

13: Integrated chapter (HIV)

Human immunodeficiency virus (HIV)

Human immunodeficiency virus (HIV) is a retrovirus, which is a class of viruses that carry genetic information in RNA. There are two types of HIV, **HIV-1** and **HIV-2**, with HIV-1 being the most predominant, it is commonly called just HIV. Both types of HIV damage a person's body by destroying specific blood cells, called **CD4+ T cells**, which are crucial to helping the body fight diseases in the immune system.

Many people infected with HIV eventually develop **acquired immune deficiency syndrome (AIDS)**. This may not occur until many years after the virus first enters the body. The virus infects and destroys helper T cells of the human immune system. This can lead to immune deficiency, which is when the infection with the virus progressively deteriorates the immune system and is considered deficient when it no longer works to help fight infection and disease.

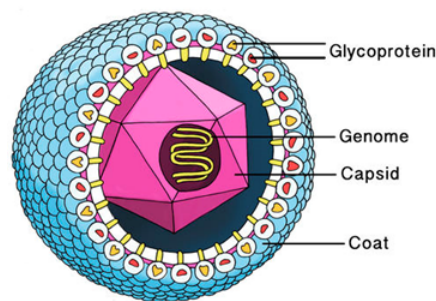


Figure 13.1: Structure of HIV virion

HIV Transmission

HIV is considered to be a sexually transmitted infection (STI) because it is the most common mode of transmission. It is transmitted, or spread, through direct contact of **mucous membranes** or body fluids such as blood, semen, or breast milk. It can also be transmitted through an infected mother's blood to her baby during late pregnancy or birth or through breast milk after birth. In the past, HIV was also transmitted through blood transfusions. Because donated blood is now screened for HIV, the virus is no longer transmitted this way. HIV is not spread through saliva, touching or in swimming pools.

Replication cycle

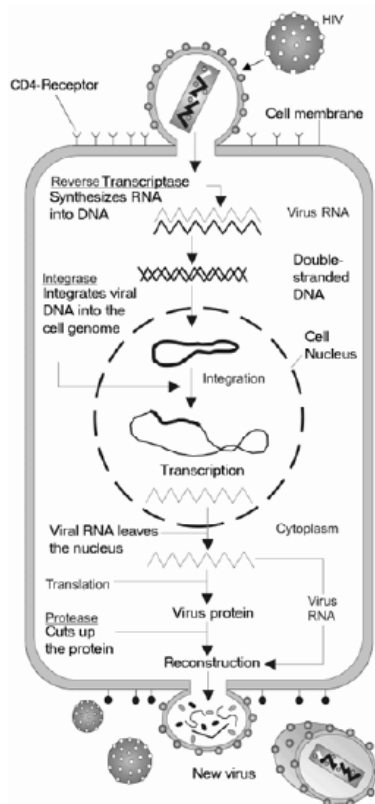


Figure 13.2: Steps in the HIV Replication Cycle

First, the viral particle attaches to the CD4 receptor and other associated receptors on the host cell membrane. The viral envelope then fuses with the cell membrane, and the viral capsid moves into the cell.

1. Once the viral capsid enters the cell, **reverse transcriptase** frees the single-stranded RNA from the viral proteins and copies it into a complementary strand of DNA. This process of reverse transcription is error-prone and it is during this step that mutations may occur. Such mutations may cause drug resistance.
2. The reverse transcriptase then makes a complementary DNA strand to form a double-stranded viral DNA (vDNA).
3. The vDNA is then moved into the cell nucleus. The integration of the *viral DNA* into the host cell's genome is carried out by another viral enzyme called **integrase**. This integrated viral DNA may then lie dormant, during the latent stage of the HIV infection. Clinical latency for HIV can vary between two weeks and 20 years.
4. To actively produce viruses, certain cellular transcription factors need to be present. These transcription factors are plentiful in activated T cells. This means that those cells most likely to be killed by HIV are those currently fighting infection. The virus DNA is transcribed to mRNA which then leads to new virus protein and genome production.
5. Viral particles are assembled inside the cell and then exit the cell by budding. The virus gets its viral envelope from the cell's plasma membrane. The cycle begins again when the new particles infect another cell.

Prevention of HIV Transmission

There is currently no approved vaccine for HIV or AIDS, although vaccine trials are ongoing. Instead, prevention of HIV transmission depends on adopting safe behaviors and/or the administration of antiretroviral drugs. HIV transmission through intravenous drug use can be reduced through harm-reduction strategies such as needle-exchange programs or the substitution of prescription drugs for illegal drugs. In cases of unanticipated exposure to infected blood, such as a needle-stick injury or sexual assault by an HIV-positive perpetrator, risk of HIV infection can be substantially reduced by the administration of **antiretroviral medications** within two or three days of the incident.

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