HIV infection. HIV-associated infection and invasion. Viral hepatitis with parenteral mechanism of transmission.

T.Koval

HIV/AIDS What Do You Know?

- What is HIV? What is AIDS?
- How is the disease transmitted?
- In what part of the world is HIV/AIDS most prevalent?

HIV/AIDS Terms to Know

- **HIV**: the Human Immunodeficiency Virus is a retrovirus that attacks the cells of the immune system. HIV is transmitted through an exchange of bodily fluids (eg. exposure to infected blood, during sexual activity with an infected individual, by sharing needles). It can also pass from an infected mother to her child. HIV is the virus that eventually causes AIDS.

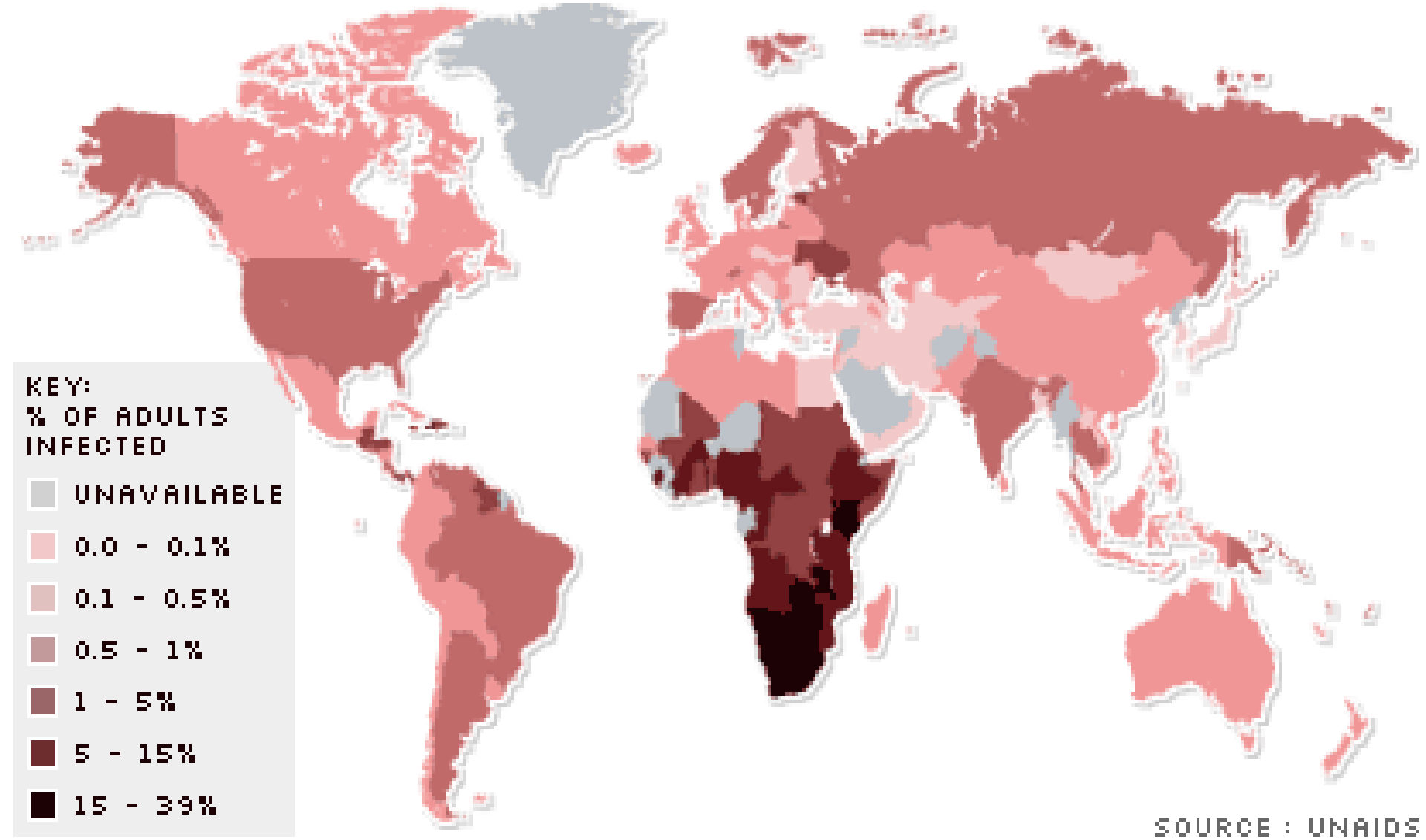
- **AIDS**: an Acquired Immune Deficiency Syndrome diagnosis is made when symptoms that indicate the disease (primarily a decrease in the number of immune system cells in a person's bloodstream) are identified by a doctor in a HIV-positive person.

This is a picture of HIV co-discoverer **Dr. Robert Gallo**. On April 23rd 1984, the United States Health and Human Services Secretary Margaret Heckler announced that Dr. Robert Gallo of the National Cancer Institute had isolated the virus which caused AIDS, that it was named HTLV-III, and that there would soon be a commercially available test for the virus. The same day patent applications were filed covering Gallo's work, but it was clearly a possibility that LAV French virus isolate and HTLV-III were the same virus.

Global epidemic

- Statistics for the end of 2010 indicate that around 33 million people are living with HIV, the virus that causes AIDS. Each year around 2.7 million more people become infected with HIV and 2 million die of AIDS

WORLDWIDE HIV PREVALENCE RATES



- HIV-1, HIV-2

Enzymes:

- Reverse transcriptase
- Integrase
- Protease

Two-thread viral RNA

Lipid membrane

Gp 41, gp 120

•Computer-generated image of HIV, the virus that causes AIDS.

HIV environmental sustainability

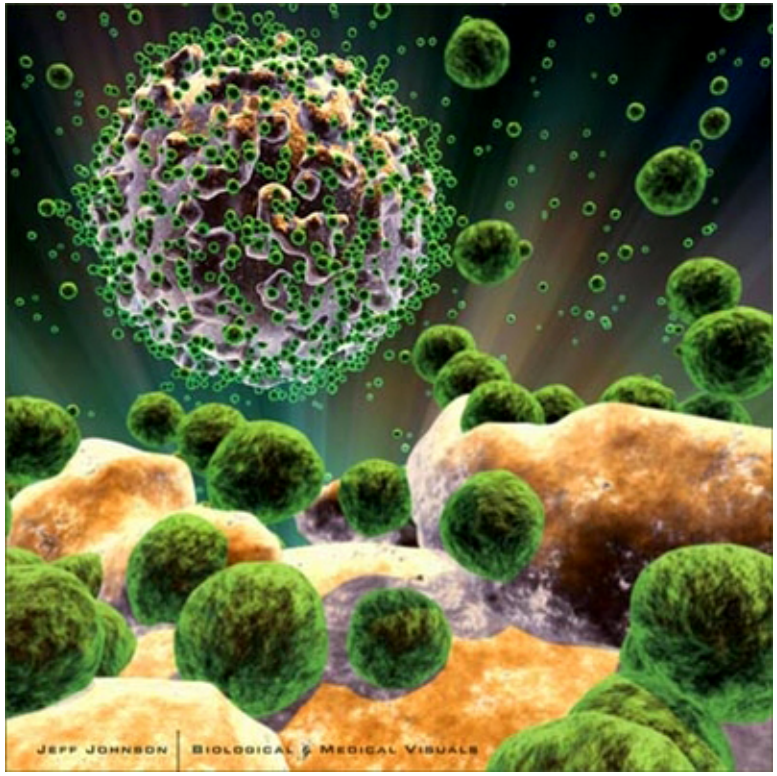
Medium	t°, C	HIV lifetime
lymphoid cells	30°	3 days
serum	23° – 27°	7 days
	54° – 56°	5 hours
liquid media	36° – 37°	11 days
-	above 56°	30 min.
-	boiling point	1 – 3 min.

Safe bioliquids (not dangerous during contact in the absence of blood)

- Tears
- Sweat
- Urine
- Vomit

Unsafe bioliquids

- Blood
- Lymph
- Sperm
- Vaginal secret
- Cerebrospinal fluid
- Brest milk

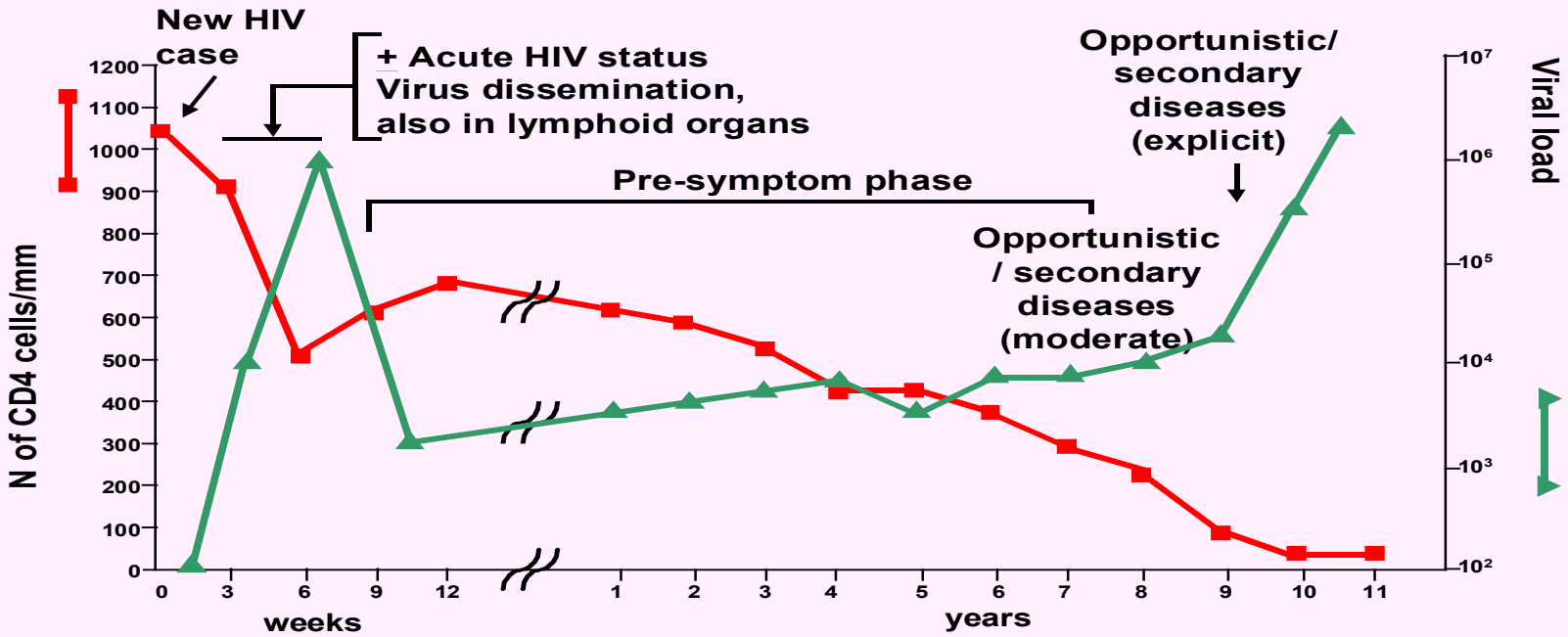


This is a picture of HIV particles (green) being released from T helper cells. HIV infects the T helper cell because it has the protein CD4 on its surface (which is why the T helper cell is also referred to as a CD4 lymphocyte). HIV needs to use CD4 to enter the cells it infects. Once inside a T helper cell, HIV takes advantage of the cellular machinery to make many copies of itself. New virus particles then leave the cell and seek out new T -helper cells to infect.

Routs of transmission HIV:

- Sexual transmission, presence of STD increases likelihood of transmission.
- Exposure to infected blood or blood products.
- Use of contaminated clotting factors by hemophiliacs.
- Sharing contaminated needles (IV drug users).
- Transplantation of infected tissues or organs.
- Mother to fetus, perinatal transmission variable, dependent on viral load and mother's CD 4 count.

Natural course of HIV development (without ART)



Stage of HIV-infection

- primary infection,
- clinically asymptomatic stage,
- symptomatic HIV infection,
- progression to AIDS

STAGE 1 : Primary HIV Infection

- This stage of infection lasts for a few weeks and is often accompanied by a short flu-like illness. In up to about 20% of people the symptoms are serious enough to consult a doctor, but the diagnosis of HIV infection is frequently missed.
- During this stage there is a large amount of HIV in the peripheral blood and the immune system begins to respond to the virus by producing HIV antibodies and cytotoxic lymphocytes. This process is known as seroconversion.

Primary HIV Syndrome

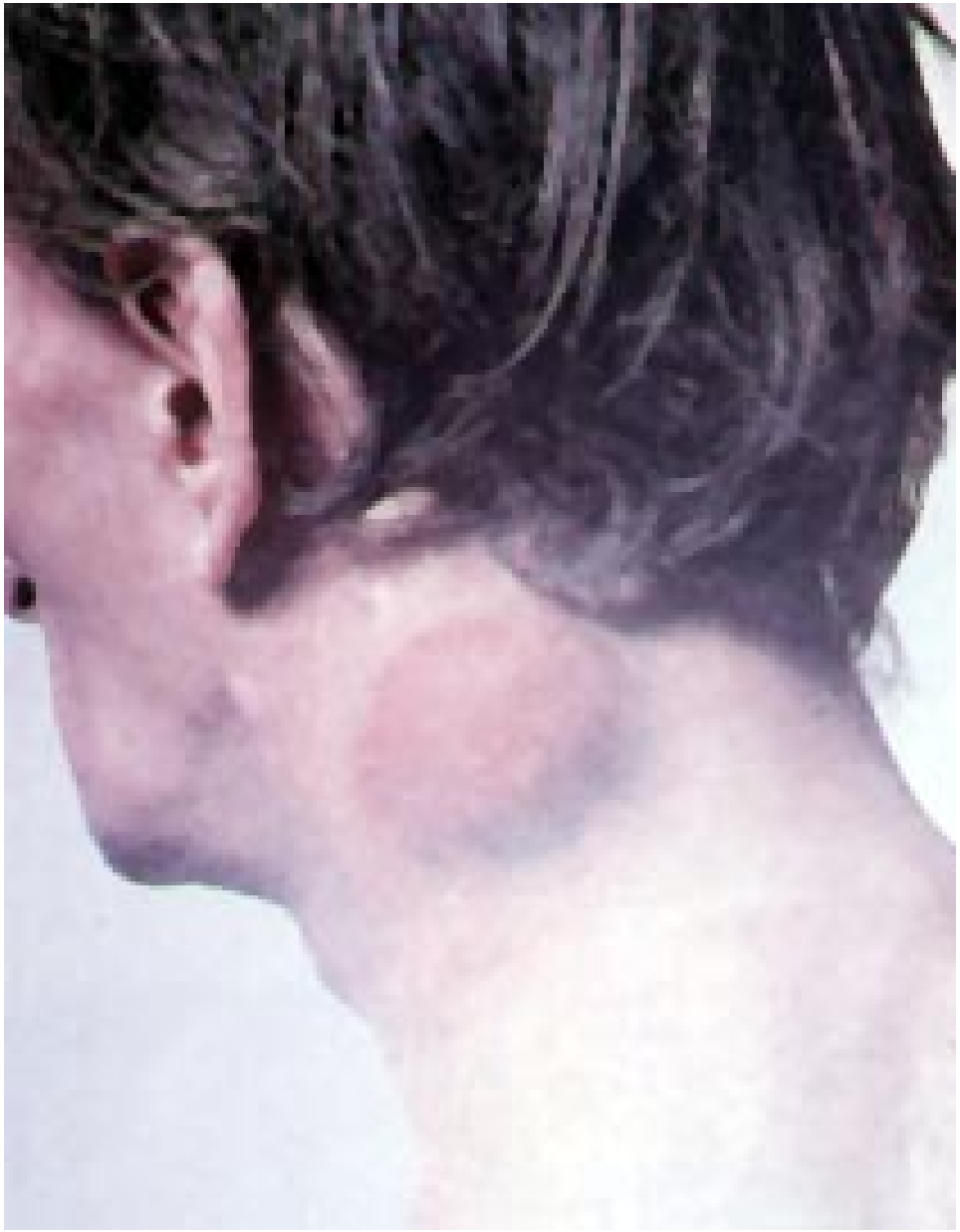
- Mononucleosis-like, cold or flu-like symptoms may occur 6 to 12 weeks after infection.
  - lymphadenopathy
  - fever
  - rash
  - headache
  - Fatigue
  - diarrhea
  - sore throat
  - neurologic manifestations.
  - no symptoms may be present

Primary HIV Syndrome

- Symptoms are relatively nonspecific.
- HIV antibody test often negative but becomes positive within 3 to 6 months, this process is known as seroconversion.
- Primary HIV can be diagnosed using viral load titer assay or other tests.
- Primary HIV syndrome resolves itself and HIV infected person remains asymptomatic for a prolonged period of time, often years.

STAGE 2 : Clinically Asymptomatic Stage

- This stage lasts for an average of ten years and, as its name suggests, is free from major symptoms, although there may be swollen glands. The level of HIV in the peripheral blood drops to very low levels but people remain infectious and HIV antibodies are detectable in the blood, so antibody tests will show a positive result.
- Research has shown that HIV is not dormant during this stage, but is very active in the lymph nodes. A test is available to measure the small amount of HIV that escapes the lymph nodes. This test which measures HIV RNA (HIV genetic material) is referred to as the viral load test, and it has an important role in the treatment of HIV infection.



Clinical Latency Period

- HIV continues to reproduce, CD4 count gradually declines from its normal value of 500-1200.
- Once *CD4 count drops below 500*, HIV infected person have risk for **opportunistic infections.**
- The following diseases are ***predictive*** of the progression to AIDS:
  - persistent herpes-zoster infection (shingles)
  - oral candidiasis (thrush)
  - oral hairy leukoplakia
  - Kaposi's sarcoma (KS)

STAGE 3 : Symptomatic HIV Infection

- Symptomatic HIV infection is mainly caused by the emergence of opportunistic infections and cancers that the immune system would normally prevent. These can occur in almost all the body systems, but common examples are featured in the table below.

System	Examples of Infection/ Cancer
Respiratory system	• Pneumocystis jirovecii Pneumonia (PCP) • Tuberculosis (TB) • Kaposi's Sarcoma (KS)
Gastro-intestinal system	• Cryptosporidiosis • Candida • Cytomegolavirus (CMV) • Isosporiasis • Kaposi's Sarcoma
Central/peripheral Nervous system	• HIV • Cytomegolavirus • Toxoplasmosis • Cryptococcosis • Non Hodgkin's lymphoma • Varicella Zoster • Herpes simplex
Skin	• Herpes simplex • Kaposi's sarcoma • Varicella Zoster

AIDS

- *CD4 count drops below 200* person is considered to have advanced HIV disease
- If preventative medications not started the HIV infected person is now at risk for:
  - Pneumocystis carinii pneumonia (PCP)
  - cryptococcal meningitis
  - toxoplasmosis
- *If CD4 count drops below 50:*
  - Mycobacterium avium
  - Cytomegalovirus infections
  - lymphoma
  - dementia
  - Most deaths occur with CD4 counts below 50.

Other Opportunistic Infections

- Respiratory system
  - Pneumocystis Carinii Pneumonia (PCP)
  - Tuberculosis (TB)
  - Kaposi's Sarcoma (KS)
- Gastro-intestinal system
  - Cryptosporidiosis
  - Candida
  - Cytomegolavirus (CMV)
  - Isosporiasis
  - Kaposi's Sarcoma
- Central/peripheral Nervous system
  - Cytomegolavirus
  - Toxoplasmosis
  - Cryptococcosis
  - Non Hodgkin's lymphoma
  - Varicella Zoster
  - Herpes simplex
- Skin
  - Herpes simple
  - Kaposi's sarcoma
  - Varicella Zoster

STAGE 4 : Progression from HIV to AIDS

- As the immune system becomes more and more damaged the illnesses that occur become more and more severe leading eventually to an AIDS diagnosis.

Laboratory Diagnosis of HIV Infection

- Methods utilized to detect:
  - Antibody
  - Antigen
  - Viral nucleic acid
  - Virus in culture

ELISA Testing

- First serological test developed to detect HIV infection.
  - Easy to perform.
  - Easily adapted to batch testing.
  - Highly sensitive and specific.
- Antibodies detected in ELISA include those directed against: p24, gp120, gp160 and gp41, detected first in infection and appear in most individuals

ELISA Testing

- ELISA tests useful for:
  - Screening blood products.
  - Diagnosing and monitoring patients.
  - Determining prevalence of infection.
  - Research investigations.

Western Blot

- Antibodies to p24 and p55 appear earliest but decrease or become undetectable.
- Antibodies to gp31, gp41, gp 120, and gp160 appear later but are present throughout all stages of the disease.

Viral Load Tests

- Viral load or viral burden is the quantity of HIV-RNA that is in the blood.
- RNA is the genetic material of HIV that contains information to make more virus.

THANK YOU!