

# HIV & AIDS

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# *Human Immunodeficiency Virus*

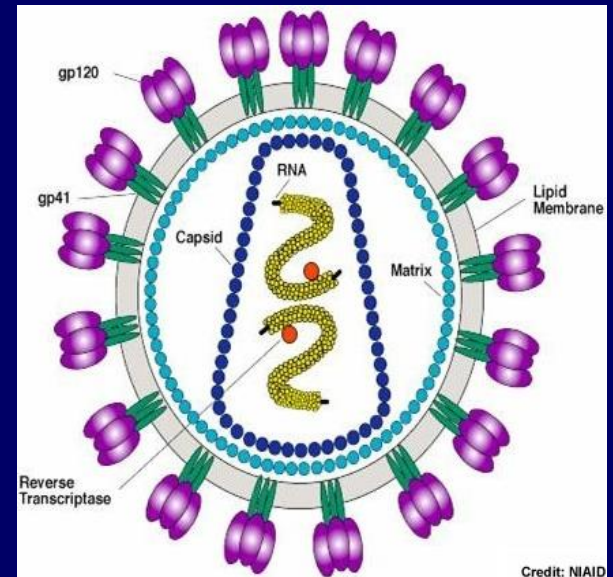
- HIV is known to infect mainly T-helper cells(CD4), macrophages and monocytes.
- Destroying *T-helper cells(CD4)* resulting in the loss of cell mediated immunity which leads to severe immunologic impairment, leading to multiple opportunistic infections, unusual cancers and death.

# Characteristics of HIV

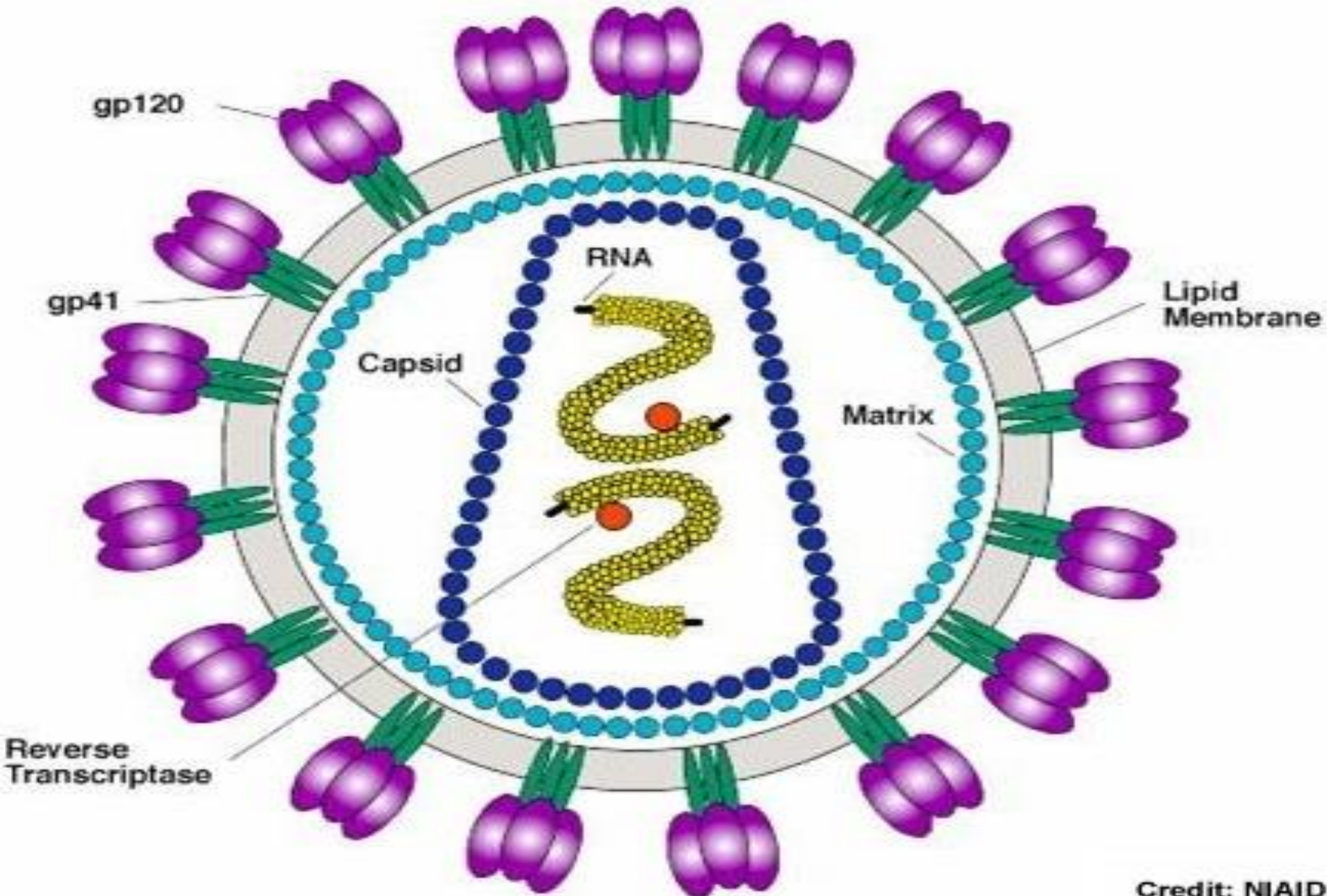
- Family of *Retroviridae*.

Virion consist of:

- Glycoprotein envelope (gp120, gp41).
- Matrix layer (p17).
- Capsid (p24).
- Two copies of ss-RNA.
- Enzymes:
  - Reverse transcriptase: converts viral RNA into DNA.
  - Integrase: integrates viral DNA with host DNA (provirus), persisting infection.
  - Protease: viral protein maturation.



# Structure of HIV



# HIV virus

- HIV-1:

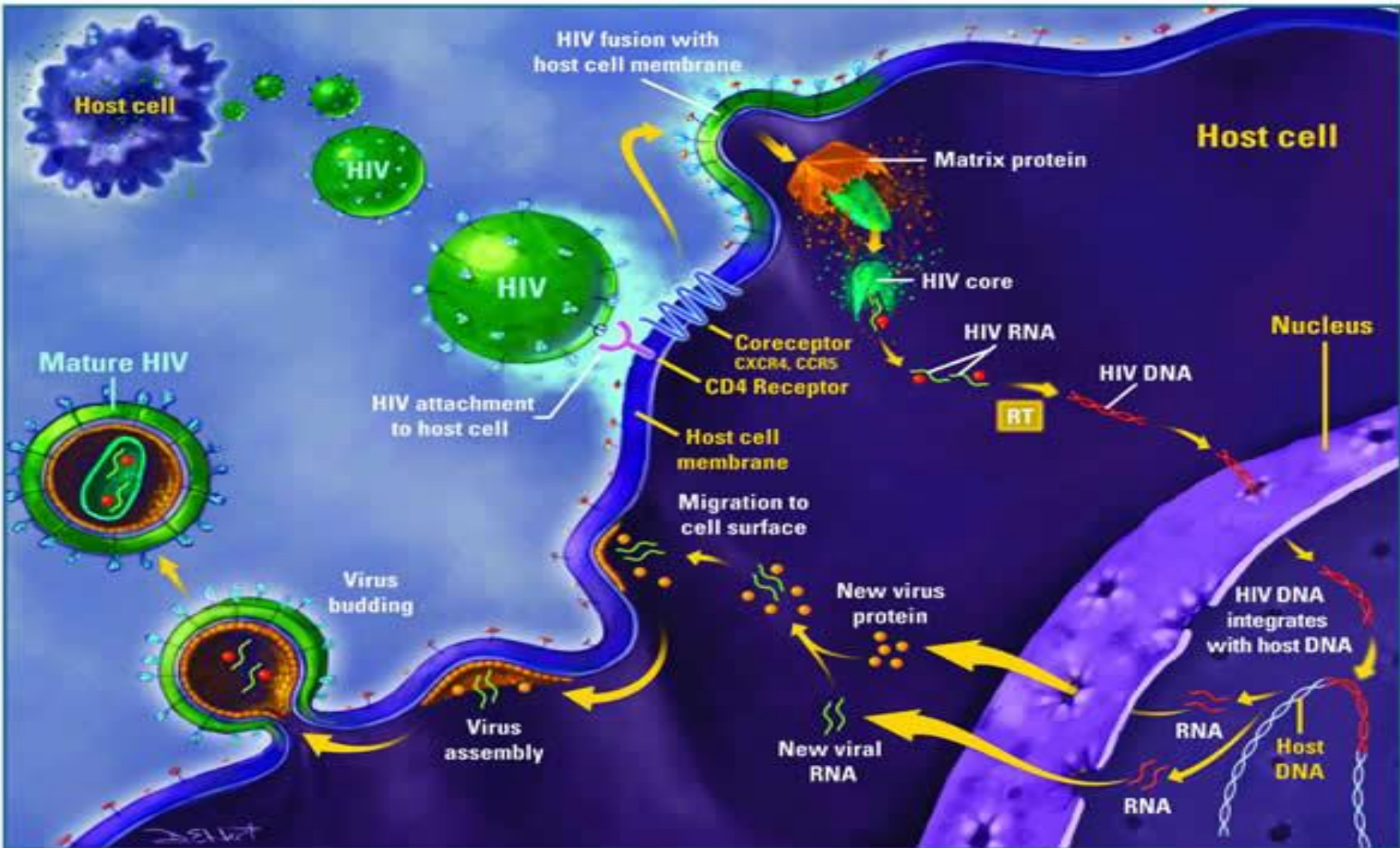
- Causes HIV infection worldwide.
- Highly virulent.
- Highly susceptible to mutations.

- HIV-2:

- Causes the infection in specific regions e.g. West Africa
- Relatively less virulent.
- Relatively less susceptible to mutations.



# HIV life cycle



## Transmission of HIV :

### Sexually:

The most common mode of HIV infection is sexual transmission at the genital mucosa through direct contact with infected blood, semen and vaginal secretion.

### Parenterally:

Direct exposure to infected blood and blood products.

Use contaminated needles and syringes as in (drug abuser) and Tattooing.

Through contaminated surgical and dental instruments.

Sharing contaminated razors , tooth brushes, and nail cutters

## Transmission of HIV :

### From mother to child

Infected mother transmit HIV to their babies transplacentally (vertical 25%) ,but Treatment of the mother with antiretroviral Anti-reverse transcriptase (Zidovudine) during **pregnancy** can reduce transmission in most cases.

Virus spread to child perinatally mainly (50%)during delivery given Anti-reverse transcriptase (Nevirapine) as single dose during delivery can reduce the transmission . breast feeding also an important way of per natal transmission (25%).Antiretroviral treatment of the mother and infant after birth can also significantly decrease the risk of HIV infection in the newborn.



# Virus Inactivation

- HIV is **easily** inactivated by treatment for 10 min at 37°C with any of the following
  - 10% house hold bleach, Sodium Hypochlorite
  - 50% ethanol
  - 35% isopropanol
  - 0.5% Paraformaldehyde
  - 0.3% hydrogen peroxide

# The Course of HIV-infection

➤ The course of HIV-infection can be divided into three stages:

- The acute phase

- The chronic phase  1- (PGL)

-  2-(ARC)

- **AIDS**

# Acute phase:

- Incubation period (2-4 weeks) ,this phase Lasts for about 12 weeks.
- Rapid viral replication (high viral load RNA in the serum).
- Gradual decrease in CD4 cell count.
- Mostly asymptomatic, if there is symptoms will be mild ,
- 25-65% of patients develop symptoms resemble **infectious mononucleosis** or **Flu like syndrome** (fever, headache, anorexia, fatigue, lymphadenopathy, & skin rash).
- Some of patients may develop aseptic meningitis.

# Serological picture of acute stage

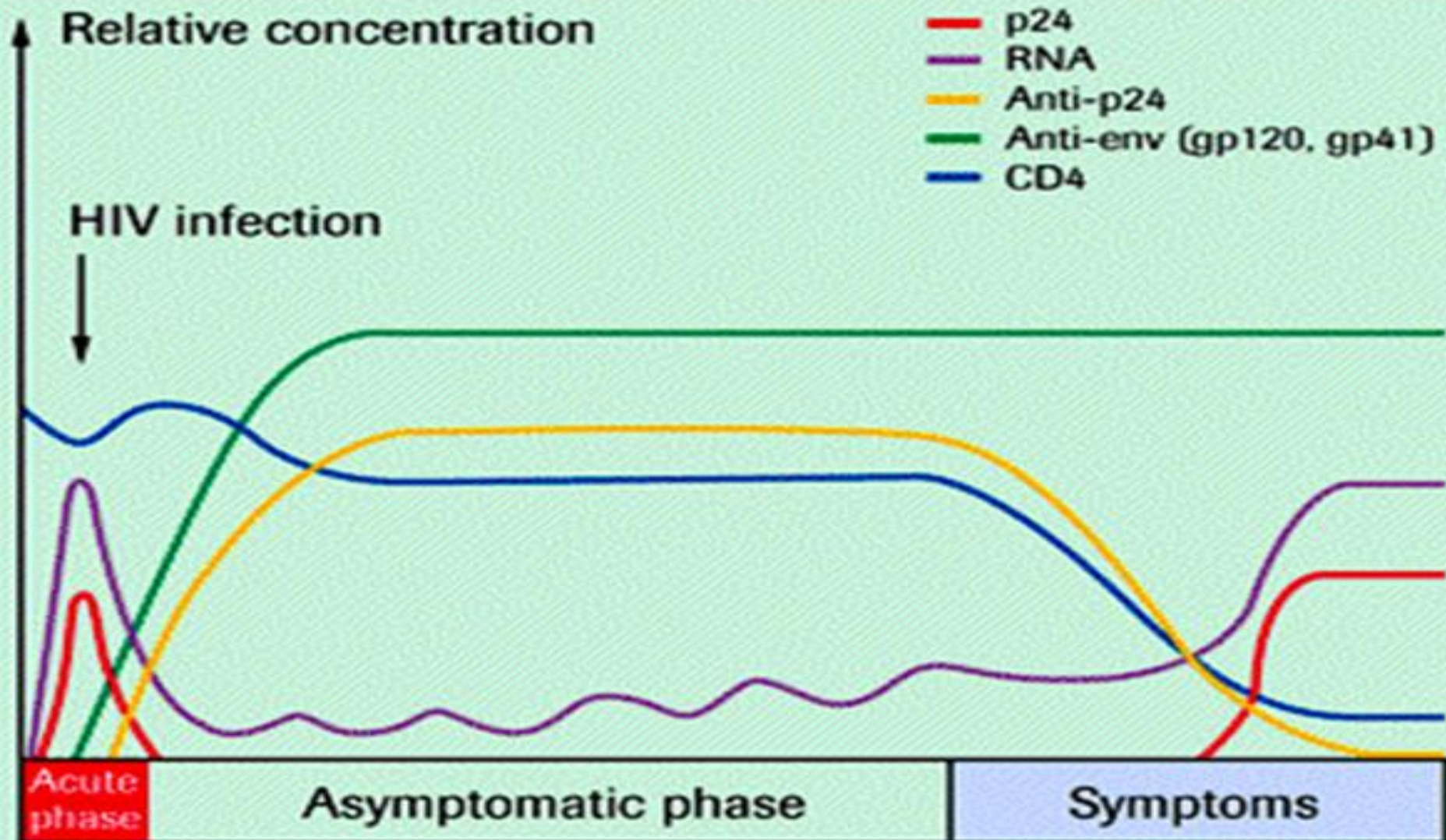
Characterized by appearance of **viral RNA first to appear.**

PCR is the recommended test for acute HIV infection.

Normal to slightly decrease in no of **CD4**.

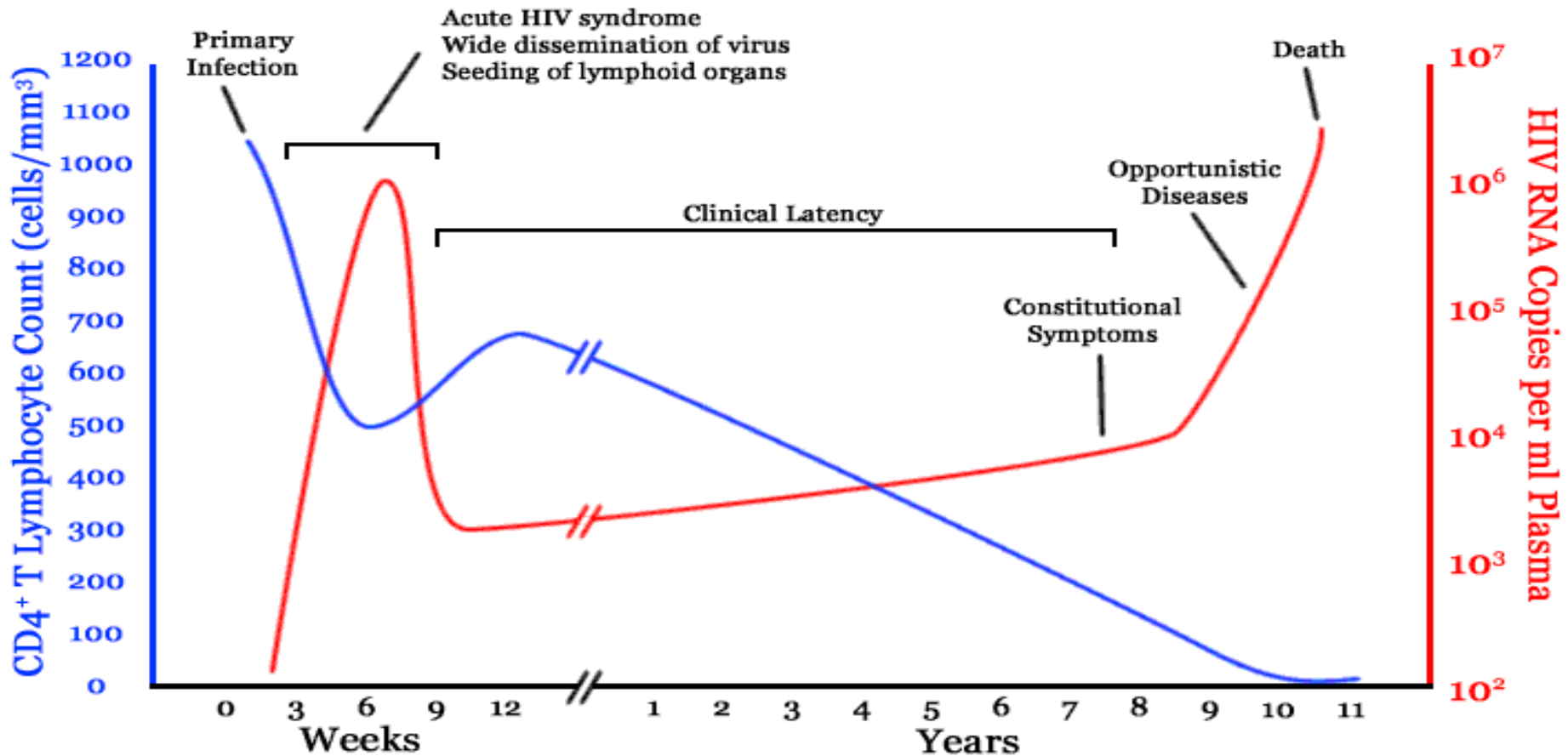
Detection of **core antigen** ( **p24 antigen**) followed by appearance of **Anti-envelop (Anti-gp120, gp41) & Anti-core (Anti-P24)**

# Serological profile of HIV infection





# Stages of HIV infection



The course of HIV infection goes through 3 stages: Acute phase, Chronic phase, and AIDS.

## Chronic phase:

- Lasts for about 10 years in adults, 5 years in children, totally **asymptomatic** but the patients still **contagious**,
- Low viral load, continuous detection of both (Anti-gp120, gp41) and (Anti-p24) diagnosis mainly by ELISA, Western Blot.

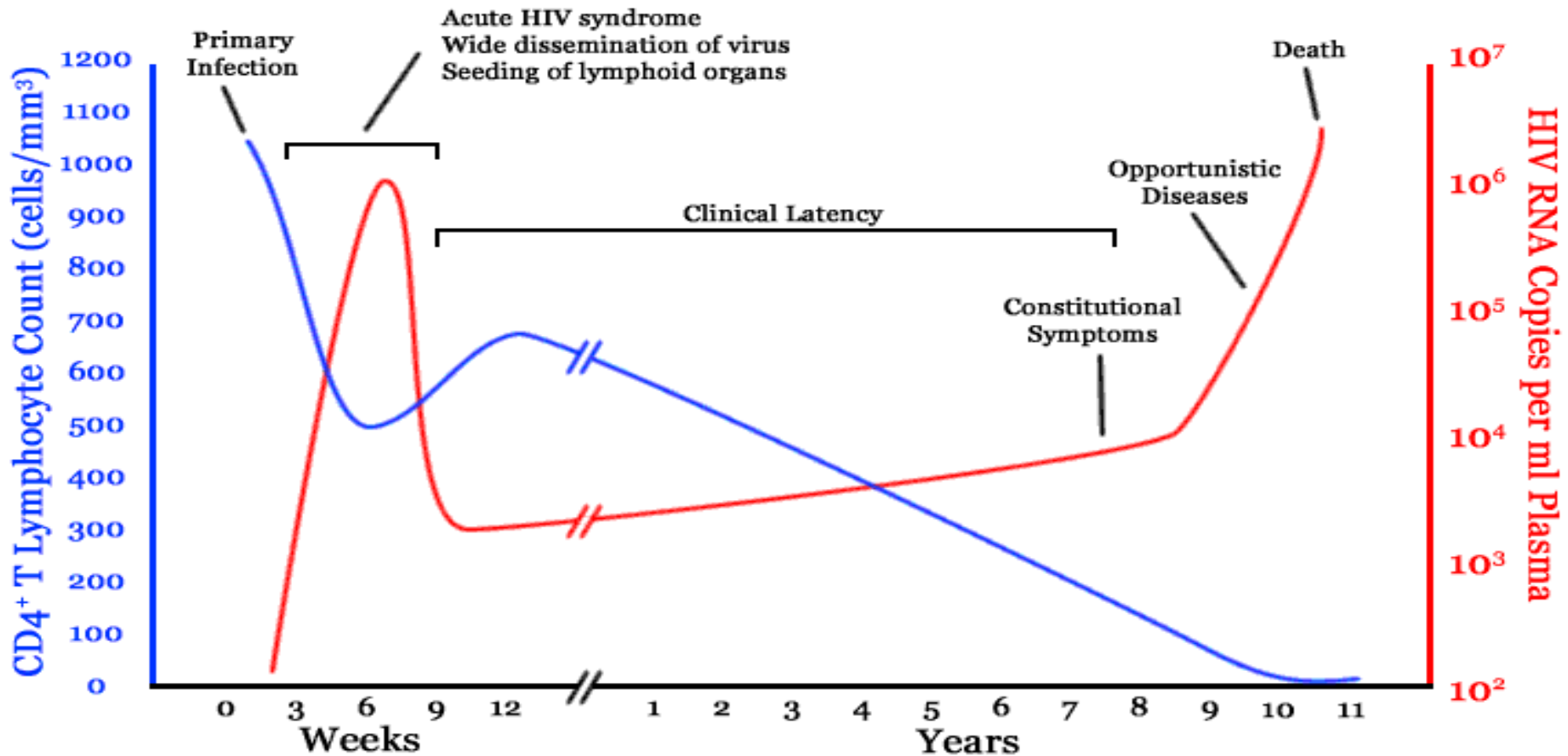
**CD4 count > 500/ml.**

at the end of this stage patients start to develop

**1-Persistent generalized lymphadenopathy (PGL)**

▪ **2-AIDS-related complex (ARC)**

# Stages of HIV infection



The course of HIV infection goes through 3 stages: Acute phase, Chronic phase, and AIDS.

# A-Persistent generalized lymphadenopathy (PGL)

Is defined as enlargement of lymph nodes for at least 1 cm in diameter, and must meet the following conditions:

- In two or more extra inguinal area.
- Persists for at least 3 months.
- In the absence of any illness or medication known to cause PGL.

# B-AIDS-related complex (ARC)

Is a group of clinical symptoms that come before **AIDS** and may include the following:

Fever of unknown origin that persists > 1 month. •

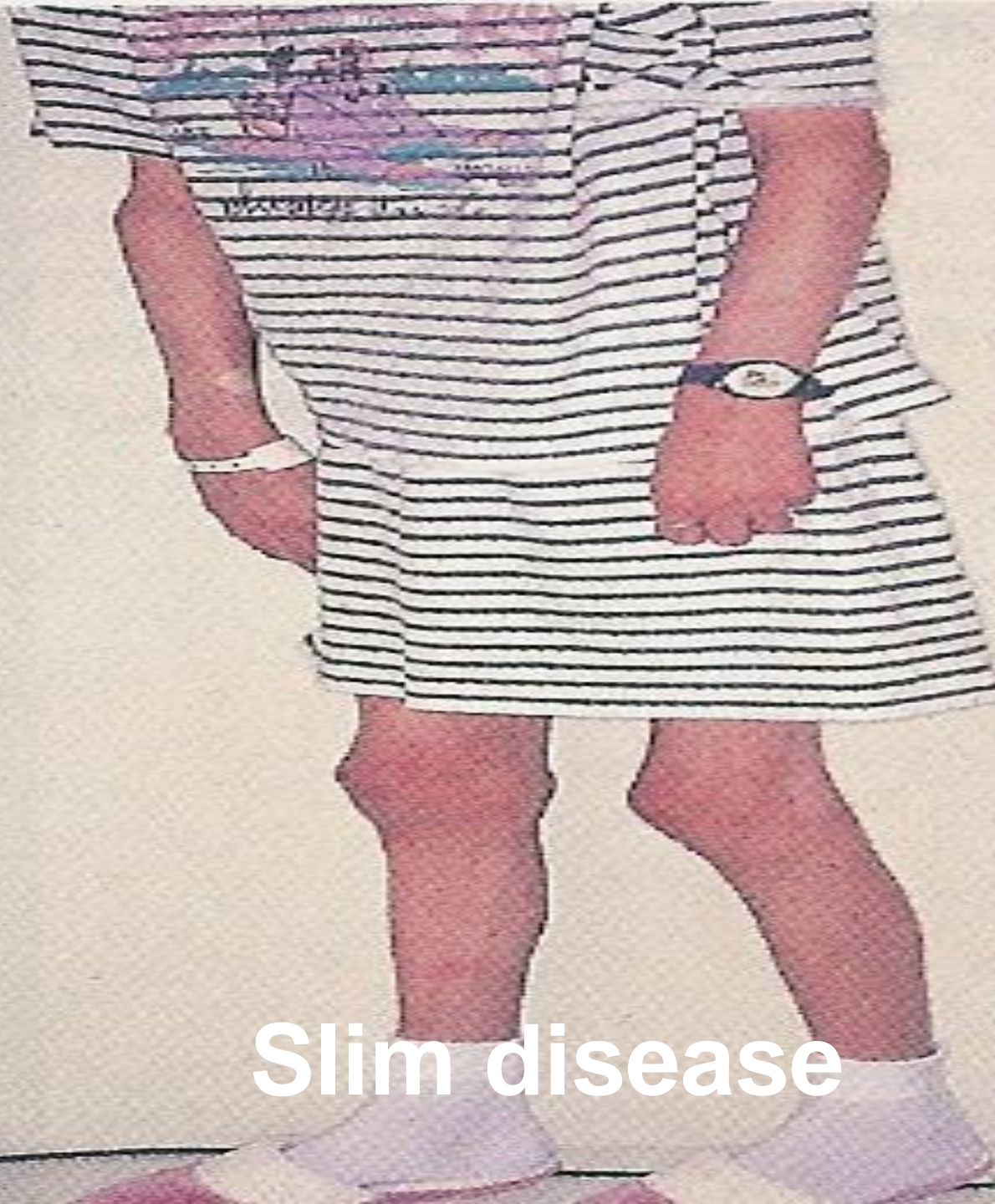
Chronic diarrhea, persisting > 1 month. •

**Weight loss (Slim disease) > 10% of the original weight.** •

Fatigue. •

Neurological disease as myelopathies and peripheral neuropathy.



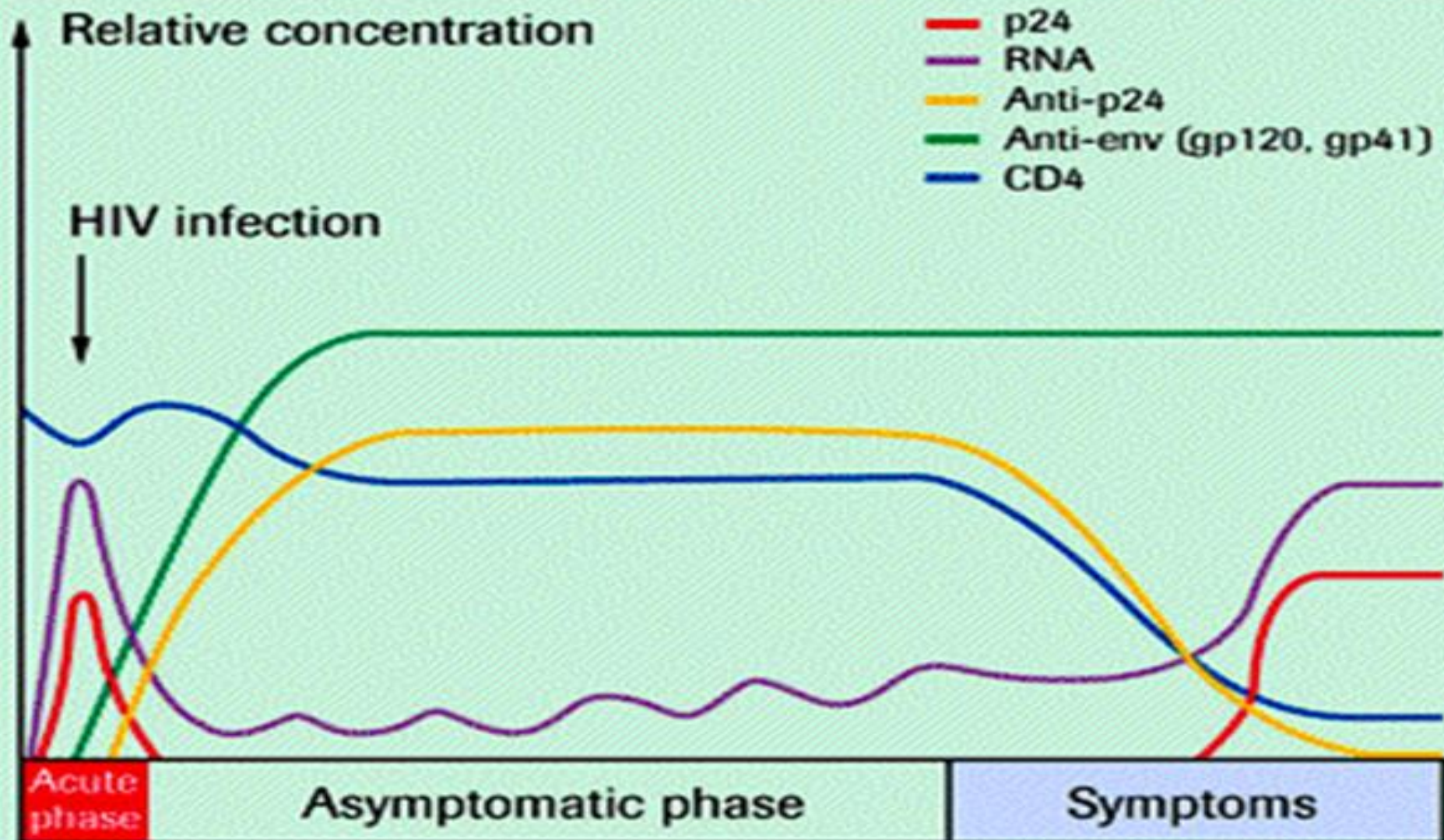


**Slim disease**

- Blood markers of (PGL) & (ARC) (ARC):
  - High load of **Viral RNA** and **core antigen p24** (indicate active viral replication)
  - **Anti-envelop +ve (Anti-gp120)**
  - **CD4** count decreased but still more than (200 cells /mm<sup>3</sup>)





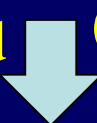
# Serological profile of HIV infection



# AIDS:

- The end stage of the disease.
- Continuous viral replication (high viral load viral RNA in the serum).
- Marked decrease in **CD4 cell count < 200**
- Persistent or frequent **multiple opportunistic infections** e.g **Pneumocystis pneumonia**, **toxoplasmosis**, **extra pulmonary myco-bacteriosis**.
- Development of unusual cancer (**Kaposi sarcoma**)

## Blood markers of AIDS stage

- Marked  **Viral RNA** and  **core antigen Ag p24**
- **Anti envelop +ve(Anti-gp120) ,**  
Marked  **CD4** count less than 200 cells/mm<sup>3</sup>



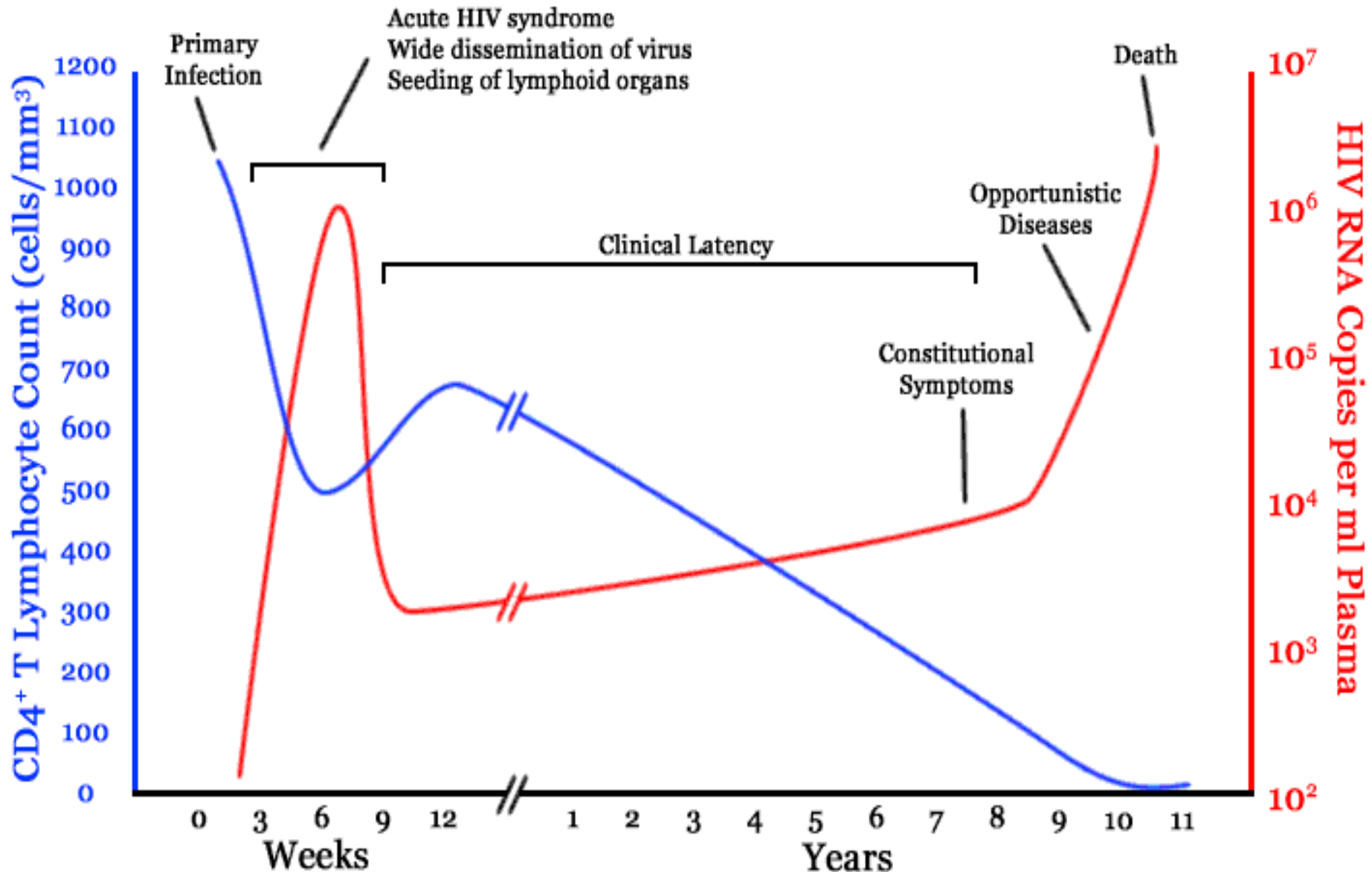
## OPPORTUNIST INFECTIONS AND TUMORS IN AIDS

viruses	<p>disseminated CMV (including retina, brain, peripheral nervous system, gastrointestinal tract)</p> <p>HSV (lungs, gastrointestinal tract, CNS, skin)</p> <p>JC virus (brain – PML)</p> <p>EBV (hairy leukoplakia, primary cerebral lymphoma)</p>
bacteria*	<p>mycobacteria (e.g. <i>Mycoplasma avium</i>, <i>M. tuberculosis</i> – disseminated, extrapulmonary)</p> <p><i>Salmonella</i> (recurrent, disseminated) septicemia</p>
protozoa	<p><i>Toxoplasma gondii</i> (disseminated, including CNS)</p> <p><i>Cryptosporidium</i> (chronic diarrhea)</p> <p><i>Isospora</i> (with diarrhea, persisting more than one month)</p>
fungi	<p><i>Pneumocystis jiroveci</i> (pneumonia)</p> <p><i>Candida albicans</i> (esophagitis, lung infection)</p> <p><i>Cryptococcus neoformans</i> (CNS)</p> <p>histoplasmosis (disseminated, extrapulmonary)</p> <p><i>Coccidioides</i> (disseminated, extrapulmonary)</p>
tumors	<p>Kaposi's sarcoma**</p> <p>B cell lymphoma (e.g. in brain, some are EBV induced)</p>
other	<p>wasting disease (cause unknown)</p> <p>HIV encephalopathy</p>

\*also pyogenic bacteria (e.g. *Haemophilus*, *Streptococcus*, *Pneumococcus*) causing septicemia, pneumonia, meningitis, osteomyelitis, arthritis, abscesses etc.; multiple or recurrent infections, especially in children

\*\*associated with HHV8, an independently-transmitted agent; 300-times as frequent in AIDS as in other immunodeficiencies

# Stages of HIV infection







**Kaposi's sarcoma**





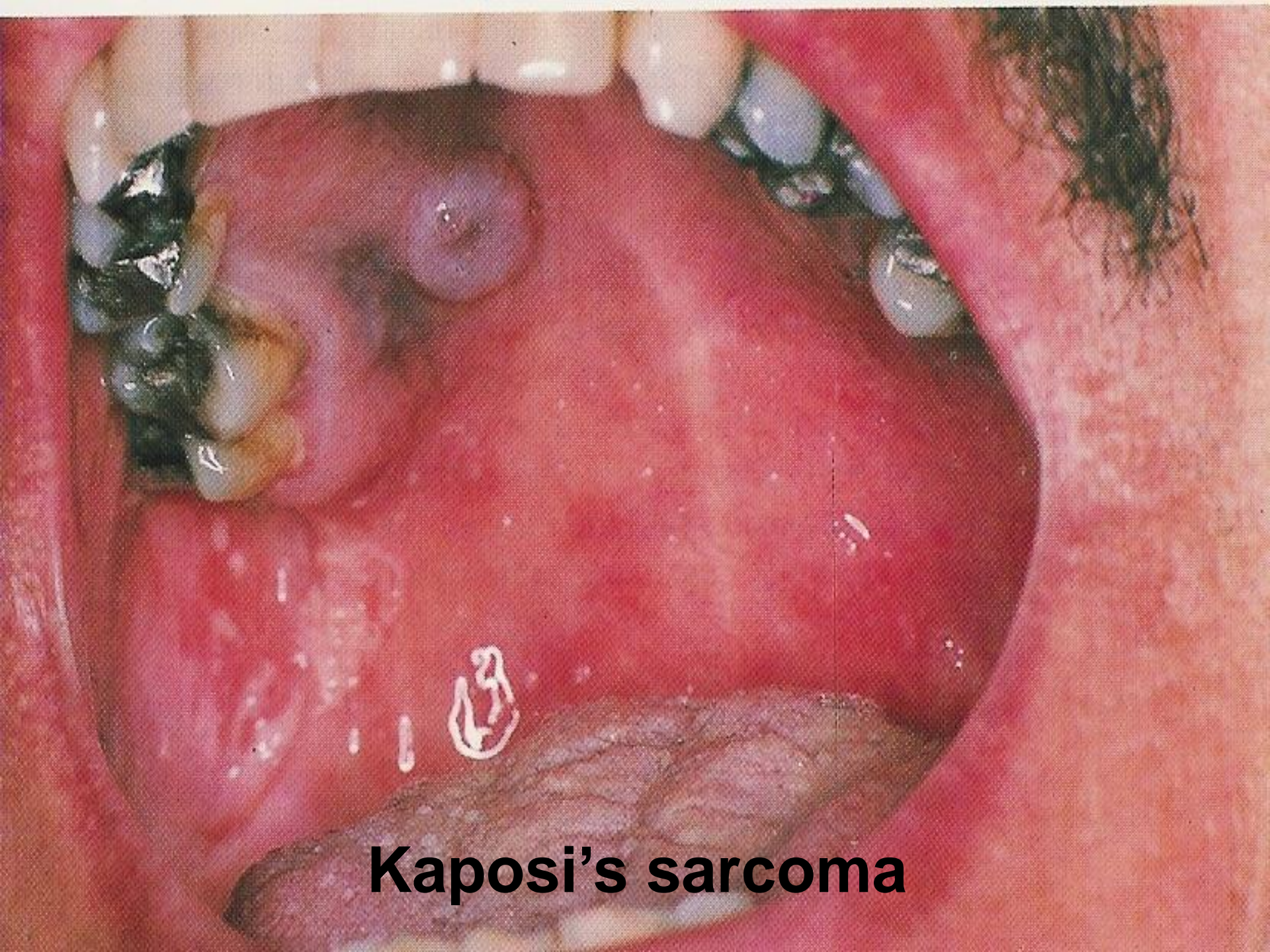
**Kaposi's sarcoma**

**&**



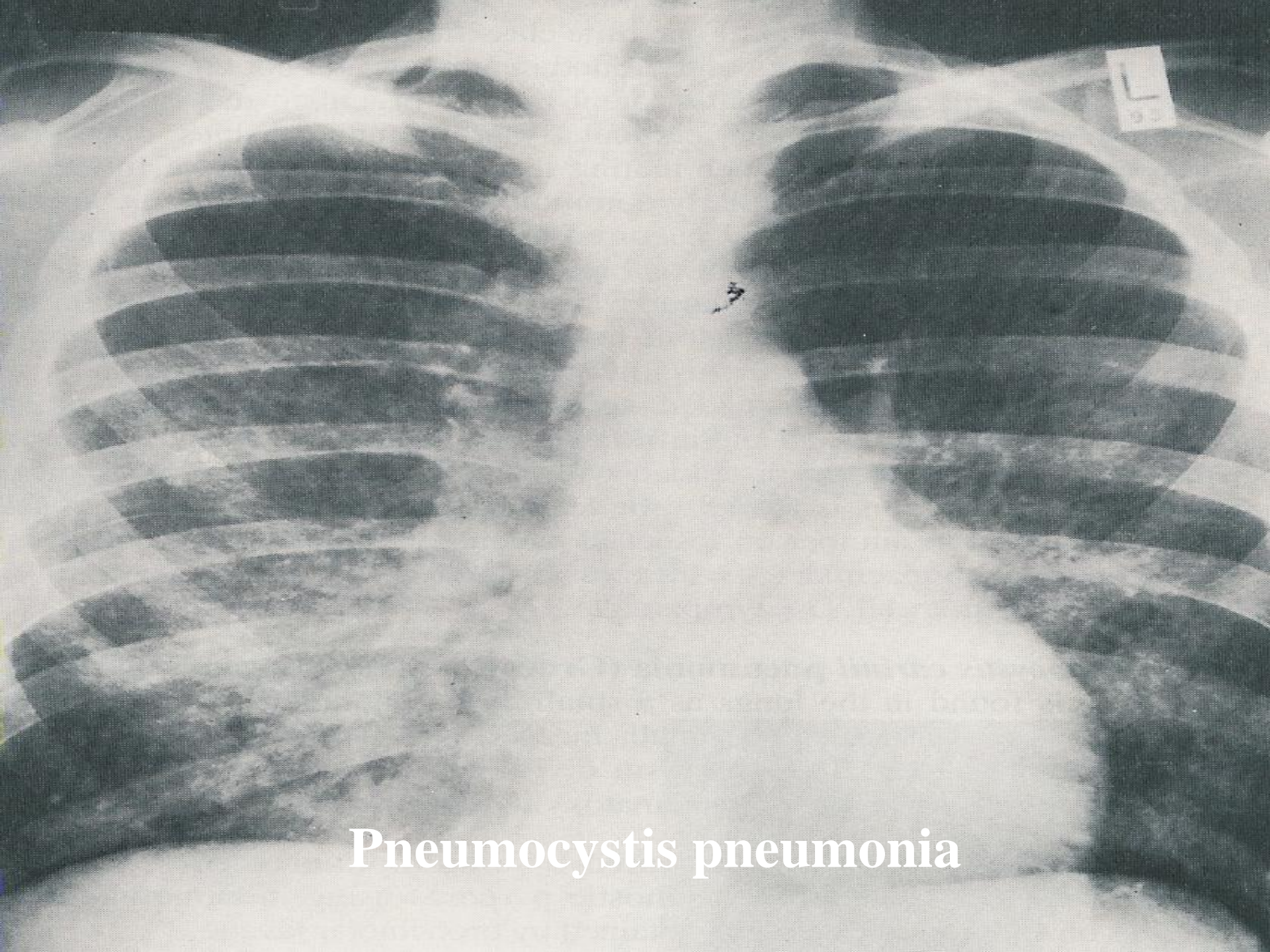
**Slim disease**





**Kaposi's sarcoma**





**Pneumocystis pneumonia**



# How to diagnose an HIV PATIENTS?

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graph TD; Root[How to diagnose an HIV PATIENTS?] --> Screening[Screening]; Root --> Confirming[Confirming]; Screening --> Elisa[Elisa]; Screening --> HIVAntibody[HIV-antibody]; Screening --> HIVAgp24[HIV Ag p24]; Confirming --> WB[W.B.]; Confirming --> Riba[Riba]; Confirming --> PCR[PCR];
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## Screening

Elisa

HIV-antibody

HIV Ag p24

## Confirming

W.B.

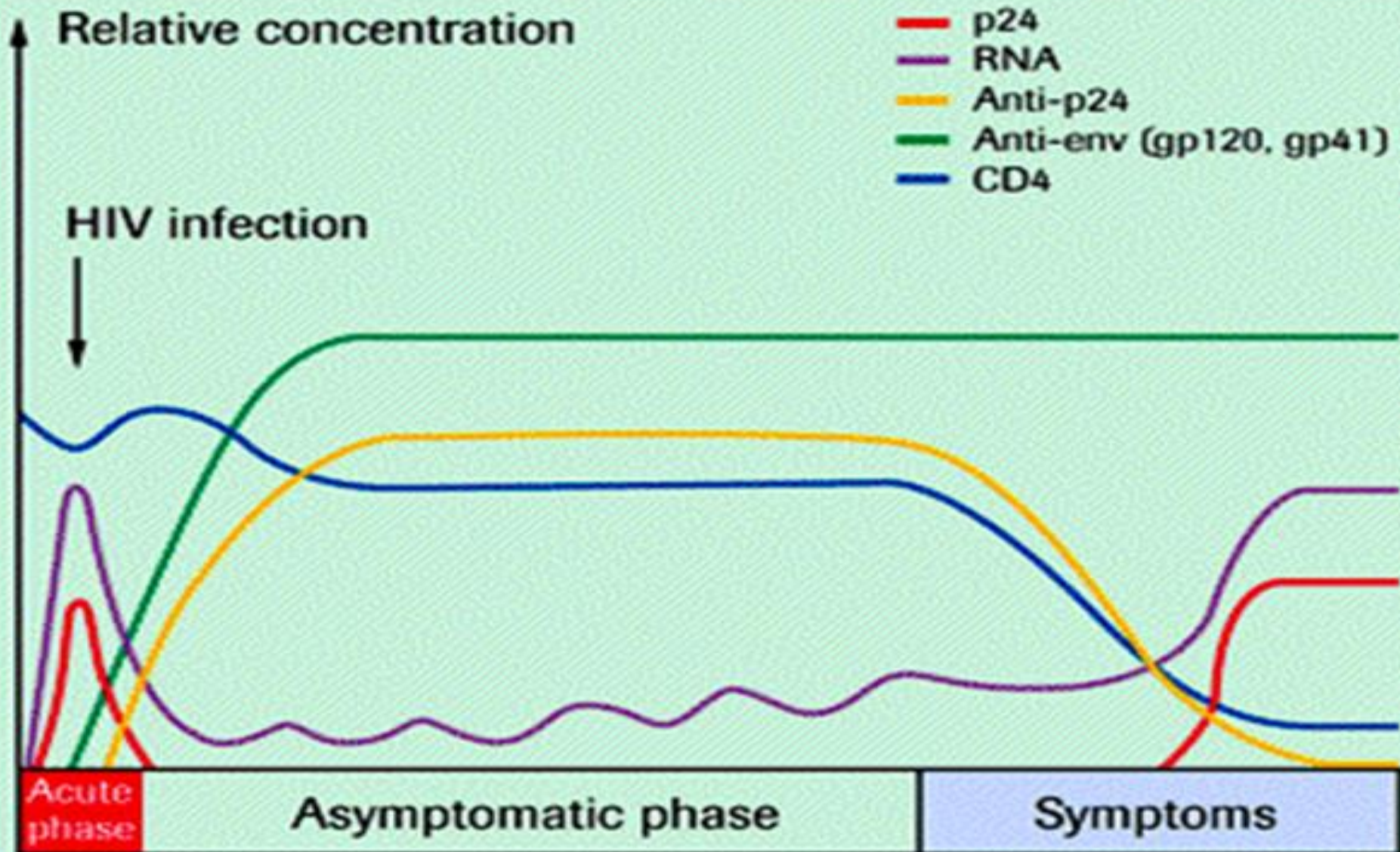
Riba

PCR

# How to diagnose an HIV patient?

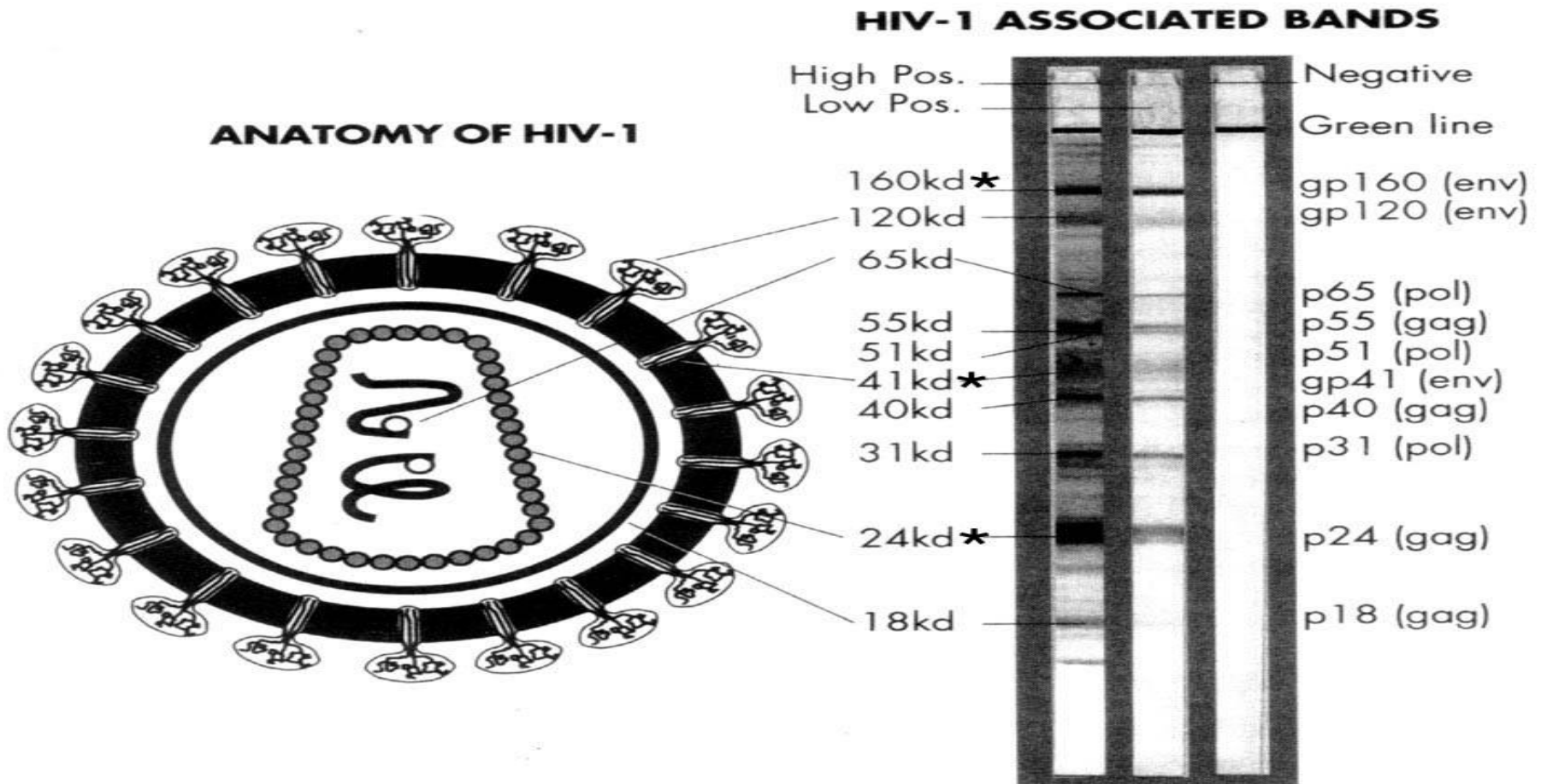
- Patient's history with or without clinical symptoms may give hints for a physician whether the patient has ever exposed to HIV or not.
- Screening patient's serum by **ELISA** for both (HIV Ag & HIV Ab) if the result is **+ve we** repeated the specimen twice in duplicate if still giving **+ve result will do confirmatory tests (Western Blot )**.
- Blood viral load by PCR is also used as confirmatory test and to follow up patients response to treatment.

# Serological profile of HIV infection

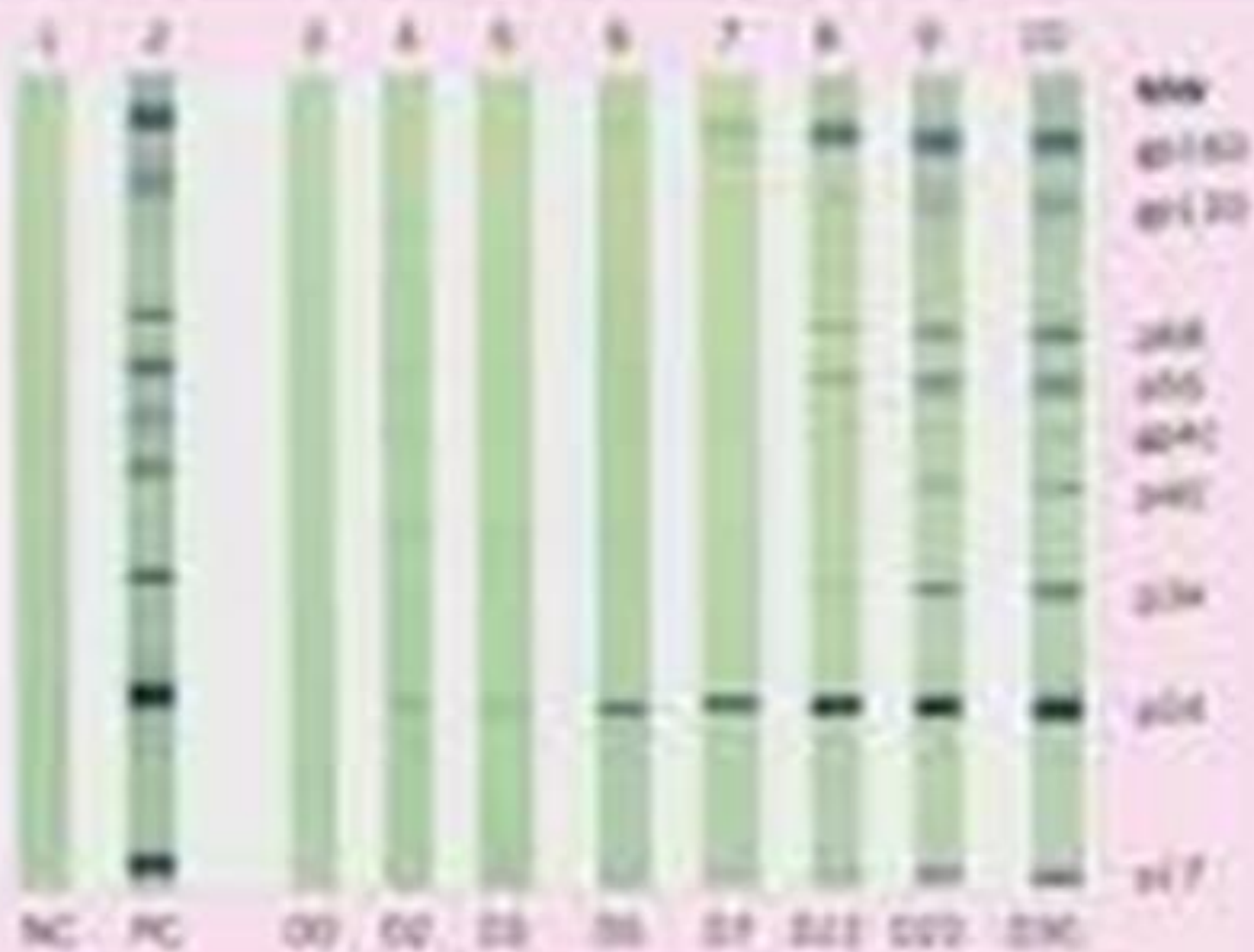


# Western Blot

To confirm the presence of Anti-HIV to the structural proteins of the virus by **ELECTROPHORESIS**



# WESTERN BLOT REACTIVITY IN ONE HIV-1 SEROCONVERTER





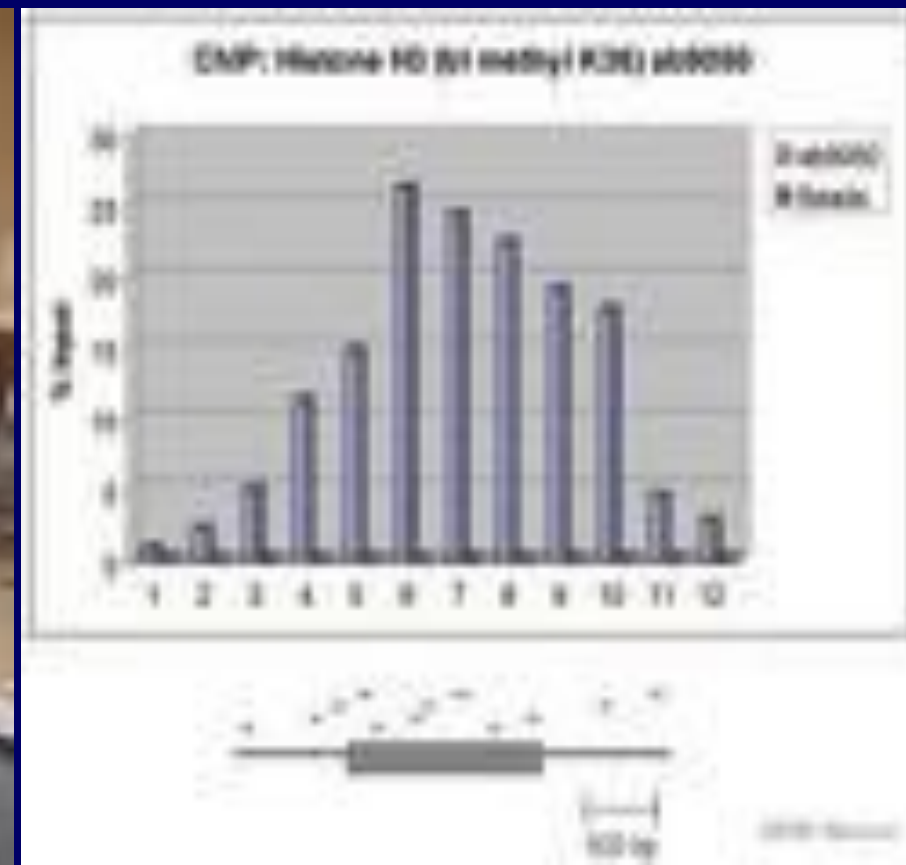
## *Indeterminate results of Western blot:*

- Western blot indeterminate result, means that the test specimen not **positive** nor **negative**.
- The individual must be retested after 8-12 weeks.
- If the result is negative, report negative
- If the result is positive, report positive
- If the individual still indeterminate then the patient must be referred to medical evaluation and PCR are recommended to look for HIV-RNA genome.



# PCR

For detection of **HIV RNA** in the blood (viral load) this test is important for diagnosis Acute HIV infection & diagnosis of HIV in infant of infected mother and also to monitor the antiviral treatment *and as confirmatory test.*



# Treatment

- Is a combined therapy known as high active antiretroviral therapy (HAART).
- **NOTE:** HAART does not clear the virus, and should be taken all life.
- **NOTE:** HAART treated patients are still contagious even if their blood viral load below detection ( $< 50$  copies/ $\mu\text{L}$ ).
- HAART is usually composed of two reverse transcriptase inhibitors and one protease inhibitor.

# Treatment (Continued)

## A. Reverse Transcriptase Inhibitors:

- AZT                    **Zidovudine**
- ddC                    Zalcitabine
- ddl                    Didanosine
- d4T                    Stavudine
- 3TC                    **Lamivudine**

## B. Protease inhibitors

- Saquinavir
- Indinavir
- Ritonavir
- Nelfinavir

# Goals of HIV treatment

- **To inhibit viral replication.**
- **To control chronic immune activation and keep the immune system close to the normal state.**
- **To prevent the development of opportunistic infection.**
- **To minimize the chance of viral transmission especially from mother to neonate.**
- **Treatment will never eradicate the HIV virus.**

# Prevention & Control:

- **There is no vaccine available yet for HIV**
- Practice safer sex .
- Do not share razors, tooth brushes, etc
- Do not share needles and syringes
- Avoid direct exposure to body fluids
- Educate the public about HIV-infection.

Thank you for your  
attention !

