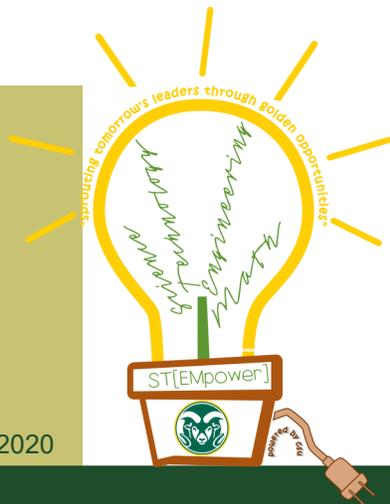


# ST[EMpower]



## VIRAL-CYCLES: CELL vs. VIRION

VOLUME 10, ISSUE 2, May 5, 2020

### Compare Models of an Animal Cell and a Virion

#### THIS ISSUE

- Making Models page 2
- Model of Animal Cell Page 5
- Model a Virion page 6
- Answers page 7

#### POWER WORDS

- **chronic**: persisting for a long time or constantly recurring
- **novel virus**: a virus not seen before
- **virion**: the complete, infective form of a virus outside a host cell, with a core of RNA or DNA and a capsid
- **virus**: an infective agent that typically consists of a nucleic acid molecule in a protein coat, is too small to be seen by light microscopy, and is able to multiply only within the living cells of a host

What a crazy year! Suddenly, all the news is about the **novel** coronavirus and the disease it causes, COVID-19. It can be scary, because you can't go to school or play with your friends right now.

After we start opening back up, things are going to be different. You and your friends might wear cloth face masks or sit further apart in your classroom. Depending on if we get an uptick in infections, we may need to stay at home again. This will last until enough people are immune to COVID-19, either by being infected and recovering, or getting a vaccine that still needs to be developed.

Some people infected by this **virus** show no symptoms. Some people have minor symptoms. Other people have very severe symptoms, and they need to go to the hospital to help them stay alive. Anyone who is infected can spread this disease.

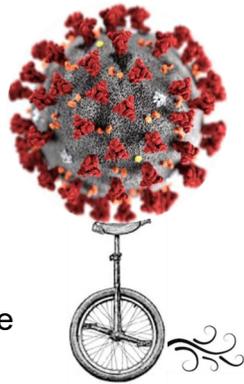
What about children? Generally

children do not get really sick. Phew! The concern with this disease is if someone has an underlying condition. That means, the person has another **chronic** illness, like diabetes. If they are infected with coronavirus, they can have severe symptoms. It also is harder for older people.

Scientists are working very hard to understand how this disease attacks the human body. Why do some people have no symptoms, but are infected, and others need to go to the hospital to help them stay alive?

Scientists are working very hard to find treatments, or medicine that helps reduce the symptoms of the disease, or a vaccine to help people get immunity to COVID-19 without having the disease.

We are in this together, and we will be okay.



SCIENCE, TECHNOLOGY,  
ENGINEERING, AND MATH  
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4-H PROGRAMS ARE AVAILABLE TO ALL WITHOUT DISCRIMINATION

In this activity, you will build a model of a typical animal cell. This model will have the major **organelles**, but not all the particles and molecules that **comprise** a cell. Our cells are packed with fibers, centrioles, nucleotides (make DNA and RNA), amino acids (make proteins), etc. You will then build a model of the coronavirus. This model will have all of the **components** of a **virion**.

**Virion** is pronounced like this:

- vi (the “i” sounds the same as in “hit”)
- ri (ree, sounds the same as in “free” without the “f”)
- on (like the preposition “on”)

**Animal Cell Model:**

- Page 5 has the components to build your cell. Don't have lunch yet! Wait until you make the **virion** and compare the two for similarities and differences before enjoying your models.
- Gather all your materials, and then build your sandwich - I mean - model of the cell.



- Wash all the produce. CSU Extension has a Fact Sheet explaining the proper way to protect yourself. The website has the video, this lesson, and the Fact Sheet. It is just a click away to read and learn the best practices

to keep you safe!

**COLORADO STATE UNIVERSITY EXTENSION**  
**Guide to Handling Fresh Produce**  
 Fact Sheet 9.980 Food and Nutrition Series | Food Safety  
 By E. Shackleton, A. Zandbergen, and M. Borengier

**Store safely.** Produce that requires refrigeration should be stored at 35-40°F in vegetable bins or containers on shelves above raw meats, poultry, or seafood to prevent cross-contamination. Storing fresh produce in cloth produce bags or perforated plastic bags will allow air to circulate.

**Trim well.** Cut away damaged areas and remove torn outer leaves of leafy vegetables before rinsing.

**Start clean.** Bacteria from the outside of produce can be transferred to the interior flesh during cutting or peeling, so the best approach is to start with clean hands, cutting boards, and utensils before washing and preparing fresh produce.

**Cleaning Fresh Produce**  
 No cleaning method completely removes or kills all microbes which may be present on produce, but studies have shown that thoroughly rinsing fresh produce under clean running water is an effective way to reduce the number of microorganisms. Rinsing fruits and vegetables not only helps remove soil, bacteria, and stubborn garden pests, but it can also help remove pesticide residues.

**Wait to clean.** Cleaning produce before storing may promote bacterial growth and speed up spoilage, so it is recommended to wait and rinse fruits and vegetables until just before using. If you choose to rinse before storing, dry thoroughly with clean paper towels.

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**Quick Facts**

- Fresh fruits and vegetables are an essential and flavorful part of a healthful diet.
- Types of fresh produce vary widely, from root vegetables to delicate berries, and recommended methods of cleaning depend on the type and characteristics of the produce.
- To ensure produce safety and quality, consumers should handle and clean produce properly.
- Following these practical tips can help you safely enjoy the wide variety of fresh fruits and vegetables available in Colorado.
- The CSU Extension's PRODUCE SMART app/website for tested high altitude recipes and instructions for canning, freezing, drying, and fermenting fruits and vegetables. <https://apps.chhs.colostate.edu/produceSMART/>

- Examine the model of the cell, and arrange the ingredients like that image.
  - Start with the bread.



**MATERIALS**

- butter knife
- plate
- 2 slices of bread
- spread like cream cheese or mayonnaise
- hard boiled egg, peeled and sliced round sections
- olives, sliced or whole
- shredded lettuce
- dried cranberries or raisins
- sliced red or green bell pepper
- minced onion or green onion
- round cracker
- deli meat (e.g. ham or turkey)
- print pages 5-6
- color pencils or markers

**POWER WORDS**

- **component:** a part or element of a larger whole
- **comprise:** consist of; be made up of
- **hijack:** to stop and steal: to take control by force
- **metabolic:** relating to the **metabolism** of a living organism
- **metabolism:** the chemical processes that occur within a living organism in order to maintain life
- **organelle:** any of a number of organized or specialized structures within a living cell

- Add spread (the mayonnaise or cream cheese).



- Add 1 sliced egg.



- Add olives (sliced or whole).



- Add shredded lettuce.



- Add dried cranberries.



- Add green or red bell pepper slices.



- Add onion.



- Compare your sandwich model to the image on page 5. As you go through each of the ingredients, read what they represent with the description in the left column.

*Virion Model:*

- Page 6 lists components to build your virion. Don't have your snack yet! Wait until you compare your typical animal cell model to the virion model.
- Gather all your materials and

**FASCINATING FACTS**

- Animal cells, in general, are eukaryotic, which means they have a nucleus. However, not all animal cells have a nucleus. For example, the red blood cells do not have a nucleus because they do not multiply by cell division. The lack of a nucleus allows them to carry more oxygen in the cell.
- During the daily activity, the cell can face some malfunction in the RNA and DNA strands amongst other things. The cell has the functionality to correct these malfunctions on their own immediately.

then build your snack - I mean - virion model.

- Examine the model of the virion, and arrange the ingredients like that image.
  - Start with the cracker.



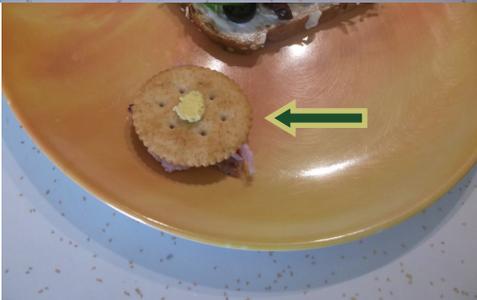
**FASCINATING FACTS**

- The genetic information of viruses can be DNA or RNA; single or double stranded; one molecule or in pieces.
- The name virus was coined from the Latin word meaning slimy liquid or poison.
- Viruses are not alive – they are inanimate complex organic matter. They lack any form of energy, carbon metabolism, and cannot replicate or evolve. Viruses are reproduced and evolve only within cells.
- Walter Reed discovered the first human virus, yellow fever virus, in 1901.

- Add 1 sliced egg yolk (remove the white).



- Add deli meat slice (cut into slivers and pieces).



- That is the complete, simple virion. When a cell is infected, the virus **hijacks** the cell's **metabolic** functions. It steals all the raw materials it needs from the cell. When so many virions have been made, the cell bursts open. The viruses capture the membrane of the ruptured cell, wrapping their capsid with membrane.
  - You can optionally add the slice of bread and wrap it around your

cracker/yolk/deli meat.



- Compare your snack model to the image. As you go through each of the ingredients, read what they represent with the description in the left column of page 6.

*Compare your two models:*

- List the similarities and differences between your two models. Write down this list on your model paper.
- The model of the cell is simplified. It also contains all the raw materials needed to make proteins, organelles,

**HOW TO WASH YOUR HANDS—FROM THE CDC**

- Wet your hands with clean, running water (warm or cold), turn off the tap, and apply soap.
- Lather your hands by rubbing them together with the soap. Be sure to lather the backs of your hands, between your fingers, and under your nails.
- Scrub your hands for at least 20 seconds. Need a timer? Hum the "Twinkle Twinkle Little Star" song from beginning to end.
- Rinse your hands well under clean, running water.
- Dry your hands using a clean towel or air dry them.

replicate DNA and translate into RNA.

- Examine your list. What thoughts or ideas do you have? Do you have any conclusions? Write down those on your paper.
- Is a virus alive? What defines life? Join the scientists' debate!

**VIDEOS**

- From the CDC—how a virus manufactures a new virus:  
<https://www.youtube.com/watch?v=QHHrph7zDLw>
- How washing hands protects us from Coronavirus:  
[https://www.youtube.com/watch?v=s2EVIqqI\\_f8](https://www.youtube.com/watch?v=s2EVIqqI_f8)

The CDC is the Center for Disease Control, housed in Atlanta, Georgia.

**Cell Components:**

**DO NOT EAT THE CELL MODEL!!!  
Yet...**

**Sketch your model here:**

**Cell Membrane:** slice of bread  
Acts like our skin, protects and contains the cell. It is made from 2 layers of proteins and fats. It controls the entry of needed supplies (e.g. nutrients) exit of waste products.

**Cytoplasm (Cytosol):** spread (mayo/cream cheese)  
Fills the cell with a jelly-like material which contains all the cell organelles, enclosed within the cell membrane.

**Nucleus:** hard boil egg slice  
DNA is the brain of the cell (yolk) is surrounded by a membrane (white). It contains genetic materials (DNA and RNA) and macromolecules to produce RNA and DNA during replication.

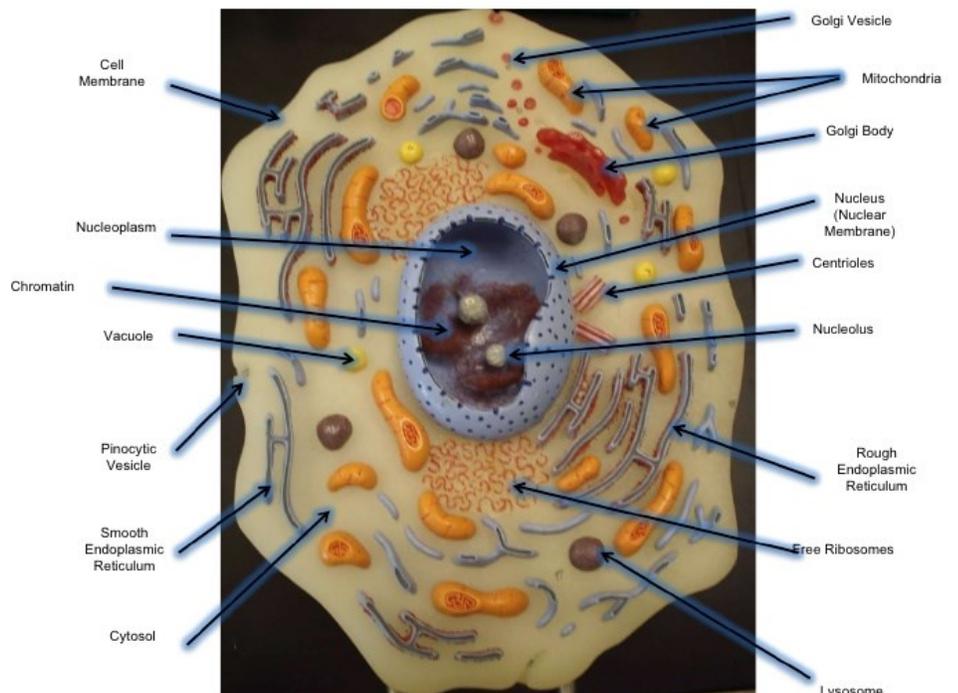
**Lysosome:** olives  
Acts like a stomach, they are small round organelles surrounded by a membrane comprising of digestive enzymes to recycle used molecules and organelles.

**Golgi Body (Apparatus):** shredded lettuce  
It acts like a big rig truck, transporting cell products to where they need to go. It is a flat, smooth, sac-like organelle located near the nucleus.

**Mitochondrion:** dried cranberries  
The powerhouse, they are rod-shaped organelles with a double membrane. They make small packets of energy called ATP.

**Endoplasmic Reticulum:** thin sliced green pepper  
This is the protein manufacturing center, folding, modifying, and transporting proteins. It is a thin, winding network of sacs originating from the nucleus.

**Ribosome:** finely chopped green onion  
Small organelles read RNA (copies of the DNA blueprint) to make new proteins for the cell to function.



## Virion Components:

## Sketch your model here:

### Capsid: round cracker

The capsid is a protein layer between the envelope and the genome to protect the viral genome. The grey surface on the bottom image is the capsid.

### Genetic Material: hard boiled egg slice, remove the white and use only the yolk

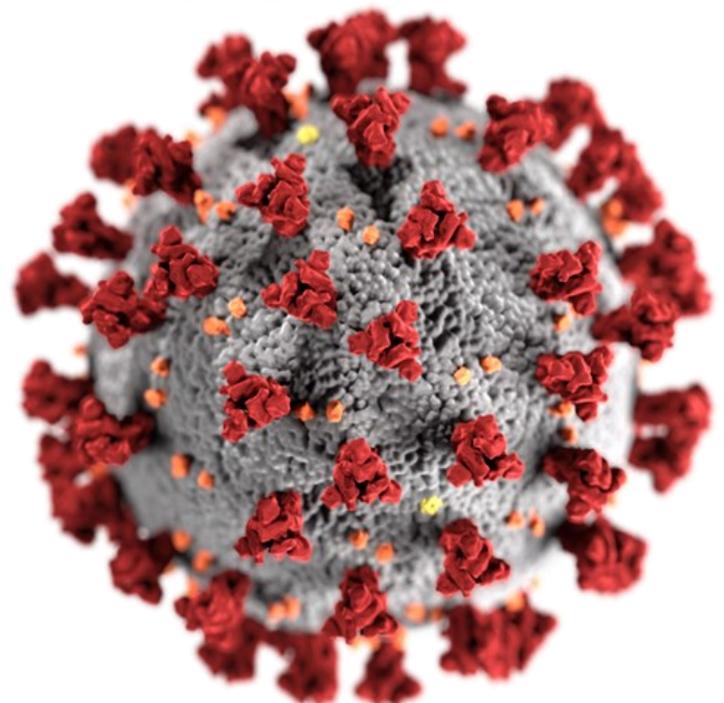
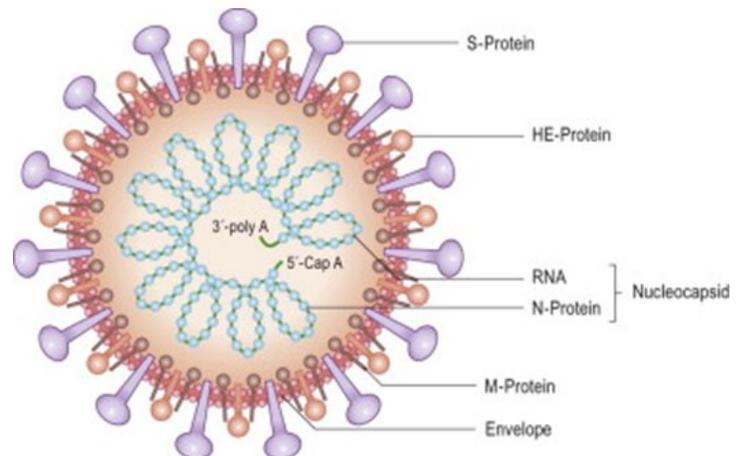
Viruses have bits of DNA or RNA. They have no DNA Polymerase (the molecule that replicates (copies) DNA), or RNA Polymerase (the molecule that transcribes (copies) RNA). To replicate new virions, they must hijack a cell (bacteria, fungi, protist, plant or animal cell), and use the molecules in the cell to copy their DNA or RNA.

### Glycoproteins: pieces of deli meat cut into small strips (like ham slice)

In the image on the right, S-Protein, M-Protein, N-Protein, and HE Protein are glycoproteins. The virus inserts viral proteins called glycoproteins in the envelop. Glycoproteins on the surface of the envelope help identify and bind to the host's membrane.

### Envelope: slice of bread

Coronavirus has an envelope as its outer layer when outside a host cell. The envelope is captured portions of the host cell membranes. The viral envelope will fuse with the host's membrane, allowing the capsid and viral genome to enter and infect the host.



**DO NOT EAT THE  
VIRION MODEL!!!**

**Yet...**

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- Fascinating Facts: <https://www.scienceshorts.com/9-interesting-animal-cell-facts/>; <https://www.virology.ws/2009/10/19/ten-cool-facts-about-viruses/>; [https://www.diffen.com/difference/Bacteria\\_vs\\_Virus](https://www.diffen.com/difference/Bacteria_vs_Virus); <https://www.cdc.gov/handwashing/show-me-the-science-handwashing.html>

### Images:

- Sandwich and snack Models: Dr. Barbara J. Shaw
- Typical Animal Cell: <https://www.slideshare.net/gkamwithi/ap-i-lab-exam-1>
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<b>Similar / Different</b>	<b>Cells</b> —Prokaryote, like bacteria, do not contain membrane bound organelles, while Eukaryote cells do	<b>Virion</b> —Generally extremely simple, although bacteriophages are more complex
Similar	Contains genetic material	Contains genetic material
Different	Double stranded DNA replicates DNA, and translates RNA	Contains double stranded or single stranded DNA, or RNA
	Can replicate to divide into new cells	Must hijack a cell to steal organelles of a cell to manufacture new viral components and put them together
	Contains membrane and membrane bound organelles (in eukaryote cells—cells found in animals, plants, fungi, and protists)	Absent
	Smallest bacterial cell 1000 nm (nanometers), largest Eukaryote cell	Virus range 20-400 nm. Coronavirus is about 40 nm, or over 15,500 can fit