

**Programme: Bachelor of Science (Third year)**

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**Paper Title: Virology**

**Unit 1 : Nature and Properties of viruses**

**Module Name : Structure : Enveloped and non - enveloped viruses**

**Module Number : 4**

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**Notes**

- **VIRAL STRUCTURE**
- A complete virus particle, known as a virion, consists of nucleic acid surrounded by a protective coat of protein called a capsid.
- The nucleic acid core surrounded by the protein coat is termed as nucleocapsid. These are formed from identical protein subunits called capsomeres.
- Some viruses can have a lipid "envelope" derived from the host cell membrane.
- Depending on the presence of envelope these viruses are called enveloped viruses.
- Viruses which do not possess the envelope are called non-enveloped viruses or naked viruses.
- The capsid is made from proteins encoded by the viral genome and its shape serves as the basis for morphological distinction.

- Viral envelopes are typically derived from portions of host cell membranes (phospholipids and proteins) but include some viral glycoproteins.
- The envelope is a cellular membrane containing lipid bilayers and proteins with special functions.
- There are two kinds of membrane proteins in the envelope:
  - A) Glycoproteins
    - Present on the surface of the envelope serve to identify and bind to receptor sites in the host membrane and are often recognisable as spikes on the outer surface of the virions.
  - B) Matrix proteins: are the second type of membrane proteins present on the inner surface of the envelope as seen in Orthomyxoviruses, Paramyxoviruses and Rhabdoviruses.
- The viral envelope then fuses with the host membrane, allowing the capsid and the viral genome to enter and infect the host.
- All enveloped viruses also have the capsid which is another protein layer, between the envelope and the genome.
- **ENVELOPED VIRUS**
  - Some species of virus envelop themselves in a modified form of one of the cell membranes, either the outer membrane surrounding an infected host cell or internal membranes such as nuclear membrane or endoplasmic reticulum, thus gaining an outer lipid bilayer known as a viral envelope.
  - This membrane is studded with proteins coded for by the viral genome and host genome; the lipid membrane itself and any carbohydrates present originate entirely from the host.
  - Influenza virus, HIV (which causes AIDS), and severe acute respiratory syndrome coronavirus 2 (which causes COVID-19) use this strategy. Most enveloped viruses are dependent on the envelope for their infectivity
- Enveloped viruses have a lipoprotein membrane surrounding the nucleocapsid and can have either RNA or DNA genomes.

- Most enveloped viruses use proteins on the virion's envelope to attach to and infect animal cells in which the cytoplasmic membrane is directly exposed to the environment.
- Typically, the entire virion enters an animal cell during infection, with the envelope, if present, assisting in the infection process by fusing with the host membrane.
- Enveloped viruses also exit more easily from animal cells. As they pass out of the host cell, they are draped in cytoplasmic membrane material.
- The viral envelope consists primarily of host cytoplasmic membrane, but some viral surface proteins become embedded in the envelope as the virus passes out of the cell.
- The viral envelope is important in infection, as it is the component of the virion that makes contact with the host cell.
- The virus-specific envelope proteins are critical for both attachment of the virion to the host cell during infection and for release of the virion from the host cell after replication.
- **NON- ENVELOPED VIRUSES**
- Non-enveloped virus lacks the membranous layer, it has the capsid as the outermost covering.
- The outermost covering capsid is made up of the proteins. This type of virus is more virulent (harmful) as it can lead to the cell lysis in which breaking down of the membrane of the cell takes place.
- They are not vulnerable to several conditions like enveloped viruses; they have strong resistance against the conditions like heat and dry.
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- They can retain their infectivity even after drying and can also survive in the gastrointestinal tract.
- The non-enveloped virus gets transmitted to the living body through the oral matter or fecal. They utilize their outer covering capsid while binding to the host cell. Seeing their resistance in different condition, they are more stable as compared to the enveloped viruses.
- Enveloped Virus v/s Non Enveloped Virus

- Enveloped virus has the membranous envelope covering the capsid, whereas non-enveloped virus lacks such covering and has capsid as the outermost part.
- The non-enveloped virus is more virulent as compared to the enveloped virus as it causes the breaking down of the membrane of the cell (lysis), on the other hand, the enveloped virus rarely does it.
- Enveloped virus are sensitive to the conditions like drying and heating while non-enveloped virus even remains effective after drying and provides resistance against the conditions like heating and drying.
- Enveloped virus gets the transmission to the living cells through the secretions, and most notably through blood or organ transplants, whereas non-enveloped virus gets the transmission to the living cells through the oral matter or fecal matter.