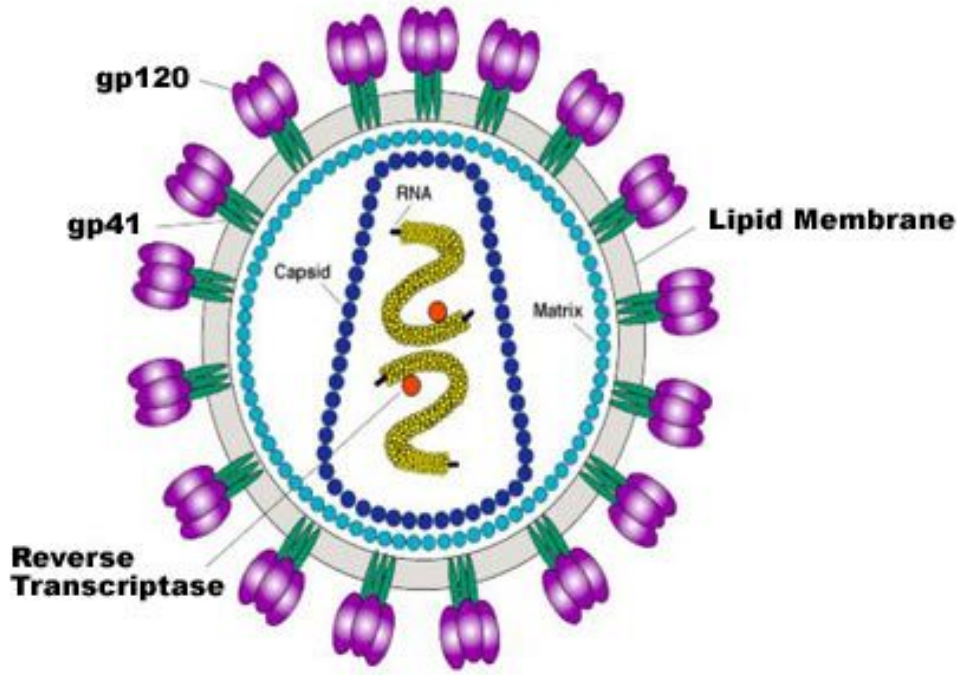
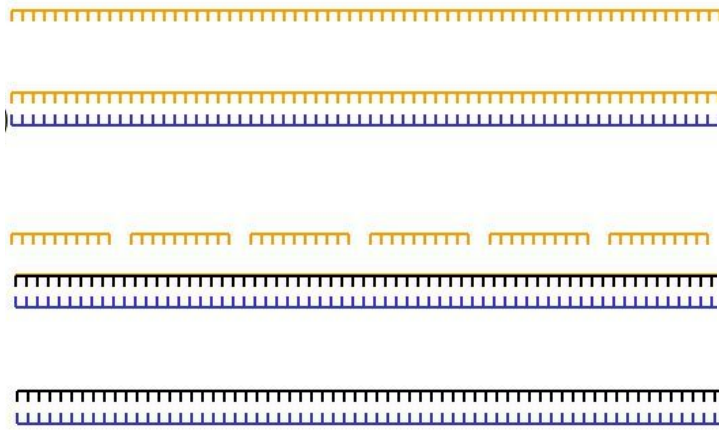
Human Immunodeficiency virus

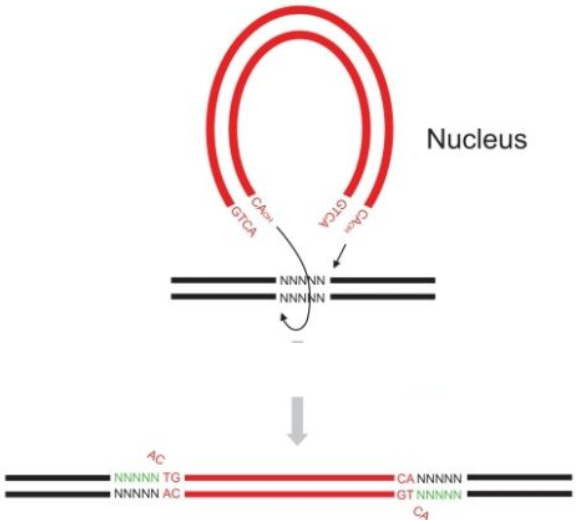


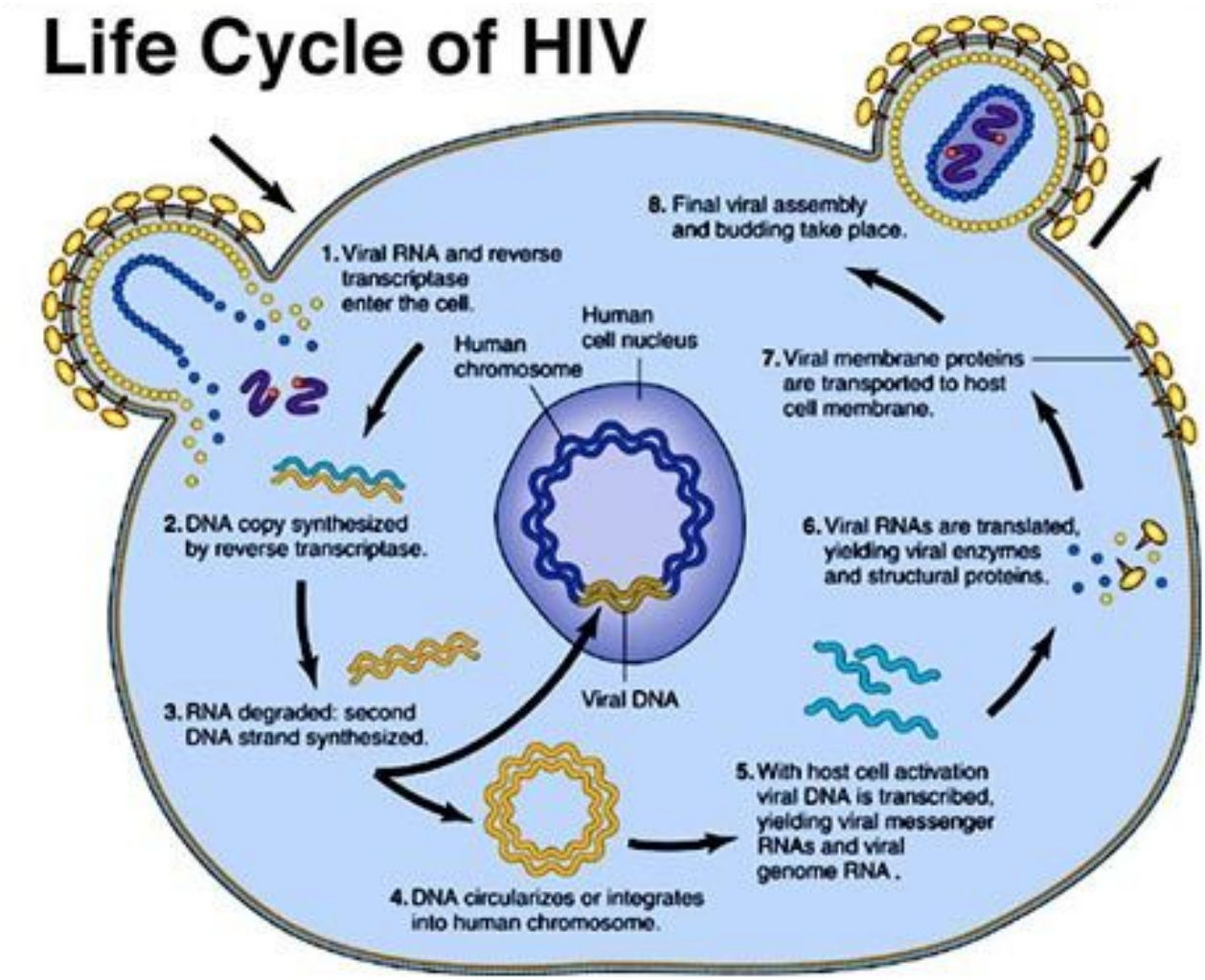
- Retrovirus - genetic material is RNA
- carries two single strands of RNA
- RNA enclosed in a capsid, made of protein
- capsid enclosed in a lipid membrane
- apart from RNA, the capsid also contains two key enzymes - Reverse Transcriptase and Intergrase
- lipid membrane has glycoprotein molecules - gp120 is used to attach to CD4 receptors on the host cell (T-helper cells, and to a lesser degree, phagocytes)

Reverse Transcriptase - converts HIV RNA (single stranded) to HIV DNA (double stranded)



Integrase - integrates viral DNA into host DNA



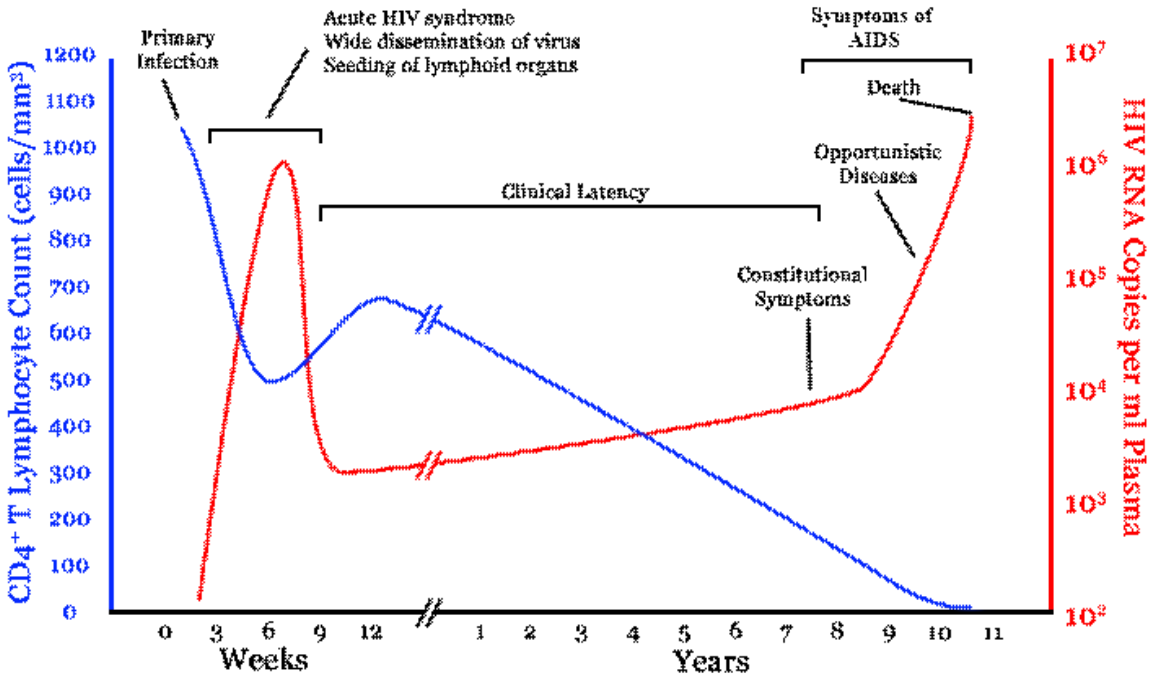


https://www.youtube.com/watch?v=odRyv7V8LAE

Life cycle of HIV

1. HIV attaches to the CD4 receptors on the T-helper cells, using its gp120 receptors
2. The viral lipid membrane fuses with the host cell membrane (using gp41 protein)
3. Viral RNA is released inside the host cell
4. Viral reverse transcriptase converts viral RNA into viral DNA
5. The viral DNA enters the host cell nucleus, and inserted into host DNA using the enzyme integrase
6. Host RNA Polymerase starts to transcribe and translate viral genes into viral proteins and enzymes
7. Viral proteins insert themselves into the cell membrane of the host cell - assembly of virus
8. New viral particles bud from the cell membrane

Phases of HIV infection



Primary infection: Large drop in $CD4^+$ cells

Clinical latency: Virus held in check by the immune system, CD4+ numbers recover, no symptoms, antibodies in blood

AIDS: Viral load starts to increase, sharp decrease in $CD4^+$ cell count (< 200/mm^3), opportunistic pathogens cause infection - pneumonia, tuberculosis

Treatment of HIV

- Antibiotics don't work, as the virus is 'hiding' inside CD4+ cells
- Many of the antibiotics in use are designed to disrupt bacterial/fungal transcription and translation - HIV uses the host (human) transcription and translation machinery/enzymes
- Best startegy is to target proteins and enzymes unique to the virus - either prevent the virus from attaching to host cells (gp120 inhibition) or prevent viral DNA synthesis or integration (reverse transcriptase or integrase)
- Lifelong treatment

E.g Efavirenz (non-competitive reverse transcriptase inhibitor)
Atazanvir (competitive protease inhibitors - prevent virus maturation)
T-20 (gp120 inhibitor)

Combined anti-retroviral therapy to prevent development of resistance