

Difference Between Capsid and Envelope

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Key Difference – Capsid vs Envelope

Virus (also called virion) is an infective particle composed of **nucleic acid** molecule covered with a protein capsid. Viruses show living as well as non-living characteristics. Two major component of a virus particle are viral genome and the protein coat. The viral genome is packaged inside the protein capsid. In some viruses, the protein capsid is surrounded by another cover called envelope. The envelope is composed of a lipid bilayer that contains viral proteins which help the virus to bind to the host cells. Protein capsid and envelope play key roles in viral infection, including virus attachment to host cell, entry into cell, release of the proteins of the capsid, assembly, and packaging of the newly synthesized viral particle, transfer of the viral genetic material from one cell to another, etc. The key difference between capsid and envelope is that **capsid is a coat made up of proteins** while **envelope is a membrane made up of lipids**. All virion particles possess a capsid while only enveloped viruses possess an envelope.

What is Capsid?

Viruses are the simplest and tiniest of microorganisms found on the Earth. Viruses consist of genetic material (**DNA or RNA**) enclosed in a protective protein coat called a capsid. Therefore, capsid can be defined as the protein shell that surrounds the **genome** of the viral particle. Capsid is mainly composed of proteins. It consists of several oligomeric structural subunits of proteins called protomers. Several protomers (5 to 6) collectively make the individual protein subunits of the protein capsid. These individual protein subunits are known as capsomeres. Capsomeres are arranged in a precise and highly repetitive pattern around the nucleic acid. These capsomeres are the smallest morphological units of capsids that are only visible under the electron microscope. A single virion has a large number of capsomeres.

Protein capsid can be arranged in different shapes. Three basic shapes are identified as helical, icosahedral or polyhedral and complex arrangement. The majority of viruses have helical or icosahedral capsid structures. Some viruses, especially bacteria infecting viruses (**bacteriophages**), have complicated capsid structures. In helical viruses, capsomeres are arranged in a spiral manner around

the genome. In icosahedral viruses, capsomeres are arranged in 20 equilateral triangular faces.

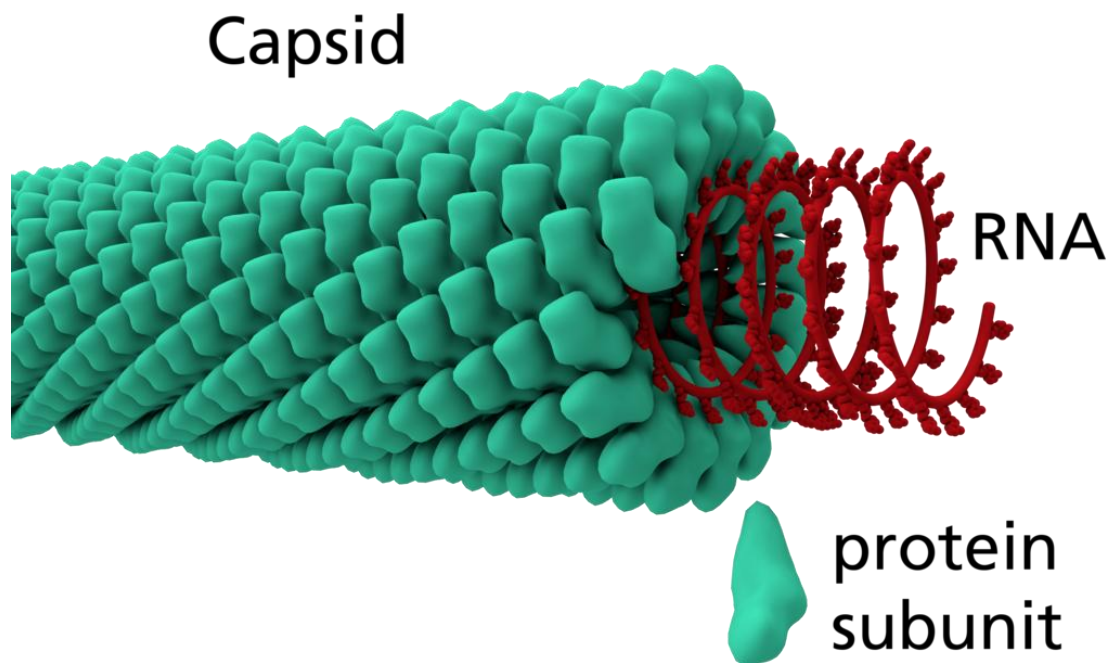


Figure 01: Viral Capsid

Protein capsid performs several functions. It protects the genetic material of the virion particle. It aids in transferring virus particles between host organisms. The spikes located on the viral capsid aid both specificity and viral infectivity. Spikes are [glycoprotein](#) protrusions which bind with certain receptors on the host cell.

What is an Envelope?

Some viruses are surrounded by an extra lipid bi-layered membrane. This lipid membrane is known as the viral envelope. It contains phospholipids and proteins and surrounds the viral capsid. It is mainly derived from host cell membranes. Viruses acquire this envelope during viral replication and release. Viral proteins in the envelope help the virus to bind to the host cell receptors. Viral envelope plays a major role in viral infection including host recognition and entry. It helps the virus for attachment, transfer of genetic material to host cell and between cells etc. The viral envelope is also involved in determining viral stability characteristics such as resistance to chemical and physical inactivation.

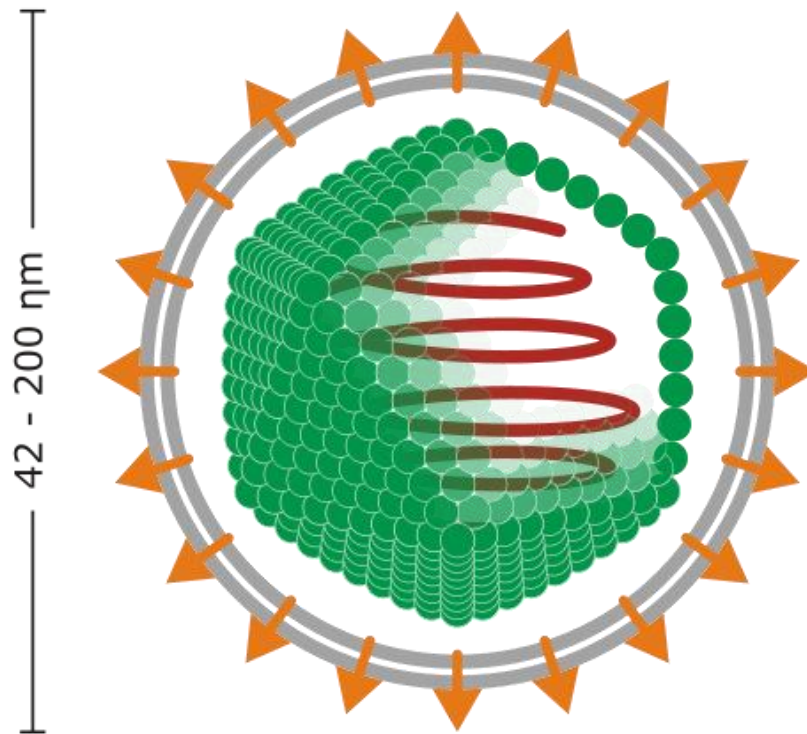


Figure 02: Viral Envelope

Based on the presence and absence of an envelope, viruses are divided into two groups called enveloped viruses and non-enveloped viruses (naked viruses). Naked viruses do not contain an envelope surrounding the nucleocapsid. Compared to enveloped viruses, naked viruses are more stable and can survive a long time in the environment.

What are the similarities between Capsid and Envelope?

- Capsid and envelope are involved in viral infection.
- Both contain proteins.
- Both are protective covers.

What is the difference between Capsid and Envelope?

Capsid vs Envelope	
Capsid is the protein shell surrounding the genetic material of the virus.	Envelope is the outer structure that encloses the nucleocapsids of some viruses.
Composition	
Capsid is composed of proteins.	Envelope is composed of phospholipids and proteins.
Cover	
Capsid covers the viral genome.	Envelope covers the nucleocapsid (viral genome + capsid).
Presence	
Capsid is present in all viruses.	Envelope is present only in some viruses.

Summary – Envelope vs Capsid

Envelope and capsid are two structural parts in viruses. Capsid is the protein shell which surrounds the viral genome. Envelope is the lipid membrane acquired by the viruses from the host cells. It covers the nucleocapsid. Envelope is composed of both phospholipids and proteins. This is the difference between capsid and envelope. Capsids and envelopes together determine the method of viral entry into and exit from host cells. Both structures also determine the stability and the resistance of the virus.

References:

- 1."Viral envelope." Wikipedia. Wikimedia Foundation, 26 Mar. 2017. Web. [Available here](#). 11 July 2017.
2. "Capsid." Wikipedia. Wikimedia Foundation, 08 July 2017. Web. [Available here](#). 11 July 2017.

Image Courtesy:

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