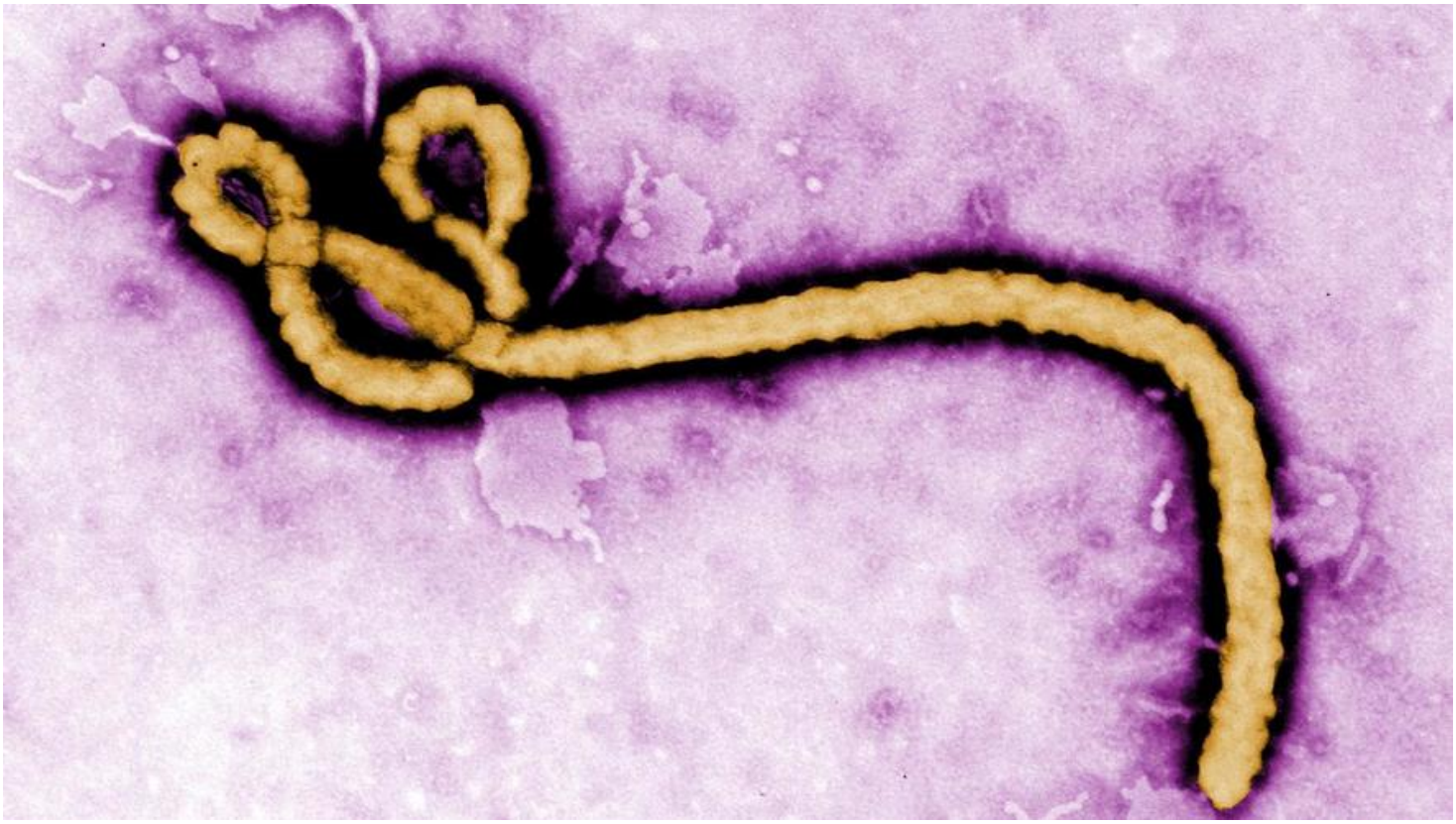
Explainer: What is a virus?

By Allen Cheng, The Conversation, adapted by Newsela staff on 03.18.20
Word Count **812**
Level **1120L**



This colorized transmission electron micrograph (TEM) revealed some of the ultrastructural morphology displayed by an Ebola virus viron. The largest ebola outbreak happened in West Africa from 2014-16. Photo from Wikimedia Commons

It may seem fairly basic, but experts are still arguing over whether viruses should be considered a form of life.

The diversity of viral infections is immense. Viruses cause everything from common cold (rhinoviruses) to Ebola, the deadly disease that has killed thousands in Africa, and warts (papillomavirus), and from influenza to smallpox. Many viruses can cause cancer, and the hepatitis B virus is a known cause of liver cancer.

Viruses show some of the characteristics of living organisms. They have DNA, which controls how every part of a living creature develops and functions. They also evolve by natural selection and create copies of themselves. However, most biologists argue they aren't alive because they can't replicate by themselves.

To say that viruses are small is an understatement. If the human genome were "War and Peace," the 1,200-page novel by Leo Tolstoy, the average bacterium would have a genome of about a page

or two. On this scale, the influenza virus is about two words, while the smallest virus, circovirus, would be merely a letter or two.

Essentially, viruses are snippets of genetic code that take over the living cells to replicate themselves. They then escape the cell and spread. There is a good reason why a “computer virus” is called what it is. Even a virus' envelope – the coating that many viruses have to protect their contents – comes from the cells of its hosts.

Vaccines Are Developed To Stop Viruses

Some viruses that cause human diseases can be killed by vaccines.

The word vaccine comes from the Latin word for “cow." It is based on an observation by English scientist and doctor Edward Jenner that milkmaids were protected from smallpox after they were exposed to cowpox, a cow disease that was similar to smallpox but not as severe. From this came the idea that infection with a closely-related but less dangerous virus could protect against serious disease.

It was then found that even inactivated viruses were able to enable the immune system to remember and protect from infection on a later date. An inactivated virus is one that has been grown and then killed. Scientists then added these inactivated viruses into the vaccines that we get as shots when we visit the doctor. Vaccines have weak viruses inside them, that are either living or dead, but can't reproduce themselves. When we get shot with vaccines it helps our bodies get used to them. Then, our bodies can defend themselves if we catch a live or strong virus.

The best vaccines have even resulted in the eradication of diseases, such as smallpox. Hopefully, in the near future, polio and measles will also become illnesses of the past.

Breaking Ground With Antiviral Treatments

While antibiotics for treating bacterial infection were developed in the 1940s, antiviral treatments are a much more recent development.

Most antiviral medication attempts to block one or more points in the viral replication cycle. Many antiviral medications used to treat HIV and herpes simplex (which causes cold sores), for instance, stop the replication mechanism itself.

Some antivirals interfere with the way viruses use to enter or exit host cells. Others activate the immune system to seek and destroy cells infected by viruses.

Mega-, Mimi- Or Truc?

Viruses can infect all living organisms, even bacteria, and they seem to be everywhere.

J. Craig Venter, the biologist and entrepreneur, was one of the first to sequence the human genome (interestingly, his own). He sailed around the world in his yacht and took samples of seawater as he went. When his team examined the samples, they found an incredible diversity of new viruses, with about 10 million copies of viruses per milliliter of water.

The recent discovery of new, very large viruses has also blurred the lines between what is and is not life. In 2003, the Mimivirus was found inside an amoeba in England. It was named the

“microbe-mimicking virus” because it was visible under a microscope and had a genome that rivaled small bacteria.

The largest known virus is the Pandoravirus, found in a pond in Melbourne, Australia. Its genome is nearly as complex as of a small parasite.

These recent discoveries have prompted a reconsideration of the nature and classification of life. Didier Raoult, the French biologist who led the team that discovered Mimivirus, has even suggested reclassifying complex organisms such as giant viruses as “truc.” This is French for “stuff,” as well as being an acronym for “things resisting [un]complete classification” — in other words, the “too hard” basket.

Are the seawater viruses the soup from which we evolved? More research may give answers to these and other interesting questions. Whatever the case, it is clear that these tiny genetic parasites will always be problems for us to deal with.

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Quiz

1 According to the article, HOW has the discovery of the Mimivirus influenced scientists' ideas about viruses?

(A) Since it acts differently than other viruses, scientists think it could lead to a vaccine for cancer.

(B) Since it seems more like a single-celled animal, some scientists are ready to call it "living."

(C) Since few viruses are this large, scientists now think they are related to bacteria.

(D) Since new viruses have emerged, scientists expect to find the origin of human life in seawater.

2 HOW does the article develop the idea that scientists have made progress treating viral illnesses?

(A) by showing how many viruses there are, and explaining which diseases have vaccines

(B) by explaining the origin of early vaccines, and describing how antivirals work

(C) by describing the characteristics of viruses, and explaining how they infect hosts

(D) by providing an example of an early scientist, and describing the role of antibiotics

3 Read the sentences from the section "Vaccines Are Developed To Stop Viruses."

The best vaccines have even resulted in the eradication of diseases, such as smallpox. Hopefully, in the near future, polio and measles will also become illnesses of the past.

The author uses the word "eradication" to mean:

(A) management

(B) opposition

(C) treatment

(D) elimination

4 Read the sentence from the introduction [paragraphs 1-5].

Even a virus' envelope – the coating that many viruses have to protect their contents – comes from the cells of its hosts.

Which word from the article helps explain what "host" means?

(A) life

(B) replication

(C) genome

(D) parasites