than you made the bacteria.
- e. *Because viruses don't make their own energy, they have to steal it. **What could a virus steal energy from? Animals, plants or even bacteria- any***

kind of organism that makes its own energy. To steal energy, a virus needs to stick to a host cell using special proteins on the outside of the virus. Using a different color of Play-Doh or beads or pieces of colored paper, make some small proteins to stick to the outside of your virus. The proteins can be round, square, spiky, or whatever shape you want.

- f. *The last step is to find a host cell for your virus! **What will happen if your virus doesn't have a host cell to steal energy from?** It will die! Using a piece of paper or the provided diagram, put your virus into a host cell so it can start stealing energy!*



In this example, the virus has infected the bacterium! Why would a virus need to infect a bacterium? (*To steal its energy.*)

4. Now, find out if antibiotics can kill your virus or bacteria.
- When do people take antibiotics?** *When they're sick. But antibiotics don't work on both viruses and bacteria- they only work against bacteria. Antibiotics find bacteria by looking for structures that are unique to the bacteria.*
  - What is a unique structure we talked about that bacteria have? (Hint: look at your bacteria model. What is the tail-like structure called?)** *Bacteria often have flagella, which are like tails that help them move. This is a structure that antibiotics can look for.*
  - Viruses don't have structures like flagella. Do you think antibiotics are able to find viruses?** *No! There aren't any unique structures for the antibiotics to look for, so they don't work against viruses.*
  - Cut out the antibiotic pills from the materials sheet or drawn your own. **Which model, the bacterium or the virus, should you stick your antibiotics to?** *The bacterium! The antibiotics would not be able to find the virus.*

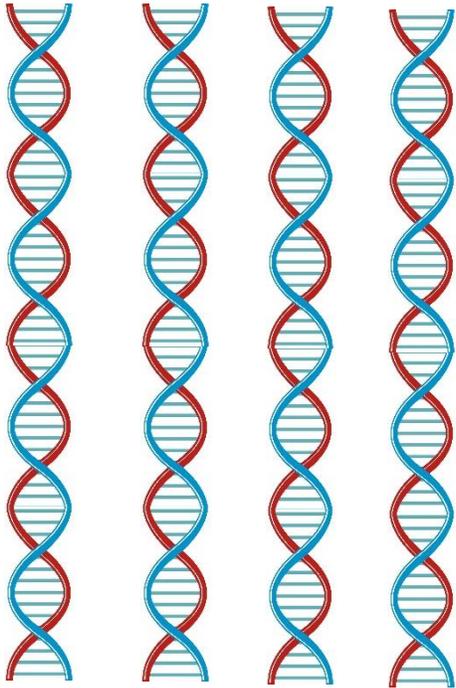
## Conclusion:

Coronavirus is a virus that has recently jumped from bat hosts into humans. Ask your child(ren) the following questions and discuss the answers, using what you have learned about viruses from the activity.

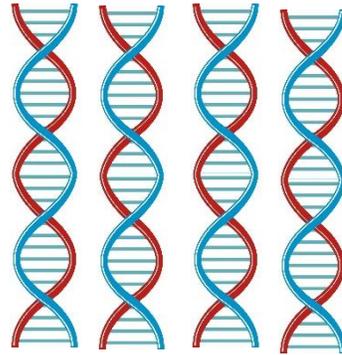
1. **Is coronavirus a virus or a bacterium?** *Coronavirus is a virus! This is easy to remember because 'virus' is part of the name. Coronavirus may also be called "covid-19".*
2. **Since coronavirus is a virus, can it make its own energy?** *No! Viruses are not "alive" and they can't make their own energy.*
3. **Where do you think coronavirus gets energy from?** *Humans/human cells. When the virus infects a person, it steals energy from their cells. It can use this energy to make more virus particles.*
4. The coronavirus makes some people very sick. **Can doctors give people antibiotics to treat coronavirus?** *No, antibiotics only fight bacteria. They cannot be used to kill coronavirus.*
5. The flu is also a virus. **What do many people get in the fall so that they don't get the flu?** *The flu shot. This is called a vaccine and it helps the body prepare to fight off a virus. Many scientists are now trying to develop a vaccine for coronavirus.*

Materials:

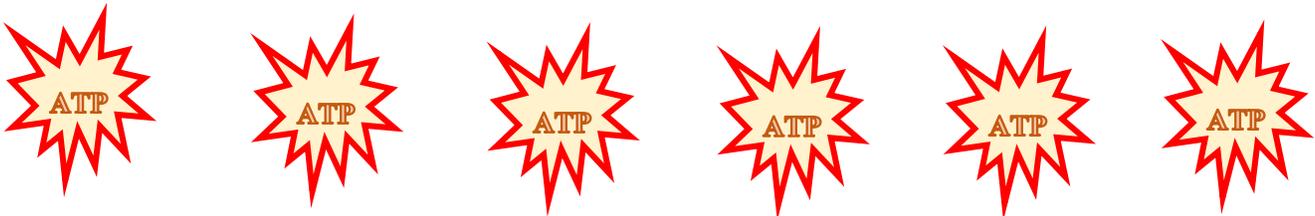
DNA for bacteria:



DNA for viruses:



ATP molecules:



Antibiotics:



Host Cell:

