

Viruses

We are all familiar with viruses since we have all at some point been infected by them. They represent an innumerable variety of viral infections from the “common cold” and the flu, to more serious illnesses like measles, mumps, ebola, hepatitis, and HIV/AIDS among countless others. Perhaps the most fascinating element of viruses beyond their capacity to cause infection is their very nature. They walk the fine line between living organism and non-living particles. Let us begin our examination of viruses by first understanding the current definition of life used in biology today that excludes this unique and fascinating group.

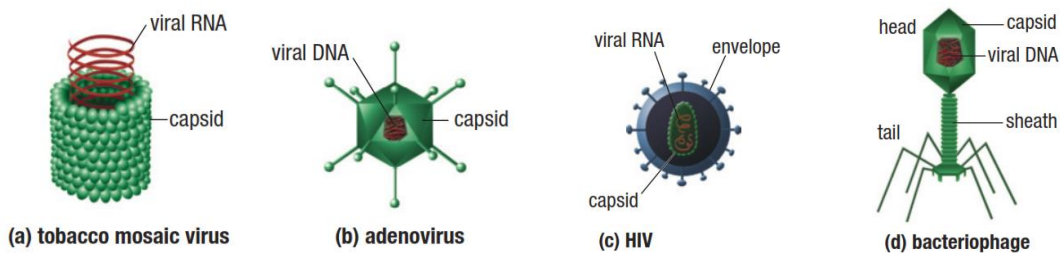
As a class brainstorm a list of characteristics that are unique to living things that can be used to classify them.

List the 7 main characteristics used by biologists today to classify living things:

- 1) _____
- 2) _____
- 3) _____
- 4) _____
- 5) _____
- 6) _____
- 7) _____

What is a Virus?

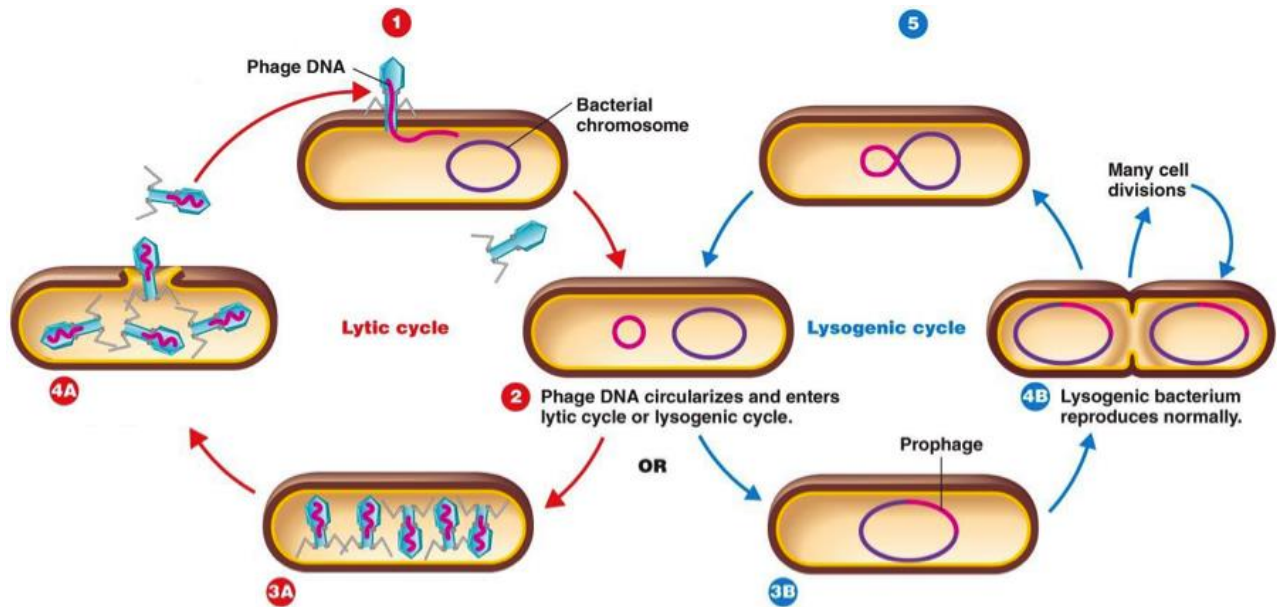
A virus consists of essentially two parts. They have a protein based capsule called a capsid and within the capsid there is a small amount of genetic material in the form of either DNA or RNA. **They have no cytoplasm, cannot grow, have no apparent metabolism, and are not able to reproduce on their own. They can only reproduce by introducing their genetic material into living cells.** The viral genetic material codes for instructions for how to make more copies of the virus. It will integrate with the host cell’s genetic material and when active, will cause the host cell to manufacture more copies of the virus. This eventually causes the host cells to burst, releasing hundreds of copies of the virus. Part of our own DNA today is believed to have been added to our genome via viral infections in our ancestors. These preserved regions of viral DNA have since lain dormant and eventually became fully inactive. I am sure you can imagine the challenges biologists have had in trying to classify viruses as either living or not. Are they non-living molecules or must we rewrite the definition of life itself?



Classification and Phylogeny

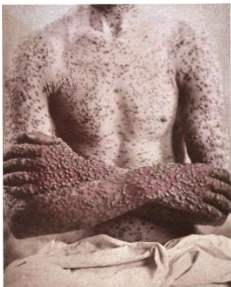
Like living things, viruses have been grouped into orders, families, genera and species. Thus far over 4000 have been formally classified but there are untold more yet to be discovered. One of more thoroughly researched types of viruses accounting for our earliest understanding of viruses is the group known as bacteriophages, or sometimes just known as phage. Phage viruses specialize on infecting bacterial cells only. Unlike most viruses they do not fully enter the host cell, but rather only inject their genetic material into the host bacterium leaving the capsid outside.

Let us examine the typical phage life cycle by labeling the key events in the diagram below.



Treatments

While bacterial infections can be treated with antibiotics that kill prokaryotic cells, there is no medical equivalent for viruses. The immune system must learn to recognize viral capsids and/or infected cells and then target them for destruction. This takes time and the immune system is not always successful at carrying out this function. Vaccines contain a mixture of altered, weakened forms or parts of viruses allowing the immune system to learn to recognize the virus without the risk of infection. Many formerly deadly viral infections including smallpox, diphtheria, tetanus, yellow fever, whooping cough, polio, measles and rubella are now considered preventable diseases. Millions of lives have been saved and there have been no reported cases of smallpox on earth since 1977. New antiviral drugs exist which do not destroy viruses, but rather attempt to inhibit their development.



Small pox has seen no new cases since Oct 26th 1977.



Measles went from 19 reported cases in 2005 to 3100 reported cases in 2014 in the Americas



In 2012 the WHO estimated that 1.6 million people died from AIDS related illness with 35.3 million people living around the world HIV/AIDS. There is currently no vaccine or cure.

Viruses in Technology

Biologists have learned to use viruses very effectively in the field of genetic engineering. By redesigning the DNA or RNA carried by a virus, biologists can now insert desired genes into other individuals or species. In medicine, researchers are beginning to explore gene therapy in which diseases may be treated by using viruses to beneficially alter genes in affected patients. It may even be possible to deliver drugs rather than genetic materials directly into specific cell types using viruses

Create your own summary below of viroids and prions.

Viroids

Prions

Homework

Do pg 59 #1-8

Viruses

The 7 main characteristics used by biologists today to classify living things:

- 1) Made of cells
- 2) Use energy to organize simple substances into more organized and complex ones. (metabolism)
- 3) Control their internal environment (maintain homeostasis)
- 4) Can grow
- 5) Can respond to their environments
- 6) Can reproduce
- 7) Can adapt to their environment by means of evolution

