AIDS

Acquired Immunodeficiency Syndrome

AIDS

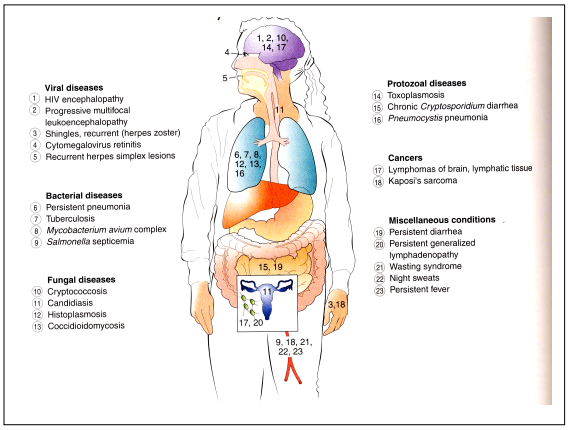
- HIV or Human Immunodeficiency virus
- Family Retroviridae
  - ssRNA virus
  - Reverse transcriptase

Transmission

- Sexual intercourse
- Sharing needles
- Mother to newborn (birthing)
- Blood transfusions

Viral epidemics

- 1918 & 1919 - Spanish flu (swine flu)
- 1940s & 50s - polio
- 1970s & 1990s - Ebola
- 1980s & 1990s - HIV
- 1996 & 1997 - hepatitis, dengue fever, yellow fever, Ebola, Lassa fever, and polio
- Others - hantavirus, West Nile virus



Kaposi's sarcoma

Treatment

- A combination of reverse transcriptase and protease inhibitors
  - Reverse transcriptase inhibitors
    - Azidothymidine (AZT) (Zidovudine)
    - Dideoxycytidine (ddC) (Zalcitabine)
    - 3TC (Lamivudine)
  - Protease inhibitors
    - Saquinavir (Invirase/Fortovase)
    - Ritonavir (Norvir)
  - HAART (Highly Active Antiretroviral Therapy

Prevention

- Abstinence from sexual intercourse and drugs
- Monogamy
- Condoms
- Avoid contact with body fluids

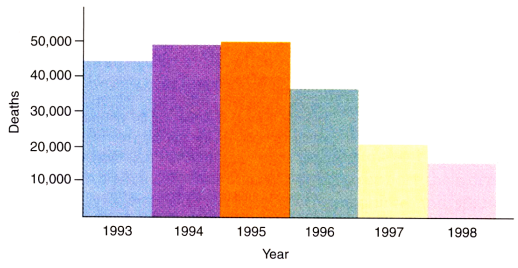
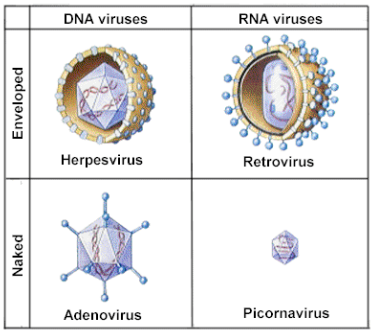


Figure 29.10 **Estimated Deaths Due to AIDS, United States, 1993 to 1998** Notice the marked drop in deaths after HAART became available in late 1995.

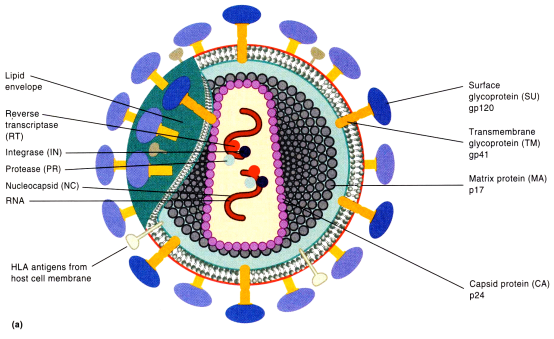
Viruses can have DNA or RNA as the for their genome



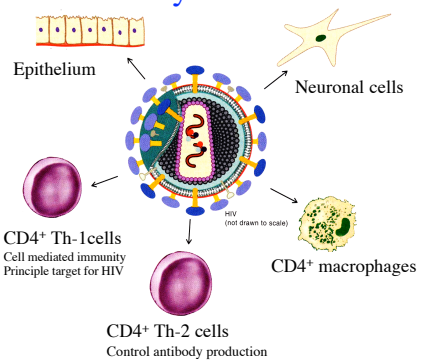
Viral replication

- Adsorption
  - The attachment of the viruses to the cells
- Penetration
  - The entry of the virion (or the genome)
- Synthesis
  - New nucleic acids, capsid proteins, & other viral components
- Maturation
  - Assembly of viral components
- Release
  - Release generally, but not always kills the cell

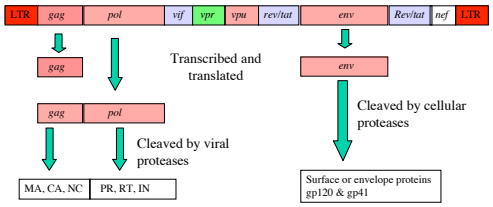
Diagram of HIV

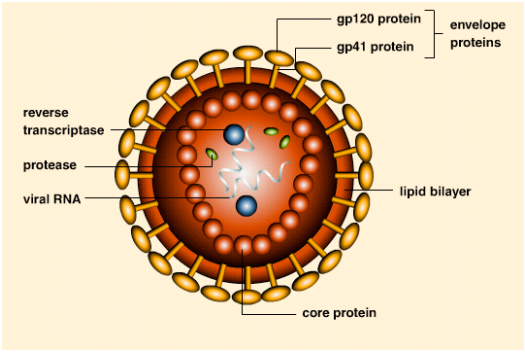


Cells infected by HIV

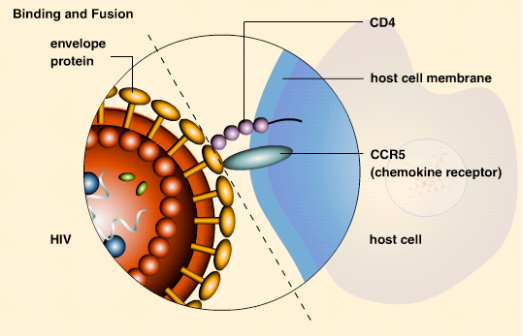


HIV-1 genome

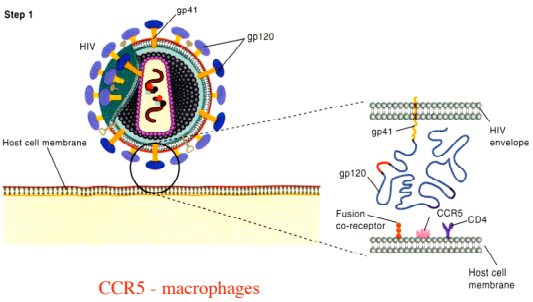




Binding of HIV in macrophages

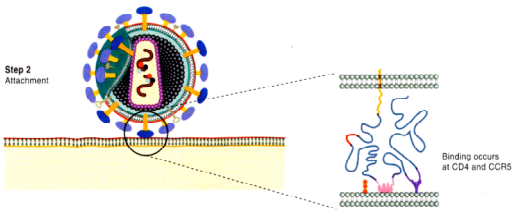


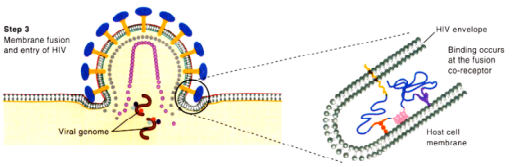
HIV receptors



CCR5 - macrophages
CXCR-4 (fusion) - T cells

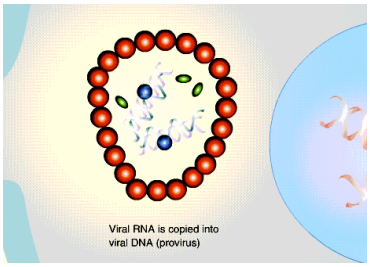
HIV attachment



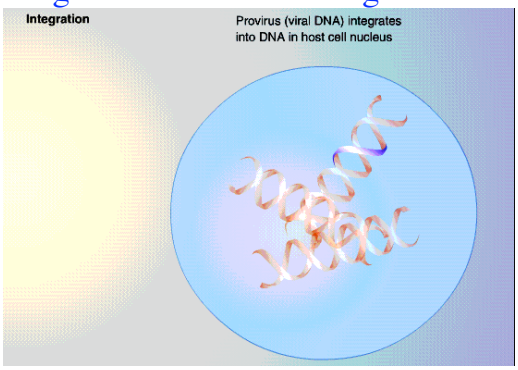


Binding of CD4 and a chemokine co-receptor change the conformation of gp41 and force the fusion of the viral and cellular membranes

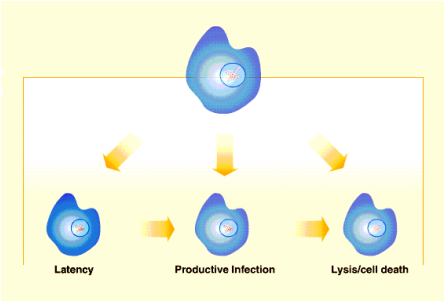
Reverse transcriptase copies viral RNA into DNA



Inegration into the host's genome

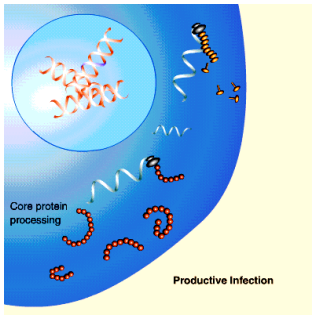


Infection pathways

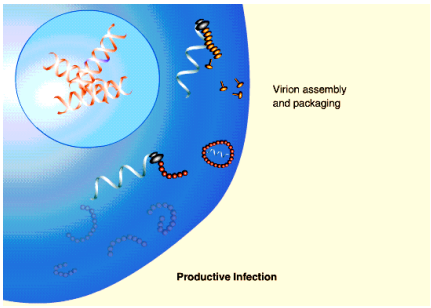


Viron production

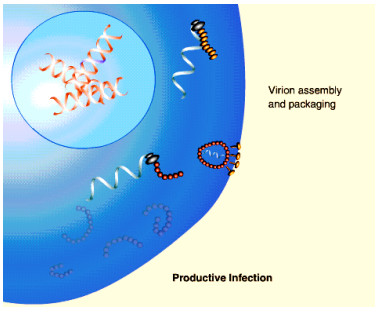
Proteins are translated and cleaved



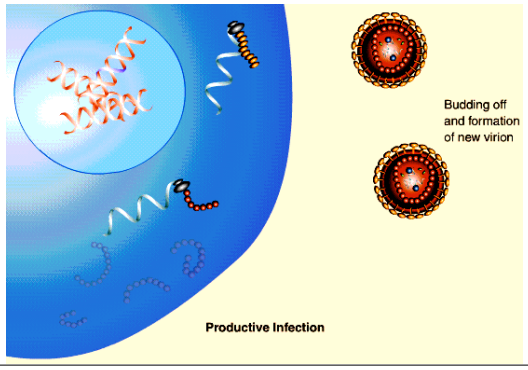
Protein production and cleavage



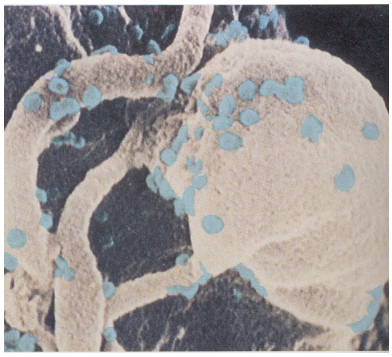
Envelope protein assemble on the cell surface



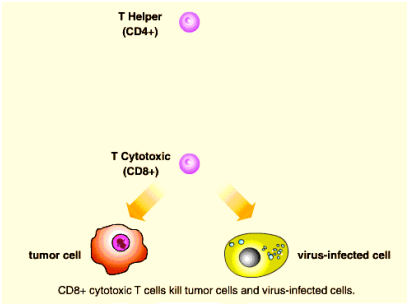
Virus budding



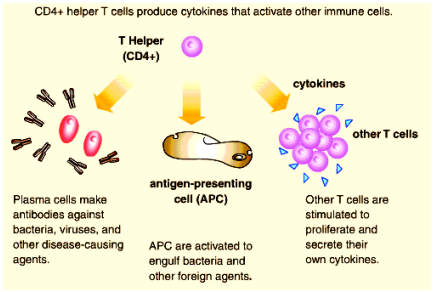
HIV budding from a T-cell



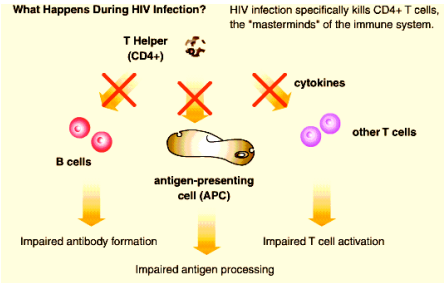
CD8 T-cells are cytotoxic

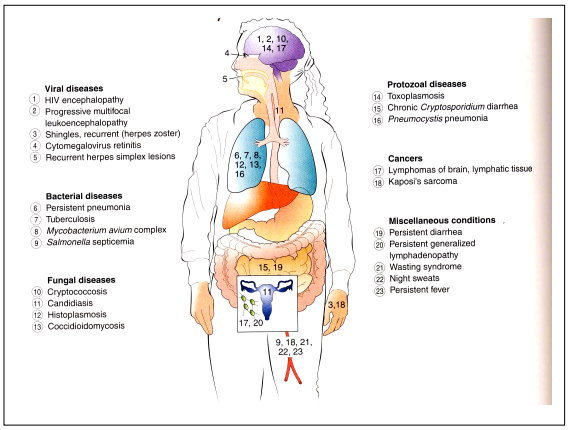


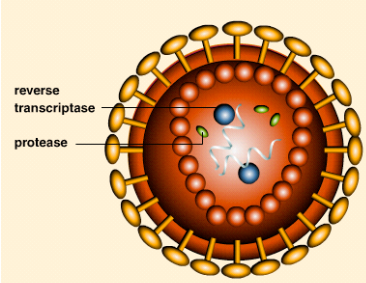
CD4 T-cells regulate the immune response



HIV infection destroys CD4 T-cells

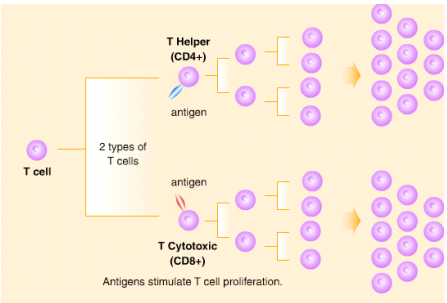






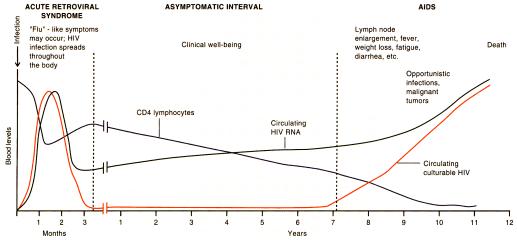
Points of attack against HIV

Types of T-cells

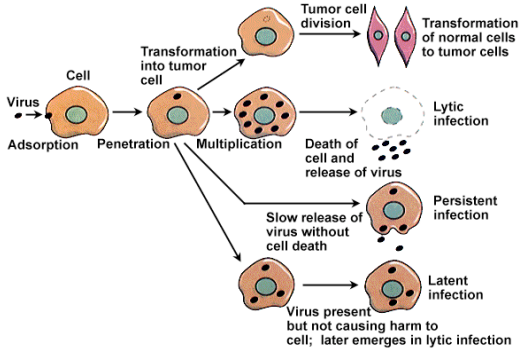


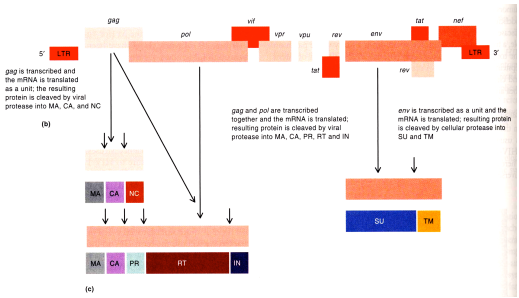
Antigens stimulate T cell proliferation.

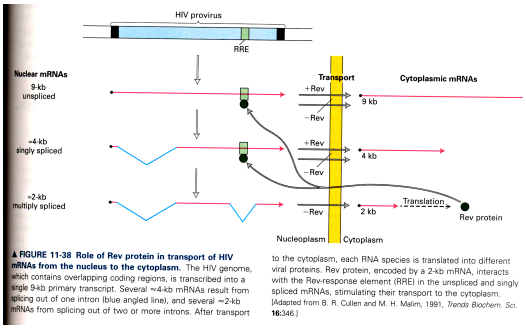
HIV Disease progression



Four effects on host cells

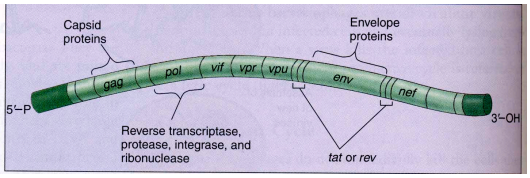




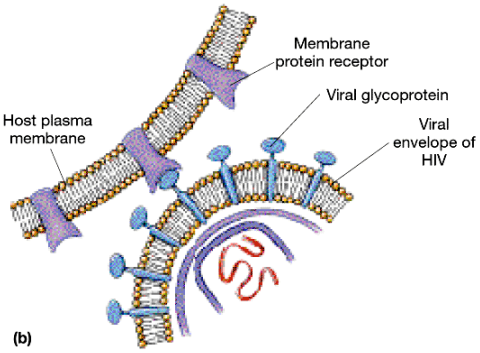


▲ **FIGURE 11-38 Role of Rev protein in transport of HIV mRNAs from the nucleus to the cytoplasm.** The HIV genome, which contains overlapping coding regions, is transcribed into a single 9-kb primary transcript. Several ≈4-kb mRNAs result from splicing out of one intron (blue angled line), and several ≈2-kb mRNAs from splicing out of two or more introns. After transport to the cytoplasm, each RNA species is translated into different viral proteins. Rev protein, encoded by a 2-kb mRNA, interacts with the Rev-response element (RRE) in the unspliced and singly spliced mRNAs, stimulating their transport to the cytoplasm. [Adapted from B. R. Cullen and M. H. Malim, 1991, *Trends Biochem. Sci.* **16**:346.]

HIV Genome



Viral binding



Accessory gene products

- Tat - regulates transcription
- Rev - nuclear export of unspliced RNA
- Nef - removes CD4 antigens from the surface of the host
- Vif - regulates virion assembly
- Vpr - Nuclear transport of uncoated viral DNA and cell arrest in G2
- Vpu - Blocks transport of CD4 to the cell surface