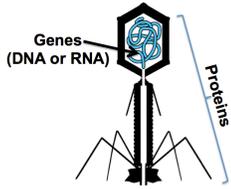


## Viruses: Are they Alive?

**Part 1. A virus**



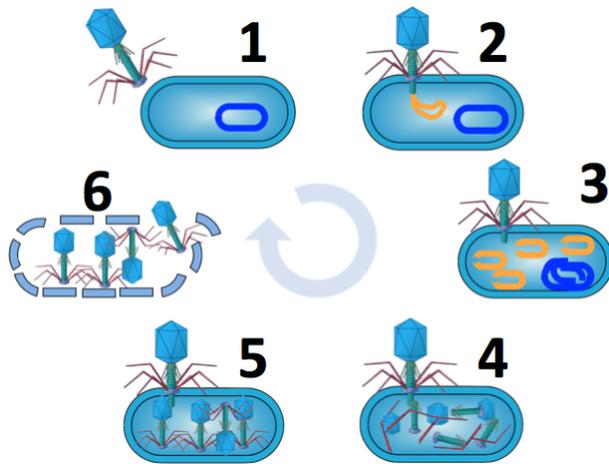
Viruses are disease-causing agents. They cause diseases like the cold, flu, chicken pox, and AIDS. Right now, an epidemic (a rapidly spreading disease) caused by the Ebola virus is occurring in western Africa.

The life of a virus has often been compared to that of a pirate. Why? Pirates make their living by taking over ships that don't belong to them, and using those ships for their own purposes (even to the point of destroying the captured ship and its crew). Similarly, viruses take over cells, and then use the cells they take over to create more viruses. In the process, the host cell is usually destroyed.

Viruses are *not* made of cells. To begin with, they're much smaller than cells (less than 1/10<sup>th</sup> the size of the smallest cells). Antibiotics, which can kill infectious bacterial cells (germs), can't kill viruses.

As you can see above, viruses consist of genes (DNA, or its close relative, RNA), surrounded by proteins.

**Part 2.**



So, what happens when a human being (or any other organism) gets infected with a virus? The diagram at left shows the sequence of events that happens when a virus attacks a cell. The cell is shown as the larger oval next to each number (the smaller oval represents the cell's genes). Imagine that in human being, there'd be many cells, side by side, in organs like the lungs, liver, etc.

*Step 1.* The virus bumps into its prey. Most viruses are very specific: they can attach to only one type of cell, in just a few species.

*Step 2.* The virus injects its genes into its victim.

*Steps 3 and 4.* The virus uses the cell's internal machinery to

- a) Copy the virus's genes, and
- b) Build new pieces of the virus.

*Step 5.* The pieces of the virus assemble themselves into new viruses

*Step 6.* The cell becomes so packed with viruses that it bursts, releasing dozens of viruses, each of which can infect another cell.

**Part 3.** Let's think about this in terms of the properties of life. Use the information above to answer the following questions. Answer "yes," "no," or "need more info."

1. Is a virus made of cells?	
2. Is it highly organized?	
3. Is matter and energy flowing through the virus? (is it eating?)	
4. Does the virus respond to its environment?	
5. Is the virus maintaining its internal environment (homeostasis)?	
6. Is the virus reproducing by passing on genes?	
7. Does the virus grow and develop?	
8. Is the virus part of an evolving species?	

**Part 4.** So let's compare and contrast viruses and organisms Use one or both of these sentence frames to compare and contrast organisms and viruses. Write at least *two* sentences

*Whereas...                      A distinction between...*

summary

Response

**Part 5: READING: Are viruses alive?** Adapted from Professor George Rice's work at

<http://serc.carleton.edu/microbelife/yellowstone/viruslive.html>

Viruses straddle the definition of life. In some ways, they're just huge complex molecules. In other ways, they're simple biological systems. Viruses have some of the structures and carry out some of the activities common to living things. But they are missing many of the others. In general, viruses consist of a single strand of genetic information (DNA or RNA), held inside a protein capsule. Viruses lack most of the internal structure and machinery that cells have, including the molecular machinery cells need for reproduction. In order for a virus to reproduce, it must infect a suitable host cell.

Viruses exist in two distinct states. When not in contact with a host cell, the virus is dormant (*asleep/resting/inactive*). During this time there are no biological activities occurring within the virus. In essence the virus is no more than a carbon-based particle. Viruses can remain in this dormant state for long periods of time, waiting to come into contact with a their host. When the virus meets its host, it becomes active, and starts to display properties typical of living organisms, such as reacting to its environment (by injecting its genes into its host cell) and directing its efforts toward self-reproduction.

**Part 6: Are viruses alive?**

*Make a claim about whether viruses are alive or not, and support it with at least 3 pieces of evidence. Your evidence should come from the paragraphs above and the material on the other side of this sheet.*

Use this language frame to take your position.

\*The evidence for the idea that \_\_\_\_\_ is as follows: ..... [point 1]. [point 2]. [point 3].

**Part 7: Science in the News: The Ebola Virus Outbreak**

1. Ebola is part of a group of viruses that are called *hemorrhagic* viruses. A hemorrhage is "an escape of blood from a ruptured blood vessel." These viruses cause so much tissue damage that severe internal bleeding results.
2. The Ebola virus can only spread through direct contact with body fluids (urine, saliva, vomit, blood).
3. At this point (2015) Ebola has no cure. Some experimental anti-viral drugs have been successfully used on infected American and British medical workers, but they will not be able to be mass produced in time to help West Africans. A vaccine is in a very early experimental trials (first human subjects).
4. The original source of the infection (the way the first victim became infected) is not known. It's hypothesized that contact with an infected animal is how human infection begins.
5. Health care workers and family members caring for Ebola victims are at *extreme risk*. Precautions such as masks, gowns, and gloves can keep the virus from infecting new victims.
6. By the end of 2014, the outbreak had spread to four countries, all in west Africa: Guinea, Liberia, Nigeria, and Sierra Leone. Over 5,000 people had been infected since the outbreak began in March of 2014. Over 2600 people have died. The World Health Organization has estimated that the total number of cases that could occur before the outbreak is controlled could rise to 20,000.
7. According to the U.S. Centers for Disease Control, the risk of an Ebola outbreak in the U.S. is very low. Part of the reason why the disease has spread in Africa is that because of poor infection control procedures (deeply connected with poverty in these countries)
8. On September 18<sup>th</sup>, 2014, President Obama announced that the US would send 3000 soldiers and medical personnel to Liberia to help that country provide medical services.

**Extension: Infection with a Hot Virus. From *The Hot Zone*, by Richard Preston. VERY GORY!**

Available on-line at <http://learn.flvs.net/educator/common/EnglishIIv10/TheHotZone.pdf>