

University of Tikrit

College of nursing

Basic Nursing Sciences



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Parasitology

Viruses

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Viruses

General properties of viruses: Viroids, Prions. Viruses :

Viruses are capable of causing several diseases in human, Viruses in size from approximately 20 nm to 300 nm. This main that the majority to viruses can only be seen through the electron microscope (EM) and the smallest infectious agents. Viruses lack cellular organization and enzymes. They are obligate intracellular parasites. There are also the 'unconventional agents' sometimes knew as 'unconventional viruses' or 'atypical viruses' - Up to now, the main kinds that have been studied are viroids and prions.

Are Viruses Living or Dead?

This depends on the definition of life. To avoid possible arguments, we often refer to whether they have or have lost some aspect of their biological activities rather than referring to living or dead viruses. Hence we talk about number of infectious particles, or number of plaque forming particles rather than number of living particles

Viroids

Viroids contain RNA only. They are small (less than 400 nucleotides), single stranded, circular RNAs. The RNAs are not packaged, do not appear to code for any proteins, and so far have only been shown to be associated with plant disease. However, there are some suggestions that somewhat similar agents may possibly be involved in some human diseases such as hepatitis delta virus (HDV).

Prions

Prions contain protein only, they are small, they contain any nucleic acid, but if there is any, there is very little. Examples of prion-caused human diseases are Kuru, Creutzfeldt-Jakob disease and Gerstmann-Straussler syndrome. Prions also cause scrapie in sheep.

Viral Structure and Shape:

Viruses contain only those components necessary to invade and utilize host cell machinery for the replication. Viruses are composed of nucleic acid genome surrounded by a protein coat called **capsid**. Two kinds of symmetry are met within the

capsid –icosahedral (cubical) and helical. They contain only one type of nucleic acid, either DNA or RNA, but never both. The genome and the capsid are together referred to as **nucleocapsid** e.g., Papilloma, Tobacco mosaic.

Viruses that have a lipid-containing envelope surrounding the capsid are called **enveloped** viruses and the ones without it called **non-enveloped** viruses. Some viruses, in addition, may have spikes extending from the surface. —e.g., Mumps virus, Herpes virus.

Five basic structural forms of viruses in nature:

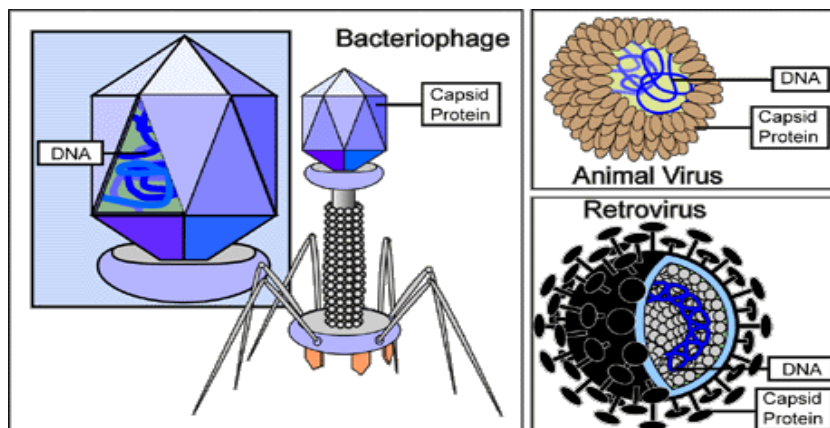
- Naked icosahedral** e.g. poliovirus, adenovirus, hepatitis A virus
- **Naked helical** e.g. tobacco mosaic virus. So far no human viruses with this structure are known
- **Enveloped icosahedral** e.g. herpes virus, yellow fever virus, rubella virus

- **Enveloped helical** e.g. rabies virus, influenza virus, parainfluenza virus, mumps virus, measles virus
- **Complex** e.g. poxvirus

Classification of viruses:

Viral taxonomy is much less structured and depends on a variety of characteristic including:

1. Nucleic acid type DNA or RNA
2. Nucleic acid stranded.
 - * Single stranded SS or
 - * Double stranded DS
3. Presence or absence of an envelope.
 - * Envelop
 - * Non-Enveloped
4. Capsid size and shape.
 - * Icosahedral as: Adenoviridae, Reoviridae.
 - * Helical as: HBV.
 - * Complex as: Poxviridae.
5. Host specificity for example + (animal, plant or bacterial



Viral Entry and Spread:

Organisms can gain entry by variety of mechanisms (Mode of transmission) including:

1. Respiratory spread to mucous membrane e.g., Influenza virus, Mumps, etc. .
2. Direct inoculation through skin contact e.g., Rabies, Varicella-zoster, HBV.
3. Direct inoculation to the bloodstream e.g., HIV, HBV.
4. Oral/fecal spread to the gastrointestinal tract e.g., HAV, HSV-1 and 2,
Genital entry (venereal route) e.g., Herpes simplex-1&2, Cold sores, HIV, HBV.
5. Vertical mother child transmission.

Virus's entry (Penetration-Recognition) into host cells occurs through one of the following methods

- a- Endocytosis.
- b- Direct fusion
- c- Nucleic acid translocation

All viruses must be transmitted to the site of infection How Do

Viruses Spread?

as latency in nerves roots and reactivation of viruses.1- Neuronal e.g., HIV, CMV2-Lymphatic spread, e.g., HIV.3-Bloodstream,

Replication of Viruses

There are principal events involved in replication:

1- Adsorption

The first step in infection of a cell is attachment to the cell surface. The viral attachment protein recognizes specific receptors, which may be protein, carbohydrate or lipid, on the outside of the cell. Cells without the appropriate receptors are not susceptible to the virus.

1-Penetration

The virus enters the cell in a variety of ways according to the nature of the virus.

*** Enveloped viruses**

- a. Entry by fusing with the plasma membrane. Some enveloped viruses fuse directly with the plasma membrane.
- b. Entry via endosomes at the cell surface.

Non-enveloped viruses

Non-enveloped viruses may cross the plasma membrane directly or may be taken up into endosomes. They then cross (or destroy) the endosomal membrane

2- Assembly

New virus particles are assembled. There may be a maturation step that follows the initial assembly process

3- Release

Virus may be released due to cell lysis, or, if enveloped, may bud from the cell. Budding viruses do not necessarily kill the cell. Thus, some budding viruses may be able to set up persistent infections. Not all released viral particles are infectious.