

Course 4
Special epidemiology

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Influenza



Definition

- A viral acute infection with aerogenous transmission and significant general effects on the body;

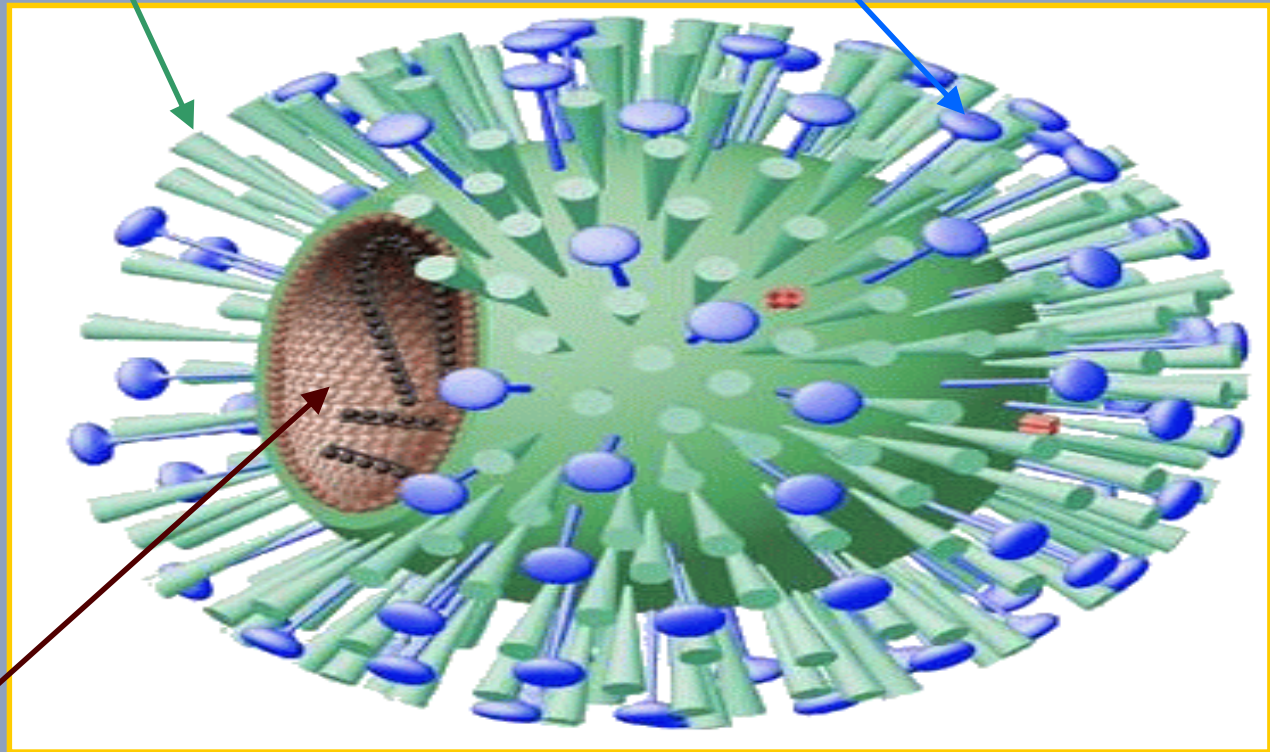
Characteristics of the aetiological agent

- ✓ part of the *Orthomyxoviridae* family, genus *Influenzae*;
- ✓ Less resistant in the external environment;
- ✓ Influenza viruses type A are sensitive to hydrochloric amantadine and to rimantadine;

The influenza virus

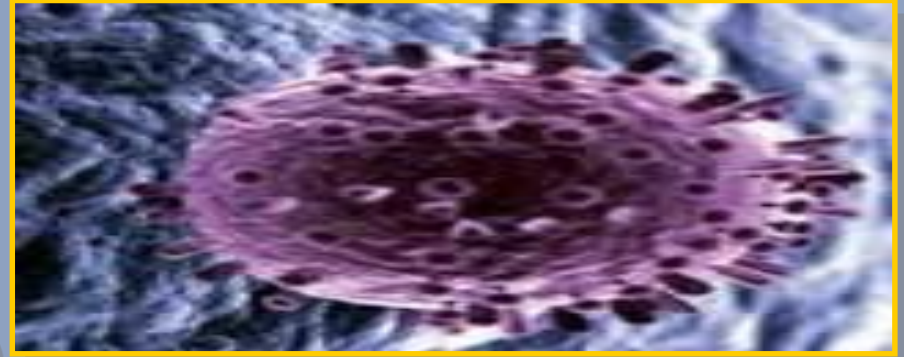
Hemagglutinin/H

Neuraminidase/N



RNP with nucleoprotein and 8 segments of single-chain RNA

The influenza virus



The central component of the virus:

- ✓ It is the soluble antigen of the influenza virus;
- ✓ It is made up of ribonucleoprotein, which contains nucleoprotein and 8 RNA segments, each of which represents a gene;
- ✓ Associated with ribonucleoprotein, we have viral transcriptase, making 256 genetic recombinations among the RNP fragments theoretically possible;

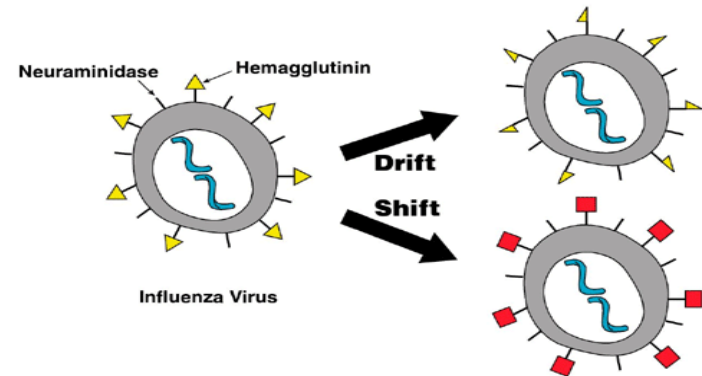
The influenza virus

Peripheral coating:

- ✓ Lipoproteic, double-layered;
- ✓ Covered with glycoproteic structures with surface antigens:
 - At least 15 haemagglutinins (H), in the shape of a cane, with a role in the attachment of the virus on the specific receptors of the host cell and in the onset of the infection;
 - At least 9 neuraminidases (N), mushroom-shaped;
- ✓ Strain formula: Ex: A/Hong-Kong/1/68(H₃,N₂)

The influenza virus

Influenza: Antigenic Drift and Shift

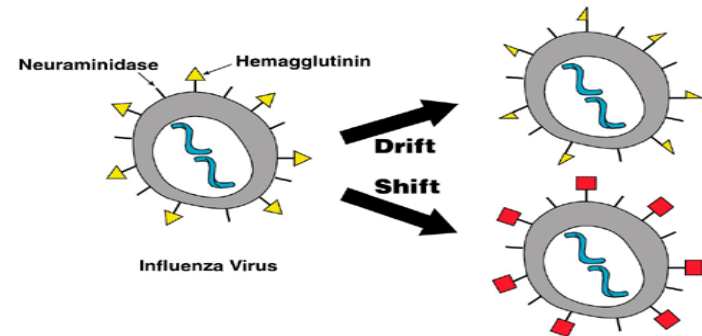


Antigenic drifts (minor variability):

- ✓ once in a few years, the sequence of some antigens in the structure of haemagglutinin or neuroaminidase changes and new variants of the same subtype of influenza virus emerge;
- ✓ They may cause moderate epidemics;

The influenza virus

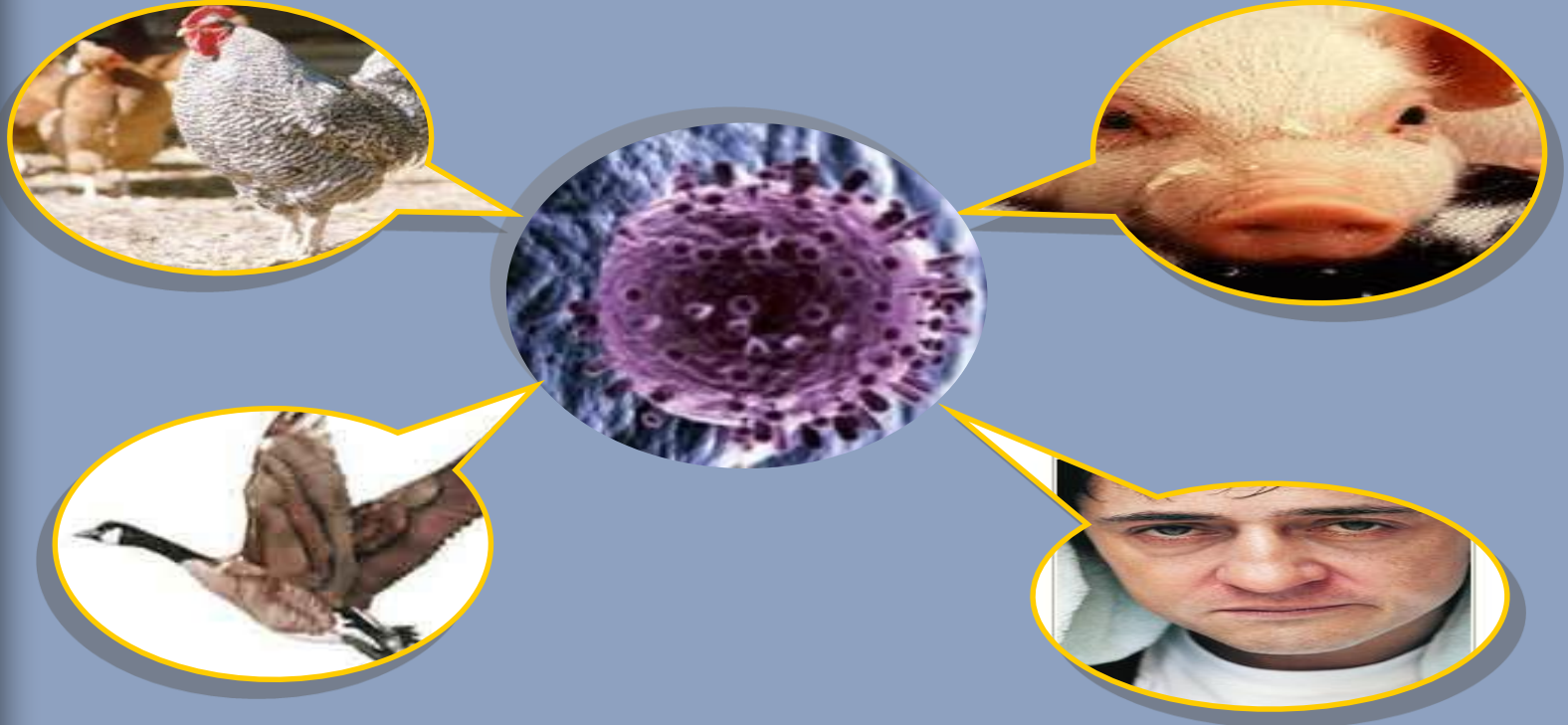
Influenza: Antigenic Drift and Shift



Antigenic shifts (major variability):

- ✓ at a larger interval of time, 2 different influenza virus subtypes simultaneously infect the same host cell and can undergo a rearrangement of the 8 genic segments;
- ✓ This generates new subtypes of the influenza virus, with a pandemic potential, in an immune naive population.

The infection source



It may be sick humans as well as sick animals, which is why influenza is considered an anthroozoonosis.

The infection source



The human infection source – is represented by:

- ✓ the acutely sick person (contagious in the first 3-5 days of the disease);
- ✓ The inapparently infected persons (with the largest share);
- ✓ The persons with a latent infection, which would maintain the virus among the population between the epidemic seasons.

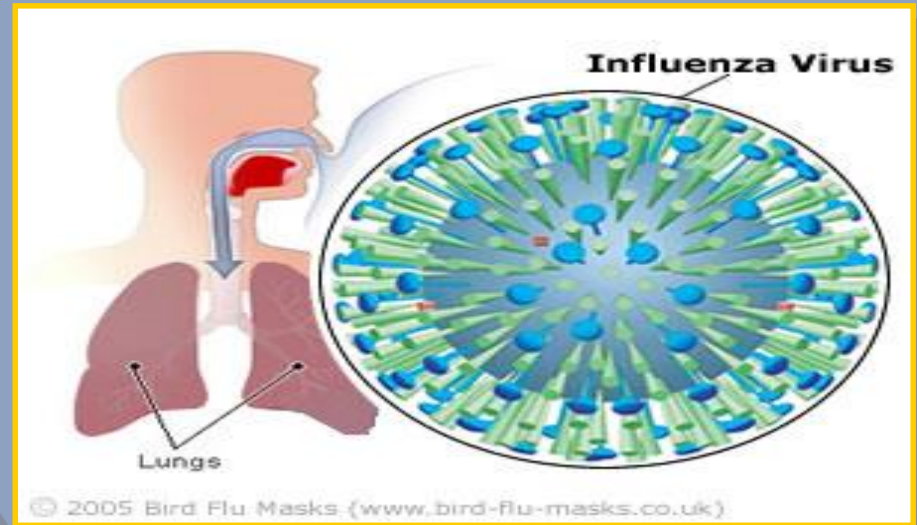


The infection source

The animal or extra-human infection source

- ✓ pigs, horses, and other wild or domestic animals/birds;
- ✓ These species can display:
 - Manifested acute infection;
 - Persistent infection;
 - Vertically transmitted infection;
 - Cross-infection among species.

Transmission routes and mechanisms



- ✓ Transmission is **direct, aerogenous**, through Flugge's droplets, especially in confined spaces;
- ✓ There is the possibility of transmitting the infection from the animal infection source to the human species, followed by inter-human retransmission of the viruses of animal origin.

The receiving population



- ✓ General population receptiveness;
- ✓ Higher among children – the most efficient vectors of influenza;
- ✓ Post-infectious immunity is **strain-specific** and permanent;
- ✓ Post-vaccine immunity is homologous to the vaccine formula and transitory – no longer than 1 year.

Factors favouring the epidemiological process



- ✓ **Natural factors:** favour the cold-season feature of influenza in the temperate area;
- ✓ **Economic and social factors** – favour the spreading of the disease among the population, especially through various types of human agglomeration.

Manifestations of the epidemiological process

Influenza can manifest itself:

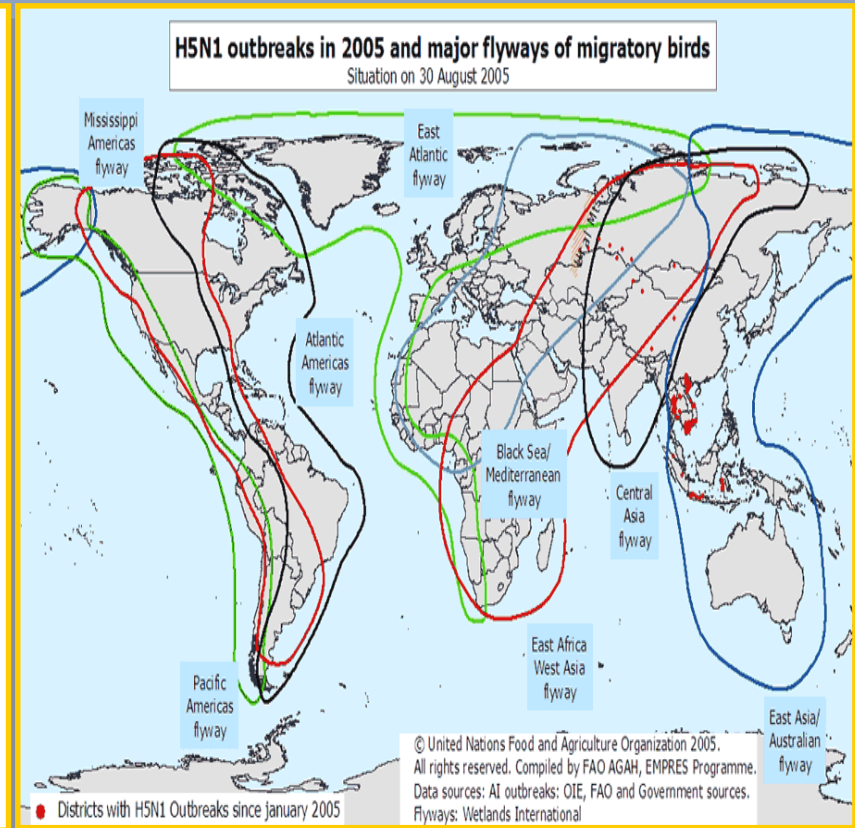
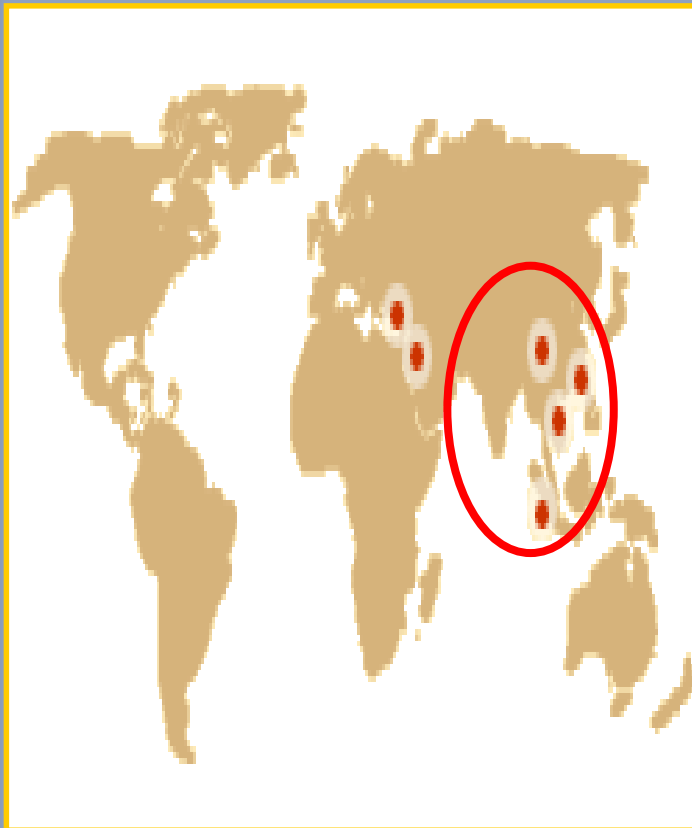
- ✓ **Sporadically (type C);**
- ✓ **Epidemically (types B and A) and**
- ✓ **Pandemically (type A).**

Epidemics occur almost exclusively in the *cold season*, in the temperate area (October-April in the northern hemisphere and May-September in the southern hemisphere), and in the *rainy season* in the tropical area.

Manifestations of the epidemiological process

- During an **epidemic**, just one influenza virus strain is predominant among the population (with one exception during the past 15 years);
- In the inter-epidemic periods, the influenza virus apparently disappears from the population (but let us not forget latent infection)!
- New influenza virus strains usually appear in **the Far East**, from where they are then spread worldwide (exception H1N1 in 2009);
- The start of an epidemic is signalled by an increase in school and industrial absences, as well as an increase in morbidity due to pneumonia and influenza infections;

The origin of antigenic shifts



Manifestations of the epidemiological process

- In any influenza epidemic wave, the case incidence rapidly rises during the first 2-3 weeks and gradually decreases during the next 4-6 weeks;
- Between epidemics, influenza manifests itself **endemo-sporadically**, especially among infants, on the background of collective immunity against the circulating strain;
- The first epidemic wave of a **pandemic** affects between 30-50% of the population, depending on the age group distribution;
- The following epidemic waves are smaller and smaller (one wave in each epidemic season);
- 5 pandemics have been signalled during the past 100 years ,the last one in 2009.

Manifestations of the epidemiological process

- The current forecast envisages the possible emergence of a resorted virus, through the combination of the H5N1 strain with a human influenza strain.



The Spanish Flu of 1918

Prevention and control

The measures regarding sick people include:

- ✓ **early identification and home quarantining for 1 week or**
- ✓ **hospital admission of the people in risk groups and those with complications.**

Measures regarding suspects:

- ✓ **Same as in the case of sick people, pending possible disproof.**

Prevention and control



Measures regarding the transmission routes:

- ✓ Those applying to aerogenous infections:
 - Avoiding human agglomerations;
 - Mechanical protection of coughing and sneezing, especially in confined spaces;
 - Hygienic education of the population;
- ✓ Closing and suspending activity in children's collectivities is generally a consequence of high absence rates, not an anti-epidemic measure.

Prevention and control



Measures regarding the receptive population:

- ✓ Measures to increase the non-specific resistance of the body (balanced diet, rich in vitamins, avoiding prolonged exposure to cold and excessive fatigue during epidemics);
- ✓ Specific prevention through anti-influenza vaccination at least 2 weeks before the occurrence of sick cases.

Prevention and control



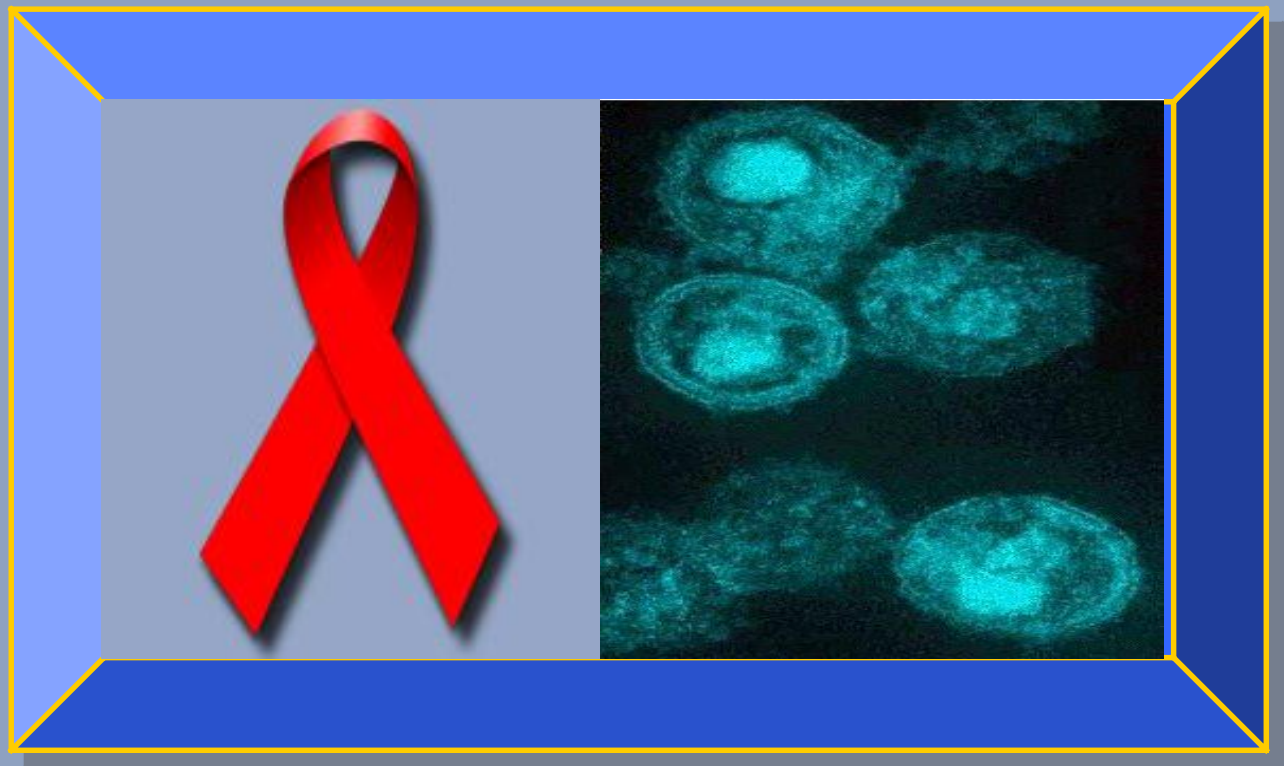
Measures regarding the receptive population:

- ✓ For type A influenza, chemoprevention with amandatine or rimantadine;
- ✓ Protection is approximately 70%;
- ✓ This type of chemoprevention is recommended to unvaccinated people, whose vaccination is not possible and where there is high individual risk.

Infections with parainfluenza viruses

- These are significant especially in the acute respiratory infection pathology of **children under 5 years of age**, with a peak of seriousness under 6 months;
- Parainfluenza viruses (1,2,3,4) are present worldwide;
- Transmission is aerogenous;
- Post infectious immunity is type-specific;
- Cases show an autumn-winter seasonal periodicity;
- There is no specific immune- or chemotherapy.

The human immunodeficiency syndrome



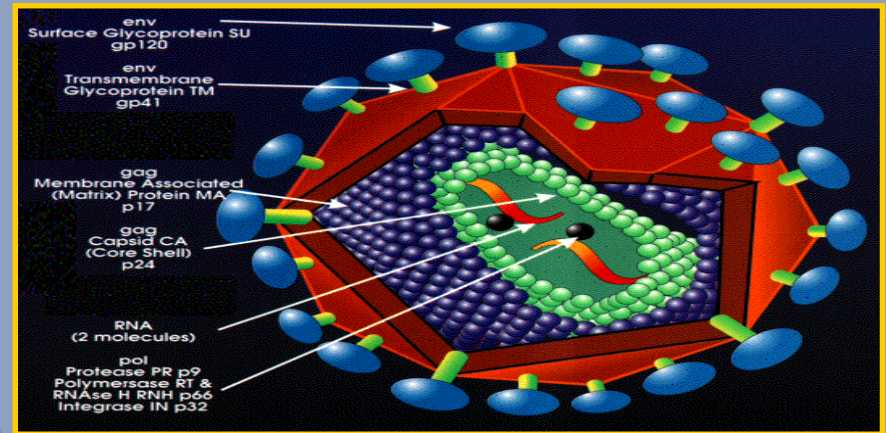
Definition

- The HIV/AIDS infection is a transmissible disease with a massive and fast spread;
- It perfectly matches the definition of a pandemic epidemiological process – new etiological agent, transmitted fast and efficiently among an immune "naive" population;
- Since the beginning of the epidemic , almost 78 million people have been infected with HIV virus and about 39 million people died of HIV. Globally , 42 million people were living with HIV at the end of 2019. Sub-saharian Africa remains most severely affected , with nearly 1 in every 20 adults living with HIV and accounting for nearly 71% of the people living with HIV worldwide !

Features of the etiological agent

- ✓ The human immunodeficiency virus is classified within the family of *Retroviridae*;
- ✓ It maintains virulence at room temperature and in dry material for 3-7 days, and in a water medium for over 2 weeks;
- ✓ Alcohols, hypochlorites, detergents make the virus inactive at lower concentrations than usual ones (ethanol 25%) but in practice, the following are used: hydrogen peroxide 6%, ethanol 70°, Ca and Na hypochlorite 1%, iodophors 2.5%, glutaraldehyde 2%, applied for 1-5 minutes.

Features of the etiological agent



- ✓ The medical instruments must be sterilized by autoclaving and with ethylene oxide;
- ✓ Instruments that cannot withstand thermal processing are immersed in glutaraldehyde solutions (2% concentration) for 30 minutes;

The epidemiological process



The infection source – is represented by the infected person, who remains contagious throughout their life;

✓ **Risk groups and infection sources:**

- **Homosexuals and bisexuals;**
- **Heterosexuals with partners from the risk groups or from areas where heterosexual transmission is dominant;**
- **Children born of HIV-infected mothers;**
- **People with sexually transmitted diseases and drug addicts.**

The infection source

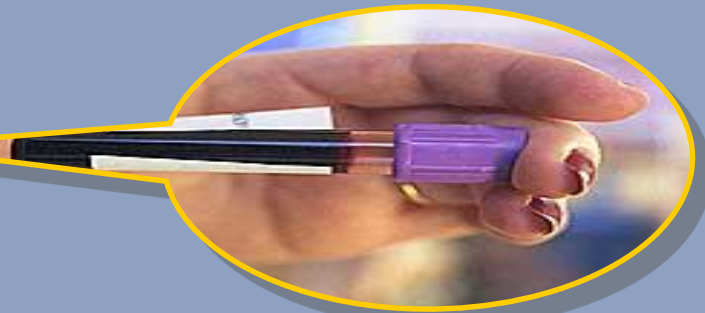
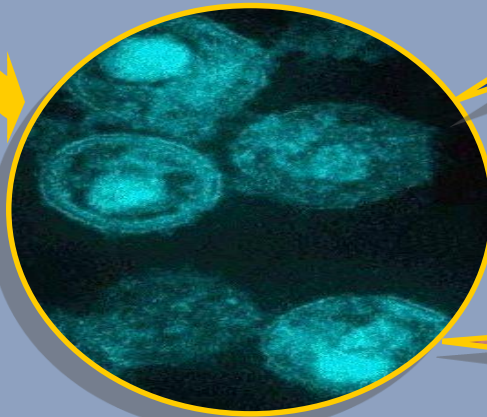
✓ the virus was isolated from:

- Blood;
- Sperm/vaginal secretion;
- Saliva;
- Milk;
- Tears;
- Urine;
- LCR;
- Alveolar and amniotic liquid;

✓ Certain role in the transmission: blood and genital secretions.

Transmission routes and mechanisms

- Occurs in practice through sexual intercourse, exposure to blood, and perinatally.



Transmission routes and mechanisms



Sexual transmission – the main transmission route worldwide(80%);

✓ The transmission risk depends on:

- Sexual practices (high risk for unprotected penetration practices);
- Source infectivity (higher towards the final stages);
- Number of partners;
- Coexistence of venereal diseases;
- Vitamin A deficit;
- Susceptibility of the partner – 4 times higher risk for the receptive partner;
- Possibly the viral strain.

Transmission routes and mechanisms



Transmission through blood and blood products

- ✓ **Transmission through contaminated needles and syringes rank first, among consumers of intravenously administered drugs;**
- ✓ **Their risk increases with the duration of drug usage, sharing of needles, number of injections, residence in areas with high HIV prevalence;**
- ✓ **The infection risk from a blood unit coming from an HIV-positive person is practically 100%;**
- ✓ **The risk of infection following artificial insemination with sperm from an HIV-positive donor is 3.5%;**

Transmission routes and mechanisms



Transmission through blood and blood products

- ✓ **The risk of seroconversion after stinging with needles coming from HIV-positive patients is 0.2-0.5%, but the individual risk is higher if:**
 - **The lesion is deep;**
 - **Performed with contaminated IV needles or instruments;**
 - **The source patient is in the final stage;**
- ✓ **In the case of nosocomial accidents, chemoprevention should be started in a triple association, 1-2 hours following exposure, serologic surveillance after 6 weeks, 3 and 6 months, and monitoring adverse reactions.**

Transmission routes and mechanisms



Perinatal transmission - with a rate of 13-30% occurs

- ✓ transplacentally,
- ✓ during birth – through exposure to blood and other contaminated liquids;
- ✓ Postpartum – through milking;
- ✓ Currently, over 80% of HIV-positive women are at the reproductive age and their number is increasing;
- ✓ Although the maternal milk contains the HIV virus, in developing countries, the risk of infection among breast-fed children is counterbalanced by the beneficial effects for diarrhoeic and respiratory illnesses.

Transmission routes and mechanisms



Although the HIV virus was isolated from saliva, the risk of saliva-based transmission is extremely low, and transmission through vectors has not been proven.

The receiving population



- ✓ Receptiveness is general and, once contracted, the infection persists for a lifetime;
- ✓ The favouring factors: ethnic minorities and low-income people are affected, due to the concentration of risk factors
 - Prostitution;
 - Drug consumption;
 - Promiscuity.

Epidemiological process manifestation



PANDEMIC

- ✓ **1,8 million new infections in 2019 !**
- ✓ **or approximately 5.000 new cases/day.**

Prevention and control

- **The anti-AIDS battle has 3 major aims:**

Prevention of HIV infection

Reducing the personal and social impact among symptomatic or asymptomatic HIV-positive people

Coordinating national and international efforts

Preventing the transmission



Prevention is based on interrupting the transmission!

- ✓ The risk of sexual transmission is reduced by:
 - Mechanical protection;
 - Reducing the number of partners;
 - Changing the sexual behaviour.

Preventing the transmission



Prevention of blood and blood product transmission is done through:

- ✓ Donor screening;
- ✓ Thermal and ethanol-based processing of the subproducts;
- ✓ For drug addicts – the correct use of needles and syringes is recommended; secondly, drug addiction prevention.

Preventing the transmission



Preventing the perinatal infection involves:

- ✓ Advising HIV-positive people not to procreate;
- ✓ Testing all pregnant women, especially in the average and high prevalence areas;
- ✓ HIV-positive women can have their pregnancy terminated (the decision belongs to the mother);
- ✓ Monitoring the pregnancy and administering antiretroviral treatment – have led to a reduction by 2/3 of maternal-foetal transmission.

Specific prevention

Tomorrow!

- ✓ Most vaccination attempts are based on the induction of neutralizing Ab with coating protein (gp 120,160). Ag are obtained through the technology of recombined molecules or chemical synthesis;
- ✓ other vaccinal candidates:
 - Vaccine with core protein (p17, p24);
 - Live vaccines, less studied;
 - Vaccines with recombined Ag, associated with adjuvants or
 - Vaccines with recombined Ag, presented by live vectors – *the vaccinia virus*.

Thank you!



*Images – sources
The Internet*