Viral Structure

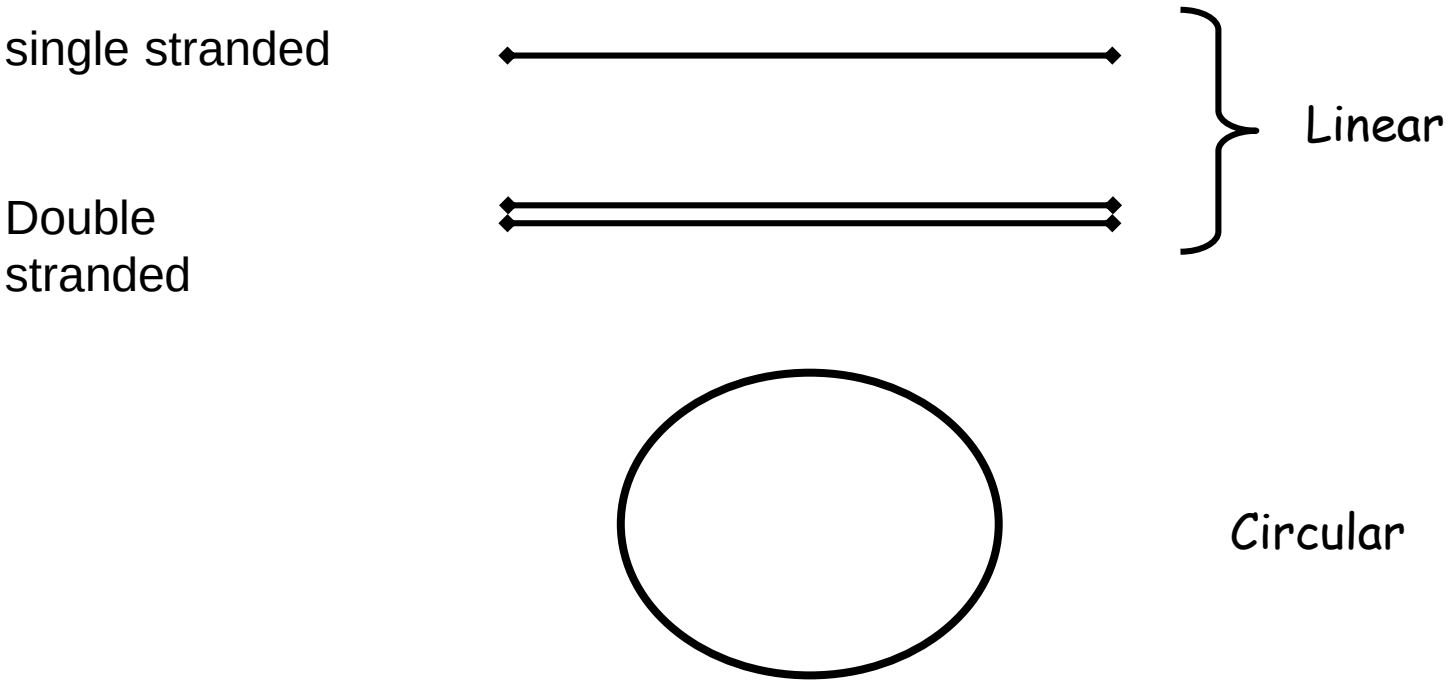
Structure

- Viruses consist of nucleic acid and protein
- the protein is arranged around the genome in the form of a Shell that is the *capsid*.
- *envelope*

Nucleic Acid

NA is the genome that contains the information necessary for virus multiplication

single vs double stranded (DNA or RNA), linear vs circular



RNA VIRUSES

- plus polarity vs minus polarity (in RNA viruses)-- the + strand can bind directly to ribosome, but the - strand needs to make + before protein synthesis occurs**,**

- Some have segmentation

  Segmentation- Reoviruses (10), influenza (8),

DNA VIRUSES

- Viruses with deoxyribonucleic acid (DNA) genomes are called DNA viruses.
- DNA viruses are able to program the cell to replicate the virus using the genes contained within the viral DNA genome. (herpesviruses)
- Some viruses encode for themselves the replication enzymes they need (Poxviruses), but some of them uses cells (Herpesviruses) for enzymes. For this reason, the second group are defined as INFECTIOUS.
- Transfection: Infection caused by direct viral genetic material delivery.

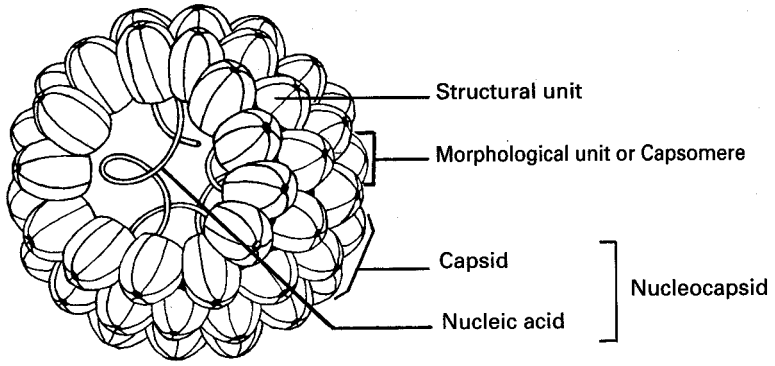
PROTEIN

- Proteins (structural proteins-- coded for by viral genome)
- sole component of the capsid
- major component of the envelope
- associated with nucleic acids as internal core proteins

Functions of structural proteins

- Delivery of the genome
- Bind host cell receptors
- Uncoating of the genome
- Fusion with cell membranes
- Transport of genome to the appropriate site.

PROTEİN



- Capsid:The name given to the protein layer surrounding the nucleic acid.
- more complex capsids are composed of many subunits of either identical of different protein molecules that are called *capsomers*.
- The capacity with the nucleic acid is called the nucleocapsid.

PROTEİN

- There is a virus specific matrix protein between the nucleocapsid and the envelope.

- Functional Proteins, neuraminidase, RNA polymerase, DNA polymerase, Reverse transcriptase. Tegument protein.

- Enzymes
- - polymerases, integrases, associated proteins - proteases - poly(A) polymerase - capping enzymes - topoisomerase

Envelopes

- For some viruses, the capsid is surrounded by lipid bilayer that contains viral proteins, usually including the proteins that enable the virus to bind to the host cells.
- The capsid and envelope play many roles in viral infection, including virus attachment to cells, entry into cells, release of the capsid contents into the cells, and packaging of newly formed viral particles.

- The envelope is derived from the cell (retrovirus) or the nucleus (herpesvirus).
- It comes from the subunits called Peplomer.
- Hemaglutinin and some viruses carry neuraminidase activity.

Envelopes

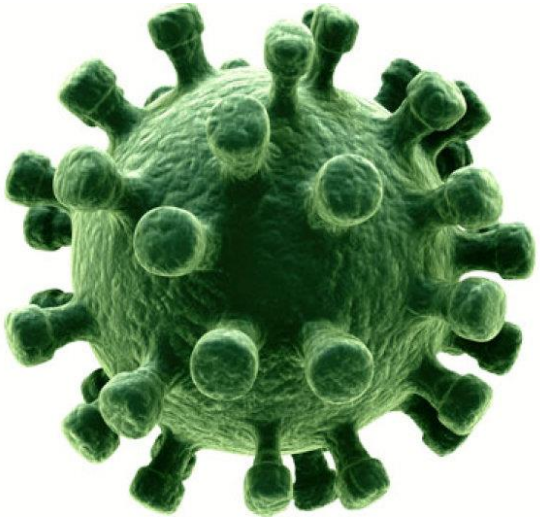
- Only few families of animals viruses exist as naked nucleocapsids, all the others are enclosed by lipid envelopes that are acquired by the *budding of viruses* through the host cell membrane. Envelope helps in attachment to host cells.

- Contains proteins and virally-coded glycoproteins (spikes)

- If a virus doesn’t have an envelope, it is considered to be a naked virus.

Virion

- Infectious virus particle



Nucleocapsid morphology

- Icosahedral symmetry→ Herpes-, Adeno- ve Rotaviruses
- Helical symmetry→ Orthomyxo-, Paramyxo-, Rhabdo- ve Coronaviruses
- complex structure→ Poxviruses
- Binal structure → Bakteriyophage

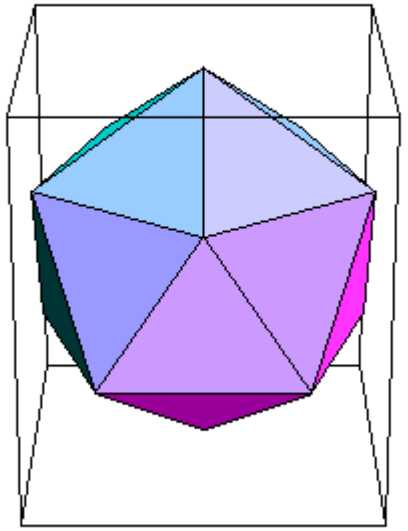
Icosahedral Symmetry

- capsid consists of a shell of protein molecules (protomers) that are clustered into small groups called capsomers (bonds between molecules within a capsomer are stronger than bonds between capsomers).

- Adenoviruses, picornaviruses, papovaviruses, reoviruses

- It could be seen both in RNA and DNA viruses

Icosahedral Symmetry



Identical capsomers, each composed of different proteins, each located equidistantly from a common center, which results in a spherical capsid.

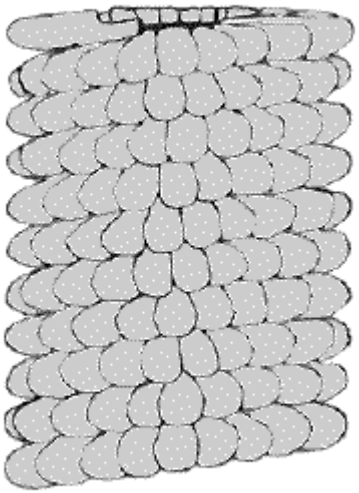
Kapsit Morfolojisi

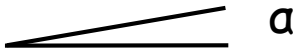
- **Capsomers**

Capsomers can be composed of identical or different

- There are 12 vertices in an icosahedron. There thus are 12 groups of five subunits (**pentons**).
- protomers (If each triangular face is further subdivided into four smaller and identical equilateral triangles, the vertices of these smaller triangles will be composed of rings of six subunits (**hexamers**).

Helical symmetry



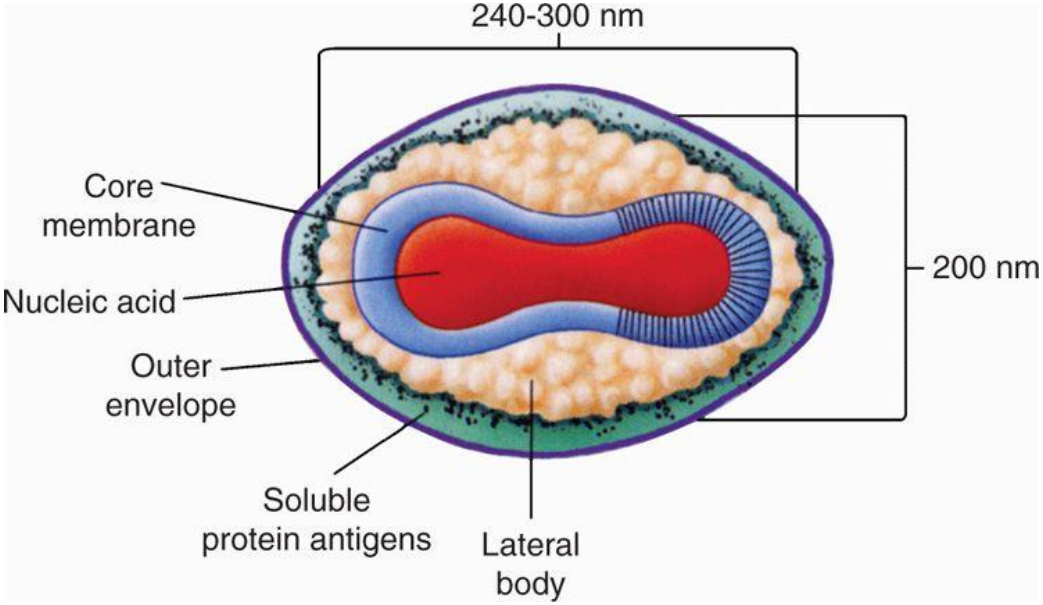


Coat protein molecules engage in identical, equivalent interactions with one another and with the viral genome to allow construction of a large, stable structure from a single protein subunit. It does not seen in DNA viruses.

Ex: vesicular stomatitis virus

COMPLEX SYMMETRY

- Oval shaped, brick-like viruses.
- It is only the symmetry seen in Poxviridae (Flower group) family.



COMBINED SYMMETRY

- The head of the structure, which contains the genetic material, features icosahedral symmetry, whereas the tail features helical symmetry.

- Only seen in Bacteriophages