

Virus:

It is a set of one or more nucleic acid molecules encased in a protective coats of protein or lipoprotein. It is able to organize its own replication only within suitable host cells.

Viruses are still biologists' puzzle because they show both living and non-living characters. Hence, they are regarded as a separate entity. They are now defined as ultramicroscopic, disease causing intracellular obligate parasites. They could not be placed in any of the kingdoms because they are practically neither living nor dead.

The name virus is derived from the word virion which means venom or poisonous fluid.

Characteristics of Virus:

1. Viruses are the smallest and simplest of all known organisms. They can only be seen with an electron microscope.
2. Viruses range in diameter from about 20-200 nm.
3. They are able to pass through bacterial filter.
4. They are composed of nucleic acid and protein.
5. Nucleic acids are either DNA or RNA surrounded by non genetic protein coat called capsid.
6. They are all obligate intracellular parasites and are incapable to carry out any function outside the living host.
7. They are parasites on living cells but are not themselves cell.
8. They cannot be cultured on any synthetic medium.
9. They are highly specific for particular organisms.
10. They exist as cubical, helical or tadpole shaped structures.
11. They infect every kind of living organisms on earth.
12. They vary greatly in their power of resistance.
13. They lack of enzymes necessary for the generation of energy.
14. They are very easily transmitted from one organism to another by mechanical means or biological vectors.

Classification of Virus

They are classified on different basis.

A) Based on host: On the basis of host, they are of three different types.

1. **Animal virus:** They infect animals and cause diseases. They may contain DNA or RNA. eg: rabies, HIV etc.
2. **Plant virus:** They infect plants and cause diseases. They mostly contain RNA as genetic material. eg: TMV, bean mosaic virus, cauliflower mosaic virus (DNA).

3. Bacteriophage: They infect bacteria. It is tadpole like in their shape. They usually contain DNA as genetic materials. eg: T₂, T₄, T₆ bacteriophage.

B) Based on nucleic acid: On the basis of nucleic acid, they are of two types.

1. DNA virus: Virus that has DNA as its genetic material is known as DNA virus. The nucleic acid is usually double stranded DNA. These viruses produce new DNA, which transmits information for protein synthesis through host RNA.

2. RNA virus: Virus that contains RNA as genetic material is known as RNA virus. The genetic material is usually single stranded. The RNA replicates new RNA which passes information to protein. There is no involvement of DNA.

Structure of Bacteriophage:

Bacteriophage is a virus that infects and replicates only within the body of bacteria. They are cosmopolitan in distribution in different environment. They are diverse in their shape, size and genome organization depending on the type of bacteria they infect, but the basic composition remains the same in all.

- A bacteriophage comprises head, neck or collar and tail.
- Head is polyhedral in shape made up of protein coat known as capsid. The genetic material either DNA or RNA lies inside the head.
- Neck is short proteinous structure that separates head and tail.
- Tail is hollow and cylindrical in structure. They may be long or short, contractile or non-contractile. The tail fibre helps in anchoring them to the bacterial cell wall.

Life Cycle of Virus:

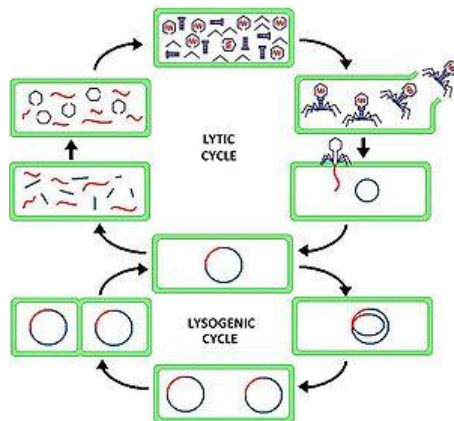
The virus is going to follow two types of life cycle that are lytic cycle and lysogenic cycle. In a lytic cycle, it undergoes replication and produces more phages while in a lysogenic cycle, it may remain as temperate, it gives rise to a prophage as its DNA integrates with the bacterial DNA.

1. Lytic Cycle: The **lytic cycle** is typically considered the main method of viral replication, since it results in the destruction of the infected cell.

Viruses of the lytic cycle are called virulent viruses. The lytic cycle is a six-stage cycle. In the first stage, the virus injects its own nucleic acids into a host cell. Then the viral acids form a circle in the center of the cell. The cell then mistakenly copies the viral acids instead of its own nucleic acids. Then the viral DNA organizes themselves as viruses inside the cell.

The reproductive process of virulent phage is called lytic cycle because the host is lysed at the end and virus particles release. Lytic cycle is common in T₂, T₄ bacteriophage. The process is divided into following stages.

- a) **Adsorption:** The bacteriophage gets attached to the wall of bacterium by its tail fibres. It brings tip of the tail in contact with host cell wall.
- b) **Penetration:** This stage is the injection of nucleic acid of the virus into the host cell. The tail sheath contracts and the enzyme lysozyme helps in creating a hole in the cell wall so, as to inject phage DNA into the bacterial cell. The protein coat remains outside, attached to the cell wall.
- c) **Eclipse stage:** The phage DNA now codes for the phage enzymes using the host machinery. The enzyme nuclease produced by the expression of viral gene breaks down the host DNA. The phage DNA replicates and codes for new coat proteins.
- d) **Maturation stage:** In this stage, the new phage particles are made by the assembly of protein coats surrounding the phage DNA.
- e) **Lysis of host and release of virus particles:** The lysozyme made by phage DNA brings about the lysis of the bacterial cell releasing the phages, ready to infect more bacteria. Such a cycle, where phage bring about the disintegration or lysis of the bacterium, is called as lytic cycle.



2. **Lysogenic Cycle:** Lysogeny, or the lysogenic cycle, is methods of viral reproduction (the lytic cycle is the other). Lysogeny is characterized by integration of the bacteriophage nucleic acid into the host bacterium's genome. Lysogenic cycles can also occur in eukaryotes, although the method of incorporation of DNA is not fully understood. Certain types of viruses replicate by the lysogenic cycle, but also partly by the lytic cycle (mixed cycles).

The adsorption and the penetration phases are same as in lytic cycle. In the process, DNA integrates with the bacterial DNA and does not exert any influence over the bacterial cell. DNA which is integrated with bacterial DNA is called prophage or provirus.

The phage DNA also replicates along with the host DNA. A repressor protein produced by the prophage keeps the phage genes in repressed stage. In this way, phage DNA may keep multiplying the prophage generation after generation without causing any damage to host. Such a bacterial cell that carries the potential seed of destruction by carrying prophage is called as lysogenic cell. The phenomenon by which phage DNA becomes a part of host cell is called as lysogeny.

Effects of Retro virus:

- Pre-adult T-cell leukemia (HTLV) is diagnosed on the basis of leukocytosis and abnormal lymphocytes.
- HIV infection is determined by demonstrating HIV-specific antibodies which usually appear at some interval of time after infection.
- AIDS is diagnosed mainly on the basis of specific opportunistic infections or cancers.

Common Symptoms of Plant Disease:

Leaf spot: dead, discolored or injured areas of tissue that usually have distinct margins; spots often appear on leaves or fruit.

Blight: rapid yellowing, browning, collapse and death of leaves, shoots, stems, flowers or the entire plant.

Chlorosis: yellowing of leaves and stems that are normally green.

Necrosis: browning or blackening of areas on the plant indicative of the death of plant cells.

Wilt: loss of turgor or drooping of leaves, shoots or the entire plant due to lack of water.

Distortion: twisting or other abnormal traits of leaves, stems and shoots.

Mosaic: uneven pattern of yellow, light green or dark green, usually on leaves.

Canker: dead area on the stem or branch; can be sunken, swollen or discoloured and is usually distinguished from adjacent healthy tissues by colour.

Rot: breakdown and decay of plant tissue, often used to describe conditions in roots and fruit.

Dieback: death of the tips of leaves, shoots and stems; failure of branches to develop, especially in the spring.

Witches' broom: abnormal proliferation of shoots from the same point on a plant resulting in a bushy, broom-like appearance.

Gall: a swelling or abnormal growth of plant tissues; can develop on leaves, stems and roots.

Stunt: abnormally small-sized plant parts due to the failure of those plant parts to grow to full size; often used to describe an entire plant.

Economic Importance of virus

- 1. Viral diseases in human:** Viruses are main agents which causes various diseases in human. The common viral diseases in human are polio, rabies, chicken pox, AIDS etc.
- 2. Viral diseases in plant:** They are also the agents that cause various diseases in plant. The common viral diseases are TMV, tomato mosaic virus, potato mosaic virus etc.
- 3. Virus in treatment:** Viruses being specific to their hosts are used in the treatment of some fungal and bacterial diseases. eg: cholera, plague, cancer etc.
- 4. Development of plant varieties:** Viral infection develops mosaic pattern in leaves and flowers. It increases ornamental value of different garden plants.