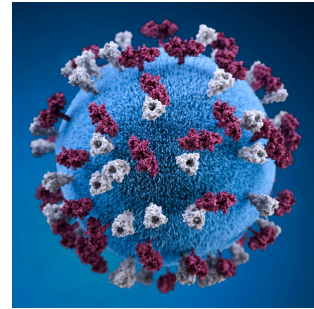


# Pandemic Modeling Experiment

For this week's experiment, we thought it would be important to talk about the current situation that is on everyone's mind: the COVID-19 pandemic. We will be discussing what a pandemic is and show why it is important to follow social distancing using an experiment and some cool online simulators!

## Background:

Before we hop into the experiment, let's talk about what a pandemic is, and how it is different from an epidemic. An epidemic is an "outbreak of disease that spreads quickly and affects many individuals at the same time". A pandemic is an epidemic, but on a larger scale. It affects a larger amount of the world's population and spreads to multiple countries. For example, the Ebola outbreak of 2014-2016 was considered an *epidemic*. Although it affected a lot of people, the outbreak mainly stayed in the area of West Africa. We are currently experiencing a *pandemic* because COVID-19 has affected countries all over the world.



So what exactly is COVID-19, and how did it start to spread? You might already know a lot about this disease because it is all over the news. COVID-19 stands for coronavirus disease 2019. It is a virus that attacks the respiratory system and can easily spread from person to person. This particular coronavirus was hypothesized by experts to have come from bats, specifically in open-air "wet markets". In wet markets, customers can buy fresh meat from animals that have been killed very recently. These markets have many exotic animals in a crowded location, so the viruses in different animals can swap genes and change genetically (this is called mutation). When people come into contact with the animals, the viruses can be passed on to them. This is what happened in Wuhan, China.

In this experiment, we will be modeling how a disease spreads and is able to affect a large amount of the population.

## Part 1- Disease Spread Model

### Materials

- red cabbage
- boiling water (get help from an adult!)
- heat proof container to hold the cabbage leaves and hot water
- strainer
- gloves
- knife (get help from an adult!)
- chopping board
- 5 clear cups
- bicarbonate soda, aka baking soda (or vinegar, or borax)
- water

### Experiment:

1. Chop the red cabbage into pieces and add them to a heatproof container. Pour boiling water over the red cabbage leaves and leave for at least 5 to 10 minutes (the more the better). *[make sure to be careful with the boiling water!]* Strain the cabbage leaves and collect the warm red cabbage juice for use in the experiment.
  - a. The cabbage leaves have a dye in them that reacts to changes in pH. In this experiment, liquids with higher pH (more basic than water) react with the dye in purple cabbage and change the color. This color change represents infection with disease.
2. Set the 5 clear cups in a row. Pour water into each of them, filling each cup  $\frac{3}{4}$  of the way. Stir a spoonful of bicarbonate soda into ONE of the cups. Make sure to stir well, so that hopefully all of the bicarbonate soda dissolves.
  - a. You could also substitute in vinegar for bicarbonate soda, this would make the color change different in step 4
3. Pour cabbage juice into the four cups of water that do not have bicarbonate soda in them.
  - a. The purple cabbage juice represents a health check of the patient (the cup of water). The light purple color of the water-only cups indicates that the patient is healthy.
4. Pour the cabbage juice into the bicarbonate soda cup. What color does it turn?
  - a. This color now represents the color of a diseased patient.
5. See what happens when you transfer some of the bicarbonate liquid into the other cups. Do the colors of the liquid change? What does this represent?

### Furthering Understanding:

(after you complete the experiment, take a moment to think about the answers to the below questions)

*How does this experiment relate to the current COVID pandemic?*

*How does the experiment show how carriers of the disease that are asymptomatic (meaning that they do not show symptoms) affect the rate of the spread of disease?*

## **Part 2- Online Simulation**

In situations like these, the best way to protect ourselves and our family is to stay safe and healthy. We can do this by social distancing, which means only being in contact with the people in your household and only traveling when necessary, like going to the grocery store or to a doctor's appointment. It is also important to follow the advice from the CDC (the Center for Disease Control), which is to wear a mask and gloves in public if possible, to wash your hands regularly, and avoid touching your face when you are in public.

*But why is it so important to do this? If people don't have symptoms of the disease, why do they have to follow these rules?*

It is important for everyone to follow these regulations so that the world can get closer to achieving "herd immunity". Herd immunity, or herd protection, occurs when most of the population is immune to a disease. Since there are less people to spread the disease to people that are at a high risk of infection, the rate of infection slows down. This is usually done with regular vaccinations for diseases like measles, mumps, and polio.

Right now, there is not a vaccine for COVID-19, so everyone has to social distance in order to create this "herd protection". By doing this, we are able to slow down the rate of the spread of the disease and protect the people that are at a higher risk of being infected.

In this part of the experiment, you can play around with two cool online epidemic simulators! Check out both links to figure out which simulator you prefer. Try changing the conditions and see how it affects the rate of infection. Pay attention to the conditions that you can change in your life (like the amount of social distancing you do).

*Online epidemic simulator and information:*

[Outbreak](#)

*A cool online epidemic simulator:*

[Epidemic Simulation](#)

As you are going through the simulations, think about these questions:

- **What did you learn about how the rate of infection changes based on the conditions?**
- **What increases the rate of infection? What decreases it?**
- **What can you and your family do to help create "herd protection" in your community?**

List of Background info Sources:

<https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/summary.html#:~:text=COVID%2D19%20is%20caused,CoV%2D2>.

<https://www.webmd.com/cold-and-flu/qa/what-is-an-epidemic>

<https://www.webmd.com/lung/coronavirus-history>

<https://www.jhsph.edu/covid-19/articles/achieving-herd-immunity-with-covid19.html>

List of Activity Sources:

<https://www.fizzicseducation.com.au/150-science-experiments/human-body-science/model-a-pandemic-classroom-activity/>

<https://meltingasphalt.com/interactive/outbreak/>

<https://prajwalsouza.github.io/Experiments/Epidemic-Simulation.html>