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ZAPORIZHZHYA STATE MEDICAL UNIVERSITY  
THE CHAIR OF MICROBIOLOGY, VIROLOGY, IMMUNOLOGY

# **MEDICALLY IMPORTANT VIRUSES**

**The methodical manual for medical students**

Zaporizhzhya  
2015

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*Guidelines ratified on meeting of the Central methodical committee of Zaporizhzhya state medical university (protocol numbers 2 (26.09.2015) and it is recommended for the use in educational process for foreign students.*

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The independent practical work of students is an important part of the syllabus in the course of microbiology, immunology. It helps students to study this fundamental subject.

The systematic independent work enables to reach the final goal in the students' education. It is also important while preparing the students for their future clinic work with patients. These theoretical material, questions and tests help students to get ready for examination.

The methodical manual for practical lessons on microbiology, virology, immunology for the medical students of II-III year of the study are approved by the Central Methods Board of ZSMU as a methodical manual on practical lessons for students of the medical faculty.

# CONTENS

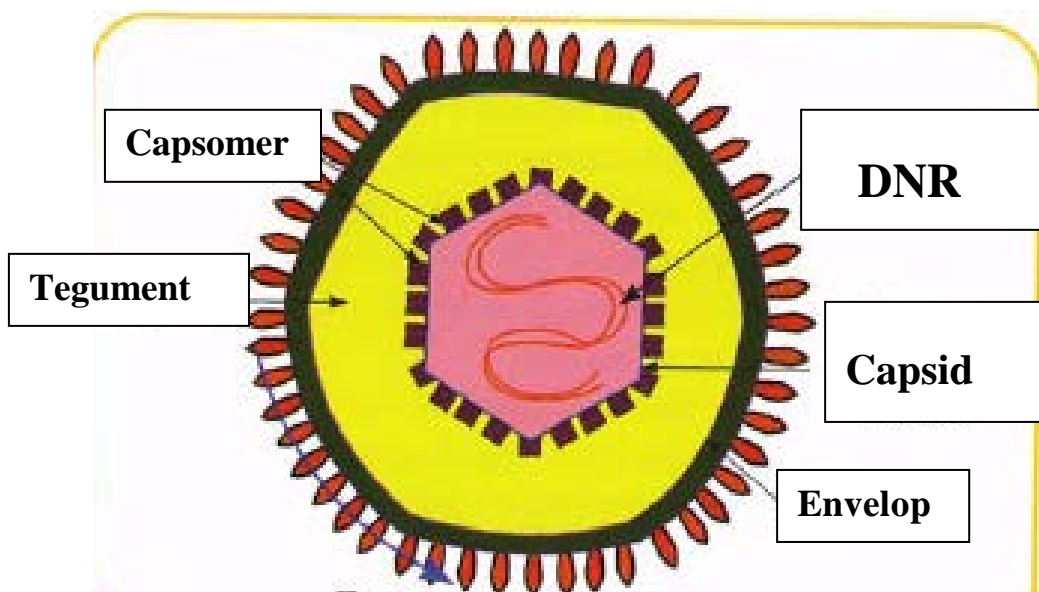
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# DNA ENVELOPED VIRUSES

## Herpes Simplex Virus Type 1

**Diseases:** Herpes labialis (fever blisters or cold sores), keratitis, encephalitis.

**Characteristics:** Enveloped virus with icosahedral nucleocapsid and linear double-stranded DNA. (**Fig. 1.**) No virion polymerase. One serotype; cross-reaction with HSV-2 occurs. No herpes group-specific antigen.



**Fig. 1. Structure of Herpes Simplex Virus**

**Transmission:** By saliva or direct contact with virus from the vesicle.

**Pathogenesis:** Initial vesicular lesions occur in the mouth or on the face.

The virus then travels up the axon and becomes latent in sensory (trigeminal) ganglia. Recurrences occur in skin innervated by affected sensory nerve and are induced by fever, sunlight, stress, etc.

Dissemination occurs in patients with depressed cell-mediated immunity.

**Laboratory Diagnosis:** Virus causes cytopathic effect (CPE) in cell culture.

It is identified by antibody neutralization or fluorescent-antibody test.

Tzanck smear of cells from the base of the vesicle reveals multinucleated giant cells with intranuclear inclusions.

These giant cells are not specific for HSV-1; they are seen in the vesicular lesions caused by HSV-2 and varicella-zoster virus as well.

A rise in antibody titer can be used to diagnose a primary infection but not recurrences. Intranuclear inclusions seen in infected cells. HSV encephalitis can be diagnosed using a PCR assay to detect HSV-1 DNA in spinal fluid.

**Treatment:** Acyclovir for encephalitis and disseminated disease. Acyclovir has no effect on the latent state of the virus.

Trifluorothymidine for keratitis. Primary infections and localized recurrences are self-limited. A variety of over-the-counter drying agents can be used to promote healing.

**Prevention:** Recurrences can be prevented by avoiding the specific inciting agent such as intense sunlight. Acyclovir can reduce recurrences. No vaccine is available.

## Herpes Simplex Virus Type 2

**Diseases:** Herpes genitalis, aseptic meningitis, and neonatal infection.

**Characteristics:** Enveloped virus with icosahedral nucleocapsid and linear double-stranded DNA. No virion polymerase. One serotype; cross-reaction with HSV-1 occurs. No herpes group-specific antigen.

**Transmission:** Sexual contact in adults and during passage through the birth canal in neonates.

**Pathogenesis:** Initial vesicular lesions occur on genitals. The virus then travels up the axon and becomes latent in sensory (lumbar or sacral) ganglion cells. Recurrences may be induced by stress.

**Laboratory Diagnosis:** Virus causes CPE in cell culture. Identify by antibody neutralization or fluorescent-antibody test. Tzanck smear reveals multinucleated giant cells but is not specific for HSV-2. A rise in antibody titer can be used to diagnose a primary infection but not recurrences.

**Treatment:** Acyclovir is useful in the treatment of both primary and recurrent disease. It has no effect on the latent state.

**Prevention:** Primary disease can be prevented by protection from exposure to vesicular lesions. Recurrences can be reduced by the long-term use of oral acyclovir. There is no vaccine.

## Varicella-Zoster Virus

**Diseases:** Varicella (chickenpox) in children and zoster (shingles) in adults.

**Characteristics:** Enveloped virus with icosahedral nucleocapsid and linear double-stranded DNA. No virion polymerase. One serotype.

**Transmission:** Varicella is transmitted primarily by respiratory droplets. Zoster is not transmitted; it is caused by a reactivation of latent virus.

**Pathogenesis:** Initial infection is in the respiratory tract. It spreads via the blood to the internal organs such as the liver and then to the skin.

After the acute episode of varicella, the virus remains latent in the sensory ganglia and can reactivate to cause zoster years later, especially in older and immunocompromised individuals.

**Laboratory Diagnosis:** Virus causes CPE in cell culture and can be identified by fluorescent-antibody test. Multinucleated giant cells seen in smears from the base of the vesicle. Intranuclear inclusions seen in infected cells. A 4-fold rise in antibody titer in convalescent-phase serum is diagnostic.

**Treatment:** No antiviral therapy is indicated for varicella or zoster in the immunocompetent patient. In the immunocompromised patient, acyclovir can prevent dissemination.

**Prevention:** Vaccine contains live, attenuated virus. Immunocompromised patients exposed to the virus should receive passive immunization with varicella-zoster immune globulin (VZIG) and acyclovir to prevent disseminated disease.

## Cytomegalovirus

**Diseases:** Cytomegalic inclusion body disease in infants. Mononucleosis in transfusion recipients. Pneumonia and hepatitis in immunocompromised patients.

**Characteristics:** Enveloped virus with icosahedral nucleocapsid and linear double-stranded DNA. No virion polymerase. One serotype.

**Transmission:** Virus is found in many human body fluids, including blood, saliva, semen, cervical mucus, breast milk, and urine.

It is transmitted via these fluids, across the placenta, or by organ transplantation.

**Pathogenesis:** Initial infection usually in the oropharynx. In fetal infections, the virus spreads to many organs, eg, central nervous system and kidneys. In adults, lymphocytes are frequently involved.

A latent state occurs in leukocytes. Disseminated infection in immunocompromised patients can result from either a primary infection or reactivation of a latent infection.

**Laboratory Diagnosis:** The virus causes CPE in cell culture and can be identified by fluorescent-antibody test. "Owl's eye" nuclear inclusions are seen. A 4-fold rise in antibody titer in convalescent-phase serum is diagnostic.

**Treatment:** Ganciclovir is beneficial in treating pneumonia and retinitis. Acyclovir is ineffective.

**Prevention:** No vaccine is available. Ganciclovir suppresses retinitis. Do not transfuse CMV antibody-positive blood into newborns or antibody-negative immunocompromised patients.

## Epstein-Barr Virus

**Characteristics:** Enveloped virus with icosahedral nucleocapsid and linear double-stranded DNA. No virion polymerase. One serotype.

**Transmission:** Virus found in human oropharynx and B lymphocytes. It is transmitted primarily by saliva.

**Pathogenesis:** Infection begins in the pharyngeal epithelium, spreads to the cervical lymph nodes, then travels via the blood to the liver and spleen.

**Laboratory Diagnosis:** The virus is rarely isolated. Lymphocytosis, including atypical lymphocytes, occurs. Heterophil antibody is typically positive (Monospot test). A significant rise in EBV-specific antibody to viral capsid antigen is diagnostic.

**Treatment:** No effective drug is available.

**Prevention:** There is no drug or vaccine.

## Hepatitis B Virus

**Diseases:** Hepatitis B; implicated as a cause of hepatocellular carcinoma.

**Characteristics:** Enveloped virus with incomplete circular double-stranded DNA; ie, one strand has about one-third missing and the other strand is "nicked" (not covalently bonded). DNA polymerase in virion. HBV-encoded polymerase acts as a reverse transcriptase by using viral mRNA as the template for the synthesis of progeny genome DNA.

There are three important antigens: the surface antigen, the core antigen, and the e antigen, which is located in the core. In the patient's serum, long rods and spherical forms composed solely of HBsAg predominate. HBV has one serotype based on the surface antigen.

**Transmission:** Transmitted by blood, during birth, and by sexual intercourse.

**Pathogenesis:** Hepatocellular injury due to immune attack by cytotoxic (CD8) T cells. Antigen-antibody complexes cause arthritis, rash, and glomerulonephritis. About 5% of HBV infections result in a chronic carrier state.

Chronic hepatitis and cirrhosis can occur. Hepatocellular carcinoma may be related to the integration of part of the viral DNA into hepatocyte DNA.

**Laboratory Diagnosis:** HBV has not been grown in cell culture.

Three serologic tests are commonly used: surface antigen (HBsAg), surface antibody (HBsAb), and core antibody (HBcAb). Detection of HbsAg for more than 6 months indicates a chronic carrier state.

The presence of e antigen indicates a chronic carrier who is making infectious virus.

**Treatment:** No specific treatment.

**Prevention:** There are three main approaches: (1) vaccine that contains HBsAg as the immuno-gen; (2) hyperimmune serum globulins obtained from donors with high titers of HBsAb; and (3) education of chronic carriers regarding precautions.



## Smallpox Virus

**Disease:** Smallpox (eradicated in 1980).

**Characteristics:** Poxviruses are the largest viruses. Enveloped virus with linear double-stranded DNA. DNA-dependent RNA polymerase in virion. One serologic type. (Fig. 2.).



**Fig. 2. Pocks on the choriollantoic membrane of the chick embryo, infected by small pox viruses.**

**Transmission:** By respiratory droplets or direct contact with the virus from skin lesions.

**Pathogenesis:** The virus infects the mucosal cells of the upper respiratory tract, then spreads to the local lymph nodes and by viremia to the liver and spleen and later the skin. Skin lesions progress in the following order: macule, papule, vesicle, pustule, crust.

**Laboratory Diagnosis:** Virus identified by CPE in cell culture or "pocks" on chorioallantoic membrane.

Electron microscopy reveals typical particles; cytoplasmic inclusions seen in light microscopy.

Viral antigens in the vesicle fluid can be detected by precipitin tests. A 4-fold or

greater rise in antibody titer in the convalescent-phase serum is diagnostic.

**Treatment:** None.

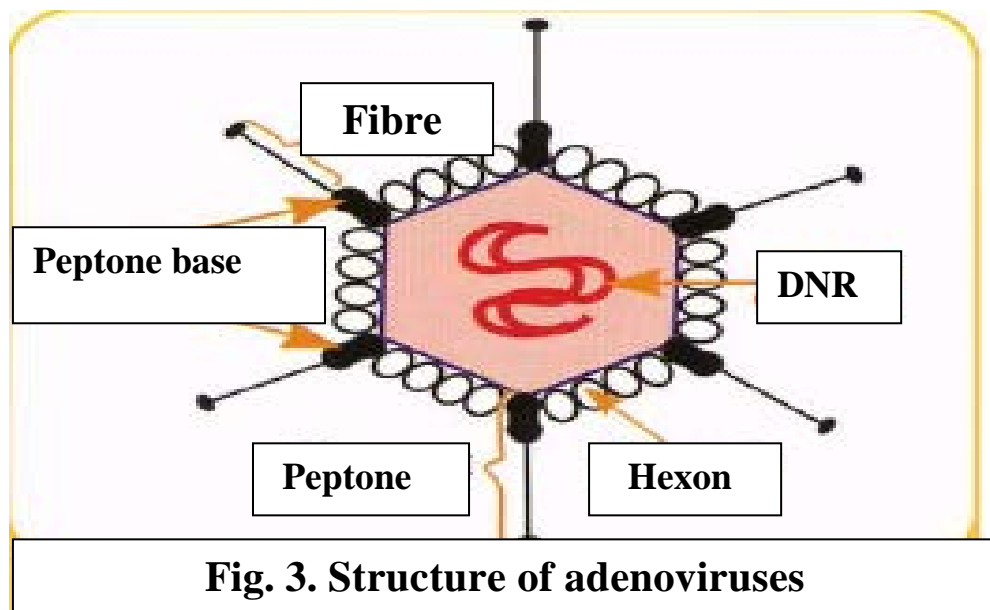
**Prevention:** Vaccine contains live attenuated vaccinia virus. Vaccine is no longer used except by the military, because the disease has been eradicated.

## DNA NONENVELOPED VIRUS

### Adenovirus

**Diseases:** Upper and lower tract respiratory disease, especially pharyngitis and pneumonia. Enteric strains cause diarrhea. Some strains cause sarcomas in certain animals but not humans.

**Characteristics:** Nonenveloped virus with icosahedral nucleocapsid and linear double-stranded DNA. No virion polymerase. (Fig. 3.).



There are 34 serotypes, some associated with specific diseases.

**Transmission:** Respiratory droplet primarily; iatrogenic transmission in eye disease.

**Pathogenesis:** Virus preferentially infects epithelium of respiratory tract and eyes. After acute infection, persistent, low-grade virus production without symptoms can occur in the pharynx.

**Laboratory Diagnosis:** Virus causes CPE in cell culture and can be identified by fluorescent-antibody or complement fixation test. Antibody titer rise in convalescent-phase serum is diagnostic.

**Treatment:** None.

**Prevention:** Live vaccine against types 3,4, and 7 is used in the military to prevent pneumonia.

## RNA ENVELOPED VIRUSES

### Influenza Virus

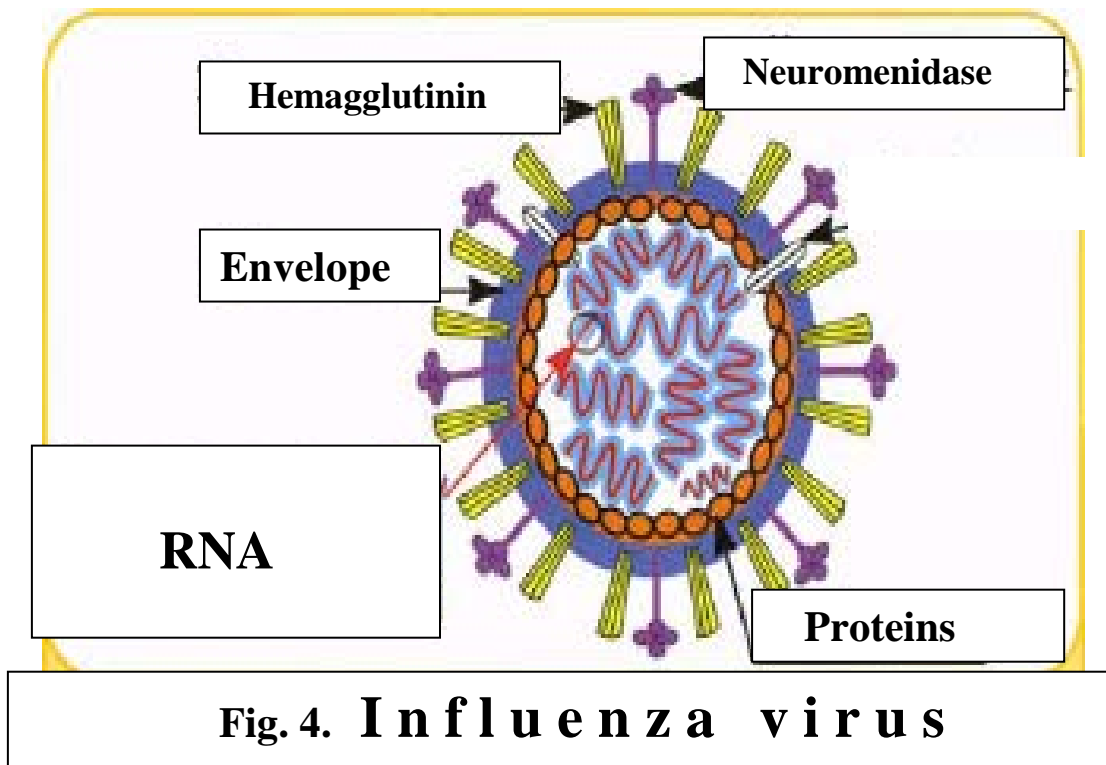
**Disease:** Influenza. Influenza A virus is the main cause of world-wide epidemics (pandemics).

**Characteristics:** Enveloped virus with a helical nucleocapsid and segmented, single-stranded RNA of negative polarity. RNA polymerase in virion.

The two major antigens are the hemagglutinin and the neuraminidase on separate surface spikes. Antigenic shift in these proteins as a result of re-assortment of RNA segments accounts for the epidemics of influenza caused by influenza A virus.

Influenza A viruses of animals are the source of the new RNA segments. Antigenic drift due to mutations also contributes. The virus has many serotypes because of these antigenic shifts and drifts.

The antigenicity of the internal capsid protein determines whether the virus is an A, B, or C influenza virus. **(Fig. 4).**



**Transmission:** Respiratory droplets.

**Pathogenesis:** Infection is limited primarily to the epithelium of the respiratory tract.

**Laboratory Diagnosis:** Virus grows in cell culture and embryonated eggs and can be detected by hemadsorption or hemagglutination. It is identified by hemagglutination inhibition or complement fixation.

Antibody titer rise in convalescent-phase serum is diagnostic.

**Treatment:** Amantadine is available but infrequently used.

**Prevention:** Vaccine contains inactivated strains of A and B virus currently causing disease.

The vaccine is not a good immunogen and must be given annually. Recommended for people older than age 65 years and for those with chronic diseases, especially of the heart and lungs.

Amantadine provides good prophylaxis in unvaccinated people who have been exposed.

## Measles Virus

**Disease:** Measles. Subacute sclerosing panencephalitis is a rare late complication.

**Characteristics:** Enveloped virus with a helical nucleocapsid and one piece of single-stranded, negative-polarity RNA. RNA polymerase in virion. It has a single serotype.

**Transmission:** Respiratory droplets.

**Pathogenesis:** Initial site of infection is the upper respiratory tract. Virus spreads to local lymph nodes and then via the blood to

other organs, including the skin. Giant cell pneumonia and encephalitis can occur. The maculopapular rash is due to cell-mediated immune attack by cytotoxic T cells on virus-infected vascular endothelial cells in the skin.

**Laboratory Diagnosis:** The virus is rarely isolated. Serologic tests are used if necessary. **Treatment:** No antiviral therapy is available.

**Prevention:** Vaccine contains live attenuated virus. Usually given in combination with mumps and rubella vaccines.

## Mumps Virus

**Disease:** Mumps. Sterility due to bilateral orchitis is a rare complication.

**Characteristics:** Enveloped virus with a helical nucleocapsid and one piece of single-stranded, negative-polarity RNA. RNA polymerase in virion. It has a single serotype.

**Transmission:** Respiratory droplets.

**Pathogenesis:** The initial site of infection is the upper respiratory tract.

The virus spreads to local lymph nodes and then via the bloodstream to other organs, especially the parotid glands, testes, ovaries, meninges, and pancreas.

**Laboratory Diagnosis:** The virus can be isolated in cell culture and detected by hemadsorption. Diagnosis can also be made serologically.

**Treatment:** No antiviral therapy is available.

**Prevention:** Vaccine contains live attenuated virus. Usually given in combination with measles and rubella vaccines.

## Rubella Virus

**Disease:** Rubella. Congenital rubella syndrome is characterized by developmental malformations, especially cardiovascular and neurologic, and by prolonged virus excretion.

**Characteristics:** Enveloped virus with an icosahedral nucleocapsid and one piece of single-stranded positive-polarity RNA. No polymerase in virion. It has a single serotype.

**Transmission:** Respiratory droplets and across the placenta from mother to fetus.

**Pathogenesis:** The initial site of infection is the nasopharynx, from which it spreads to local lymph nodes.

It then disseminates to the skin via the bloodstream. The rash is attributed to both viral replication and immune injury.

During maternal infection, the virus replicates in the placenta and then spreads to fetal tissue. If infection occurs during the first trimester, a high frequency of congenital malformations occurs.

**Laboratory Diagnosis:** Virus growth in cell culture is detected by interference with plaque formation by coxsackievirus; rubella virus does not cause CPE.

To determine whether an adult woman is immune, a single serum specimen to detect IgG antibody in the hemagglutination inhibition test is used.

To detect whether recent infection has occurred, either a single serum specimen for IgM antibody or a set of acute- and convalescent-phase sera for IgA antibody can be used.

**Treatment:** No antiviral therapy is available.

**Prevention:** Vaccine contains live attenuated virus. Usually given in combination with measles and mumps vaccine.

## Parainfluenza Virus

**Disease:** Bronchiolitis in infants, croup in young children, and the common cold in adults.

**Characteristics:** Enveloped virus with helical nucleocapsid and one piece of single-stranded, negative-polarity RNA. RNA polymerase in virion.

Unlike influenza viruses, the antigenicity of its hemagglutinin and neuraminidase is stable. There are four serotypes.

**Transmission:** Respiratory droplets.

**Pathogenesis:** Infection and death of respiratory epithelium without systemic spread of the virus. Multinucleated giant cells caused by the viral fusion protein are a hallmark.

**Laboratory Diagnosis:** Isolation of the virus in cell culture is detected by hemadsorption. Im-munofluorescence is used for identification.

A 4-fold or greater rise in antibody titer is diagnostic in primary infections, but the heterotypic response limits its usefulness in repeated infections.

**Treatment:** None.

**Prevention:** No vaccine or drug is available.

### Respiratory Syncytial Virus

**Diseases:** Bronchiolitis and pneumonia in infants. Otitis media in older children.

**Characteristics:** Enveloped virus with a helical nucleocapsid and one piece of single-stranded, negative-polarity RNA. RNA polymerase in virion.

Unlike other paramyxoviruses, it has only a fusion protein in its surface spikes. It has no hemagglutinin.

It has a single serotype.

**Transmission:** Respiratory droplets.

**Pathogenesis:** Infection involves primarily the lower respiratory tract in infants without systemic spread.

Immune response probably contributes to pathogenesis.

**Laboratory Diagnosis:** Isolation in cell culture. Multinucleated giant cells visible. Immunofluorescence is used for identification.

Serology is not useful for diagnosis in infants.

**Treatment:** Aerosolized ribavirin for sick infants.

**Prevention:** No vaccine or prophylactic drug is available.

## **Rabies Virus**

**Disease:** Rabies.

**Characteristics:** Bullet-shaped enveloped virus with a helical nucleocapsid and one piece of single-stranded, negative-polarity RNA.

RNA polymerase in virion. The virus has a single serotype.

**Transmission:** Animal bite, usually by wild animals such as skunks, raccoons, and bats.

In the United States, dogs are infrequently involved, but in developing countries they are often involved.

**Pathogenesis:** Viral receptor is the acetylcholine receptor on the neuron. Replication of virus at the site of the bite, followed by ascension up the nerve to the central nervous system.

After replicating in the brain, the virus migrates peripherally to the salivary glands, where it enters the saliva.

When the animal is in the agitated state as a result of encephalitis, virus in the saliva can be transmitted via a bite.

**Laboratory Diagnosis:** Tissue can be stained with fluorescent antibody or with various dyes to detect inclusions called Negri bodies.

The virus can be isolated in newborn mice, but because this procedure takes 1 or 2 weeks, it cannot be used to determine whether a person should receive the vaccine.

Serologic testing is useful only to make the diagnosis in the clinically ill patient; it does not help the person who has been bitten. It is also used to evaluate the antibody response to the vaccine given before exposure to those in high-risk occupations.

**Treatment:** No antiviral therapy is available.

**Prevention:** Preexposure prevention of rabies consists of the vaccine only.



Postexposure prevention consists of (1) washing the wound; (2) giving immune serum, mostly into the wound; and (3) giving the inactivated vaccine made in human cell culture.

The decision to give the immune serum and the vaccine depends on the circumstances.

Prevention of rabies in dogs and cats by using a killed vaccine has reduced human rabies significantly.

## Human Immunodeficiency Virus

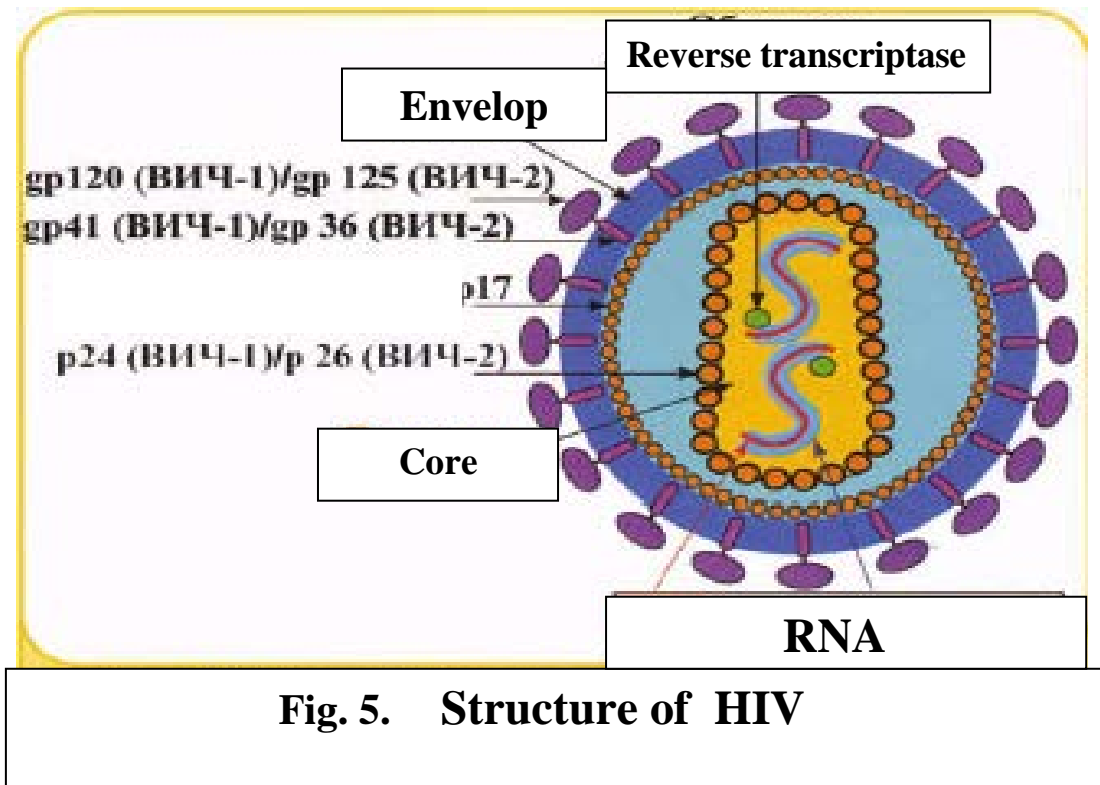
**Disease:** Acquired immunodeficiency syndrome (AIDS).

**Characteristics:** Enveloped virus with two copies (diploid) of a single-stranded, positive-polarity RNA genome. RNA-dependent DNA polymerase (reverse transcriptase) makes a DNA copy of the genome, which integrates into host cell DNA.

Precursor polypeptides must be cleaved by virus-encoded protease to produce functional viral proteins.

The *tat*<sup>1</sup> gene encodes a protein that activates viral transcription.

It is a type D retrovirus (lentivirus). Antigenicity of the gp120 protein changes rapidly; therefore, there are many serotypes. **(Fig. 5).**



**Transmission:** Transfer of body fluids, eg, blood and semen. Also transplacental and perinatal transmission.

**Pathogenesis:** Two receptors are required for HIV to enter cells.

One receptor is CD4 protein found primarily on helper T cells. HIV infects and kills helper T cells, which predisposes to opportunistic infections.

Other cells bearing CD4 proteins on the surface, eg, astrocytes, are infected also. The other receptor for HIV is a chemokine receptor such as CCR5. The NEF protein is an important virulence factor. It reduces class I MHC protein synthesis, thereby reducing the ability of cytotoxic T cells to kill HIV-infected cells.

Cytotoxic T cells are the main host defense against HIV.

**Laboratory Diagnosis:** Virus can be isolated from blood or semen, but this procedure is not routinely available.

Diagnosis is usually made by detecting antibody with ELISA as screening test and Western blot as confirmatory test.

Determine the "viral load", ie, the amount of HIV in the plasma, using PCR-based assays. PCR-based assays can also detect viral RNA in infected cells, which is useful to detect early infections.

**Treatment:** Azidothymidine (AZT), 3TC, d4T, ddI, and ddC inhibit HIV

replication by inhibiting reverse transcriptase. Protease inhibitors, eg, indinavir, prevent cleavage of precursor polypeptides.

Highly active retroviral therapy (HAART) consists of two nucleoside inhibitors and one protease inhibitor. Non-nucleoside inhibitors such as nevirapine are also useful.

Clinical improvement occurs, but the virus persists. Treatment of the opportunistic infection depends on the organism.

**Prevention:** Screening of blood prior to transfusion for the presence of antibody.

"Safe sex," including the use of condoms. AZT with or without a protease inhibitor should be given to HIV-infected mothers and their newborns.

AZT, 3TC, and a protease inhibitor should be given after a needle-stick injury. There is no vaccine.

## Hepatitis C Virus

**Disease:** Hepatitis C; associated with hepatocellular carcinoma.

**Characteristics:** Enveloped virus with one piece of single-stranded, positive-polarity RNA.

No polymerase in virion. HCV has multiple serotypes.

**Transmission:** Most transmission is via blood. Sexual transmission and transmission from mother to child probably occurs as well.

**Pathogenesis:** Hepatocellular injury probably caused by cytotoxic T cells. HCV does not cause a cytopathic effect.

More than 50% of infections result in the chronic carrier state.

The chronic carrier state predisposes to chronic hepatitis and to hepatocellular carcinoma.

**Laboratory Diagnosis:** Serologic testing detects antibody to HCV.

**Treatment:** Alpha interferon mitigates chronic hepatitis but does not eradicate the carrier state.

**Prevention:** Posttransfusion hepatitis can be prevented by detection of antibodies in donated blood. There is no vaccine, and hyperimmune globulins are

not available.

## Hepatitis D Virus

**Disease:** Hepatitis D (delta).

**Characteristics:** Defective virus that uses hepatitis B surface antigen as its protein coat. HDV can replicate only in cells already infected with HBV; ie, HBV is a helper virus for HDV.

Genome is one piece of single-stranded, negative-polarity, circular RNA. No polymerase in virion.

**Transmission:** Transmitted by blood, sexually, and from mother; to child.

**Pathogenesis:** Hepatocellular injury probably caused by cytotoxic T cells. Chronic hepatitis and chronic carrier state occur.

**Laboratory Diagnosis:** Serologic testing detects either delta antigen or antibody to delta antigen.

**Treatment:** Alpha interferon mitigates symptoms but does not eradicate the carrier state.

**Prevention:** Prevention of HBV infection by using the HBV vaccine and the HBV hyperimmune globulins will prevent HDV infection also.

## RNA NONENVELOPED VIRUSES

### Poliovirus

**Diseases:** Paralytic poliomyelitis and aseptic meningitis.

**Characteristics:** Naked nucleocapsid with single-stranded, positive-polarity RNA. No virion polymerase. There are three serotypes.

**Transmission:** Fecal-oral route.

**Pathogenesis:** The virus replicates in the pharynx and the gastrointestinal tract.

It can spread to the local lymph nodes and then through the bloodstream to the central nervous system.

Most infections are asymptomatic or very mild. Aseptic meningitis is more frequent than paralytic polio.

Paralysis is the result of death of motor neurons, especially anterior horn cells in the spinal cord. Pathogenesis of postpolio syndrome is unknown.

**Laboratory Diagnosis:** Recovery of the virus from spinal fluid indicates infection of the central nervous system.

Isolation of the virus from stools indicates infection but not necessarily disease. It can be found in the gastrointestinal tract of asymptomatic carriers.

The virus can be detected in cell culture by CPE and identified by neutralization with type-specific antiserum.

A significant rise in antibody titer in convalescent-phase serum is also diagnostic.

**Treatment:** No antiviral therapy is available.

**Prevention:** Disease can be prevented by both the inactivated (Salk) vaccine and the attenuated (Sabin) vaccine; both induce humoral antibody that neutralizes the virus in the bloodstream.

The oral Sabin vaccine is used for routine childhood immunizations, because it

- (1) induces IgA immunity in the gut, thereby interfering with transmission;
- (2) induces immunity of longer duration; and
- (3) is administered orally.

Current practice in the United States is to give two immunizations of the inactivated vaccine followed by the live, attenuated vaccine.

The inactivated vaccine induces antibodies, which can prevent virulent revertants in the live vaccine from causing paralytic poliomyelitis.

Immune globulins are available but rarely used.

## Coxsackieviruses

**Diseases:** Aseptic meningitis, herpangina, pleurodynia, myocarditis, and pericarditis are the most important diseases.

**Characteristics:** Naked nucleocapsid with single-stranded, positive-polarity RNA. No virion polymerase.

Group A and B viruses are defined by their different pathogenicity in mice. There are multiple serotypes in each group.

**Transmission:** Fecal-oral route.

**Pathogenesis:** The initial site of infection is the oropharynx, but the main site is the gastrointestinal tract. The virus spreads through the bloodstream to various organs.

**Laboratory Diagnosis:** The virus can be detected by CPE in cell culture and identified by neutralization. A significant rise in antibody titer in convalescent-phase serum is diagnostic.

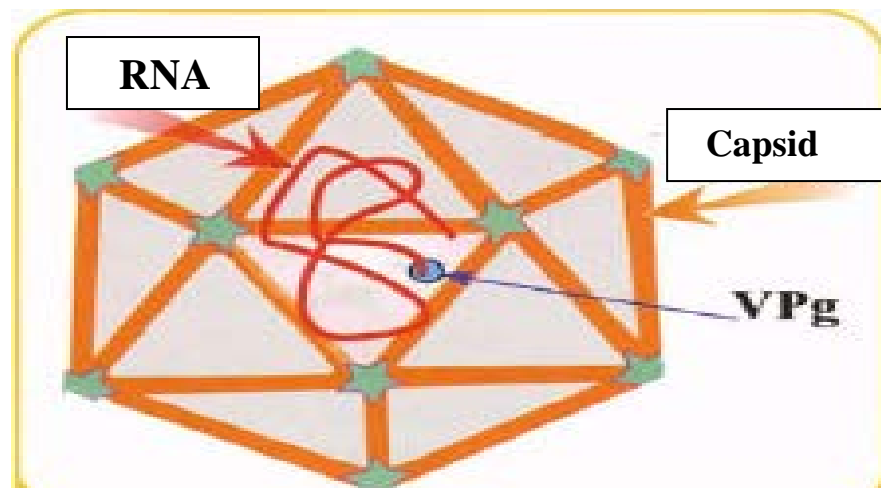
**Treatment:** No antiviral therapy is available.

**Prevention:** No vaccine is available.

## Hepatitis A Virus

**Disease:** Hepatitis A.

**Characteristics:** Naked nucleocapsid virus with a single-stranded, positive-polarity RNA. No virion polymerase. Virus has a single serotype. (Fig. 6).



**Fig. 6. Structure of Hepatitis A Virus**

**Transmission:** Fecal-oral route.

**Pathogenesis:** The virus replicates in the gastrointestinal tract and then spreads to the liver during a brief viremic period.

The virus is not cytopathic for the hepatocyte. Hepatocellular injury is caused by immune attack by cytotoxic T cells.

**Laboratory Diagnosis:** The most useful test is IgM antibody.

Isolation of the virus from clinical specimens is not done.

**Treatment:** No antiviral drug is available.

**Prevention:** Vaccine contains killed virus. Administration of immune globulin during the incubation period can mitigate the disease.

## Rotavirus

**Disease:** Rotavirus causes gastroenteritis (diarrhea), especially in young children.

**Characteristics:** Naked double-layered capsid with 10 or 11 segments of double-stranded RNA.

RNA polymerase in virion. Rotavirus is resistant to stomach acid and hence can reach the small intestine. There are at least six serotypes.

**Transmission:** Rotavirus is transmitted by the fecal-oral route.

**Pathogenesis:** Rotavirus infection is limited to the gastrointestinal tract, especially the small intestine.

**Laboratory Diagnosis:** Detection of rotavirus in the stool by ELISA.

Isolation of the virus is not done from clinical specimens.

**Treatment:** No antiviral drug is available.

**Prevention:** A vaccine containing live, attenuated virus was available but has been withdrawn because of side effects.

## Rhinoviruses

**Disease:** Common cold.

**Characteristics:** Naked nucleocapsid viruses with single-stranded, positive-polarity RNA. No virion polymerase.

There are more than 100 serotypes. Rhinoviruses are destroyed by stomach acid

and do not replicate in the gastrointestinal tract, in contrast to other picornaviruses such as poliovirus, coxsackievirus, and echovirus, which are resistant to stomach acid.

**Transmission:** Aerosol droplets and hand-to-nose contact.

**Pathogenesis:** Infection is limited to the mucosa of the upper respiratory tract and conjunctiva.

The virus replicates best at the low temperatures of the nose and less well at 37 °C, accounting for its failure to infect the lower respiratory tract.

**Laboratory Diagnosis:** Laboratory tests are rarely used clinically.

The virus can be recovered from nose or throat washings by growth in cell culture.

Serologic tests are not useful.

**Treatment:** No antiviral therapy is available.

**Prevention:** No vaccine is available because there are too many serotypes.

## **SLOW DISEASES CAUSED BY PRIONS**

There are five human transmissible spongiform encephalopathies caused by prions: kuru, CJD, variant CJD, Gerstmann-Straiussler-Scheinker syndrome (GSS), and fatal familial insomnia.

**Kuru.** This fatal disease is characterized by progressive tremors and ataxia but not dementia. It occurs only among the Fore tribes in New Guinea. It was transmitted during a ritual in which the skulls of the dead were opened and the brains eaten. It is suspected that transmission occurred through cuts in the skin during preparation rather than by eating the brain, because the women who prepared the brains were affected more frequently than the men who ate them. Since the practice was stopped, kuru has almost disappeared.

The agents of kuru and CJD have been transmitted serially in primates.

**Creutzfeldt-Jakob Disease.** Pathologic examination of the brains of patients with CJD and kuru reveals a spongiform sponge or Swiss-cheese) appearance similar to that associated with scrapie in sheep. The spongiform changes are the result



of neuronal vacuolation and neuronal loss rather than demyelination. No inflammatory cells are seen in the brains. Prions cause scrapie and have been found in the brains of CJD patients; they appear to cause CJD and kuru as well. A variant form of CJD and its relationship to "mad cow" disease. In contrast to kuru, CJD is found sporadically worldwide and affects both sexes. The incidence of sporadic CJD is approximately 1 case per 1 million population, and there is no increased risk associated with dietary habits, occupation, or animal exposure. Vegetarians and meat eaters have the same rate.

The rate of CJD is the same in countries whose animals have scrapie and those whose animals do not. There is no evidence for person-to-person or transplacental transmission. There is no increased risk for medical caregivers; therefore, gowns and masks are unnecessary. The standard precautions for obtaining infectious specimens should be observed. It has been transmitted iatrogenically, eg, in a corneal transplant, via intracerebral electrodes, in hormones extracted from human pituitaries, and in grafts of cadaveric dura mater. There is no evidence of transmission by blood transfusion, and intravenous drug use does not increase the risk.

Proper sterilization of CJD agent-contaminated material consists of either autoclaving or treating with sodium hypochlorite. The main clinical findings of CJD are dementia (including behavioral changes, memory loss, and confusion) and myoclonic jerking. Additional findings include ataxia, aphasia, visual loss, and hemiparesis. The symptoms typically appear gradually and progress inexorably. In the terminal stage, the patient becomes mute and akinetic, then comatose. About 80% of those affected die within 1 year. Most cases occur in people who are 50-70 years of age. A presumptive diagnosis of CJD can be made pathologically by detecting spongiform changes in a brain biopsy specimen. Neuronal loss and gliosis are seen. Amyloid plaques are also seen in some cases of CJD. In variant CJD, "florid" plaques composed of flower-like amyloid plaques surrounded by a halo of vacuoles are seen. Brain imaging and the electroencephalogram may show characteristic changes. There is no evidence of inflammation, ie, no neutrophils or lymphocytes are seen. The blood count and routine spinal fluid test results are normal.

The finding of a normal brain protein called 14-3-3 in the spinal fluid supports the diagnosis. The specific diagnosis of CJD is typically made by

immunohistochemistry in which labeled anti-prion antibodies are used to stain the patient's brain specimen. Because we do not make antibodies to prion proteins, there are no serologic diagnostic tests. (No antibodies are made in humans because humans are tolerant to our prion proteins.) Unlike viruses, prions cannot be grown in culture, so there are no culture-based diagnostic tests. (The antibodies used in the immunohistochemical lab tests are made in other animals in which the human prions are immunogenic.) Tonsillar tissue obtained from patients with variant CJD was positive for prion protein using monoclonal antibody-based assays. The use of tonsillar or other similar lymphoid tissue may obviate the need for a brain biopsy. Pathologic prion proteins have also been detected in the olfactory epithelium of patients with CJD. There is no treatment for CJD, and there is no drug or vaccine available for prevention. Although most cases of CJD are sporadic, about 10% are hereditary. The hereditary (familial) form is inherited as an autosomal dominant trait. In these patients, 12 different point mutations and several insertion mutations in the prion protein gene have been found. One of these, a point mutation in codon 102, is the same mutation found in patients with GSS syndrome, another slow central nervous system disease of humans. The main clinical features of GSS are cerebellar ataxia and spastic paraparesis. The hereditary forms of these diseases may be prevented by the detection of carriers and genetic counseling. The origin of these spongiform encephalopathies is three-fold: infectious, hereditary, and sporadic. The infectious forms are kuru and probably variant CJD. Transmission of the infectious agent was documented by serial passage of brain material from a person with CJD to chimpanzees. The hereditary form is best illustrated by GSS syndrome described above and by a disease called fatal familial insomnia. The term "sporadic" refers to the appearance of the disease in the absence of either an infectious or a hereditary cause. Fatal familial insomnia is a very rare disease characterized by progressive insomnia, dysautonomia (dysfunction of the autonomic nervous system) resulting in various symptoms dementia and death. A specific mutation in the prion protein is found in patients with this disease.

## **SLOW DISEASES OF ANIMALS**

There are three "slow" transmissible diseases of animals that are important models

for human diseases. Scrapie and visna are diseases of sheep, and BSE ("mad cow" disease) is a disease of cattle that appears to have arisen from the ingestion of sheep tissue by the cattle. Visna is caused by a virus, whereas the other two are prion-mediated diseases.

**Scrapie** is a disease of sheep, characterized by tremors, ataxia, and itching, in which the sheep scrape off their wool against fence posts. It has an incubation period of many months. Spongiform degeneration without inflammation is seen in the brain tissue of affected animals. It has been transmitted to mice and other animals via a brain extract that contained no recognizable virus particles.

Studies of mice revealed that the infectivity is associated with a 27,000-molecular-weight protein known as a prion.

Scrapie occurs in sheep in the United States, but neither BSE in cattle nor variant CJD in humans have been seen in the United States (see below).

**Visna** is a disease of sheep that is characterized by pneumonia and demyelinating lesions in the brain. It is caused by visna virus, a member of the lentivirus sub-group of retroviruses. As such, it has a single-stranded, diploid RNA genome and an RNA-dependent DNA polymerase in the virion. It is thought that integration of the DNA provirus into the host cell DNA may be important in the persistence of the virus within the host and, consequently, in its long incubation period and prolonged, progressive course.

**Bovine Spongiform Encephalopathy** A third slow transmissible disease of animals is BSE, also known as "mad cow" disease. The cattle become aggressive, ataxic, and eventually die. Cattle acquire BSE by eating feed supplemented with organs, eg, brains, obtained from sheep infected with scrapie prions. (It is also possible that BSE arose in cattle by a mutation in the gene encoding the prion protein.) BSE is endemic in Great Britain. Supplementation of feed with sheep organs was banned in Great Britain in 1988 and thousands of cattle were destroyed, two measures that have led to a marked decline in the number of new cases of BSE. BSE has been found in cattle in other European countries such as France, Germany, Italy, and Spain, and there is significant concern those countries that variant CJD may emerge in humans. The

first case of BSE in cattle in the United States was reported in December 2003. In 1996, several cases of CJD occurred in Great Britain that are attributed to the ingestion of beef. These cases are a new variant of CJD (vCJD, also called nvCJD) because they occurred in much younger people than usual and had certain clinical and pathologic findings different from those found in the typical form of the disease. None of those affected had consumed cattle or sheep brains, but brain material may have been admixed into processed meats such as sausages.

The prions isolated from the "variant CJD" cases in humans chemically resemble the prions isolated from "mad cow" disease more than they resemble other prions, which is evidence to support the hypothesis that variant CJD originated by eating beef. There is no evidence that eating lamb is associated with variant CJD. As of June 2002, vCJD has killed more than 120 people in Europe, 117 of whom live in Great Britain. It is unknown how many people harbor the pathogenic prion in a latent (asymptomatic) form. No cases of variant CJD have occurred in North America.

The possibility that there may be people who are asymptomatic carriers of the vCJD prion and who could be a source for infection of others, eg, via blood transfusions, has led blood banks in the United States to eliminate from the donor pool people who have lived in Great Britain for more than 6 months.

Chronic Wasting Disease Chronic wasting disease (CWD) of deer and elk is a prion-mediated disease that exists in the United States. Because vCJD is strongly suspected to be transmitted by ingesting meat, there is concern regarding the consequences of eating deer and elk meat (venison).

In 2002, it was reported that neurodegenerative diseases occurred in three men who ate venison in the 1990s. One of these diseases was confirmed as CJD. Whether there is a causal relationship is unclear and surveillance continues.

## **Practical class # 1**

***Theme: Laboratory diagnostic of influenza and parainfluenza.***

### **Question for the learning.**

1. Antiviral immunity. Features of specific protection of organism.
2. Interferon, its properties.

3. Influenza viruses, their properties. Classification and variability, cultivation. Antigenic structure of influenza viruses.
4. Pathogenesis, mechanism of contamination, clinical development of influenza.
5. Role of specific and non specific mechanisms in antinflue immunity.
6. Laboratory diagnostic, specific treatment and prophylaxis of influenza.
7. Parainfluenza viruses, main properties, cultivation.
8. Pathogenesis and clinical manifestation, immunity.
9. Laboratory diagnostic, treatment of parainfluenza.

***Independent work.***

**1. Draw the structure of the influenza virus.**

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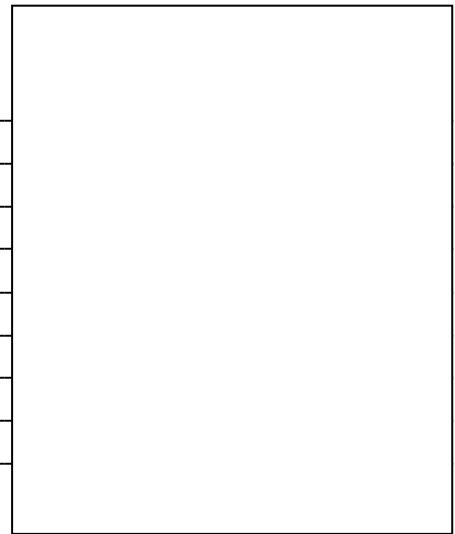
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**2. Name taxonomy of the influenza virus and parainfluenza virus.**

	<b>Influenza</b>	<b>Parainfluenza</b>
<b>Family</b>		
<b>Genus</b>		

**3. Name morphological properties of the influenza virus and parainfluenza virus.**

	<b>Influenza</b>	<b>Parainfluenza</b>
<b>Genome</b>		
<b>Shape</b>		
<b>Size of virion</b>		
<b>Site of synthesis of</b>		

<b>ribonucleoprotein</b>		
<b>Antigenic stability</b>		

**4. Name antigens of the influenza virus.**\_\_\_\_\_

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**5. Explain the terms “Antigenic drift” and “Antigenic shift”.**

*Antigenic drift*\_\_\_\_\_

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*Antigenic shift*\_\_\_\_\_

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**6. Fill in the table.**

**Virological investigations of influenza and parainfluenza.**

	<b>Specimens</b>	<b>Object for cultivation of the virus</b>	<b>Indication of the virus</b>	<b>Identification of the virus</b>
<b>Influenza</b>				
<b>Parainfluenza</b>				

**7. Enumerate biological preparations for treatment of influenza and parainfluenza.**

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**8. Enumerate biological preparations for specific prophylaxis of influenza and parainfluenza.**

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**9. Name peculiarity of the antiviral immunity.**

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**10. Enumerate non specific factors of antiviral immunity and give examples.**

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**11. Enumerate specific factors of antiviral immunity .**

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**12. What is the interferon? Its main properties.**

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## **Practical class # 2**

*Theme: Laboratory diagnostic of acute respiratory virus infections (adenovirus, rhinovirus, reovirus, respiratory-syncytial virus).*

### **Question for the learning.**

1. Adenoviruses and their characteristics. Mechanism of infection, pathogenesis, immunity. Laboratory diagnostic and specific prophylaxis.

2. Rhinoviruses, their characteristic.
3. Reoviruses, their characteristic.
4. Respiratory-syncytial viruses, their characteristic.

***Independent work.***

**1. Name taxonomy of the adenovirus, rhinovirus, respiratory-syncytial virus.**

	<b>Adenovirus</b>	<b>Rhinovirus</b>	<b>Respiratory-syncytial virus</b>
<b>Family</b>			
<b>Genus</b>			

**2. Name morphological properties of the adenovirus, rhinovirus, respiratory-syncytial virus infections.**

	<b>Adenovirus</b>	<b>Rhinovirus</b>	<b>Respiratory-syncytial virus</b>
<b>Genome</b>			
<b>Shape</b>			
<b>Size of virion</b>			
<b>Site of synthesis of ribonucleoprotein</b>			
<b>Antigenic stability</b>			

**3. Name antigens of the adenovirus.** \_\_\_\_\_

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**4. Name antigens of the rhinovirus.**

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**5. Name antigens of the respiratory-syncytial virus.**

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**6. Fill in the table.**

**Virological investigations of the adenovirus, rhinovirus, respiratory-syncytial virus infections.**

	Specimens	Object for cultivation of the virus	Indication of the virus	Identification of the virus
<b>Adenovirus infection</b>				
<b>Rhinovirus infection</b>				
<b>Respiratory-syncytial virus infection</b>				

**7. Enumerate biological preparations for treatment of the adenovirus, rhinovirus, respiratory-syncytial virus infections.**

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**8. Enumerate biological preparations for specific prophylaxis of the adenovirus, rhinovirus, respiratory-syncytial virus infections.**

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### Practical class # 3

**Theme: Laboratory diagnostic of measles, mumps and rubella.**

**Question for the learning.**

1. Measles virus. Main biological properties, cultivation. Pathogenesis and clinical manifestation, immunity. Laboratory diagnostic, specific prophylaxis.
2. Mumps virus. Main properties, cultivation. Pathogenesis and clinical manifestation, immunity. Laboratory diagnostic, specific prophylaxis of mumps.
3. Rubivirus. Main properties, cultivation. Pathogenesis and clinical manifestation, immunity. Laboratory diagnostic, specific prophylaxis of rubella.

**Independent work.**

1. Name taxonomy of the measles, mumps and rubella viruses .

	Measles virus	Mumps virus	Rubella virus
Family			
Genus			

2. Name morphological properties of the measles, mumps and rubella viruses .

	Measles virus	Mumps virus	Rubella virus
Genome			
Shape			
Size of virion			
Site of synthesis of ribonucleoprotein			
Antigenic stability			

3. Name antigens of the measles virus.

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**4. Name antigens of the mumps virus.**

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**5. Name antigens of the rubella virus.**

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**6. Fill in the table.**

**Virological investigations of the measles, mumps and rubella.**

	<b>Specimens</b>	<b>Object for cultivation of the virus</b>	<b>Indication of the virus</b>	<b>Identification of the virus</b>
<b>Measles</b>				
<b>Mumps</b>				
<b>Rubella</b>				

**7. Enumerate biological preparations for treatment of the measles, mumps and rubella viruses infections.**

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**8. Enumerate biological preparations for specific prophylaxis of the measles, mumps and rubella viruses infections.**

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**Practical class # 4**

***Theme:* Laboratory diagnostic of smallpox, chickenpox (varicella), herpes simplex, zoster.**

**Question for the learning.**

1. Smallpox viruses, their characteristic. Mechanism of infection. Pathogenesis, immunity. Laboratory diagnostic and specific prophylaxis. Liquidation of smallpox all over the world.
2. Herpesviruses. Characteristic, cultivation. Pathogenesis, clinical manifestation, immunity. Laboratory diagnostic, treatment and prophylaxis.
3. Virus of the chicken pox (varicella) and zoster. Characteristic, cultivation. Pathogenesis, clinical manifestation, immunity. Laboratory diagnostic, treatment and prophylaxis.

***Independent work.***

**1. Name taxonomy of the smallpox, chickenpox, herpes simplex, zoster viruses .**

	<b>Smallpox virus</b>	<b>Herpes simplex virus</b>	<b>Chickenpox virus</b>	<b>Zoster virus</b>
<b>Family</b>				
<b>Genus</b>				

**2. Name morphological properties of the smallpox, chickenpox, herpes simplex, zoster viruses .**

	<b>Smallpox virus</b>	<b>Herpes simplex virus</b>	<b>Chickenpox virus</b>	<b>Zoster virus</b>
<b>Genome</b>				
<b>Shape</b>				
<b>Size of virion</b>				
<b>Site of synthesis of ribonucleoprotein</b>				
<b>Antigenic stability</b>				

**3. Name antigens of the Smallpox virus.**

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**4. Name antigens of the Herpes simplex virus.**

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**5. Name antigens of the Chickenpox and Zoster viruses.**

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**5. Fill in the table.**

**Virological investigations of the smallpox, chickenpox (varicella), herpes simplex, zoster.**

	<b>Specimens</b>	<b>Object for cultivation of the virus</b>	<b>Indication of the virus</b>	<b>Identification of the virus</b>
<b>Smallpox</b>				

<b>Chickenpox (varicella)</b>				
<b>Herpes simplex</b>				
<b>Zoster</b>				

**7. Enumerate biological preparations for treatment of the smallpox, chickenpox (varicella), herpes simplex, zoster.**

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**8. Enumerate biological preparations for specific prophylaxis of the smallpox, chickenpox (varicella), herpes simplex, zoster.**

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**9. Fill in the table.**

## Classification of human herpesviruses

Species		Subfamily	Cytopathology	Site of latent infection
Official name	Common name			

### Practical class # 5

***Theme: Laboratory diagnostic of poliomyelitis, Coxsackie, ECHO.***

**Question for the learning.**

1. Picornoviruses. Viruses of poliomyelitis, their properties, classification. Pathogenesis, clinical manifestation, immunity. Laboratory diagnostic, treatment and prophylaxis.
2. Viruses of Coxsackie and ECHO, their properties. Pathogenesis. Laboratory diagnostic, treatment and prophylaxis.

***Independent work.***

- 1. Name taxonomy of the viruses of poliomyelitis, Coxsackie, ECHO.**

	<b>Poliovirus</b>	<b>Coxsackie virus</b>	<b>ECHO virus</b>

<b>Family</b>			
<b>Genus</b>			

**2. Name morphological properties of the viruses of poliomyelitis, Coxsackie, ECHO.**

	<b>Poliovirus</b>	<b>Coxsackie virus</b>	<b>ECHO virus</b>
<b>Genome</b>			
<b>Shape</b>			
<b>Size of virion</b>			
<b>Site of synthesis of ribonucleoprotein</b>			
<b>Type of symmetry</b>			

**3. Name antigens of the poliovirus.**

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**4. Name antigens of the coxsackie virus.**

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**5. Name antigens of the ECHO virus.**

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**6. Fill in the table.**

**Virological investigations of poliomyelitis, Coxsackie, ECHO .**

	<b>Specimens</b>	<b>Object for cultivation of the virus</b>	<b>Indication of the virus</b>	<b>Identification of the virus</b>
<b>Poliomyelitis</b>				



<b>Coxsackie</b>				
<b>ECHO</b>				

**7. Enumerate biological preparations for treatment of poliomyelitis, Coxsackie, ECHO.**

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**8. Enumerate biological preparations for specific prophylaxis of poliomyelitis, Coxsackie, ECHO.**

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**10.Fill in the table.**

**Clinical features of poliomyelitis, Coxsackie, ECHO .**

<b>Poliomyelitis</b>	<b>Coxsackie</b>	<b>ECHO</b>


**Practical class # 6**

***Theme: Laboratory diagnostic of hepatitis A, B, C, D, E, G, F.***

**Question for the learning.**

1. Hepatitis viruses. Hepatitis A, B, C, D, E, G. Biological characteristic of viruses. Sources of infections, mechanism of transmission. Pathogenesis and clinical manifestations. Laboratory diagnostic. Treatment and specific prophylaxis.

***Independent work.***

**1. Name taxonomy of the viruses of hepatitis A, B, C, D, E, G, F.**

**2.**

	Hepatitis A	Hepatitis B	Hepatitis C	Hepatitis D	Hepatitis E	Hepatitis F	Hepatitis G
<b>Family</b>							
<b>Genus</b>							

**3. Name morphological properties of the viruses of hepatitis A, B, C, D, E, G, F.**

	Hepatitis A	Hepatitis B	Hepatitis C	Hepatitis D	Hepatitis E	Hepatitis F	Hepatitis G
<b>Genome</b>							
<b>Shape</b>							
<b>Size of virion</b>							
<b>Antigenic stability</b>							
<b>Type of symmetry</b>							

**3a. Draw the structure of Hepatitis B virus .**


**4. Fill in the table.**

**Virological investigations of hepatitis A, B, C, D, E, G, F.**

	<b>Specimens</b>	<b>Object for cultivation of the virus</b>	<b>Indication of the virus</b>	<b>Identification of the virus</b>
<b>Hepatitis A</b>				
<b>Hepatitis B</b>				
<b>Hepatitis C</b>				
<b>Hepatitis D</b>				
<b>Hepatitis E</b>				
<b>Hepatitis F</b>				
<b>Hepatitis G</b>				

**4. Fill in the table.**

	Source of infection	Transmission of infection
Hepatitis A		
Hepatitis B		
Hepatitis C		
Hepatitis D		
Hepatitis E		
Hepatitis F		
Hepatitis G		

**6. Enumerate biological preparations for treatment of hepatitis A, B, C, D, E, G, F.**

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**7. Enumerate biological preparations for specific prophylaxis of hepatitis and give characteristic them.**

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**8. Name peculiarity of the morphological structure and reproduction of the Hepatitis D virus.**

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**Practical class # 7**

**Theme: Laboratory diagnostic of rabies, encephalitis, hemorrhagic fevers.**

**Question for the learning.**

1. Rabies virus, their properties, cultivation. Mechanism of man's infection and pathogenesis. Laboratory diagnostic of rabies. Antirabic immunoglobulin and vaccine. Pasteur's merits in creation of antirabic vaccine.
2. Infections, caused by arthropod borne viruses (encephalitis).

3. Morphology, antigenic structure of viruses.
4. Virus of hemorrhagic and yellow fevers.

***Independent work.***

**1. Name taxonomy of the viruses of rabies, encephalitis, hemorrhagic fevers.**

	<b>Rabies</b>	<b>Encephalitis</b>	<b>Hemorrhagic fevers</b>
<b>Family</b>			
<b>Genus</b>			

**2. Name morphological properties of the viruses of rabies, encephalitis, hemorrhagic fevers.**

	<b>Rabies</b>	<b>Encephalitis</b>	<b>Hemorrhagic fevers</b>
<b>Genome</b>			
<b>Shape</b>			
<b>Size of virion</b>			
<b>Site of synthesis of ribonucleoprotein</b>			
<b>Antigenic stability</b>			

**4. Fill in the table.**

**Clinical features of rabies, encephalitis, hemorrhagic fevers.**

<b>Rabies</b>	<b>Encephalitis</b>	<b>Hemorrhagic fevers</b>

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**5. Fill in the table.**

**Virological investigations of rabies, encephalitis, hemorrhagic fevers.**

	<b>Specimens</b>	<b>Object for cultivation of the virus</b>	<b>Indication of the virus</b>	<b>Identification of the virus</b>
<b>Rabies</b>				
<b>Encephalitis</b>				
<b>Hemorrhagic fevers</b>				

**5. Enumerate biological preparations for treatment of rabies.**

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**6. Enumerate biological preparations for specific prophylaxis of rabies.**

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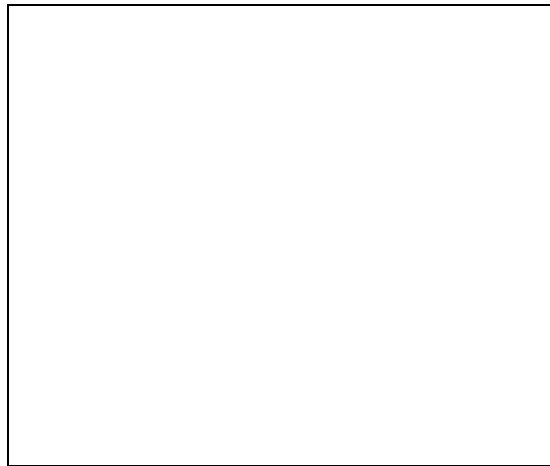


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**7. Draw inclusion bodies.**

**Negri bodies in the cytoplasm of neurons in rabid dog brain.**

**Mann's stain.**



**8. Fill in the table.**

**Arboviruses associated with different clinical syndromes**

<b>Virus</b>	<b>Distribution</b>	<b>Vector</b>	<b>Reservoir</b>
<b>E n c e p h a l i t i s</b>			
<b>Eastern equine encephalitis</b>			
<b>Western equine encephalitis</b>			
<b>St. Louis encephalitis</b>			
<b>Murray Valley encephalitis</b>			
<b>Japanese encephalitis</b>			
<b>H e m o r r h a g i c F e v e r</b>			
<b>Yellow fever</b>			
<b>Omsk hemorrhagic fever</b>			

<b>Hemorrhagic fever</b>			
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**9. Enumerate biological preparations for treatment of encephalitis, hemorrhagic fevers.**

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**10. Enumerate biological preparations for specific prophylaxis of encephalitis, hemorrhagic fevers.**

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**Practical class # 8**

***Theme: Laboratory diagnostic of HIV-infection. AIDS. Oncogenic viruses.***

**Questions for the learning.**

1. Viruses of immunodeficiency. HIV-infection and AIDS. Mechanism of transmission, clinical manifestations, pathogenesis.

Laboratory diagnostic of disease. Treatment and prophylaxis. Prospects of specific prophylaxis and treatment.

2. Oncogenic viruses, general characteristic, classification. Mechanism of viral carcinogenesis.

Virusogenetic theory of oncogenesis. Works by Zilber in questions of development of doctrine on role of viruses in occurrence of new formations.

***Independent work.***

**1. Decipher HIV** \_\_\_\_\_

**2. Decipher AIDS** \_\_\_\_\_



**3. Draw the structure of HIV.**

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**4. Name taxonomy of HIV.**

	<b>H I V</b>
<b>Family</b>	
<b>Genus</b>	

**5. Name morphological properties of HIV.**

	<b>H I V</b>
<b>Genome</b>	
<b>Shape</b>	
<b>Size of virion</b>	
<b>Site of synthesis of ribonucleoprotein</b>	
<b>Type of symmetry</b>	

**6. Name major antigens of HIV.**

**Major antigens of HIV**

**A.** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**B.** \_\_\_\_\_

\_\_\_\_\_

**C.** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**D.** \_\_\_\_\_

\_\_\_\_\_



**12. Fill in the table.**

**Virological investigations of AIDS.**

<b>Specific tests for HIV infections</b>	<b>Laboratory tests for detection of specific antibodies in HIV infections</b>

**13. Name the classification of oncogenic viruses and oncogenic diseases.**

# \_\_\_\_\_  
\_\_\_\_\_

# \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## Quizzes

**1. In addition to acute respiratory diseases, adenoviruses also cause:**

- A. Tumors in humans
- B. Otitis media
- C. Diabetes
- D. Acute diarrhea in children
- E. Gastric ulcers

**2. The main method of virological diagnostics of influenza is isolation a virus on tissue cellular culture. The presence of the virus in considered according to its specific effect on the cell. How do they call it?**

- A. Hemagglutination phenomenon
- B. Hemagglutination inhibition test
- C. Cytopathogenic effect
- D. Hemadsorption phenomenon
- E. Neutralization test

**3. The smears – imprints were taken from inferior concha of a patient with the symptoms of influenza. An orange luminescence was observed in the cells after working up acridin orange. What method of study was used?**

- A. Reaction of direct immunofluorescence
- B. Reaction of indirect immunofluorescence
- C. Reaction of luminescence
- D. Morosov staining

E. Hemagglutination test

**4. What reaction did a virologist use to reveal antibodies in the serum of a patient with the grippe?**

A. Hemagglutination inhibition test

B. Vidal's test

C. ELISA

D. Wasserman's test

E. Hemagglutination test

**5. While studying the smears – imprints from inferior concha of a patient with the grippe, a doctor identified the grippe virus. What method the doctor used?**

A. Hemagglutination test

B. Reaction of luminescence

C. Reaction of immunofluorescence

D. Neisser staining

E. Gram staining

**6. Each of the following statements concerning adenoviruses is correct, EXCEPT:**

A. Adenoviruses are composed of a double-stranded DNA genome and a capsid

B. Adenoviruses cause both a sore throat and pneumonia

C. Adenoviruses have only one serological variant

D. Adenoviruses are thought to cause tumor in animals but not humans

E. Adenoviruses can cause conjunctivitis

**7. Doctor has diagnosed that the patient has influenza. To which family does influenza virus belong to?**

A. Paramyxoviridae

B. Orthomyxoviridae

C. Picornaviridae

D. Retroviridae

E. Herpesviridae

**8. Which one of the following clinical state is LEAST likely to be caused by adenoviruses?**

- A. Pharyngitis
- B. Glomerulonephritis
- C. Pneumonia
- D. Gastroenteritis
- E. Conjunctivitis

**9. Which vaccine can be used for specific prevention of influenza?**

- A. MMR
- B. "Ruvax"
- C. BCG
- D. "Pryorix"
- E. "Influvac"

**10. Which pharmacological agent is prescribed for non – specific treatment of influenza?**

- A. Penicillin
- B. Interferon
- C. Diagnostic
- D. Serum
- E. Vaccine

**11. Which immune – biological preparation is prescribed for specific prevention of influenza?**

- A. Penicillin
- B. Interferon
- C. Diagnostic
- D. Serum
- E. Vaccine

**12. Individuals vaccinated with the HBsAg vaccine would be protected from infection by:**

- A. Hepatitis A virus only

- B. Hepatitis B virus only
- C. Hepatitis C virus only
- D. Hepatitis D virus only
- E. Hepatitis B and delta viruses

**13. Adenovirus is:**

- A. Nonenveloped virus with single-stranded DNA
- B. Enveloped virus with double-stranded DNA
- C. Nonenveloped virus with segmented double-stranded RNA
- D. Nonenveloped virus with double-stranded linear DNA
- E. Enveloped virus with positive polarity RNA

**14. All of the following are true about Hepatitis C virus EXCEPT:**

- A. Is an RNA virus
- B. contain an envelope
- C. may cause chronic liver damage
- D. it is defective
- E. it is primary cause of transfusion associated hepatitis

**15. Which one of the following viruses contains a partially double-stranded DNA?**

- A. Hepatitis C
- B. Hepatitis B
- C. Enterovirus 72
- D. Hepatitis D
- E. Coxsackievirus

**16. Each of the following statements concerning hepatitis E virus is correct, EXCEPT:**

- A. The initial site of viral replication is gastro-intestinal tract
- B. It causes more severe disease in pregnant women
- C. It is oncogenic and can cause hepatocellular carcinoma
- D. It is transmitted by fecal-oral route
- E. It is naked RNA virus

**17. Incidence of AIDS transmission from infective to non-infective partner is more with:**

- A. Homosexual partners
- B. No risk of heterosexual transmission
- C. From a male to a female partner increased
- D. Equal risk to both risk
- E. From a female to a male partner increased risk

**18. Each of the following statements concerning rabies vaccine is correct, EXCEPT:**

- A. The vaccine contains whole-killed virions
- B. The vaccine is monovalent
- C. The vaccine is used for post exposure prophylaxis
- D. The vaccine contains live attenuated virus
- E. It is usually used in combination with passive immunization

**19. What is not true about both rabies and influenza viruses?**

- A. They are usually transmitted by respiratory route
- B. Their virions contain RNA polymerase
- C. They are enveloped viruses
- D. They both have a negative-sense RNA
- E. Killed vaccines are available for both viruses

**20. Which one of the following viruses causes encephalitis, but killed inactivated vaccine is available for post exposure prophylaxis?**

- A. Herpes simplex virus tipple
- B. Measles virus
- C. Varicella-zoster virus
- D. Mumps virus
- E. Rabies virus

**21. In which component of adenovirus the hemagglutinin is found?**

- A. The core
- B. The DNA protein



- C. The hexon
- D. The M protein
- E. The penton with fiber

**22. Each of the following statements concerning rabies virus and its replicative cycle is correct, EXCEPT:**

- A. The virus has positive-sense RNA which is infectious
- B. The assembled virions release by budding
- C. The virions contains RNA-dependent RNA polymerase to start mRNA transcription
- D. Reproduction of the virus occurs in cytoplasm
- E. The virus has lipoprotein envelope embedded with viral-specific G proteins

**23. Mail hunters were attacked by a fox and got several scratches and bites on their hands and legs. They failed to catch or shoot the animal. What should be done as a post exposure prophylaxis?**

- A. Clean wounds with soap and give antibiotic treatment
- B. Wash wounds with detergent and inject rabies immune globin
- C. Try to catch an animal to check whether it is rabid or not
- D. Use human rabies immune serum and human diploid cell vaccine for immunization
- E. Give active immunization with human diploid cell vaccine

**24. Infection with herpes simplex virus, a common human pathogen, is best described by which of the following statements?**

- A. The CNS and visceral organs are usually involved
- B. It rarely recurs in a host who has a high antibody titer
- C. It can be reactivated by emotional disturbances or prolonged exposure to sunlight
- D. Initial infection usually occurs by intestinal absorption of the virus
- E. Infection with type 1 virus is most common

**25. The latest and most effective therapy for AIDS patients includes azidothymidine (AZT), dideoxyinosine (DDI), and saquinavir or similar**

**agents. Which of the following viral processes would using of these three drugs inhibit?**

- A. RNase, DNase
- B. gp120 formation
- C. p24 antibody expression
- D. All membrane synthesis
- E. Reverse transcriptase, protease

**26. Infectious mononucleosis, a viral disorder that can be debilitating, is characterized by which of the following statements?**

- A. It is most prevalent in children less than 14 years old
- B. It is caused by a rhabdovirus
- C. The causative pathogen is an Epstein-Barr virus
- D. Affected persons respond to treatment with the production of heterophil antibodies
- E. Ribavirin is the treatment of choice

**27. Which one of the following statements best describes interferon's suspected mode of action in producing resistance to viral infection?**

- A. It stimulates a cell-mediated immunity
- B. It stimulates humoral immunity
- C. Its direct antiviral action is related to the suppression of messenger RNA formation
- D. Its action is related to the synthesis of a protein that inhibits translation or transcription
- E. It alters the permeability of the cell membrane so that viruses cannot enter the cell

**28. Delta hepatitis only occurs in patients who also have either acute or chronic infection with hepatitis B virus. The delta agent is:**

- A. An incomplete hepatitis B virus
- B. Related to hepatitis A virus
- C. A hepatitis B mutant

D. An incomplete RNA virus

E. Hepatitis C

**29. Mumps virus accounts for 10 to 15% of all cases of aseptic meningitis in the United States. Infection with mumps virus:**

A. Is apt to recur periodically in many affected persons

B. Will usually cause mumps orchitis in post pubertal males

C. Is maintained in a large canine reservoir

D. Usually produces severe systemic manifestations

E. Is preventable by immunization

**30. A 3-year-old child presents at the physician's office with symptoms of coryza, conjunctivitis, low-grade fever, and Koplik's spots. The causative agent of this disease belongs to which group of viruses?**

A. Adenovirus

B. Herpes virus

C. Picornaviruses

D. Orthomyxoviruses

E. Paramyxovirus

**31. Which of the following congenital abnormalities is/are seen in infants born to women infected with rubella?**

A. Neurosensory deafness

B. Congenital heart disease

C. Retinopathy

D. Hepatosplenomegaly

E. All of the above

**32. Which family does contain rubella virus?**

A. Paramyxovirus family

B. Togavirus family

C. Paramyxovirus family

D. Togavirus family

E. Togavirus family

**33. One of the most common sexually transmitted diseases that may lead to cervical carcinoma is caused by which of the following viruses?**

- A. Cytomegalovirus
- B. Papillomavirus
- C. Epstein-Barr virus
- D. Herpes simplex virus
- E. Adenovirus

**34. Hepatitis E, a recently characterized hepatitis virus, is best described by which of the following statements?**

- A. It is not a threat to the blood supply
- B. It is a major cause of blood-borne hepatitis
- C. It is prevalent in North America
- D. It is a single-stranded DNA virus
- E. The disease resembles hepatitis C

**35. Infection with hepatitis D virus (HDV; delta agent) can occur simultaneously with infection with hepatitis B virus (HBV) or in a carrier of hepatitis B virus because HDV is a defective virus that requires HBV for its replicative function. What serologic test can be used to determine whether a patient with HDV is an HBV carrier?**

- A. HBsAg
- B. HBc IgM
- C. HBeAg
- D. HBs IgM
- E. HBs IgG

**36. Adults who have had varicella as children occasionally suffer a recurrent form of the disease, shingles. The agent causing these diseases is a member of which of the following viral families?**

- A. Herpes virus
- B. Poxvirus
- C. Adenovirus

D. Myxovirus

E. Paramyxovirus

**37. Rhinovirus is primarily transmitted by:**

A. Droplet aerosolization

B. Sexual activity

C. Fecal-oral route

D. Vomits

E. Vertical transmission from mother to child

**38. The presence of Negri inclusion bodies in host cells is characteristic of...**

A. Mumps

B. Infectious mononucleosis

C. Congenital rubella

D. Aseptic meningitis

E. Rabies

**39. What rapid method of diagnostics of rubella did a virologist use?**

A. Immunofluorescence test

B. Hemagglutination inhibition test

C. Citopathogenic effect

D. Hemagglutination phenomenon

E. Neutralisation test

**40. According to recommendations issued by the U.S. Public Health Service, which of the following statements regarding vaccination against smallpox is true?**

A. Pregnant women should be vaccinated in the first trimester

B. Persons who have eczema should be vaccinated soon after diagnosis

C. Persons who have immune deficiencies should be vaccinated every 5 years

D. Persons traveling abroad need not be vaccinated

E. Children should be vaccinated before they begin school

**41. Hepatitis D virus (delta agent) is a defective virus that can replicate only in cells already infected with which of the following viruses?**

- A. Hepatitis A virus
- B. Epstein-Barr virus
- C. Hepatitis G virus
- D. Hepatitis B virus
- E. HIV

**42. A patient presents with keratoconjunctivitis. The differential diagnosis should include infection with which of the following viruses?**

- A. Parvovirus
- B. Adenovirus
- C. Epstein-Barr virus
- D. Respiratory syncytial virus
- E. Varicella-zoster virus

**43. A hospital worker is found to have hepatitis B surface antigen. Subsequent tests reveal the presence of e antigen as well. The worker most likely:**

- A. Is infective and has active hepatitis
- B. Is infective but does not have active hepatitis
- C. Is not infective
- D. Is evincing a biologic false-positive test for hepatitis
- E. Has both hepatitis B and C

**44. An immunocompromised person with history of seizures had an MRI that revealed a temporal lobe lesion. Brain biopsy results showed multinucleated giant cells with intranuclear inclusions. The most probable cause of the lesion is**

- A. Hepatitis C virus
- B. Herpes simplex virus
- C. *Listeria monocytogenes*
- D. Coxsackievirus
- E. Parvovirus

**45. Which of the following procedures or clinical signs is most specific for the diagnosis of infectious mononucleosis caused by the Epstein-Barr virus?**

- A. Laboratory diagnosis is based on the presence of “atypical lymphocytes” and EBV-specific antibody
- B. Growth in tissue culture cells
- C. Heterophil antibodies in serum
- D. Lymphadenopathy and splenomegaly on physical examination
- E. B-cell lymphocyte proliferation

**46. This is a double-stranded DNA virus. It is responsible for 15% of pediatric respiratory infections and 10 to 15% of acute diarrhea in children.**

- A. Measles virus
- B. Influenza virus
- C. Respiratory syncytial virus
- D. Parainfluenza virus
- E. Adenovirus

**47. This virus is a single-stranded RNA paramyxovirus. The rash known as Koplik’s spots is pathognomonic.**

- A. Measles virus
- B. Influenza virus
- C. Respiratory syncytial virus
- D. Parainfluenza virus
- E. Adenovirus

**48. Poliovirus is:**

- A. Non enveloped virus with single-stranded DNA
- B. Enveloped viruses with double-stranded DNA
- C. Non enveloped virus with segmented double-stranded RNA
- D. Enveloped virus with positive RNA
- E. Non enveloped virus with single-stranded DNA

**49. This virus is a single-stranded RNA Orthomyxovirus. Annual vaccination is necessary because of antigenic drift and shift.**

- A. Measles virus
- B. Influenza virus

- C. Respiratory syncytial virus
- D. Parainfluenza virus
- E. Adenovirus

**50. This hepatitis virus is a calicivirus. The reservoir is in pigs, and humans acquire it via the fecal-oral route.**

- A. Hepatitis A
- B. Hepatitis B
- C. Hepatitis C
- D. Hepatitis D
- E. Hepatitis E

**51. This virus belongs to the family of Flavi viruses and its reservoir is strictly human. Transmission is blood-borne so the blood supply is routinely screened for this virus.**

- A. Hepatitis A
- B. Hepatitis B
- C. Hepatitis C
- D. Hepatitis D
- E. Hepatitis E

**52. In the kinder garden, there was a case of measles. Which preparation for the specific prevention should be taken?**

- A. Serum
- B. Vaccine
- C. Gamma globulin
- D. Diagnostic
- E. Antibiotic

**53. Measles is highly contagious infection among children. What is the main mechanism of transmission?**

- A. Aerogenic
- B. Fecal-oral
- C. Transplacental



- D. Direct
- E. Indirect

**54. 1 year old infants are vaccinated against measles. What kind of vaccine is used for it?**

- A. Live vaccine
- B. Bacterial vaccine
- C. Killed vaccine
- D. Chemical vaccine
- E. Ana toxin

**55. Which one of the following strategies will induce lasting mucosal immunity to poliovirus?**

- A. Parental administration of poliovirus immune globin
- B. Oral administration of poliovirus immune globin
- C. Parenteral vaccination with live vaccine
- D. Oral vaccination with live vaccine
- E. Intramuscular vaccination with inactivated vaccine

**56. A virologist revealed Babesh – Negri bodies in the smears – imprints of the mad dog's brain. What coloring method was used?**

- A. According Gram
- B. According Morosov
- C. According Romanowsky - Giemsa
- D. According Ziehl - Nielsen
- E. According Neisser

**57. Blood analysis of a patient showed signs of HIV infection (human immunodeficiency virus). Which cells does HIV-virus primarily attack?**

- A. Cells that contain receptor IgM (B-lymphocytes)
- B. Cells that contain receptor CD4 (T-helpers)
- C. Mast cells
- D. Specialized nervous cells (neurons)
- E. Prolifediting cells (stem hematoplastic cells)

**58. The donor who didn't donate the blood for a long time was investigated with IFA method. Anti - Hbs - antibodies were revealed. What does positive result of IFA in this case mean?**

- A. Acute hepatitis C
- B. Chronic hepatitis C
- C. Chronic hepatitis B
- D. Previous hepatitis B
- E. Acute hepatitis B

**59. Viruses containing DNA are included in family:**

- A. Paramyxoviridae
- B. Orthomyxoviridae
- C. Picornaviridae
- D. Retroviridae
- E. Herpesviridae

**60. A virologist revealed Guarnieri bodies in the smears – imprints. What is doctor's diagnosis?**

- A. Influenza
- B. Mumps
- C. Hepatitis
- D. Smallpox
- E. Measles

**61. Identify the true statement cited below concerning the Sabin (live) polio vaccine.**

- A. Infectious progeny virus cannot be disseminated from the vaccinated individual.
- B. The vaccine confers humoral and intestinal immunity.
- C. Induction of lifelong immunity is not possible.
- D. It can be given to immunodeficient individuals without reservation.
- E. It is administered parenterally.

**62. Chicken's embryo was infected to isolate a virus of smallpox in a virological laboratory. In this case, where should the examined material be**

**traced on?**

- A. In chorionallontoic membrane
- B. In amniotic cavity
- C. In yolk sac
- D. In shell membrane
- E. In allantoic cavity

**63. A 6-year-old boy was bitten by a dog about the face and neck. What strategy will be used for immunization?**

- A. Use hyper immune serum and active immunization
- B. Use hyper immune serum only
- C. Use active immunization only
- D. Use active immunization, than check if adequate antibody titers will be produced; if the level is low use hyper immune serum
- E. All strategies can be use for post exposure immunization

**64. Choose among listed viruses which are not enteroviruses:**

- A. Coxsackieviruses
- B. Echoviruses
- C. Hepatitis A virus
- D. Polioviruses I
- E. Polioviruses II

**65. Which one of the following vaccines could safely be given to an immunocompromised individual?**

- A. Mumps
- B. IPV (Salk)
- C. Measles
- D. OPV (Sabin)
- E. Rubella

**66. Which of the statement concerning epidemiology of arbovirus infections is NOT correct?**

- A. Alpha virus equine encephalitis is mosquito-borne

- B. Arboviruses have wide host range
- C. Bunya virus Crimean-Congo hemorrhagic fever is tick-borne
- D. Hantavirus hemorrhagic fever with renal syndrome and pulmonary syndrome is tick born
- E. Arboviruses cause typical zoonotic diseases

**67. Which of the following viruses is primarily transmitted by the fecal-oral route?**

- A. St. Louis encephalitis virus
- B. Colorado tick fever virus
- C. Coxsackievirus
- D. Yellow fever virus
- E. Dengue fever virus

**68. Reverse transcriptase is an enzyme unique to the retroviruses. Which one of the following is a function of the enzyme reverse transcriptase?**

- A. DNase activity
- B. RNA-dependent RNA polymerase activity
- C. RNA isomerase's activity
- D. RNA-dependent DNA polymerase activity
- E. Integration activity

**69. Orchitis, which may cause sterility, is a possible manifestation of which of the following?**

- A. Rabies
- B. Rhinovirus
- C. Cytomegalovirus
- D. Respiratory syncytial virus
- E. Mumps

**70. For indication of the viruses in tested material we can use all tests EXCEPT:**

- A. Complement fixation test
- B. Haemadsorption test

- C. Inoculation of laboratory animal
- D. Inoculation of chicken embryo
- E. Haemagglutination test

**71. To determine viral particles (Pashen's bodies) an original method of colouring is used which provides a work – up of smear – preparation with formalin, glacial acetic acid and 5 per cent tannin solution at the first stage.**

**How do they call it?**

- A. Munn staining
- B. Morozov staining
- C. Romanowsky - Giemsa staining
- D. Ziel – Neelsen staining
- E. Pavlovskiy staining

**72. Vaccines protect us against dangerous viral diseases by training the body to recognize and destroy specific invading viruses. Vaccines are made from:**

- A. Weakened or dead versions of a dangerous virus
- B. Antibiotics.
- C. Human white blood cells.
- D. Medicines that cure the symptoms of viral diseases.
- E. DNA of virus

**73. There are such components of haemagglutination test:**

- A. Viruses, chicken red cells, electrolyte
- B. Viruses, chicken red cells
- C. Viruses, chicken red cells, specific serum
- D. Viruses, chicken red cells, paired patient's serums
- E. Viruses, chicken red cells, viral diagnosticum, electrolyte

**74. Respiratory syncytial virus (RSV) is most associated with which of the following syndromes:**

- A. Bronchiolitis of young adults
- B. Lower lobe infiltrates of young adults
- C. Upper lobe infiltrates of young adults

- D. Upper lobe infiltrates of young children
- E. Bronchiolitis of young infants

**75. An adenovirus:**

- A. Has a neuraminidase
- B. Has a hemagglutinin
- C. Has a double shelled capsid
- D. Has an RNA genome
- E. Has an envelope

**76. How can an eye infection by a specific serotype of adenovirus be diagnosed?**

- A. By monitoring the response of the infection to steroid therapy.
- B. By using serotype antibody to test inhibition of hemagglutination.
- C. By detecting the presence of viral double stranded DNA.
- D. By using electron microscopy to detect viral particles in an eye swab.
- E. By detecting nuclear inclusions in infected cells collected in an eye swab.

**77. Which one of the following is correct regarding adenovirus replicative cycle?**

- A. They are not cytopathogenic, thus the infected cell survives the infection
- B. They shut off the host cell protein synthesis
- C. They can replicate in almost any type of the cells in the human organism
- D. The factors will be produced within replicative cycle to suppress host defensive mechanisms
- E. Penetration of the virus occurs by fusion

**78. An adenovirus contains:**

- A. a neuraminidase
- B. fibrinolysin
- C. a double shelled capsid
- D. DNA genome
- E. an envelope

**79. Examination of the 10-year old patient reveals fever and bilateral**

**parotitis. A clinical diagnosis of mumps was developed. Which one of the following tests is the BEST to confirm a clinical diagnosis of acute mumps disease?**

- A. A positive skin test
- B. A history of exposure to a mumps case
- C. Orchitis in young adult male
- D. A 4-fold rise to in antibody titer to mumps surface antigen
- E. Syncytia formation in virus-infected cells

**80. Such material is used for serological diagnostics of mumps:**

- A. Saliva
- B. Blood
- C. Urine
- D. Spinal liquid
- E. Paired serums

**81. In which of the following populations does rubella infection cause long term serious sequelae?**

- A. Women of childbearing age
- B. Children infected in the first trimester in utero
- C. Children infected during the first grade (age 6-7 yrs)
- D. Children who have received the attenuated vaccine
- E. Children who have received the interferon

**82. Rubella is transmitted from human to human. How is this source of infection called?**

- A. Latent infection
- B. Zoonotic
- C. Anthrozoönotic
- D. Anthroponotic
- E. Acute-infection

**83. Which vaccine is used for vaccination against mumps?**

- A. Live vaccine

- B. Immunoglobulin
- C. Toxoid
- D. The killed vaccine
- E. Antitoxic serum

**84. Measles is a member of the paramyxovirus family, but it differs from mumps and the parainfluenza viruses structurally with respect to envelope proteins. How do they differ?**

- A. Measles has a neuraminidase but no hemagglutinin; mumps and parainfluenza have only hemagglutinin
- B. Measles has no hemagglutinin or neuraminidase, mumps and parainfluenza have only neuraminidase
- C. Measles has a neuraminidase but no hemagglutinin; mumps and parainfluenza have hemagglutinin and neuraminidase
- D. Measles has a hemagglutinin but no neuraminidase; mumps and parainfluenza have hemagglutinin and neuraminidase
- E. Measles has no hemagglutinin or neuraminidase, mumps and parainfluenza have hemagglutinin and no neuraminidase

**85. What are the smallest known viruses?**

- A. Picornavirus
- B. Adenovirus
- C. Enterovirus
- D. Orthomyxovirus
- E. Paramyxovirus

**86. Most common manifestations of coxsackievirus type B infection are all of the followings, EXCEPT:**

- A. Herpangina
- B. Myocarditis and pericarditis
- C. Paralytic diseases
- D. Encephalitis and meningitis
- E. Pleurodynia and respiratory diseases



**87. Poliovirus vaccine is correctly described by all of the following statements, EXCEPT:**

- A. The Sabin vaccine is a live attenuated virus
- B. The Salk vaccine contains formalin-inactivated virus
- C. It is a polyvalent preparation
- D. Active virus is excreted in the feces of Sabin-vaccine immunized individuals
- E. The Sabin vaccine could not cause disease in humans

**88. All of the following statements about arboviruses are TRUE, EXCEPT that:**

- A. Bunyaviruses differ in their structure and replicative cycle
- B. Flavi- and Togaviruses have negative ssRNA genome
- C. They have wide host range
- D. They can grow in arthropod vector
- E. One of the major clinical manifestations of arbovirus infections is encephalitis

**89. Which of the following viruses do cause jaundice and can be life threatening?**

- A. Measles
- B. Rubella virus
- C. Rhinovirus
- D. Rabies virus
- E. Yellow fever virus

**90. All of the following diseases are mosquito borne, EXCEPT:**

- A. Japanese encephalitis
- B. Russian (European) encephalitis
- C. Dengue fever
- D. EE encephalitis
- E. Yellow fever

**91. Which of the following viral genera is/are not arthropod-borne?**

- A. Alphavirus
- B. Flavivirus

- C. Rubivirus
- D. Togavirus
- E. All of the above

**92. Which of the following are reservoirs of Japanese encephalitis virus?**

- A. Cats and dogs
- B. Cows and goats
- C. Pigs and man
- D. Water birds and man
- E. Water birds and pigs

**93. Which description of the arbovirus infections diagnosis is LESS accurate:**

- A. Viruses can be recovered by intracerebral inoculation of mice
- B. Neutralizing and hemagglutination inhibition antibody can be detected by serological reaction
- C. IgG antibody is of high diagnostic value when detected in serum, taken after the onset of the disease
- D. IgM is of high diagnostic value
- E. Genetic methods can be used to detect viral genome in clinical specimens

**94. What is the shape of rabies virus?**

- A. Spherical
- B. Polygonal
- C. Bullet-shaped
- D. Tubular
- E. Stick-like

**95. Choose among following family of yellow fever virus:**

- A. Bunyaviridae
- B. Flaviviridae
- C. Reoviridae
- D. Rhabdoviridae
- E. Togaviridae

## CORRECT ANSWERS

1	2	3	4	5	6	7	8	9	10	11	12	13	14
D	C	C	A	C	C	B	B	E	B	E	E	B	D
15	16	17	18	19	20	21	22	23	24	25	26	27	28
B	C	A	D	A	E	E	A	D	C	E	C	D	D
29	30	31	32	33	34	35	36	37	38	39	40	41	42
B	E	E	B	B	A	E	A	A	E	A	D	D	B
43	44	45	46	47	48	49	50	51	52	53	54	55	56
A	B	A	E	A	A	B	E	C	C	A	A	D	C
57	58	59	60	61	62	63	64	65	66	67	68	69	70
B	E	E	D	B	A	A	C	D	D	E	D	E	A
71	72	73	74	75	76	77	78	79	80	81	82	83	84
A	A	A	A	B	B	C	D	D	E	B	D	A	D
85	86	87	88	89	90	91	92	93	94	95			
A	A	E	B	E	B	C	E	C	C	B			