Viruses

✓Viruses occupy the twilight zone that separates the living from nonliving.

✓These are the smallest, ultramicroscopic living organisms, which reproduce only inside the living cell.

✓Viruses possess neither cellular structure nor the organelles.

✓Therefore they are unable to make their own essential enzymes and proteins and are completely dependent on the hot cell for multiplication and energy.

✓Viruses are known to infect unicellular organisms such as bacteria, algae, mycoplasmas as well as higher animals and plants.

General Properties of Viruses:

✓They do not possess cellular organization.

✓They are obligate intracellular parasites.

✓They lack enzymes necessary for protein and nucleic acid synthesis.

✓They multiply by complex processes, but not by budding or binary fission.

✓They possess either RNA or DNA but never both.

✓They are unaffected by antibiotics.

✓They are sensitive to interferon.

✓They can be crystallized like chemicals and are extracted from infected host cells.

✓With a few exceptions, viruses are vary heat labile. They can be destroyed by heating at 60ºc for 30 minutes. Viruses are inactive by sunlight, UV rays and ionizing radiation.

✓Chemical disinfectants are less effective on viruses.

HIV and AIDS

✓Acquired immune deficiency syndrome (AIDS) was first described in the USA in 1981, amongst homosexuals and drug addicts.

✓AIDS is defined as HIV infection on helper T cells, i.e. CD4 antigen, leading to a number of immunological deficiencies.

Structure:

A complete structure of HIV consists of the –

Envelope:

Envelop is a lipid bi-layer membrane surrounding the virus and is derived from the host cell membrane. It also contains some host protein. In the envelop, viral encoded glycoprotein is embedded.

Capsid:

Capsid is the protein coat that surrounds the core of the virus.

Core:

Core is the elongated dense inner mass of the virus. It contains two identical single strands of viral RNA, structural protein and some enzymes.

Epidemiology:

HIV occurs in two main striations.

HIV 1:

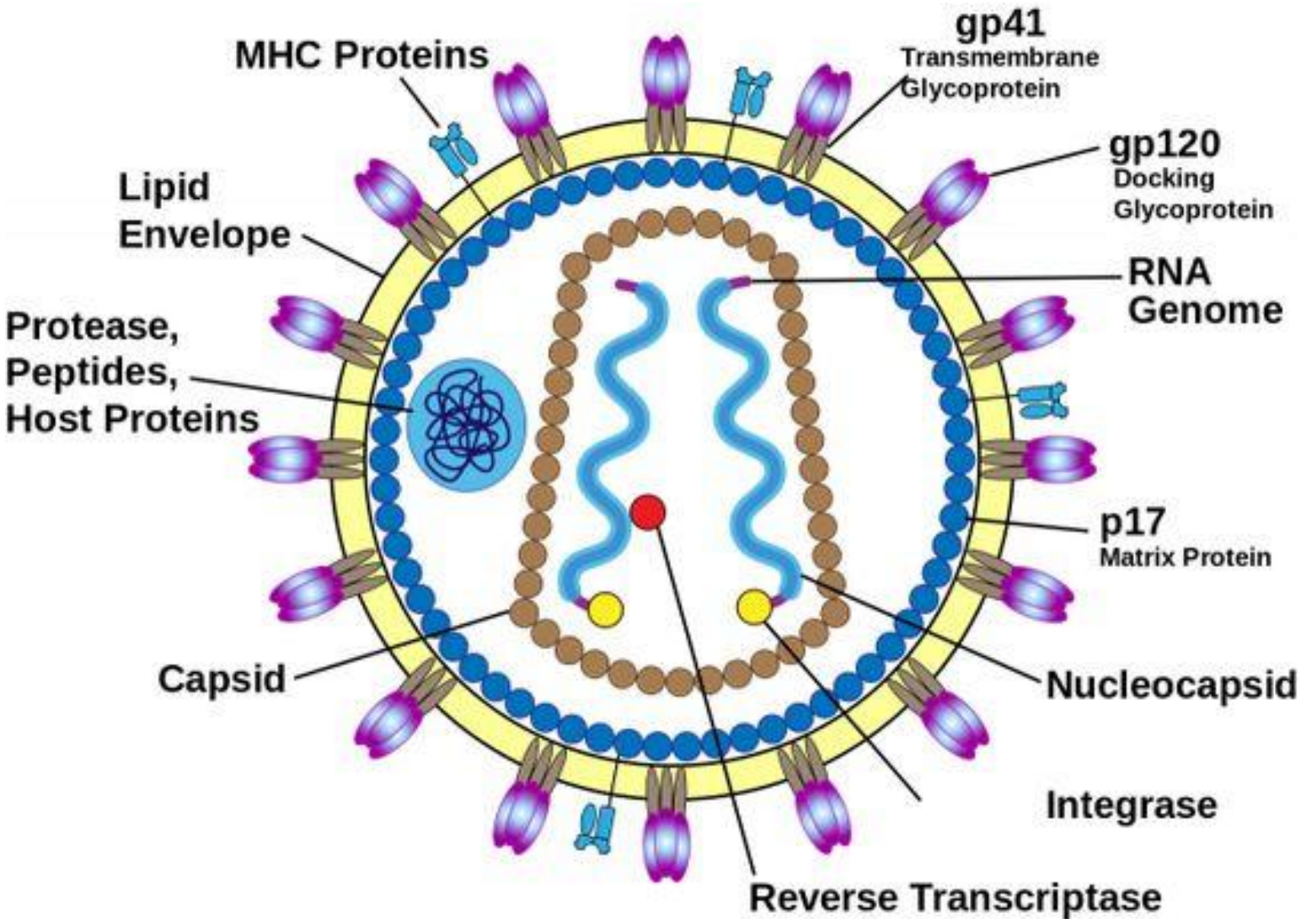
HIV 1 is isolated from America, Europe and Central Africa. It has the widest distribution.

HIV 2:

HIV 2 is isolated from West Africa and is limited there.

✓HIV affects both sexes and peak incidence is seen in infected younger age group (20-39 yr).

✓An HIV infected person, from any group or stage of clinical AIDS, is the significant source of virus.


MHC Proteins
gp41
Transmembrane
Glycoprotein
gp120
Docking
Glycoprotein
Lipid
Envelope
RNA
Genome
Protease,
Peptides,
Host Proteins
p17
Matrix Protein
Capsid
Nucleocapsid
Integrase
Reverse Transcriptase

Transmission:

HIV is transmitted through-

Sexual Contact:

Sexual transmission occurs among homosexual and heterosexual individuals during sexual intercourse, through infected semen or having multiple sex partners.

Blood Transfusion:

Transmission occurs after receiving infected blood transfusions or blood product transfusions.

✓Sharing of needle, especially among drug addicts, is one of the significantly observed routes of transmission of HIV.

✓Accidental inoculation of organism in the blood also occurs.

Perinatal Transmission:

✓Transmission occurs from an infected mother to her child either transplacentally or perinatally at birth.

✓After the birth, HIV transmission occurs via breast milk.

Pathogenesis:

✓HIV enters in the patients body and enters the bloodstream.

✓HIV infects any cell bearing CD4 antigen receptor, such as T_H lymphocytes, 40 percent of blood monocytes, and tissue macrophages, B-lymphocytes, lymph node and skin, glial cells of brain etc.

✓The principal target cell is T_H lymphocyte.

✓The glycoprotein on the surface of the virus interacts and binds to the CD4 antigen on the host cell.

✓The core of the virus, containing RNA, enters the host cell.

✓The virus is duplicated together with the host's cells own genes, every time with the host cell is activated and divided.

✓Once activated, the DNA produces copies of viral RNA and viral proteins.

✓The mature virus leaves the cell by rupturing it.

✓In this way, a marked reduction in circulating T_H lymphocytes take place. This lead to severe immunosuppression, as T_H lymphocytes are reduced in numbers.

Laboratory Diagnosis:

Laboratory diagnosis of AIDS is based on specific and non specific tests for HIV.

Specific Test:

Isolation of Virus:

The virus can be isolated on tissue culture from body fluids containing T_H lymphocyte.

Antigen Detection:

Antigens are detected during the window phase. Polymerase chain reaction (PCR) is performed for detection of viral genome and antigens.

Antibody Detection:

After a period of window period, antibodies can be detected in the circulation of the patient body fluid. It can be done by –

ELISA and Western blot test

ELISA: This is most widely used test in the diagnosis of AIDS. The antigen is prepared from HIV cultivated in cell culture or by recombinant technique for the detection of antibody.

Western Blot test:

In this test, HIV is broken down into protein fragments and moved on the strip of nitrocellulose sheet. This strip is then incubated with the patient's serum containing antibodies.

Non Specific Test:

The non specific test includes total and differential cell count, assay to T lymphocyte, platelet counts, estimation of IgG and IgA levels.