

ONTÜSTIK QAZAQSTAN MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ		SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
Department of microbiology, allergology and immunology Control and measuring means		50-11 1 p. from 16

CONTROL AND MEASURING MEANS

Name and cipher of the EP: 6B10115 «Medicine»

Discipline code: MI 2225

Discipline: Microbiology and Immunology

Amount of study hours/credits: 150 hours (5 credits)

Course and semester of study: 2, IV

Shymkent 2025 y.

QUESTIONS OF THE MID-TERM № 1

1. What is immunological memory? What is its significance?
2. What role do T-helper cells play in the immune response?
3. Give examples of antigen-presenting cells (APCs) and describe their main function.
4. In which reactions is immunoglobulin E involved?
5. Why are MHC molecules important in transplantation?
6. Describe the role of cytokines in the immune response.
7. Why is *Pseudomonas aeruginosa* considered an antibiotic-resistant pathogen?
8. Name the main microbiological methods used for purulent-septic infections.
9. Describe the mechanism of action of the *Clostridium tetani* toxin.
10. Name 1–2 methods for cultivating pathogens under anaerobic conditions.
11. What role does *Pseudomonas aeruginosa* play in respiratory tract infections?
12. What additional factors are required for the growth of *Haemophilus influenzae*?
13. What media are used for diagnosing *Shigella* and *Salmonella* pathogens?
14. Why does diarrhea in cholera resemble "rice water"?
15. Under what conditions do enteropathogenic strains of *Escherichia coli* become dangerous?

Table Assignments for Midterm Control No. 1

1. Comparison of Immunity Types

Criteria	Innate Immunity	Acquired Immunity
Response time		
Antigen specificity		
Presence of memory cells		
Main participating cells		
Examples		

2. Comparison of Immunoglobulins

Properties / Indicators	IgG	IgA	IgM	IgE
Structure				
Serum concentration				
Functions				
Placental transfer				
Importance in diseases				

3. Comparison of Hypersensitivity Types (I–IV)

Criterion	Type I (IgE)	Type II (IgG/IgM)	Type III (immune complexes)	Type IV (cell-mediated)
Immune mechanism				
Reaction time				
Mediators / cells				
Examples of diseases				

4. Difference Between Antigen and Antibody

Characteristic	Antigen	Antibody
Chemical composition		
Function		
Role in the immune system		

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Molecule type		
Site of synthesis		

5. Comparison of Immune Response Phases

Phase name	Description / What happens?	Participating cells	Timing
Induction			
Activation			
Effector			
Regression			

6. Comparison of Immunocompetent Cells

Cell Type	Function	Type of Immunity	Features
T-helper cells (CD4+)			
Cytotoxic T cells			
B lymphocytes			
Macrophages			
Natural Killer (NK) cells			

7. Comparison of Immune System Organs

Organ Name	Location	Function	Central / Peripheral?
Thymus			
Spleen			
Lymph nodes			
Red bone marrow			

8. Immune Response Cells and Their Mediators

Cell Type	Involved Mediators	Function	Example Situation
T-helper cells (CD4+)			
Cytotoxic T cells			
B cells			
Macrophages			

9. Comparison of Cytokines

Cytokine Name	Produced by Which Cells?	Function	Type of Immune Response
IL-1			
IL-2			
IFN- γ			
TNF- α			

10. Comparison of Types of Immunization

Property	Active Immunization	Passive Immunization
Source of antibodies		
Duration of protection		
Example		

11. Table on Purulent-Septic Infections

Pathogen	Morphology	Cultural Properties	Toxins	Type of Disease
<i>S. aureus</i>				
<i>S. pyogenes</i>				
<i>P. aeruginosa</i>				

12. Table on Sexually Transmitted Infections (STIs)

Pathogen	Morphology	Diagnostic Method	Transmission Routes	Features
<i>Treponema pallidum</i>				
<i>Neisseria gonorrhoeae</i>				
<i>Chlamydia trachomatis</i>				

13. Table on Anaerobic Infections

Pathogen	Morphology	Toxin	Name of Disease	Prevention
<i>Clostridium tetani</i>				
<i>C. perfringens</i>				
<i>C. botulinum</i>				

14. Comparative Table: Pseudomonas vs Haemophilus

Property	<i>P. aeruginosa</i>	<i>H. influenzae</i>
Morphology		
Cultural properties		
Pathogenic factors		
Types of infections		
Antibiotic resistance		

15. Table on Intestinal Infections

Pathogen	Morphology	Type of Disease	Diagnostic Method	Prevention
<i>Escherichia coli</i>				
<i>Shigella spp.</i>				
<i>Salmonella spp.</i>				

Case-Based Questions for Midterm Control №1

1. Patient: A 5-year-old child was brought to the clinic after developing a fever and rash in kindergarten. Upon examination, a diagnosis of measles was made. The parents reported that the child had not received any vaccinations.

Questions:

- Which type of immunity—innate or acquired—was involved in the development of the disease? Explain.
- What type of immunity is formed after vaccination, and which immunocompetent cells are involved?

2. Patient: A 67-year-old man was hospitalized with pneumonia. Immunological testing revealed a decrease in nonspecific defense factors (phagocytosis, interferon levels).

Questions:

- Which humoral and cellular immune factors decline with age?
- How can the weakening of nonspecific immunity contribute to the development of pneumonia?

3. Patient: A 45-year-old woman undergoing cancer treatment is receiving immunomodulators. Blood analysis showed an increase in T-lymphocytes and natural killer (NK) cells, as well as high levels of interleukin-2.

Questions:

- Which phases of the immune response are activated in this case and which cells are involved?
- What is the role of interleukins in interactions between immune cells?

4. Patient: A 9-month-old infant frequently develops bacterial infections following a recent viral respiratory illness. Immunological testing revealed weak antibody production, low B-lymphocyte count, and decreased IgG levels.

Questions:

1. Which phases of the immune response are impaired, and what is the role of antigen-presenting cells in this case?
2. Which immunoglobulin is deficient and what is its role in infection protection?

5. Patient: A 25-year-old man experienced kidney transplant rejection. Cytotoxic T-lymphocyte activity and interleukin-2 levels were elevated.

Questions:

1. Which T-lymphocyte function is activated and what is the role of antigen-presenting cells?
2. Which phases of the immune response are involved and what is the role of immunological memory?

6. Patient: A 6-year-old child developed itching, skin redness, and difficulty breathing shortly after eating nuts. Emergency treatment was required. Elevated IgE levels were detected.

Questions:

1. Which type of hypersensitivity does this reaction represent and what mechanisms are involved?
2. Which cells and mediators are responsible for the clinical manifestations of allergy?

7. Patient: A 32-year-old woman developed fever and pain in the transplant area 10 days after a kidney transplant. Anti-donor antibodies were found in her serum (precipitation reaction).

Questions:

1. What type of hypersensitivity is involved and which serological method was used?
2. What is the principle of the precipitation or agglutination reaction and how is the result interpreted?

8. Patient: A 25-year-old man developed a purulent wound, swelling, and fever after a hand injury. *Staphylococcus aureus* was isolated from the pus. Hemolysis was observed on blood agar, and the coagulase test was positive.

Questions:

1. Describe the morphological, cultural, and biochemical characteristics of *S. aureus*.
2. What microbiological methods were used, and which antibiotics are typically applied?

9. Patient: A 28-year-old man reported pain during urination and purulent discharge. Smear showed Gram-negative cocci (*Neisseria gonorrhoeae*), and PCR detected *Chlamydia trachomatis* DNA.

Questions:

1. What are the differences in morphology and diagnostics between *N. gonorrhoeae* and *C. trachomatis*?
2. What diagnostic methods are used for these STIs, and what are the modern treatment approaches?

10. Patient: A 4-year-old child presented with fever, cough, and shortness of breath. X-ray confirmed pneumonia. Sputum showed Gram-positive lancet-shaped diplococci (*Streptococcus pneumoniae*), α-hemolysis, and optochin sensitivity.

Questions:

1. Describe the morphology, cultural, and biochemical properties of *S. pneumoniae*.
2. What diagnostic methods and specific prevention measures are used?

11. Patient: A 35-year-old man developed swelling, pain, foul odor, and gas bubbles at the wound site four days after an injury with rebar. Gram-positive rods and gas bubbles were observed in the smear. *Clostridium perfringens* was isolated.

Questions:

1. Describe the morphology, cultural properties, and toxins of *C. perfringens*.

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2. What microbiological methods and prevention strategies are used?

12. Patient: A 2-year-old child presented with trismus, difficulty swallowing, and rigidity. History revealed an untreated iron-related wound. Suspected *Clostridium tetani*.

Questions:

1. Describe the biological characteristics of *C. tetani* and the action of tetanospasmin.
2. Name the microbiological diagnostic methods and specific preventive measures for tetanus.

13. Patient: A 60-year-old experienced worsening symptoms after bronchitis. Sputum contained *Pseudomonas aeruginosa* and *Haemophilus influenzae*. Antibiotic susceptibility testing was performed.

Questions:

1. Compare the morphology, biochemical features, and pathogenic factors of *P. aeruginosa* and *H. influenzae*.
2. What diagnostic methods are used, and what are the features of antibiotic resistance?

14. Patient: A 7-year-old child with fever, abdominal pain, and frequent bloody diarrhea. He had eaten at the school cafeteria. *Shigella sonnei* was detected in stool.

Questions:

1. Describe the morphology, biochemical characteristics, and pathogenesis of *Shigella*.
2. What diagnostic and prevention methods are used in shigellosis?

15. Patient: A 30-year-old man developed watery diarrhea, vomiting, and dehydration after a business trip. Stool resembled "rice water." Possibly waterborne. Suspected *Vibrio cholerae*.

Questions:

1. Describe the morphology and pathogenesis of *V. cholerae*.
2. What diagnostic methods are used and how is specific prevention carried out?

QUESTIONS OF THE MID-TERM № 2

1. Describe the natural reservoir and transmission routes of brucellosis.
2. Why is *Bacillus anthracis* dangerous due to its ability to form spores?
3. What are the main methods used in the microbiological diagnosis of tuberculosis?
4. What clinical symptoms are caused by the toxin produced by the diphtheria pathogen?
5. Why is rubella virus dangerous during pregnancy?
6. Where in the body does the varicella-zoster virus persist in a latent form?
7. Explain the mechanisms of antigenic drift and shift in the influenza virus.
8. What is unique about the replication of coronavirus infection?
9. In which cells does herpes simplex virus establish latency?
10. Who is at particular risk from cytomegalovirus infection and why?
11. Name the transmission routes and the most common diseases caused by enteroviruses.
12. In which age group are rotavirus infections most common and what are their clinical manifestations?
13. Compare the transmission routes of hepatitis A and hepatitis B viruses.
14. Why does the hepatitis C virus have a high risk of progressing to a chronic form?
15. Describe how the rabies virus reaches the central nervous system.

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Table Assignments for Midterm Control No. 2

1. Comparison of Plague and Brucellosis

Indicator	Plague	Brucellosis
Name of pathogen		
Morphology		
Gram staining		
Spore/capsule formation		
Motility		
Transmission routes		
Natural reservoir		
Clinical forms		
Diagnostic methods		
Specific prevention/vaccination		

2. Comparison of Anthrax and Tularemia

Indicator	Anthrax	Tularemia
Name of pathogen		
Morphology		
Spore/capsule formation		
Oxygen relationship		
Transmission routes		
Natural reservoir		
Main clinical forms		
Diagnostic methods		
Specific prevention/vaccination		

3. Comparison of Natural-Foci Zoonotic Viral and Parasitic Infections

Indicator	Cutaneous Leishmaniasis	Crimean-Congo Hemorrhagic Fever	Hemorrhagic Fever with Renal Syndrome
Type of pathogen			
Nature of pathogen (virus/parasite)			
Morphology and genome			
Transmission routes			
Natural reservoir			
Vector			
Incubation period			
Diagnostic methods			
Specific prevention (vaccine/none)			
Seasonality			
Endemic regions in Kazakhstan			

4. Comparative Characteristics of Pathogenic Fungi

Indicator	<i>Candida</i> spp.	<i>Aspergillus</i> spp.	<i>Trichophyton</i> spp.	<i>Microsporum</i> spp.
Morphology				
Type of hyphae				
Spore formation features				

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Diseases caused			
Main localization			
Source of infection			
Transmission routes			
Diagnostic methods			
Treatment methods			
Specific prevention (if any)			

5. Comparative Characteristics of Pathogenic Protozoa

Indicator	<i>Entamoeba histolytica</i>	<i>Giardia lamblia</i>	<i>Trichomonas vaginalis</i>	<i>Leishmania</i> spp.	<i>Toxoplasma gondii</i>
Morphology					
Life cycle stages					
Disease					
Main symptoms					
Source of infection					
Transmission routes					
Diagnostic methods					
Preventive measures					

6. Comparison of Tuberculosis and Meningococcal Infection

Indicator	Tuberculosis	Meningococcal Infection
Name of pathogen		
Morphology of pathogen		
Cultural properties		
Transmission routes		
Source of infection		
Pathogenesis		
Main clinical manifestations		
Diagnostic methods		
Specific prevention (vaccination)		

7. Comparison of Diphtheria and Whooping Cough

Indicator	Diphtheria	Whooping Cough
Name of pathogen		
Morphology of pathogen		
Toxin production		
Transmission routes		
Source of infection		
Pathogenesis features		
Main clinical manifestations		
Diagnostic methods		
Specific prevention (vaccine)		
Specific treatment		

8. Comparison of Influenza and Parainfluenza Viruses

Indicator	Influenza Virus	Parainfluenza Virus
Pathogen name (family)		
Genetic material		
Morphology		
Antigenic structure		
Replication characteristics		
Transmission routes		
Incubation period		
Clinical manifestations		
Complications		
Diagnostic methods		
Specific prevention		

9. Comparison of Adenovirus and Coronavirus Infections

Indicator	Adenovirus	Coronavirus
Virus family		
Genetic material		
Morphology		
Site of replication		
Antigenic structure		
Transmission routes		
Source of infection		
Incubation period		
Main clinical manifestations		
Diagnostic methods		
Specific prevention		

10. Comparison of Human Herpesviruses

Indicator	HSV-1	HSV-2	CMV
Full virus name			
Morphology			
Site of replication			
Site of latency			
Tropism (target cells/tissues)			
Diseases caused			
Transmission routes			
Diagnostic methods			
Specific prevention			

11. Comparison of Rickettsioses and Borrelioses

Indicator	Epidemic Typhus	Tick-Borne Typhus	Q Fever	Lyme Disease
Name of pathogen				
Taxonomic group				
Morphology				
Vector				
Natural reservoir				
Transmission routes				
Incubation period				

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Main clinical manifestations			
Diagnostic methods			
Specific prevention			

12. Comparison of Rabies and Tick-Borne Encephalitis

Indicator	Rabies	Tick-Borne Encephalitis
Pathogen name		
Viral taxonomy		
Genetic material		
Morphology		
Source of infection		
Transmission routes		
Natural reservoir		
Incubation period		
Pathogenesis features		
Clinical manifestations		
Diagnostic methods		
Specific prevention		
Seasonality		
Endemic regions in Kazakhstan		

13. Comparison of Measles, Rubella, Chickenpox, and Mumps

Indicator	Measles	Rubella	Chickenpox	Mumps
Pathogen name				
Virus family				
Genetic material				
Morphology				
Site of replication				
Transmission routes				
Incubation period				
Main symptoms				
Complications				
Diagnostic methods				
Specific prevention				

14. Comparison of Enteroviruses and Rotaviruses

Indicator	Enteroviruses (Polioviruses)	Rotaviruses
Pathogen name		
Virus family		
Genetic material		
Morphology		

Site of replication			
Source of infection			
Transmission routes			
Incubation period			
Clinical manifestations			
Complications			
Diagnostic methods			
Specific prevention			

15. Comparison of Viral Hepatitis Types

Indicator	Hepatitis A	Hepatitis B	Hepatitis C	Hepatitis D	Hepatitis E
Genetic material					
Virus morphology					
Transmission routes					
Source of infection					
Incubation period					
Disease course characteristics					
Risk of chronicity					
Diagnostic methods					
Specific prevention					

Case-Based Tasks for Midterm Control No. 2

1. Patient: A 45-year-old man engaged in livestock farming in a rural area presents with fever, chills, muscle pain, and shortness of breath. Examination reveals lymphadenopathy and harsh breath sounds. He recently slaughtered sheep.

Questions:

1. Which zoonotic infection is characterized by such clinical features?
2. What microbiological methods are used to diagnose this disease?

2. Patient: A 35-year-old woman with diabetes complains of white coating in the mouth, burning, and pain when swallowing. Microscopy reveals pseudomycelium and round cells.

Questions:

1. What is the suspected pathogen and its morphology?
2. What are the features of laboratory diagnosis and treatment of this mycosis?

3. Patient: A 6-year-old boy presents with fever, neck stiffness, vomiting, and altered consciousness. Purulent CSF shows Gram-negative diplococci.

Questions:

1. What disease is suspected and what are the morphological features of the pathogen?
2. What are the diagnostic methods and specific prevention for this disease?

4. Patient: A 24-year-old man presents with itchy lesions on hairy areas, with peripheral redness and central scaling. Microscopy shows branched hyphae and microconidia.

Questions:

1. What type of mycosis and likely pathogen? What is its life cycle?
2. What laboratory diagnostics and preventive measures are used?

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5. Patient: A 22-year-old male student reports burning and itching on the lips followed by vesicular rash. He had exam-related stress a month ago.

Questions:

1. Which herpes virus is suspected and in which cells does it remain latent?
2. What laboratory methods are used to diagnose this infection?

6. Patient: A 38-year-old man developed a ring-shaped erythema, weakness, fever, and later joint pain and neurological symptoms 10 days after visiting a forested area.

Questions:

1. What is the possible pathogen, its morphology, and vector?
2. Diagnosis and prevention of Lyme disease?

7. Patient: A 27-year-old man has a fever up to 39°C, muscle aches, headache, and dry cough. There is a seasonal influenza outbreak.

Questions:

1. What are the types of influenza virus and what cultures are used to grow them?
2. What rapid diagnostic methods are used and how are results interpreted?

8. Patient: A 2-year-old boy has hoarseness, "barking" cough, inspiratory dyspnea, and moderate intoxication.

Questions:

1. What virus is likely and where is biomaterial collected from?
2. What laboratory methods are used and how is the material prepared?

9. Patient: A 50-year-old woman complains of dry cough, weakness, loss of smell, and low-grade fever. She was in contact with a sick person.

Questions:

1. What laboratory methods are used to detect COVID-19 and what material is studied?
2. What vaccines are used for specific prevention?

10. Patient: A 10-year-old boy was bitten by a wild dog. Three days later: weakness, headache, photophobia, painful swallowing, neck muscle spasms. The wound was untreated.

Questions:

1. What is the suspected diagnosis and pathogenesis?
2. What preventive measures should have been taken?

11. Patient: A 5-year-old boy presents with fever, catarrhal symptoms, Koplik spots on the mucosa, followed by a rash. A measles case was registered at his kindergarten.

Questions:

1. What is the morphology and antigenic structure of the measles virus?
2. What diagnostic and prevention methods are used?

12. Patient: A 32-year-old man with prolonged diarrhea, candidiasis, weight loss, and frequent pneumonias. CD4 < 200/μL.

Questions:

1. What stage of HIV infection is this and what are the clinical features?
2. What are the diagnostic methods and treatment principles?

13. Patient: A 38-year-old woman was diagnosed with cervical dysplasia. PCR detected HPV types 16 and 18. She was not vaccinated.

Questions:

1. How does the virus contribute to oncogenesis and which oncogenic proteins are involved?

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2. What are the prevention and early detection strategies?

14. Patient: A 4-year-old boy presents with fever, loss of appetite, oral blisters, and red spots on hands and feet. Similar cases were noted in the kindergarten.

Questions:

1. What enterovirus is suspected, its morphology and transmission routes?
2. Diagnosis and prevention of the infection?

15. Patient: A 34-year-old man complains of jaundice, weakness, nausea, and loss of appetite. Lab results: elevated bilirubin, ALT/AST. History of dental and injection procedures.

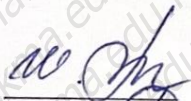
Questions:

1. What is the structure of hepatitis B virus and its transmission routes?
2. Diagnostic methods and prevention?

List of Practical Skills in the Discipline

1. Proper collection of diagnostic material from the oral mucosa (tongue, gums, tonsils, etc.) using a sterile swab or spatula.
2. Collection of purulent or mucous discharge from anterior and posterior nasal cavity using a sterile cotton swab.
3. Collection of material from damaged skin areas (pus, scales, exudate) using sterile instruments.
4. Collection of material using the "cough plate" method.
5. Streak inoculation of diagnostic material onto solid nutrient medium.
6. Loop inoculation into liquid nutrient medium.
7. Inoculation onto media designed for anaerobic conditions.
8. Air sampling using the sedimentation method for microbiological analysis.
9. Subculturing onto slant meat-peptone agar to isolate pure cultures.
10. Preparing smears from agar culture of bacteria.
11. Staining smears with aqueous solutions of fuchsin and methylene blue.
12. Gram staining of smears.
13. Microscopy of stained smears using the immersion system.
14. Identification of *Staphylococcus* morphology in Gram-stained smears.
15. Identification of *Enterobacteriaceae* morphology in Gram-stained smears.
16. Determination of catalase enzyme activity.
17. Determination of antibiotic susceptibility using disk diffusion method.
18. Inoculation of viral material into chick embryos.

Complied by:



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Date «

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