

Pathogen Modeling

Recommended Age: 8-12 years old

Time: 45 minutes



When you feel sick, you often go to visit the doctor. He or she may tell you what is causing your illness. In most cases, you will probably be told that your illness is caused by a type of bacteria or virus. However, there are other ***pathogens*** that can make you ill as well. The word ***pathogen*** refers to any particle or organism that can enter the body and cause illness or infection. There are four major types of ***pathogens*** that can invade the human body – bacteria, viruses, fungi and parasites. In this activity you will learn how to identify each of these four pathogens and make models of common examples in each category.

In this activity we will:

- learn the different categories of pathogens that can infect your body.
- make models of specific pathogens that can infect your body.

Materials

- Different colors of modeling clay or Play-Doh
- Pipe Cleaners
- String
- Scissors

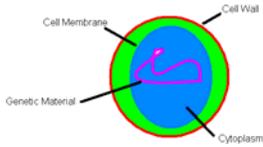
Safety

- Be careful when using scissors as they can be sharp and can cut you. Ask an adult for help if necessary.

Activity

The following paragraphs will describe each type of pathogen first and then provide you with instructions in order to make models of your own.

Bacteria



There are many types of bacteria that can infect the human body. Bacteria are single-celled organisms that come in a variety of shapes and sizes. However, most bacteria are smaller than 0.01 mm and all have similar features within their cell. A bacteria cell typically contains a cell wall, a cell membrane, cytoplasm and genetic material in a coiled chain. The picture below gives a general idea of the layout of a bacterial cell.

Bacteria reproduce through binary fission, which occurs when the bacteria replicates its genetic material and splits in half. Bacteria do not need other bacteria in order to reproduce. In the right conditions, one single bacterial cell can reproduce to thousands in a very short period.

Some of the most well known bacterial infections are strep throat, food poisoning and the Black Death (Bubonic Plague). Only infections that are caused by bacteria can be treated with antibiotics. The instructions below show you how to make models of the strep throat bacteria, the Black Death and E. Coli, a type of bacteria that can cause food poisoning.

To make **Strep Throat** (*streptococcus*) bacteria

1. Roll some clay into 5 or 6 round balls.
2. Thread a pipe cleaner through each of the balls to make a strand.



To make **E. Coli** bacteria

1. Roll a hunk of clay into an oval shape.
2. Cut a pipe cleaner into small 1 cm pieces. Insert the pipe cleaner pieces all around the oval shaped clay.
3. Cut some small pieces of string several centimeters in length. Insert the strands into one end of the clay. This tail, which is normally called the **flagella**, is something that bacteria use to move themselves around.

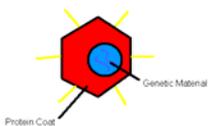


To make the **Black Death** (*yersinia pestis*) bacteria

1. Shape a long flat oval of one color of clay.
2. Decorate the edge of the oval with black clay.



Viruses



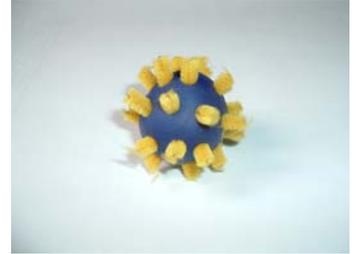
Although viruses can cause very nasty illnesses, most scientists have supported the idea that viruses are not even living organisms. Most viruses are on the nanometer scale, which is a billion times smaller than a meter. A virus has two main parts – a protein coating and genetic material (DNA or RNA). A virus cannot reproduce by itself. It requires a host cell, into which it can inject its genetic material. The cell will then reproduce more viruses until it becomes so full it bursts open, releasing all of the new viruses into the body. The new viruses can move on to infect more cells.

Common viruses that you may be familiar with are the common cold, the flu, and the chicken pox. Some viruses, such as polio and the measles, can be prevented with vaccines. **Vaccines** are usually dead or weakened forms of the virus that are introduced in the human body in order to allow the immune system to build defense against the virus. Viruses like the cold, flu and HIV are more difficult to make vaccines for because there are so many different types of each. You cannot treat a viral infection with an antibiotic.

Follow the directions below to make a model of one common cold virus (a rhinovirus).

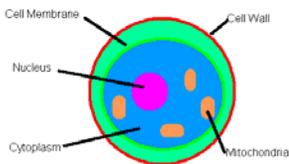
To make a **Rhinovirus**

1. Roll a piece of clay into a ball.
2. Cut two pipe cleaners into 1/2 cm pieces.
3. Insert the pipe cleaner pieces all over the clay ball.



Fungus

A fungus that causes an infection or illness can range in size from a single celled organism to several cells connected together, which can grow up to centimeters in length. Fungus cells are different from bacterial cells in that their genetic material is enclosed in a control center called a **nucleus**. It also contains energy factories called **mitochondria**. Like bacteria, fungus cells contain a cell wall, a cell membrane and cytoplasm.

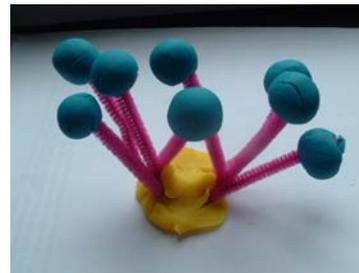


Single celled fungus organisms reproduce much like bacteria by splitting in two. Larger fungus, however, require multiple fungi in order to fertilize and reproduce. The mushrooms and toadstools that you see in the grocery store or in your yard are actually reproductive organs for fungus!

Some fungi you may be familiar with are athlete's foot, ringworm and bread mold. Below you will find instructions for making a model of bread mold.

To make **Bread Mold** (*Rhizopus nigricans*)

1. Cut 2 pipe cleaners in half.
2. Roll small balls of clay for each end and insert the clay onto each end of the pipe cleaner.
3. Fold the pipe cleaner in half so that the balls are all clustered together.
4. Wrap a large piece of clay around the bent part of the cleaners to act as a base for your bread mold. Place the a flat surface so the model can stand upright.



balls

pipe
base on

Parasites

There are three major types of parasites – protozoa (single-celled parasites), insects and worms. Protozoa behave much like bacterial cells and reproduce in a comparable manner. Parasitic insects and worms behave like regular insects and worms, except they use humans to get nutrients and transportation. Parasites that you may have heard of are tapeworms, hook worms, lice or bed bugs. Follow the directions below to make a model of a hookworm.

To make a **Hookworm** (*Ancylostoma duodenale*)

1. Roll a large piece if clay into a tube.
2. Flatten one end of the tube on a flat surface. Bend the other part of the tube forward.



3. Make a flat circular disk that is slightly smaller than the end of the tube. Stick the flat disk to the end of the tube.
4. Shape four small triangles to make teeth for your hookworm. Put them in one area of the black disk.

Extension Activities

1. Find information and actual pictures of these pathogens on the internet and compare them to your models. Look up symptoms and how each pathogen can be passed from human to human,
2. Look for other interesting pathogens online and make your own models!

Summary

The next time you get sick and the doctor tells you what illness you have, you might be able to tell whether or not it is a virus, bacteria, parasite or fungus! You may already know what it looks like! However, if it is something that is unfamiliar to you, you can always look it up and make your own model to play with while you stay at home and get better!

References

<http://www.schoolscience.co.uk/content/4/biology/abpi/immune/immune2.html>