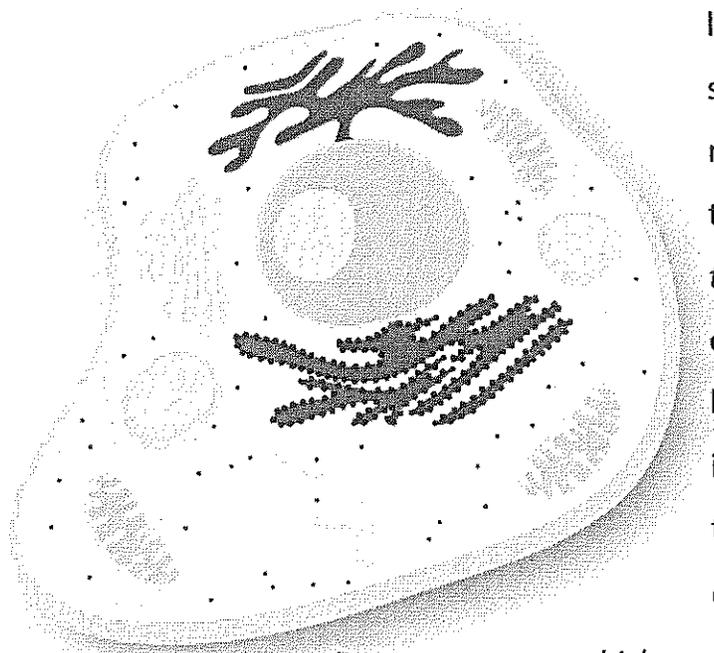
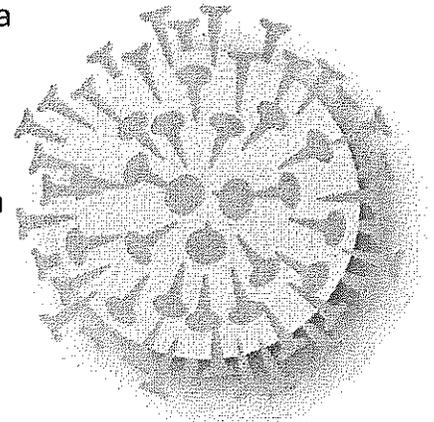


Are Viruses Alive?

ARE VIRUSES ALIVE? Although a simple question, this is a question that has been known to spark debates among many in the scientific community for years. Let's attempt to answer it!

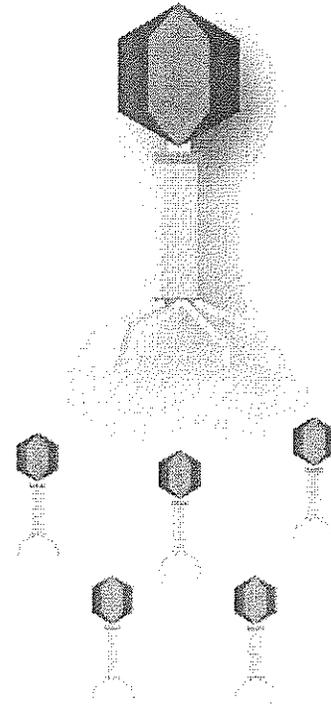
First of all, we must consider a virus. So, what exactly is a virus? A *virus* is a very small particle of nucleic acid, such as DNA or RNA, that is surrounded by a protective protein coat called a capsid. Many viruses act as infectious agents, just like bacteria, to different types of organisms including plants and animals. The common cold, the flu, the mosaic viruses, the zika virus, and HIV are some examples of viruses that you might have heard of before.



Now that we know what a virus is, let's look at what it takes to deem something a living thing. There are numerous characteristics that all living things have in common. First of all, *living things are made up of units called cells*. All cells, no matter how simple or complex, have a cytoplasm and genetic material that is enclosed by a phospholipid bilayer called the cell membrane. *These structures of a cell are essential in allowing organisms*

to maintain stable conditions, a process which we call homeostasis and another characteristic of living things. In addition, *living things have a complex organization that is not found in abiotic objects.* Atoms and molecules make up cells. Cells combine to make tissues. Tissues make up organs. Different organs work together in systems that function for the organism as a whole. Viruses do show this increasing level of complexity and genetic material, nonetheless they are not made up of cellular structures and therefore are not able to maintain homeostasis on their own.

Secondly, *living things use energy for sustaining life, growing, and reproducing*. Viruses do all of these things as well. The difference is however, viruses do these things by utilizing a host cell. Viruses essentially hack into the cell of another and hijack their mechanisms. For energy, viruses utilize the host cell's metabolism. To make more copies, viruses insert their genetic material into the host cell's DNA. When the host cell reproduces, it makes more copies of the virus. Essentially, the virus does not reproduce, it replicates. When the viruses replicate in the host cell, new virion particles are formed in their complete state. For that reason, it is said that viruses do not grow.



Finally, *living things respond to stimuli and adapt to their environment*. What about viruses? Although we are unsure if viruses are able to respond immediately to all stimuli, we are sure that viruses adapt and evolve. Unlike response to stimuli, adaptations result from random mutations in genetic material. In viruses, mutations occur because of the ability of the virus to quickly replicate in its host cell. Vaccinations and medications may prevent the un-mutated virus from spreading but allow those with the mutation to survive. Those that survive, will continue to replicate and make more of the virus with the immunity. Thus, evolution has occurred.

In summary, all living things meet the following criteria: 1) they are made up of cells, 2) they maintain homeostasis, 3) they have organized levels of complexity, 4) they use energy, 5) they grow, and reproduce, and 6) they respond stimuli and adapt to changes in the environment. Based on what you read, do viruses meet all of this criteria? The answer is, NO. Viruses meet some but, not all of the characteristics of living things. Therefore, many biologists do not classify viruses as living things.

Are Viruses **Alive**? Guided Reading Notes

Directions: Answer the questions and complete the task below as you read through the "Are Viruses Alive?" article.

1. **Before you begin reading**, predict the answer to the following question: *Are viruses alive?* Write your prediction in the space below.

2. What are viruses? Find the answer to the question in the article. Underline or highlight the answer in red.

3. What are some examples of viruses? Find the answer to the question in the article. Underline or highlight the answer in blue.

4. What are the characteristics of all living things? Find the answer to the question in the article. Underline or highlight the answer in orange.

5. Are viruses considered to be cells? Why or why not? Find the answer to the question in the article. Underline or highlight the answer in green.

6. Do viruses maintain homeostasis? Why or why not? Find the answer to the question in the article. Underline or highlight the answer in purple.

7. Do viruses show levels of organization? Why or why not? Find the answer to the question in the article. Underline or highlight the answer in yellow.

8. Do viruses use energy, grow, or reproduce? Why or why not? Find the answer to the question in the article. Underline or highlight the answer in black.

9. Do viruses respond to stimuli or adapt to their environment? Why or why not? Find the answer to the question in the article. Underline or highlight the answer in brown.

10. Are viruses considered to be alive? Explain your answer.

