Topic: Nature , Properties and Structure of Viruses

B.Sc. Botany (Hons.) I

Group: C

Dr. Sanjeev Kumar Vidyarthi

Department of Botany

Dr. L.K.V.D. College, Tajpur

Nature, Properties and Structure of Viruses

Viruses are genetic elements enclosed in protein and are not considered to be organisms, as they cannot reproduce independently. Because of their disease-producing potential, viruses are important biological entities. Viruses possess only a portion of the properties of organisms. Viruses are literally "parasitic" chemicals, segments of DNA or RNA wrapped in a protein coat.

Viruses vary greatly in appearance and size. The smallest are only about 17 nanometers in diameter, and the largest are up to 1000 nanometers (1 micrometer) in their greatest dimension. The largest viruses are barely visible with a light microscope, but viral morphology is best revealed using the electron microscope. Viruses are so small that they are comparable to molecules in size; a hydrogen atom is about 0.1 nanometer in diameter, and a large protein molecule is several hundred nanometers in its greatest dimension.

The true nature of viruses was discovered in 1933, when the biologist Wendell Stanley prepared an extract of a plant virus called tobacco mosaic virus (TMV.). Each particle of TMV virus is in fact a mixture of two chemicals: RNA and protein. The TMV virus has the structure of a Twinkie, a tube made of an RNA core surrounded by a coat of protein.

The Nature of Viruses

Structure

All viruses have the same basic structure: a core of nucleic acid surrounded by protein. Individual viruses contain only a single type of nucleic acid, either DNA or RNA. The DNA or RNA genome may be linear or circular, and single-stranded or double-stranded. Viruses are frequently classified by the nature of their genomes. RNA-based viruses are known as retroviruses.

Nearly all viruses form a protein sheath, or capsid, around their nucleic acid core. The capsid is composed of one to a few different protein molecules repeated many times .In some viruses, specialized enzymes are stored within the capsid. Many animal viruses form an envelope around the capsid rich in proteins, lipids, and glycoprotein molecules. While some of the material of the envelope is derived from the host cell's membrane, the envelope does contain proteins derived from viral genes as well.

Viruses occur in virtually every kind of organism that has been investigated for their presence. However, each type of virus can replicate in only a very limited number of cell types. The suitable cells for a particular virus are collectively referred to as its host range. The size of the host range reflects the coevolved histories of the virus and its potential hosts. Still other viruses remain dormant for years until a specific signal triggers their expression. A given organism often has more than one kind of virus. This suggests that there may be many more kinds of viruses than there are kinds of organisms—perhaps millions of them. Only a few thousand viruses have been described at this point.

Replication

Viruses can reproduce only when they enter cells and utilize the cellular machinery of their hosts. Viruses code their genes on a single type of nucleic acid, either DNA or RNA, but viruses lack ribosomes and the enzymes necessary for protein synthesis. Viruses are able to

reproduce because their genes are translated into proteins by the cell's genetic machinery. These proteins lead to the production of more viruses.

Shape

Most viruses have an overall structure that is either helical or isometric. Helical viruses, such as the tobacco mosaic virus, have a rod like or threadlike appearance. Isometric viruses have a roughly spherical shape whose geometry is revealed only under the highest magnification. The only structural pattern found so far among isometric viruses is the icosahedron, a structure with 20 equilateral triangular facets, like the adenovirus. Most viruses are icosahedral in basic structure. The icosahedron is the basic design of the geodesic dome. It is the most efficient symmetrical arrangement that linear subunits can take to form a shell with maximum internal capacity.

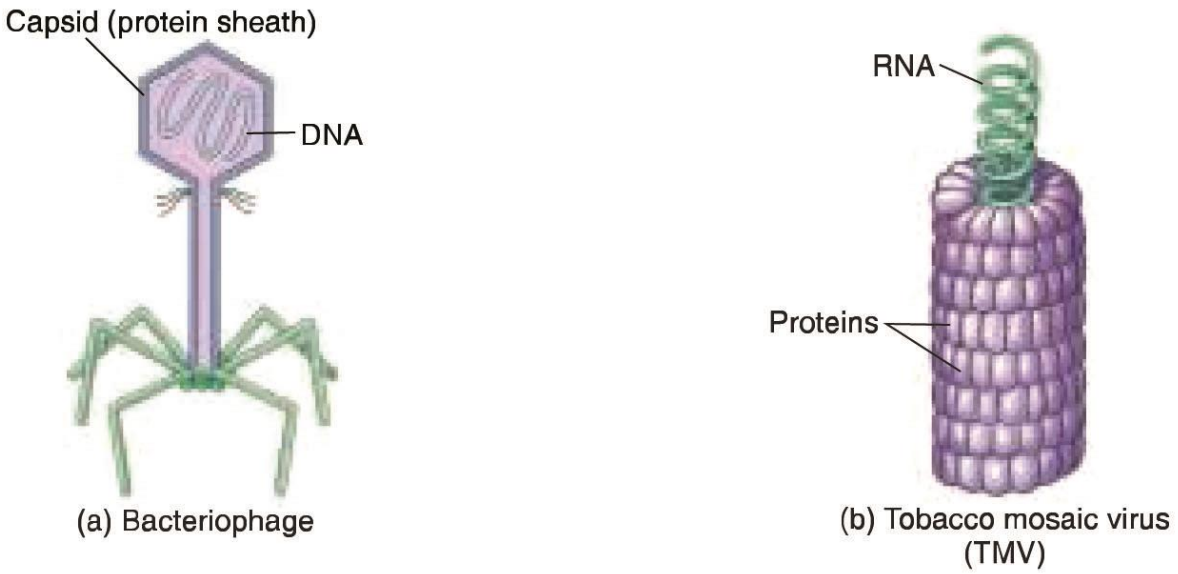

FIGURE. The structure of a bacterial, plant (*a*) Bacterial viruses, called bacteriophages, often have a complex structure. (*b*) TMV infects plants and consists of 2130 identical protein molecules (*purple*) that form a cylindrical coat around the single strand of RNA (*green*). The RNA backbone determines the shape of the virus and is protected by the identical protein molecules packed tightly around it.

Properties-

The most important properties of viruses are as follows-

- They are transmissible from unhealthy to healthy plants.
- They are inferable through filter paper.
- They can multiply only within the living host cell.
- They possess the capacity of variations and adaptation.
- They are highly resistant to acids, alkalies and salts.
- They are resistant to high temperatures.
- There is no direct effect of sunlight on viruses.