

Virus Life Cycle (Lytic Cycle)

Imagine a sinister (and, luckily, fictional) military tank driving around in Michigan, where many American cars are made. Imagine that the tank finds a major auto factory and crashes through the wall into the plant, destroying itself. Imagine then that the crew (also sinister) gets out from the wrecked tank and re-trains the factory's workers to make other sinister tanks.



The plant produces more and more tanks until soon the factory can hold no more, and it literally bursts. Hundreds of tanks crash through the walls in every direction and rumble off across the countryside in search of more auto factories, where the process is repeated.

This story, while strange, is a remarkably accurate analogy of the life cycle of a virus. That tank represents a virus and the automotive factory is an infected cell. In the vocabulary of viruses, you can say that the virus causes the infected cell to burst, or **lyse**. A virus that causes this is called a **lytic virus**.

Exploring Viruses

In this activity, you will examine the life cycle of a lytic virus.

- In the Gizmo™, be sure that the **DESCRIPTION** pane is visible, and if the simulation is running, click Reset. Be sure that the first stage in the virus life cycle is selected. (You can use the right and left arrows to select the first stage of the life cycle, or simply click the first small virus image at the bottom of the **DESCRIPTION** pane.)
- Examine the diagram of this stage in the virus life cycle and read the information.**
 - Why is this type of virus called a bacteriophage?

 - What are the basic parts of a virus?

- Examine the second and third stages of the life cycle and read the information.**
 - What happens to the viral nucleic acid once it is inside the cell?

 - What activity does the nucleic acid direct within the cell?

 - Nucleic acids provide the templates that are used in the production of proteins.
- Examine the fourth and fifth stages of the virus life cycle.**
 - How do viruses kill the infected cell?

 - This process is known as **lysis**.

- Click Play.** Watch the simulation for about 120 to 130 (simulated) minutes. Then click Pause.
 - How does the number of viruses change as time passes?

 - Also, would you say that the rate at which new viruses are formed speeds up, slows down, or stays about the same over time?

6. Click **Reset** (↺). Run the simulation again. This time you will be collecting data to illustrate your initial observation. Press the pause (⏸) button every 10 seconds to collect your data. Complete the data table below and prepare a graph (Three lines/three colors) that shows you data.

Time (min)	#Healthy Cells	#infected cells	#dead cells	Time (min)	# Healthy Cells	# infected cells	# dead cells
10				100			
20				110			
30				120			
40				130			
50				140			
60				150			
70				160			
80				170			
90							

7. Click **Reset** (↺) and display the **TABLE** pane. This table will be updated every time the number of viruses, uninfected cells, or infected cells changes. Click **Play** (▶).

After about 40 (simulated) minutes, click **Pause** (⏸).

- How many cells are there initially? _____
- At what time was the first cell infected? _____ How long after the first cell was infected were the newly created viruses released from the cell? _____
- Does this data match your data table and graph? _____



8. Click **Play** (▶) again. Let the simulation run until there are no healthy cells remaining.
- How long did it take for all 50 cells to lyse? _____
 - Scroll up in the table. How much time did it take to reach the point at which there were 25 healthy cells remaining? _____
 - Does this data match your data table and graph? _____
 - Then how long did it take for those 25 cells to die? _____
 - Does this data match your data table and graph? _____
 - Based on your previous answers, would you say the rate of lysis increased or decreased as time went by? Explain your answer. _____



Make sure you look at the assessment questions below the Gizmo! You may see them on your quiz!



Name:

Date:

Disease Spread Gizmo

Blackboard – CB biology – external links – Spread of Disease Gizmo

Pathogens are very small living things that can cause disease in plants, animals, and people. When a pathogen spreads widely, the results can be devastating. In the United States, an outbreak of influenza ("the flu") in 1918 killed approximately 675,000 Americans. Understanding how pathogens are transmitted helps us prevent diseases from spreading.



Foodborne and Airborne Transmission

Some diseases can spread through eating food or drinking water containing pathogens. For example, foodborne pathogens can cause the diarrhea associated with "food poisoning." Pathogens can also enter our bodies through the air we breathe. This kind of airborne transmission occurs when you catch a cold from a sneezing person or become sick from a pathogen in an air conditioning vent.

- Select the **Controls** tab. Place **20** people in the room by setting the **Number of people** slider to 20. Then, turn on **Foodborne** under **Allowed diseases**, and turn off **Airborne** and **Person-to-person**. Under **Probability of Transmission**, set the **Food-to-person** slider to High.
- Select the **Simulation** tab, and then click the **Play** button. Notice that when the simulation starts, all the people in the room are healthy. Each time a person goes to the buffet table at the top-left wall and eats or drinks something from it, however, he or she may ingest pathogens and become sick. While the simulation is running, inspect the table (on the **Table** tab) and the graph (on the **Graph** tab).

- How does the speed of foodborne transmission of pathogens compare to the speed of person-to-person transmission?* _____
- If a person in the simulation never eats or drinks anything from the buffet table, is it possible for them to become sick with the foodborne disease? Explain why or why not.* _____

- Select the **Controls** tab. Make sure there are still **20** people in the room. Then, turn on **Airborne** under **Allowed diseases**, and turn off **Foodborne** and **Person-to-person**. Under **Probability of Transmission**, set the **Airborne** slider to High.
- Select the **Simulation** tab, and then click the **Play** button. Notice that when the simulation starts, all the people in the room are healthy. Each time they breathe the air in the room, however, they have a chance of catching the airborne disease. While the simulation is running, inspect the table (on the **Table** tab) and the graph (on the **Graph** tab).

- How does the speed of airborne transmission of pathogens compare to the speed of person-to-person transmission?* _____
- If a person in the simulation never eats or drinks anything from the buffet table, is it possible for them to become ill with an airborne disease? Explain why or why not.* _____

If the same disease could spread through both airborne and foodborne transmission, would it spread more quickly or more slowly than if it could only spread by one of these means? Think about your answer, and then check it by running another trial of the simulation with both **Airborne** and **Foodborne** turned on under **Allowed diseases** on the **Controls** tab. Explain how the simulation's results support your answer. _____

Name:

Date:



Person-To-Person Transmission

You can also catch a disease through physical contact between healthy and infected people. For example, a person infected with one of these diseases might accidentally pass on his or her pathogens to healthy people by shaking their hands or patting them on the back. These are examples of person-to-person transmission.

- In the Gizmo™, select the **Controls** tab. Place **5** people in the room by setting the **Number of people** slider to 5. Then, turn on **Person-to-person** under **Allowed diseases**, and turn off **Airborne** and **Foodborne**. Under **Probability of Transmission**, set the **Person-to-person** slider to **High**.
- Select the **Simulation** tab. Notice that the simulation starts with one infected person and four healthy people. Click the **Play** button. The people will begin to walk randomly about the room. Each time a healthy person comes in contact with an infected person, the healthy person has a chance of becoming infected. Watch the simulation until all the people in the room are infected, then select the **Table** tab. The table shows when each person caught the disease.

e. How long did it take for all 5 people to become sick? _____

- Click the **Reset** button and then the **Play** button to try the experiment again under the same conditions. Look at the table to see when all the people in the room became sick.

f. How does this compare to what you found in the previous experiment? Explain why the times can be different. _____

- Select the **Controls** tab. Increase the **Number of people** in the room to **35** using the slider. Then, select the **Simulation** tab and start the simulation by clicking **Play**. Look at the table (on the **Table** tab) and the graph (on the **Graph** tab).

g. How do your results with 35 people in the room compare to your results with 5 people in the room? _____

h. Why do you think this is? _____