HIV & AIDS

UG module

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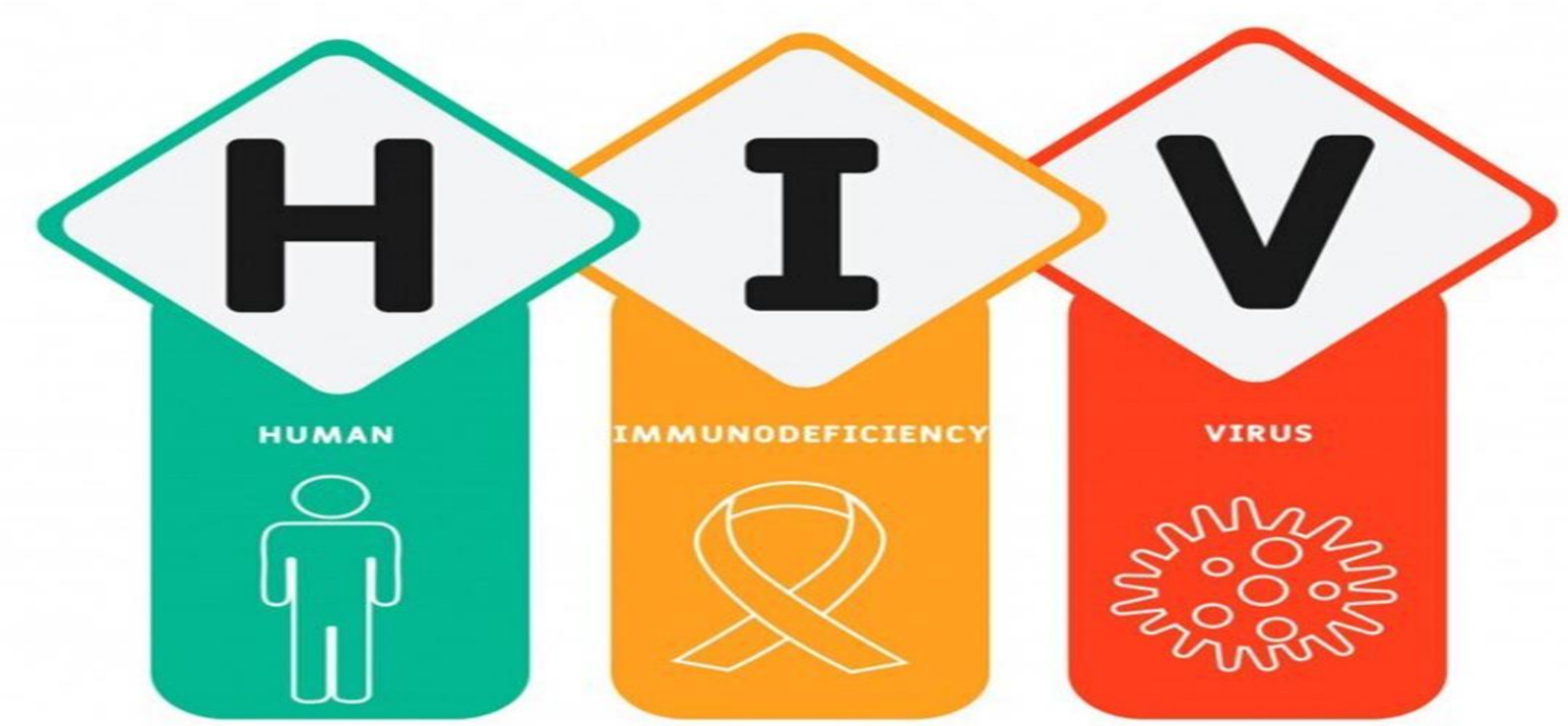
HIV

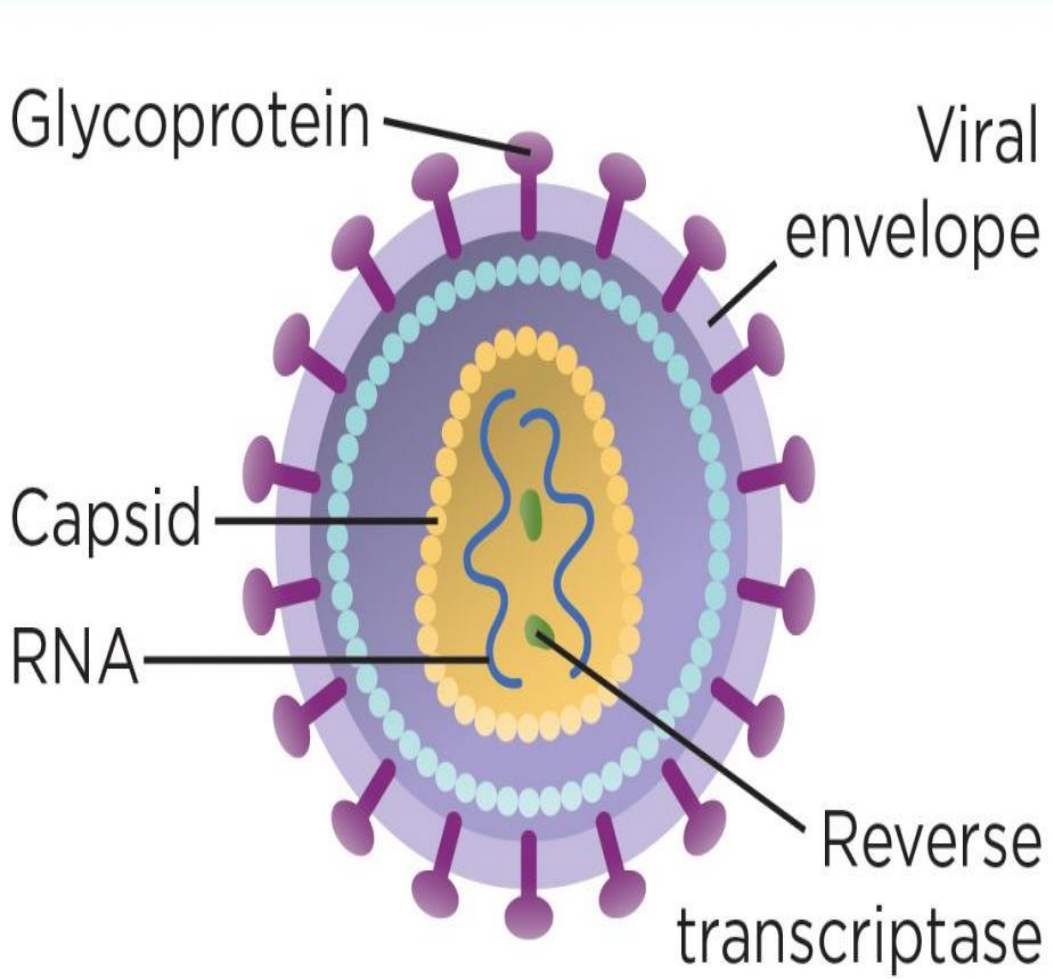
Human **I**mmunodeficiency **V**irus



A virus that attacks the body's **immune system**

HIV

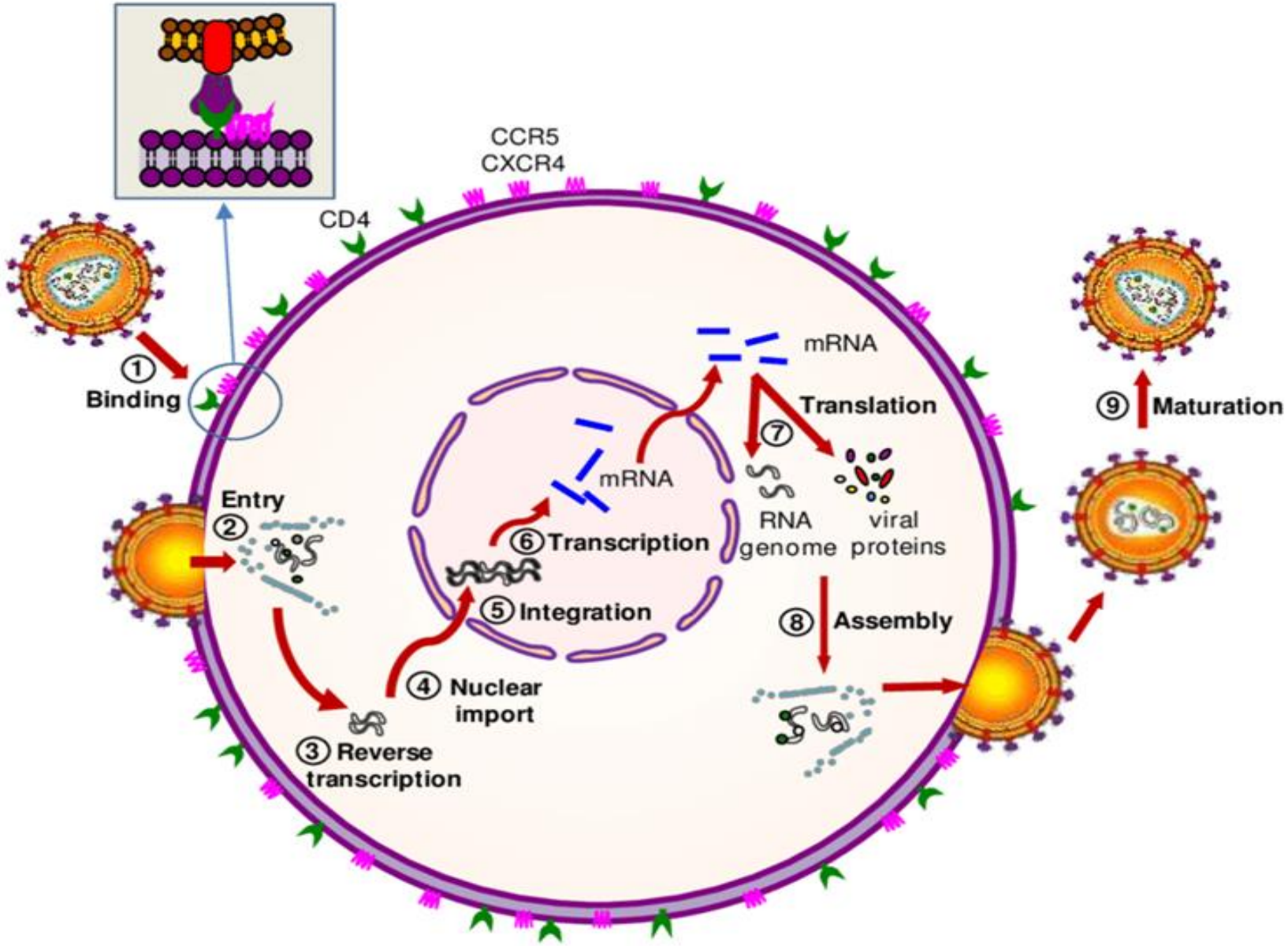
- Family: **Retroviridae**
- Genus: Lentivirus
- Species:
  - HIV-1: most common species worldwide
  - HIV-2: restricted to West Africa
- Structure: icosahedral with a conical capsid and a spiked envelope.
- Genome: it carries single-stranded RNA as its genetic material.



HIV: Routes of Transmission

- Sexual: responsible for ~ 80% of infections worldwide.
- Parenteral transmission:
  - Needle sharing, Needlestick injuries
  - Infectious blood on mucous membranes
  - Blood transfusions.
- Vertical transmission: from mother to child during childbirth or through breastfeeding after birth.

HIV replication cycle



HIV: HIV replication cycle

1. HIV enters the body (e.g., via mucosal lesions), then attaches to the CD4 receptor on host cells with its gp120 glycoprotein (Binding)
   - Cells that have CD4 receptors: T lymphocytes (e.g., T helper cells), macrophages, monocytes, dendritic cells.
2. Viral envelope fuses with host cell, capsid enters the cell. (Fusion)
   - For fusion, CD4 receptor and a coreceptor (CCR5 in macrophages) must be present.
3. A virion's RNA is transcribed into dsDNA by viral reverse transcriptase. (Reverse transcription)
4. Viral DNA is transported across the nucleus and integrated into the host DNA by viral integrase. (Integration)
5. Viral DNA is transcribed, and multiple copies of new HIV RNA form and are transported to the cytoplasm → new HIV RNA becomes the genome of a new

HIV: HIV replication cycle

6. New viral RNA + proteins + enzymes move to the cell surface and form a non-infectious particle (Assembly)
7. Particle (viral RNA + proteins) eventually buds out of the host cell with the immature HIV. (Budding)
8. Viral protein protease then cleaves newly synthesized polyproteins, producing a **mature HIV**.

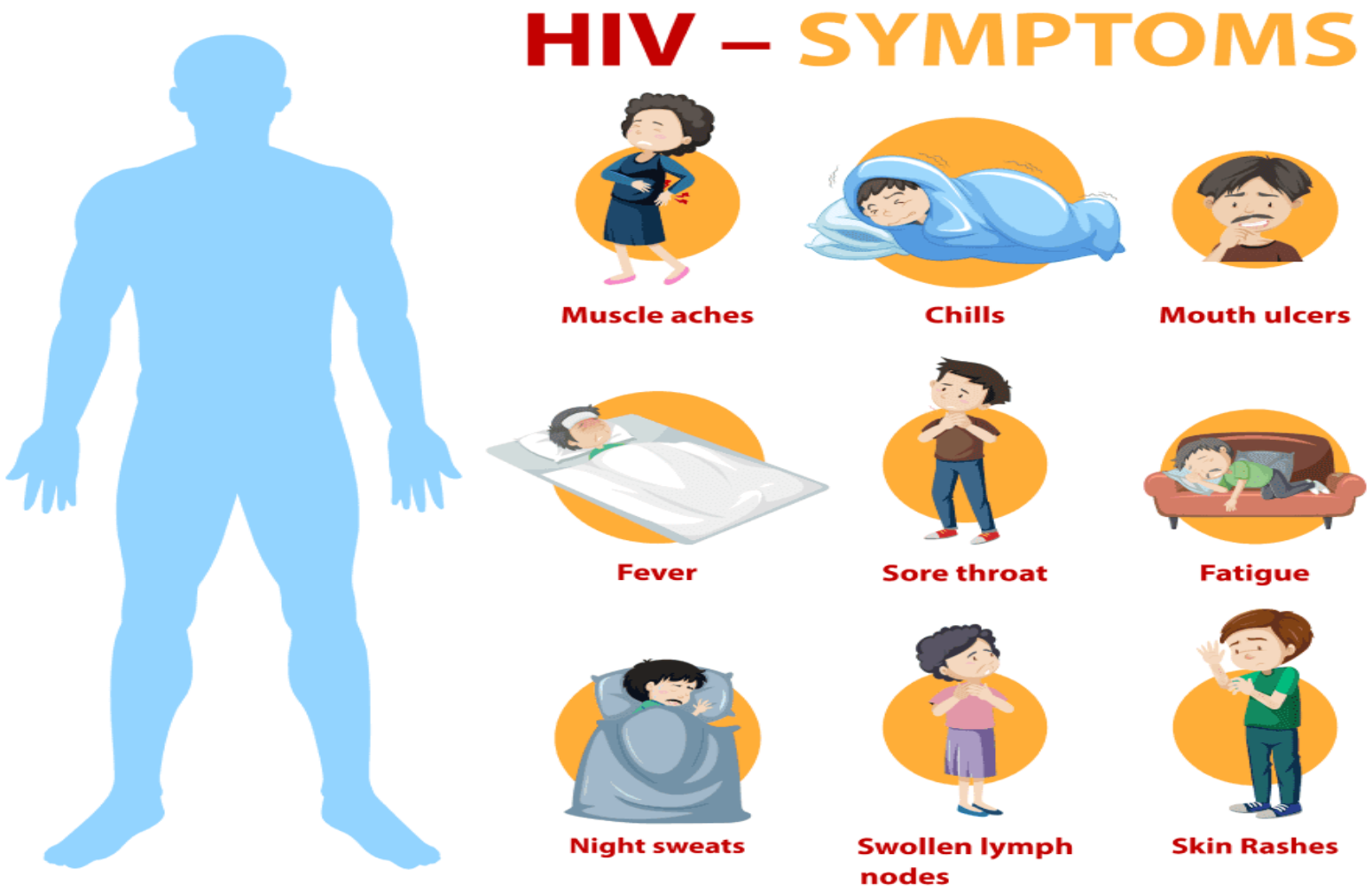
HIV: Progression of Disease- Acute Phase

1. HIV infects and destroys CD4+ T cells, macrophages, and dendritic cells in mucosal tissues.
2. Dissemination and replication in lymph nodes occur, then proceed to other lymphoid compartments (more CD4+ target cells) → viremia.
3. CD8+ cytolytic T lymphocytes (CTLs) are activated, and this immune response produces a partial control of viral replication.
4. Acute retroviral syndrome:
    1. Clinical presentation of self-limited acute viral illness
    2. Associated with millions of copies of HIV RNA/mL of plasma
    3. High likelihood of transmission during this period

HIV: Clinical features- Acute HIV infection

- In early HIV infection, patients are often asymptomatic.
- Fever, Fatigue, headache
- Myalgia and arthralgia
- Generalized nontender lymphadenopathy, Generalized rash
- Gastrointestinal symptoms (nausea, diarrhoea, weight loss)
- Oropharyngeal symptoms (sore throat, ulcerations, painful swallowing)

HIV: Clinical features- Acute HIV infection



HIV: Progression of Disease- Chronic phase

- Low-level replication of virus in lymphoid tissues and slow progressive T cell depletion
- Sustained replication generates mutation, contributing to viral escape from the control of CD8+ CTLs.

HIV: Clinical features- Chronic HIV infection

- Chronic infection (clinical latency): Few or no clinical manifestations of infection

HIV: Progression of Disease- AIDS

Acquired Immune Deficiency Syndrome (AIDS)

- Increasing loss of CD4+ lymphocytes → impairs immune function → facilitates opportunistic infections and development of malignancies (AIDS).
- These secondary diseases are usually the cause of death in individuals with HIV.

HIV: Clinical features- AIDS

- AIDS (also known as advanced HIV) is defined as the development of an AIDS-defining condition or a CD4 count of < 200 cells/μL in HIV-infected patients.
- AIDS-defining conditions are a set of potentially life-threatening conditions that indicate the progression of HIV infection to AIDS.

HIV: Clinical features- AIDS

- As the CD4 count declines, the immune system is weakened and many pathological processes may occur, such as:
  - Development of malignancies e.g., non-Hodgkin lymphomas
  - Rapid spread of opportunistic and non-opportunistic bacterial and fungal infections (e.g., coccidioidomycosis, pneumocystis pneumonia, mycobacterial infections)
  - Reactivation of latent infections (e.g., tuberculosis, herpes simplex infections, shingles).

CLINICAL MANIFESTATION OF AIDS

IMMUNOLOGIC:

- Low white cell counts
  CDT_4 count < 200/mm^3
- Opportunistic Infections
- Lymphadenopathy
- Fatigue

INTEGUMENTARY:

- Poor Wound Healing
- Skin Lesions
- Night Sweats

RESPIRATORY:

- Cough
- SOB

GASTROINTESTINAL:

- Diarrhea
- Weight Loss
- Nausea/Vomiting

CENTRAL NERVOUS SYSTEM:

- Confusion
- Dementia
- Headache
- Visual Changes
- Personality Changes
- Pain
- Seizures

OPPORTUNISTIC INFECTIONS:

Protozoal Infections

- Pneumocystis Carinii Pneumonia
- Toxoplasmosis (Encephalitis)
- Cryptosporidiosis (GI)

Fungal Infections

- Candidiasis - Stomatitis
  Esophagitis
  Vaginal

Bacterial Infections

- Mycobacterium Complex
- Tuberculosis

Viral Infections

- Cytomegalovirus
- Herpes Simplex Virus
- Varicella-Zoster Virus

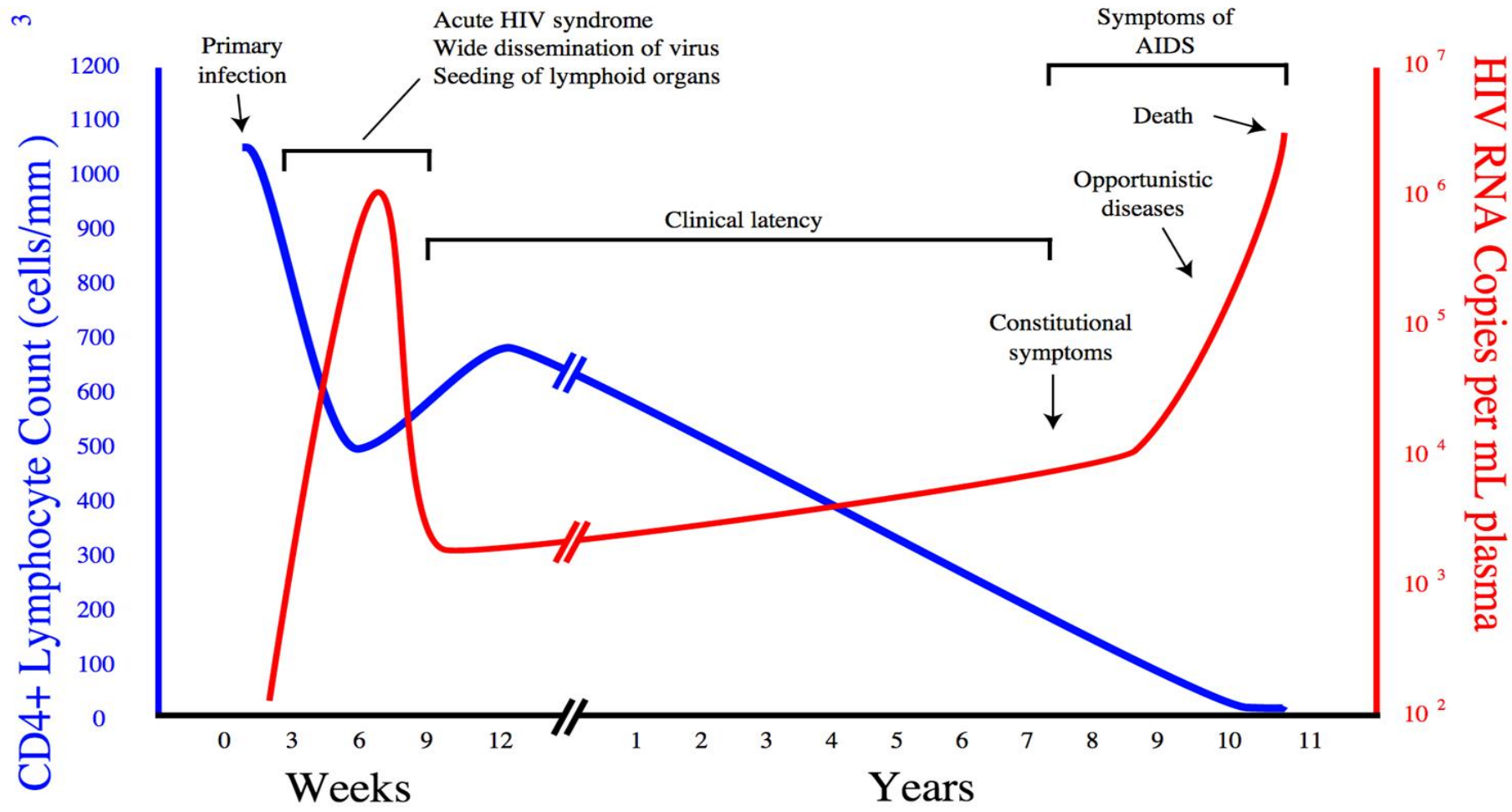
MALIGNANCIES:

- Kaposi's Sarcoma
- Non-Hodgkin's Lymphoma
- Hodgkin's Lymphoma
- Invasive Cervical Carcinoma

AIDS DEMENTIA COMPLEX:

Cognitive, Motor and Behavioral Impairments in 70% AIDS Clients

HIV: Progression to chronic immunodeficiency



HIV: Diagnosis

- **Serological assays**
  - HIV antigen alone: detects HIV p24 antigen
  - HIV antibody assays: Detect IgM and IgG antibodies
- **Virological testing:**
  - Virological tests are most commonly used for screening infants and confirmation of disease in both infants and adults.
  - Can detect HIV-1 RNA and/or DNA through nucleic acid testing (NAT).
  - Can measure the amount of viral RNA in the blood and detect HIV infection earlier than antibody/antigen-based tests

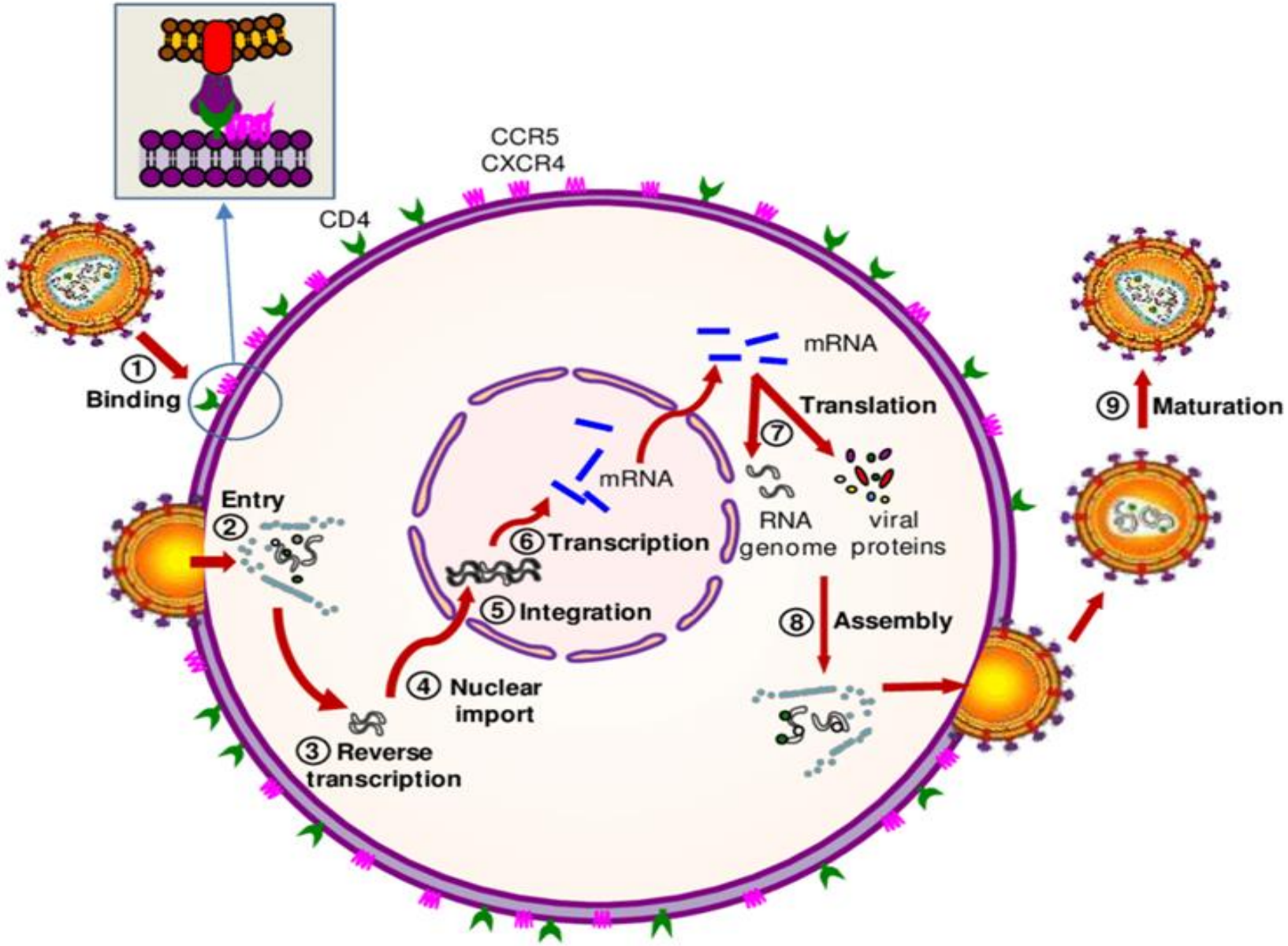
HIV: Management

- There is **no cure for HIV**, but all individuals with HIV infection should begin **antiretroviral therapy** (ART) as soon as possible.
- Goals:
  - Suppress plasma HIV RNA.
  - Improve immunologic function.
  - Reduce HIV-associated complications and prolong survival.
  - Reduce HIV transmission.
- Once initiated, treatment is indefinite.
- Establish regular monitoring to assess treatment response.

HIV: Management- Antiretroviral Drugs

- Th Entry inhibitors:
  - CCR5 antagonist: Inhibits the attachment of the virus to the CD4 cell by blocking binding of gp120
  - Attachment inhibitor: Binds gp120, preventing viral attachment
- Reverse transcriptase inhibitors interfere with the translation of viral RNA into DNA
- Integrase strand transfer inhibitors: Prevent the insertion of the viral genome into the host DNA
- Antiretroviral drugs are combined to prevent resistance

HIV replication cycle



HIV: Management

- If CD4 count is < 200, start prophylaxis for opportunistic infections.
- Treat AIDS-defining condition if present.
- Immunizations: in addition to routine vaccinations, the following vaccines should be prioritized in this population:
  - Hepatitis A&B
  - Human papilloma virus vaccine
  - Influenza vaccine (annually)
  - Meningococcal and Pneumococcal vaccine
  - Herpes zoster, and COVID vaccine.

HIV: Prognosis

- Untreated HIV leads to death on average 8–10 years after infection.
- Progression varies among individuals: Some patients may die within a few years while others can remain asymptomatic for decades.
- The average life expectancy of HIV-infected individuals who receive adequate antiretroviral treatment is approaching that of noninfected individuals of the same age.

Thank you