**Microbiology Dr. Sukayna Jaabar**

**Viruses**

Viruses are show both living and nonliving characters.

**Living characteristics of virus Non-living characteristics of virus**

1. Ability to multiply inside a host plant or animal cell Inability to multiply extra cellularly

2. Ability to cause diseases Absence of any metabolic activity

3. Possession of nucleic acid,protein, enzyme, etc. Absence of protoplasm

4. Ability to undergo mutation Can be crystallized

General characteristics &structure of viruses:

Viruses are smaller than bacteria, they range in size between 20-300 nanometer ( nm ).

Viruses contain only one type of nucleic acid, either DNA or RNA, but never both.

Viruses consist of nucleic acid surrounded by a protein coat called capsid.

The capsid is composed of small structural units called capsomeres.

The capsid protects nucleic acid from inactivation by the outer physical conditions.

Some viruses have lipoprotein envelope , composed of virally coded protein and host lipid.

The viral envelope is covered with glycoprotein spikes.

Some viruses have enzymes inside the virion.

All RNA viruses have the enzyme transcriptase ( RNA dependent RNA polymerase) inside virions .

Retroviruses and hepatitis B virus contain the enzyme reverse transcriptase.

Viruses lack cellular organelles, such as mitochondria and ribosomes.

Viruses are obligate cellular parasite( they replicate only inside living cells)

Viruses replicate through replication of their nucleic acid and synthesis of the viral protein.

Viruses do not multiply in chemically defined media.

Viruses do not undergo binary fission.

**The structure of viruses:**

**1. Viral nucleic acid:**

The viral nucleic acid is located internally and can be either single- or double- stranded RNA or DNA. The nucleic acid can be either linear or circular. The DNA is always a single molecule, the RNA can exist either as a single molecule or in several pieces (segmented).

**2. Capsid:**

The protein shell, or coat, that encloses the nucleic acid genome and mediates the attachment of the virus to specific receptors on the host cell surface.

**3. Capsomeres:**

Morphologic units seen in electron microscope. Each capsomere, consisting of one or several proteins. Naked viruses are composed of nucleic acid + capsid (nucleocapsid).

**4. Viral envelope :**

The envelope is a lipoprotein membrane composed of lipid derived from the host cell membrane and protein that is virus- specific.there are frequently glycoproteinsin form of spike-like projections on the surface, which attach to host cell receptors. Matrixproteinmediates the interaction between the capsid proteins and envelope.The presence of an envelope confers instability on the virus.

Enveloped viruses ( NA + capsid + envelope)

The whole virus particle is called virion.

**Types of symmetry of virus particles**:

**1. Icosahedral symmetry**

Composed of 12 vertices, has 20 faces (each an equilateral triangle) with the approximate outline of a sphere. e.g. Herpes viruses , Adenoviruses

**2. Helical symmetry**

In which the capsomeres are arranged in a hollow coil that appears rod shaped. The helix can be either rigid or flexible. e.g. Influenza viruses

**3. Complex structures** e.g. Poxviruses

The shape of the virus vary, may be: \_ Spherical \_ Filamentous \_ Bullet shape.

**Reaction to physical and chemical agents**:

**1. Heat and cold**

Viral infectivity is generally destroyed by heating at 50-60 C0 for 30 mint., hours at 20 C0, days at 4 C0. Viruses can be preserved at -90 C0 or -196 C0 (liquid nitrogens).

**2. PH :**Viruses can be preserved at physiological PH (7.3).

**3. Ether susceptibility :** Ether susceptibility can be used to distinguish viruses that possess

an envelope from those that do not.

**4. Detergents:** Nonionic detergents solubilize lipid constituents of viralmembranes. The viral proteins in the envelope are released.Anionic detergents also solubilize viral envelopes; in addition, theydisrupt capsids into separated polypeptides.

**5. Salts :**Many viruses can be stabilized by salt in concentrations of 1 mol/L.e.g. MgCl2, MgSO4, Na2SO4.

**6. Radiation:** Ultraviolet, X-ray, and high-energy particles inactivate viruses.

**7. Formaldehyde :**Destroys viral infectivity by reacting with nucleic acid.

**8. Antibiotics :**Antibacterial antibiotics have no effect on viruses.