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Life Science: Part 2

2c. Are Viruses Alive?



Are viruses alive?

Anyone with a cold or the flu virus feels as if they are under attack by some organism. But in the scientific community it's still an open-ended question. This is why viruses do not belong to a kingdom of living things. Just because a virus *seems* alive doesn't mean it *is* alive. After all, it's not even a single-celled organism.

A virus is little more than a strand of DNA or RNA covered by a protein coating. Viruses are a thousand times smaller than bacteria and come in a wide range of shapes. Some look like weird, tall spiders whereas others look like prickly porcupinelike soccer balls.

One thing is for sure; viruses are very much a part of life on Earth and the human experience. Viruses infect animals, plants, and even bacteria. Humans are in a constant battle with viruses. HIV (the virus that causes AIDS), the Ebola virus, and the West Nile virus continue to make headlines and take millions of lives.

Other maladies, such as colds, the flu, chicken pox, measles, and hepatitis, are more common, but sometimes just as deadly. Symptoms vary depending on which kind of cell is under attack. Cold viruses attack the nose and throat, the rabies virus attacks the brain and nervous system, and the human immunodeficiency virus (HIV) attacks white blood cells in the bloodstream. Viruses can even cause some kinds of cancers and leukemia.

Live and Let Die

To determine whether a virus is alive or not, we could compare the virus's characteristics to what many biologists consider the requirements of life. All living things have several common characteristics. Some nonliving things may have one or more of



Vaccines
Chicken pox, measles, mumps, polio, rubella, sound familiar? Probably gave you a vaccine when you were a baby to protect you from these horrible diseases.

characteristics. Some nonliving things may have one or more of the characteristics but not all of them. For a virus then to be classified as alive it must:

- Reproduce
- Obtain and use energy
- Grow, develop, and die
- Respond to the environment

Viruses do have DNA or RNA, and DNA is the code for life. Having genetic material is an important step towards being classified as alive. DNA controls the evolution of the cell and the organism. Like living things, viruses evolve through time and thus can adapt to their environment. But unlike cells, viruses cannot use their genetic material by themselves. They need a living cell in order to function and reproduce; otherwise they are playing dead.

Resistance Is Futile

Because viruses are not cells, they can't divide by binary fission like bacteria. Yet they do reproduce themselves in an extraordinary way. Their structure enables viruses to attack a plant or animal cell called a **HOST CELL**. The protein shell protecting the virus's DNA is covered with spike-like protrusions. These spikes allow the virus to latch onto the cells they infect. Once hooked on, the virus injects its genetic material into the host cell.



The Virus: © 2009 by 2009

The virus's DNA takes control of the cell once it's within the cytoplasm and begins to make the cell produce virus DNA and other parts of viruses. The host cell is forced to expend all of its energy and resources to help the virus replicate and make hundreds more viruses. The poor, weak cell usually bursts like an overinflated balloon from all the viruses and is destroyed in the process. Then, the replicated virus

An animation of a virus infecting a host cell.

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_____ attaches itself to a new, uninfected host cell, and the viral infection continues.

Living things do more than just reproduce. They also must obtain food to fuel the cell's metabolic activity. Some organisms, such as animals, eat other living things for energy. Other organisms, such as plants, harness the Sun's energy to make their own food. Because viruses aren't cells and have no activity within it, it has need for food. However, the virus-controlled host cell needs material and energy to reproduce the viruses. Maybe viruses can fit the requirement that life forms need to obtain and use energy.

All other living things also grow or get bigger. A virus does nothing inside its protein coat; therefore, it does not grow. But some scientists argue that a virus's growth occurs inside the host cell where parts of viruses are built during reproduction.

Virus Poll
Are Viruses Alive?
 Yes
 No
 Undecided

Plants and animals react to the environment. All living things have ways of sensing the world around them and can respond to changes in their environment. Do viruses react? Viruses cannot move themselves, but there are some differences in opinion that viruses do react to changes in the environment.

Remember, the virus's DNA or RNA can evolve over time, thereby increasing its chances for survival and adapting to the environment. Like bacteria, they adapt through genetic mutations caused by rapid reproduction. That is why it is so hard to cure viral diseases. Viruses keep changing their DNA and protein coat to further their "life form" and keep ahead of the game.

What's Your Final Answer?

As humans, we like to classify things because it helps us understand the physical world. Viruses must have a host cell to live and reproduce. Outside of the host cell, viruses are pieces of genetic molecules that can do nothing by themselves. Viruses are right on the border between living and nonliving. Some biologists currently see the virus as a nonliving infectious particle. Other biologists disagree and suggest they are alive because of what happens inside the host cell.

Getting a definite answer if viruses are alive or not may never happen.

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