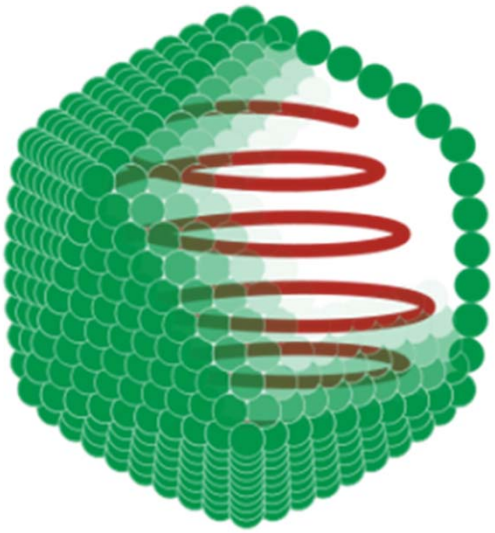
Virus Structure

Viruses come in an amazing variety of shapes and sizes. They are very small and are measured in nanometers, which is one-billionth of a meter. Viruses can range in the size between 20 to 750nm, which is 45,000 times smaller than the width of a human hair. The majority of viruses cannot be seen with a light microscope because the resolution of a light microscope is limited to about 200nm, so a scanning electron microscope is required to view most viruses.

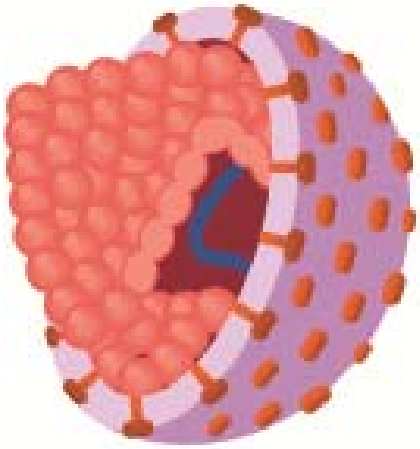
The basic structure of a virus is made up of a genetic information molecule and a protein layer that protects that information molecule. The arrangement of the protein layer and the genetic information comes in a variety of presentations. The core of the virus is made up of nucleic acids, which then make up the genetic information in the form of RNA or DNA. The protein layer that surrounds and protects the nucleic acids is called the capsid. When a single virus is in its complete form and has reached full infectivity outside of the cell, it is known as a virion. A virus structure can be one of the following: icosahedral, enveloped, complex or helical.

Icosahedral

These viruses appear spherical in shape, but a closer look actually reveals they are icosahedral. The icosahedron is made up of equilateral triangles fused together in a spherical shape. This is the most optimal way of forming a closed shell using identical protein sub-units. The genetic material is fully enclosed inside of the capsid. Viruses with icosahedral structures are released into the environment when the cell dies, breaks down and lyses, thus releasing the virions. Examples of viruses with an icosahedral structure are the poliovirus, rhinovirus, and adenovirus.



Icosahedral
Rhinovirus



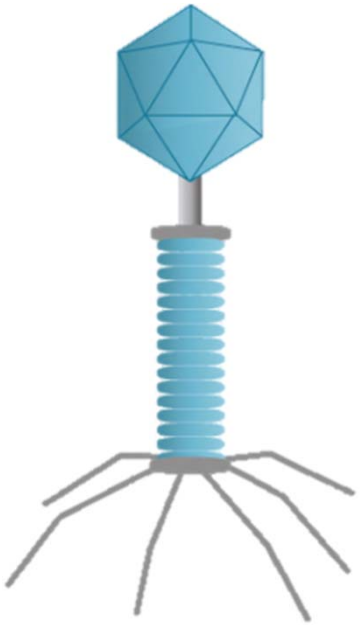
Envelope
Hepatitis C

Envelope

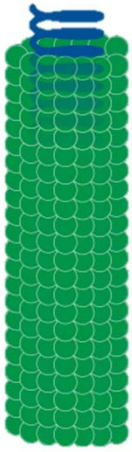
This virus structure is a conventional icosahedral or helical structure that is surrounded by a lipid bilayer membrane, meaning the virus is encased or enveloped. The envelope of the virus is formed when the virus is exiting the cell via budding, and the infectivity of these viruses is mostly dependent on the envelope. The most well-known examples of enveloped viruses are the influenza virus, Hepatitis C and HIV.

Complex

These virus structures have a combination of icosahedral and helical shape and may have a complex outer wall or head-tail morphology. The head-tail morphology structure is unique to viruses that only infect bacteria and are known as bacteriophages. The head of the virus has an icosahedral shape with a helical shaped tail. The bacteriophage uses its tail to attach to the bacterium, creates a hole in the cell wall, and then inserts its DNA into the cell using the tail as a channel. The Poxvirus is one of the largest viruses in size and has a complex structure with a unique outer wall and capsid. One of the most famous types of poxviruses is the variola virus which causes smallpox.



Complex
Bacteriophage



Helical
Tobacco Mosaic Virus

Helical

This virus structure has a capsid with a central cavity or hollow tube that is made by proteins arranged in a circular fashion, creating a disc like shape. The disc shapes are attached helically (like a toy slinky) creating a tube with room for the nucleic acid in the middle. All filamentous viruses are helical in shape. They are usually 15-19nm wide and range in length from 300 to 500nm depending on the genome size. An example of a virus with a helical symmetry is the tobacco mosaic virus.