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.

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 porcupine like 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 viruses, such as colds, the flu, chickenpox, 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.

Instructions: Read the following article carefully and make notes in the margin as you read. Your notes may include:

- Comments that show that you understand the article. (A summary or statement of the main idea of important sections may serve this purpose)
- Questions you have that show what you are wondering as you read.
- Notes that differentiate between fact and opinion.

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 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, which is the code for life. Having genetic material is an important step towards being classified as alive. 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 themselves. 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'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 attaches itself to a new, unaffected host cell, and the viral infection continues.

Living things do more than just reproduce. They also must obtain food to fuel the cell. 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. Viruses have no need for food. However, the virus-controlled host cell needs material and energy to reproduce the viruses.

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.

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. 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 change 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 keep ahead of the medicine game.

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 non-living 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. But hey, that's life.
Demonstrate Understanding

1. If you were trying to summarize this article for someone who had not read it, what would you say? Include main ideas and supporting details.

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2. Are viruses alive? In the chart below, list evidence from the article that viruses are alive and evidence that viruses are not alive. List three of each.

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<th>Viruses are Alive</th>
<th>Viruses are Not Alive</th>
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Develop an Interpretation

3. What conclusion does the author come to concerning whether viruses are alive or not?
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4. Do you agree with the author? Give evidence from the article to support your opinion.
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5. How do you think viruses will be classified in the future? What evidence from the article has helped you come to this conclusion?
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