

A **virus** is a biological agent that reproduces inside the cells of living hosts. When infected by a virus,

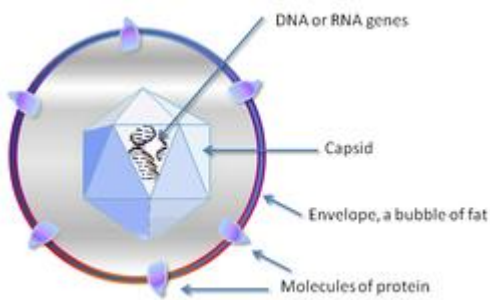
virus consists of two or three parts: genes, made from either DNA or RNA, long molecules that carry genetic information; a protein coat that protects the genes; and in some viruses, an envelope of fat that surrounds the protein coat and is used, in combination with specific receptors, to enter a new host cell. Viruses vary in shape from the simple helical and icosahedral to more complex structures. Viruses range in size from 20 to 300 nanometres.

Viruses spread in many ways. Just as many viruses are very specific as to which host species or tissue they attack, each species of virus relies on a particular method for propagation. Plant viruses are often spread from plant to plant by insects and other organisms, known as *vectors*. Some viruses of animals, including humans, are spread by exposure to infected bodily fluids. Viruses such as influenza are spread through the air by droplets of moisture when people cough or sneeze. Viruses such as norovirus are transmitted by the faecal–oral route, which involves the contamination of hands, food and water. Rotavirus is often spread by direct contact with infected children. The human immunodeficiency virus, HIV, is transmitted by bodily fluids transferred during sex. Others are spread by blood-sucking insects.

Viral infections can cause disease in humans, animals and even plants. However, they are usually eliminated by the immune system, Antibiotics have no effect on viruses, but antiviral drugs have been developed to treat life-threatening infections. Vaccines that produce lifelong immunity can prevent some viral infections.

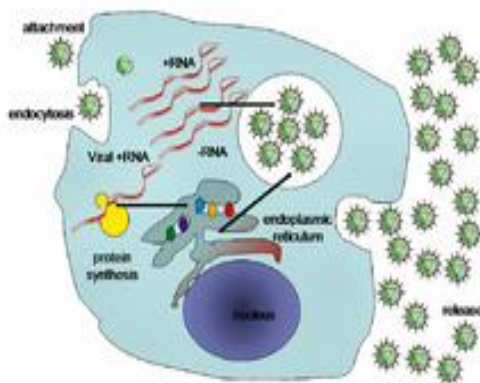
**Structure** A virus particle, also known as a virion, consists of genes made from DNA or RNA which are surrounded by a protective coat of protein called a capsid.<sup>[21]</sup> The capsid is made of many smaller, identical protein molecules which are called

capsomers. The arrangement of the capsomers can either be icosahedral (20-sided), helical or more complex. There is an inner shell around the DNA or RNA called the nucleocapsid, which is formed by proteins. Some viruses are surrounded by a bubble of lipid (fat) called an envelope. Some viruses are surrounded by a bubble of lipid (fat) called an envelope.



A simplified diagram of the structure of a virus

## Life-cycle



Life-cycle of a typical virus ; following infection of a cell by a single virus, hundreds of offspring are released.

When a virus infects a cell, the virus forces it to make thousands more viruses. It does this by making the cell copy the virus's DNA or RNA, making viral proteins, which all assemble to form new virus particles.

There are six basic, overlapping stages in the life cycle of viruses in living cells:

- **Attachment** is the binding of the virus to specific molecules on the surface of the cell. This specificity restricts the virus to a very limited type of cell. For example, the human immunodeficiency virus (HIV) infects only human T cells, because its surface protein, gp120, can only react with CD4 and other molecules on the T cell's surface. Plant viruses can only attach to plant cells and cannot infect animals. This mechanism has evolved to favour those viruses that only infect cells in which they are capable of reproducing.
- **Penetration** follows attachment; viruses penetrate the host cell by endocytosis or by fusion with the cell.
- **Uncoating** happens inside the cell when the viral capsid is removed and destroyed by viral enzymes or host enzymes, thereby exposing the viral nucleic acid.
- **Replication** of virus particles is the stage where a cell uses viral messenger RNA in its protein synthesis systems to produce viral proteins. The RNA or DNA synthesis abilities of the cell produce the virus's DNA or RNA.
- **Assembly** takes place in the cell when the newly created viral proteins and nucleic acid combine to form hundreds of new virus particles.
- **Release** occurs when the new viruses escape or are released from the cell. Most viruses achieve this by making the cells burst, a process called lysis. Other viruses such as HIV are released more gently by a process called budding.