Viral Structure

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Size

Viruses have a very large size range, from about $50nm - 1\mu m$ in length/diameter. For example example rabies virus is $70 - 170nm$, whereas Ebola is about 970nm.

> NOTE: This size range implies that viruses are 10-100 times smaller than bacterial cells, and $10^3 - 10^4$ times smaller than eukaryotic cells.

Icosahedral Viruses

As the structure of an icosahedral virus is very set, size can only be increased by increasing the size of triangular constituents, (while maintaining their equilateral shape), or by the formation of larger (equilateral) triangular subunits from four smaller one. Increasing size of the basic triangular subunits implies increasing the size of the polypeptide(s) which they consist of.

Shape

Overall virion shape is quite diverse, but the majority of virion have an icosahedral shape.

Enveloped viruses

Virions which contain an outer envelope have a far more amorphous shape due to the fluid properties of the envelope.

Icosahedral

Icosahedral viruses contain an icosahedral capsid, that is a capsid consisting of 20 equilateral triangular faces, fitted together to form an icosahedron.

Helical

Helical viruses contain a helical/rod shaped capsid, This capsid may be long and thin or short and thick. Furthermore they may be flexible folding into loops and coils.

> NOTE: Most helical viruses are ssRNA Viruses.

Internal Organisation

All virions contain a capsid. Some virions, additionally contain an envelope which surrounds the capsid. Within the protein coat, and often associated with it s the nucleic acid molecule(s) of the virus.

Virion formation

Viruses must pack viral proteins inside the capsid, but very little is known about the mechanism. The mechanisms of nucleic acid packaging is also poorly understood, and can differ between different viral species/clades. In some viral species the capsid assembles around the viral nucleic acid, in others, first then capsid is formed, and then the nucleic acid is forced into it. The capsid proteins.

Helical Viruses

The nucleic acid of the virus naturally forms a helix, and the capsid proteins packaging around the helix. The origin of helix formation is usually at one end of the nucleic acid molecule within capsid formation proceeding in one direction only. Sometimes, however, capsid formation may start at the middle of the nucleic acid and from outwards from both ends.

In the assembly of the capsid the capsid proteins first form into disk structure, due to pH and possible other drivers. The nucleic acid is then threaded into this disk, and as the disk grows upwards it pulls the nucleic acid upwards through the disk into the interior of the newly formed capsid.As the nucleic acid is pulled up into the capsid it takes on its normal helical shape. At the end of capsid formation the 5- end of the nucleic acid molecule is pulled up through the loop.

Constituents

Capsid

Envelope

A envelope is polymorphic and may or may not contain spikes.

Formation

The viral envelope is derived from the cell membrane of the host cell, although it may also contain viral protein deposited by the virus into the envelope.

NOTE: Not all viruses contain envelopes