

**Ministry of Health Care, the Republic of Belarus**

**Vitebsk State Medical University**

**Department of Microbiology**

# **INSTRUCTIONS**

## **FOR LABORATORY TRAINING**

**in Special Microbiology & Virology  
for students of the Faculty of General Medicine**

**VITEBSK  
2018**

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Instructions for laboratory training in Special Microbiology and Virology for students of the faculty of General Medicine are prepared according to basic educational plan and program, approved by Ministry of Health Care of the Republic of Belarus. The instructions include the working plan, schedule of training and basic theoretical and practical skills in special microbiology and virology.

The instructions are prepared for the students of medical faculties of higher medical educational establishments.

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## Laboratory class №1

**The topic:** *Causative agents of suppurative and wound infections: streptococci and clostridia*

### **The main aim and the tasks of the work:**

1. To learn the taxonomy of streptococci, and the role of various streptococcal species in human pathology.
2. To know the methods of laboratory diagnosis of streptococcal infections.
3. To know the basic properties of clostridia and their role in the development of gas gangrene.
4. To learn the principles of laboratory diagnosis of gas gangrene.
5. To know etiology, pathogenesis, clinical findings, laboratory diagnosis, specific prophylaxis and treatment of tetanus.
6. To know the basic properties of clostridia difficile and their role in human pathology.

### **The questions to the topic:**

1. Classification, structure and properties of streptococci.
2. Virulence factors of streptococci.
3. Pathogenesis and clinical findings in streptococcal infections.
4. Laboratory diagnosis of streptococcal infections. Differential diagnosis of *S. pyogenes*, *S. agalactiae*, *S. pneumoniae*, *Enterococcus spp.* Specific prophylaxis and treatment of streptococcal infections.
5. Classification, structure and properties of clostridia.
6. Virulence factors of clostridia – causative agents of gas gangrene.
7. Pathogenesis and clinical findings in gas gangrene. Laboratory diagnosis, prophylaxis and treatment.
8. Structure and properties of *C. tetani*.
9. Pathogenesis and clinical findings in tetanus. Laboratory diagnosis, specific prophylaxis and treatment.
10. *Clostridium difficile* – causative agent of pseudomembranous colitis.

### **THE LITERATURE:**

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 15-24, 32-44.

## Personal work of students:

### 1. Indirect hemagglutination test for perfringens toxin determination in the serum of patient with gas gangrene

Reagents	Patient's serum dilutions				
	1:2	1:4	1:8	1:16	Control
Saline	0,2	0,2	0,2	0,2	0,2
Patient's serum	0,2 →	0,2 →	0,2 →	0,2	-
Erythrocyte anti-perfringens diagnosticum	0,2	0,2	0,2	0,2	0,2
<b>Incubation</b>	at 37°C for 1 h				
<b>Results:</b>	↓				

## Conclusion

**2. Demonstration:** microscopy of smears with pneumococci (Gram stain); *C. tetani* (Gram stain); *C. perfringens* (Gram stain).

**3. Demonstration:** biomedical products for diagnosis, specific prophylaxis and treatment of tetanus and gas gangrene – ADPT vaccine, tetanus toxoid, anti-tetanus donor's immunoglobulin, erythrocyte anti-perfringens diagnosticum.

## Laboratory class №2

### The topic: Pathogenic enterobacteria: *Escherichia coli* and *shigellae*

#### The main aim and the tasks of the work:

1. To learn general characteristics of *Enterobacteriaceae* family.
2. To learn main properties of *Escherichia coli* and its role in human pathology.
2. To know the methods of laboratory diagnosis of coli-infections.
3. To know the basic properties of shigellae.
4. To learn the role of shigellae in human pathology, pathogenesis, clinical findings and laboratory diagnosis of shigelloses.

#### The questions to the topic:

1. Classification, structure and properties of *Escherichia coli*.
2. Specific and non-specific *Escherichia coli* infections.

3. Enteropathogenic and enterotoxigenic *E. coli* infections: pathogenesis and clinical findings.
4. Enteroaggregative, enteroinvasive and enterohemorrhagic *E. coli* infections: pathogenesis and clinical findings of diseases.
5. Laboratory diagnosis of escherichioses. Specific prophylaxis and treatment of escherichioses.
6. Classification, structure and properties of shigellae.
7. Virulence factors of shigellae.
8. Pathogenesis and clinical findings in shigellosis.
9. Laboratory diagnosis, prophylaxis and treatment of shigellosis.

***THE LITERATURE:***

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 51-64.

**Personal work of students:**

***1. Laboratory examination of coli-enteritis.***

Day of examination	Material for examination	Steps of examination	Results						
1.	Patient's feces.	Plating of material onto EMB (eosin-methylene blue) medium.	—						
2.		Evaluation of microbial growth on EMB agar. Slide tentative agglutination reaction with polyspecific OK(B) antiserum. Inoculation of material from positive colony on the slant agar.							
3.		Evaluation of microbial growth on slant agar. Slide tentative agglutination reaction with monospecific OK(B) antisera: O <sub>111</sub> K <sub>58</sub> , O <sub>55</sub> K <sub>59</sub> , O <sub>20</sub> K <sub>84</sub> , O <sub>26</sub> K <sub>60</sub> . Extended agglutination reaction with monospecific OK(B) antiserum. Inoculation of isolated culture into Hiss media							
4.		Evaluation of biochemical properties of isolated culture	<b>G</b>	<b>L</b>	<b>Mn</b>	<b>S</b>	<b>M</b>	<b>Indole</b>	<b>H<sub>2</sub>S</b>

**Conclusion:**

**2. Demonstration:** biological products for diagnosis of coli-enteritis and shigelloses: microbial diagnosticums and specific antisera.

### **Laboratory class №3**

#### **The topic: *Pathogenic Salmonellae and Yersiniae***

#### **The main aim and the tasks of the work:**

1. To learn the common properties of salmonellae.
2. To learn the main steps of pathogenesis of enteric typhoid fever and other salmonelloses.
3. To get skills of basic methods of laboratory diagnosis of salmonelloses.
4. To know the principles of prophylaxis and treatment of enteric typhoid fever and salmonelloses.
5. To learn the basic properties of *Yersinia pseudotuberculosis* and *Yersinia enterocolitica* and the methods of laboratory diagnosis of yersinioses.

#### **The questions to the topic:**

1. Classification, structure and main properties of salmonellae.
2. Antigenic structure of salmonellae. Kauffmann and White`s classification.
3. Virulence factors of salmonellae.
4. Pathogenesis and clinical findings in enteric typhoid fever.
5. Pathogenesis and clinical findings in salmonelloses.
6. Laboratory diagnosis, prophylaxis and treatment of enteric typhoid fever and salmonelloses.
7. Classification, structure and properties of pathogenic yersiniae. Virulence factors.
8. Pathogenesis and clinical findings in yersinioses.
9. Laboratory diagnosis, prophylaxis and treatment of yersinioses.

#### ***THE LITERATURE:***

1. Lecture contents.
2. "Medical Microbiology, Virology & Immunology: Lecture Course". Part 2. I. I. Generalov, 2016. P. 65-78.

**Personal work of students:**

**1. Hemoculture examination in enteric typhoid fever**

Day of examination	Material for examination	Steps of examination	Results						
1.	Patient's blood	Inoculation of 5 ml of blood into 50 ml of bile salt broth.	—						
2.		Evaluation of microbial growth on bile salt broth. Planting of material from bile salt broth onto EMB agar.							
3.		Evaluation of microbial growth on EMB agar. Planting of material from lactose-negative colorless colony into Russel medium.							
4.		Evaluation of microbial growth on Russel medium. Slide tentative agglutination reaction with specific H-antisera to <i>S. typhi</i> and <i>S. paratyphi B</i> ( <i>S. schottmuelleri</i> ). Inoculation of isolated culture into Hiss media							
5.		Evaluation of biochemical properties of isolated culture	G	L	Mn	S	M	Indole	H <sub>2</sub> S

**Conclusion:**

**2. Indirect hemagglutination test for the determination of carriers in enteric typhoid fever**

Reagents	Patient's serum dilutions				
	1:10	1:20	1:40	1:80	Control
Saline	0,1	0,1	0,1	0,1	0,1
Patient's serum	0,1 →	0,1 →	0,1 →	0,1	-
Erythrocyte diagnosticum with Vi-antigen	0,1	0,1	0,1	0,1	0,1
<b>Incubation</b>	at 37°C for 1 h				
<b>Results:</b>	↓				

**3. Demonstration:** biological products for diagnosis of typho-paratyphoidal diseases and salmonellosis: microbial diagnosticums and specific antisera.



## Laboratory class №4

***The topic: Pathogenic vibrios – causative agents of cholera. Causative agent of botulism. Helicobacter pylori – the agent of chronic gastritis, gastric and duodenal ulcers***

### **The main aim and the tasks of the work:**

1. To know the common properties of vibrios.
2. To learn main steps of cholera pathogenesis.
3. To know the methods of laboratory diagnosis of cholera.
4. To know the properties of botulism causative agent, pathogenesis, laboratory diagnosis, prophylaxis and treatment of botulism.
5. To know the properties of *Helicobacter pylori*, pathogenesis, laboratory diagnosis, prophylaxis and treatment of diseases, associated with *H. pylori*.

### **The questions to the topic:**

1. Classification, structure and properties of vibrios.
2. Virulence factors of cholera vibrios.
3. Pathogenesis and clinical findings in cholera.
4. Laboratory diagnosis of cholera, specific prophylaxis and treatment of the disease.
5. Classification and properties of *C. botulinum*.
6. Pathogenesis and clinical findings in botulism.
7. Laboratory diagnosis of botulism, prophylaxis and treatment.
8. Classification and properties of *Helicobacter pylori*. Virulence factors.
9. Pathogenesis, laboratory diagnosis, prophylaxis and treatment of diseases, associated with *H. pylori*.

### **THE LITERATURE:**

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 79-96.

### **Personal work of students:**

**1. Demonstration:** *Helicobacter pylori* in gastric tissue specimen, silver stain.

**2. Demonstration:** biological products for diagnosis and treatment of cholera and botulism: microbial diagnosticums and specific antisera.

**3. Demonstration:** microscopy of smears with cholera vibrios (Gram stain).

## Laboratory class №5

**The topic:** *Causative agents of bacterial respiratory infections: meningococci, bordetellae, mycoplasmas. Haemophilus influenzae*

### **The main aim and the tasks of the work:**

1. To learn a theoretical knowledge of the topic.
2. To learn the methods of laboratory diagnosis of meningococcal infections.
3. To renew the skills of precipitation reaction technique for determination of meningococcal antigen in cerebrospinal fluid.
4. To learn the methods of laboratory diagnosis of whooping cough disease.
5. To learn the role of mycoplasmas in human pathology, clinical findings and laboratory diagnosis of mycoplasmal pneumonias.
6. To renew the skills of indirect hemagglutination test for laboratory diagnosis of mycoplasmal pneumonia.
7. To learn the role of *Haemophilus influenzae* in human pathology; clinical findings and laboratory diagnosis of infections, associated with *H. influenzae*.

### **The questions to the topic:**

1. Meningococci, taxonomy, properties.
2. Virulence factors of meningococci. Pathogenesis of meningococcal diseases. Immunity.
3. Laboratory diagnosis of meningococcal infections. Specific prophylaxis and treatment.
4. Classification, structure and properties of bordetellae.
5. Bordetellae virulence factors. Pathogenesis of whooping cough. Immunity.
6. Laboratory diagnosis, prophylaxis and treatment of whooping cough.
7. Pathogenic mycoplasmas, classification and properties.
8. Virulence factors of mycoplasmas. Pathogenesis of mycoplasmal pneumonia. Immunity.
9. Laboratory diagnosis, prophylaxis and treatment of mycoplasmal pneumonias.
10. *Haemophilus influenzae* – taxonomy, properties, virulence factors.
11. Pathogenesis, laboratory diagnosis, prophylaxis and treatment of infections, associated with *H. influenzae*.

### **THE LITERATURE:**

1. Lecture contents.

2. "Medical Microbiology, Virology & Immunology: Lecture Course". Part 2. I. I. Generalov, 2016. P. 97-112, 119-122.

**Personal work of students:**

**1. Serological diagnosis of mycoplasmal pneumonia in paired sera test.**

Reagents	Serum dilutions						Control
	1:10	1:20	1:40	1:80	1:160	1:320	
	1	2	3	4	5	6	
Saline	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Patient's serum I, 1/5	0,1 →	0,1 →	0,1 →	0,1 →	0,1 →	0,1	
Patient's serum II, 1/5	0,1 →	0,1 →	0,1 →	0,1 →	0,1 →	0,1	
Erythrocyte mycoplasmal antigenic diagnosticum	0,1	0,1	0,1	0,1	0,1	0,1	0,1
<b>Incubation</b>	at 37°C for 1 h						
<b>Results:</b>							
Serum I							
Serum II							
<b>Conclusion:</b>							

**2. Ring precipitation reaction for determination of meningococcal antigens in cerebrospinal fluid.**

- Reagents:**
- 1) Patient's liquor.
  - 2) Meningococcal precipitating serum.
  - 3) Pneumococcal precipitating serum.

**Reaction steps:**

1. 1 ml of serum for precipitation of meningococcal antigens is dropped into the test tube N1.
2. 1 ml of liquor is layered carefully on the serum surface.
3. The same manipulation is made with test tube N2, where the serum for precipitation of pneumococcal antigens is used.
4. Incubation for 10 min at room temperature. Ring of precipitation is to be formed.
5. Drawing of the results.

**3. Demonstration:** microscopy of patient's liquor smear with meningococci; Gram stain.

## Laboratory class №6

**The topic:** *Pathogenic mycobacteria – causative agents of tuberculosis and leprosy. Corynebacterium diphtheriae. Legionella pneumophila*

### **The main aim and the tasks of the work:**

1. To learn theoretical knowledge of the topic
2. To be able to detect pathogenic mycobacteria and corynebacteria in smears from clinical specimens.
3. To know the methods of laboratory diagnosis of tuberculosis and diphtheria.
4. To get skills of *C. diphtheriae* toxigenicity determination.
5. To know the methods of laboratory diagnosis of legionellosis.

### **The questions to the topic:**

1. Classification of mycobacteria. Epidemiology of tuberculosis.
2. Structure and properties of pathogenic mycobacteria.
3. Pathogenesis and clinical findings in tuberculosis.
4. Laboratory diagnosis of tuberculosis.
5. Specific treatment and prophylaxis of tuberculosis.
6. Structure and properties of *Mycobacterium leprae*.
7. Pathogenesis and clinical findings in leprosy. Laboratory diagnosis, treatment and prophylaxis of leprosy.
8. Classification, structure and properties of *C. diphtheriae*.
9. Virulence factors of *C. diphtheriae*, mechanism of action of diphtheria exotoxin.
10. Pathogenesis and clinical findings in diphtheria.
11. Laboratory diagnosis of diphtheria. Specific treatment and prophylaxis of diphtheria.
12. Classification, structure and properties of *Legionella pneumophila*. Virulence factors.
13. Pathogenesis, clinical findings and laboratory diagnosis of legionellosis, methods of treatment and prophylaxis.

### ***THE LITERATURE:***

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 112-118, 123-145.

### **Personal work of students:**

1. **Demonstration:** a) microscopy of smears with *Corynebacterium diphtheriae* (Neisser stain);

- b) microscopy of smears with *M. tuberculosis* (Ziehl-Neelsen stain);
- c) microscopy of smears with *M. tuberculosis* micro-colonies – cord-factor detection (Ziehl-Neelsen stain).

**2. Demonstration:** biological products for diagnosis, specific prophylaxis and treatment of diphtheria and tuberculosis.

### **Laboratory class №7**

**The topic:** *Causative agents of sexually transmitted diseases (syphilis, gonorrhoea, urogenital chlamydioses and mycoplasmoses)*

#### **The main aim and the tasks of the work:**

1. To learn theoretical knowledge of the topic
2. To know the properties of *T. pallidum*, and the methods of laboratory diagnosis, treatment and prophylaxis of syphilis.
3. To be able to evaluate ELISA test for serological diagnosis of syphilis.
4. To know how to use bright-field microscopy for detection of treponemas, gonococci and chlamydiae in patient's specimens.

#### **The questions to the topic:**

1. Classification, structure and properties of treponemas.
2. Pathogenesis and clinical findings in syphilis.
3. Laboratory diagnosis of syphilis, treatment and prophylaxis of the disease.
4. Classification, structure and properties of *Neisseria gonorrhoeae*.
5. Pathogenesis and clinical findings in gonorrhoea, laboratory diagnosis, treatment and prophylaxis of the disease.
6. Classification, structure and properties of pathogenic chlamydiae.
7. Pathogenesis and clinical findings in chlamydial urogenital infections, laboratory diagnosis, prophylaxis and treatment of the diseases.
8. Classification, structure and properties of uropathogenic mycoplasmas.
9. Pathogenesis and clinical findings in mycoplasmal urogenital infections, laboratory diagnosis, prophylaxis and treatment of the diseases.

#### **THE LITERATURE:**

1. Lecture contents.
2. «Medical Microbiology, Virology & Immunology: Lecture Course». Part 2. I. I. Generalov, 2016. P. 144-161.

## **Personal work of students:**

**1. Demonstration:** a) microscopy of smears with *T. pallidum* (Giemsa stain); b) microscopy of smears with chlamidiae (Giemsa stain); c) microscopy of smears with incomplete phagocytosis of *N. gonorrhoeae* (methylene blue stain).

**2. Demonstration:** evaluation of ELISA test for serological diagnosis of syphilis.

**3. Demonstration:** biological products for diagnosis, specific prophylaxis and treatment of syphilis and gonorrhoea.

## **Laboratory class №8**

### **The topic: final classes of section “Medical bacteriology”**

#### **The main aim and the tasks of the work:**

To summarize the data of most significant bacterial infections, to learn major diseases of bacterial origin and methods of their laboratory diagnosis, prophylaxis and treatment.

#### **The questions to the topic:**

1. Staphylococci: classification, structure and properties. Virulence factors of staphylococci.
2. Pathogenesis and clinical findings in staphylococcal infections. Laboratory diagnosis, specific prophylaxis and treatment.
3. *Pseudomonas aeruginosa*: classification, structure and properties.
4. Pathogenesis and clinical findings in *Pseudomonas aeruginosa* infections. Laboratory diagnosis, prophylaxis and treatment.
5. Classification of pathogenic gram-negative non-sporeforming anaerobes. Structure and properties of bacteroids, prevotellae, porphyromonads.
6. Bacteroidal infections. Laboratory diagnosis, prophylaxis and treatment.
7. Streptococci: classification, structure and properties. Virulence factors of streptococci.
8. Pathogenesis and clinical findings in streptococcal infections. Laboratory diagnosis. Differential diagnosis of *S. pyogenes*, *S. agalactiae*, *S. pneumoniae*, and *Enterococcus spp.* Specific prophylaxis and treatment of streptococcal infections.
9. Classification, structure and properties of clostridia. Virulence factors of clostridia – causative agents of gas gangrene.

10. Pathogenesis and clinical findings in gas gangrene. Laboratory diagnosis, prophylaxis and treatment.
11. Structure and properties of *C. tetani*. Virulence factors.
12. Pathogenesis and clinical findings in tetanus. Laboratory diagnosis, specific prophylaxis and treatment.
13. *Clostridium difficile* – causative agent of pseudomembranous colitis.
14. Classification, structure and properties of *Escherichia coli*. Non-specific *Escherichia coli* infections.
15. Enteropathogenic, enterotoxigenic, enteroaggregative, enteroinvasive and enterohemorrhagic *E. coli*: pathogenesis and clinical findings of diseases.
16. Laboratory diagnosis of escherichioses. Prophylaxis and treatment.
17. Shigellae: classification, structure and properties. Virulence factors.
18. Pathogenesis and clinical findings in shigelloses. Laboratory diagnosis, prophylaxis and treatment.
19. Salmonellae: classification, structure and properties. Antigenic structure. Kauffmann and White scheme of salmonella typing. Virulence factors.
20. Pathogenesis and clinical findings in enteric fever. Laboratory diagnosis, specific prophylaxis and treatment.
21. Pathogenesis and clinical findings in salmonellosis. Laboratory diagnosis of salmonellosis, specific prophylaxis and treatment.
22. Classification, structure and basic properties of yersiniae.
23. Pathogenesis and clinical findings in yersinioses. Laboratory diagnosis, prophylaxis and treatment.
24. Classification, structure and properties of vibrios. Virulence factors of cholera vibrios. Mechanism of action of cholero-gen.
25. Pathogenesis and clinical findings in cholera. Laboratory diagnosis, specific prophylaxis and treatment of cholera.
26. Classification and properties of *C. botulinum*. Botulotoxin – properties, mechanism of action.
27. Pathogenesis and clinical findings in botulism. Laboratory diagnosis, prophylaxis and treatment.
28. Classification, properties and virulence factors of *Helicobacter pylori*.
29. Pathogenesis, laboratory diagnosis, prophylaxis and treatment of infections, associated with *H. pylori*.
30. Meningococci, taxonomy, properties. Virulence factors of meningococci.
31. Pathogenesis of meningococcal diseases. Laboratory diagnosis of meningococcal infections. Specific prophylaxis and treatment.
32. Classification, structure and properties of bordetellae. Bordetellae virulence factors.
33. Pathogenesis of whooping cough. Laboratory diagnosis, prophylaxis and treatment of whooping cough.
34. Pathogenic mycoplasmas, classification and properties. Virulence factors of mycoplasmas.
35. Pathogenesis of mycoplasmal pneumonia. Laboratory diagnosis, prophylaxis and treatment of mycoplasmal pneumonias.

36. *Haemophilus influenzae*, taxonomy, properties, virulence factors,
37. Pathogenesis, clinical characteristics, laboratory diagnosis of infections, associated with *Haemophilus influenzae*. Treatment and specific prophylaxis.
38. Classification of mycobacteria. Structure and properties of pathogenic mycobacteria. Virulence factors of *M. tuberculosis*.
39. Pathogenesis and clinical findings in tuberculosis. Laboratory diagnosis of tuberculosis. Specific treatment and prophylaxis of tuberculosis.
40. Structure and properties of *M. leprae*.
41. Pathogenesis and clinical findings of leprosy. Laboratory diagnosis, treatment and prophylaxis.
42. Classification, structure and properties of *C. diphtheriae*. Virulence factors of *C. diphtheriae*, mechanism of action of diphtheria exotoxin.
43. Pathogenesis and clinical findings in diphtheria. Laboratory diagnosis, Specific treatment and prophylaxis of diphtheria.
44. Classification, properties and virulence factors of *Legionella pneumophila*.
45. Pathogenesis, clinical findings and Laboratory diagnosis of legionellosis.
46. Classification, structure and properties of pathogenic treponemas (*T. pallidum*).
47. Pathogenesis and clinical findings in syphilis. Laboratory diagnosis of syphilis, treatment and prophylaxis of the disease.
48. Classification, structure and properties of *Neisseria gonorrhoeae*.
49. Pathogenesis and clinical findings in gonorrhoea, laboratory diagnosis, treatment and prophylaxis of the disease.
50. Classification, structure and properties of pathogenic chlamydiae.
51. Pathogenesis and clinical findings in chlamydial urogenital infections, laboratory diagnosis, prophylaxis and treatment of the diseases.
52. Pathogenesis and clinical findings in mycoplasmal urogenital infections, laboratory diagnosis, prophylaxis and treatment of the diseases.

### ***THE LITERATURE:***

1. Lecture contents.
2. "Medical Microbiology, Virology & Immunology: Lecture Course". Part 2. I. I. Generalov, 2016. P. 8-161.

**Demonstration materials:** Vi-hemagglutination test for enteric fever carriage detection, nutrient media for culture of pathogenic bacteria, biomedical products for immunodiagnosics, immunoprophylaxis and immunotherapy of bacterial infections.



## Laboratory class №9

**The topic:** *Causative agents of bacterial zoonoses (plague, anthrax, brucellosis, and tularemia)*

### **The main aim and the tasks of the work:**

1. To learn theoretical knowledge of the topic
2. To be able to detect pathogenic yersiniae, brucellae, francisellae and anthracoides bacilli in smears from clinical specimens.
3. To know the methods of laboratory diagnosis of plague, anthrax, brucellosis, and tularemia.
4. To get skills of serological diagnosis of brucellosis (Huddleson and Wright agglutination reactions).

### **The questions to the topic:**

1. Classification, structure and properties of *Y. pestis*.
2. Virulence factors of *Y. pestis*. Pathogenesis and clinical findings in plague.
3. Laboratory diagnosis of plague, specific prophylaxis and treatment of the disease.
4. Classification, structure and properties of *B. anthracis*.
5. Virulence factors of *B. anthracis*. Pathogenesis and clinical findings in anthrax.
6. Laboratory diagnosis of anthrax, specific prophylaxis and treatment.
7. Structure and properties of brucellae.
8. Pathogenesis and clinical findings in brucellosis.
9. Laboratory diagnosis of brucellosis, specific prophylaxis and treatment.
10. Structure and properties of *F. tularensis*.
11. Pathogenesis and clinical findings in tularemia.
12. Laboratory diagnosis of tularemia, specific prophylaxis and treatment.

### **THE LITERATURE:**

1. Lecture contents.
2. "Medical Microbiology, Virology & Immunology: Lecture Course". Part 2. I. I. Generalov, 2016. P. 162-182.

### **Personal work of students:**

**1. Demonstration:** a) microscopy of smears with *Y. pestis* (methylene blue stain); b) microscopy of smears with *B. anthracis* (Gram stain); c) microscopy of smears with *F. tularensis* (Gram stain); d) microscopy of smears with *B. abortus* (Gram stain);

**2. Demonstration:** biological products for diagnosis, specific prophylaxis and treatment of plague, anthrax, brucellosis, and tularemia.

**3. Extended agglutination test (Wright's reaction) for serological diagnosis of brucellosis**

Reagents	Serum dilutions					
	1:100	1:200	1:400	1:800	1:1600	K
Saline	1,0	1,0	1,0	1,0	1,0	1,0
Patient's serum	1,0 →	1,0 →	1,0 →	1,0 →	1,0	-
Brucella microbial diagnosticum	3 drops into every test tube					
<b>Results</b>						
<b>Conclusion:</b>						



### Laboratory class №10

**The topic:** *Pathogenic borreliae, leptospirae, rickettsiae and coxiellae. Laboratory diagnosis of relapsing fever, Lyme disease, leptospirosis, epidemic typhus, Q fever*

#### The main aim and the tasks of the work:

1. To learn theoretical knowledge of the topic
2. To know the properties of borreliae, leptospirae, rickettsiae and coxiellae.
3. To know the methods of laboratory diagnosis, treatment and prophylaxis of relapsing fever, Lyme disease, leptospirosis, epidemic typhus, Q fever.
4. To be able to perform indirect hemagglutination assay to differentiate primary epidemic typhus and Brill-Zinsser disease.

#### The questions to the topic:

1. Classification, structure and common properties of borreliae.
2. Pathogenesis, clinical findings and laboratory diagnosis of relapsing fevers.
3. Pathogenesis, clinical findings and laboratory diagnosis of Lyme disease.
4. Classification, structure and properties of leptospirae.
5. Pathogenesis, clinical findings and laboratory diagnosis of leptospirosis.
6. Classification, structure and properties of rickettsiae.
7. Pathogenesis and clinical findings in rickettsioses.
8. Laboratory diagnosis, prophylaxis and treatment of epidemic and endemic typhus.
9. Classification, structure and properties of *Coxiella burnetii*.

10. Pathogenesis and clinical findings in Q fever. Laboratory diagnosis, prophylaxis and treatment of the disease.

**THE LITERATURE:**

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 183-206.

**Personal work of students:**

**1. Demonstration:** a) microscopy of smears with *B. recurrentis* in patient’s blood (Giemsa stain); b) microscopy of smears with *R. provazekii* in infected tissues (Zdrodovsky stain).

**2. Demonstration:** biological products for diagnosis, specific prophylaxis and treatment of leptospirosis, borrelioses and rickettsioses.

**3. Indirect hemagglutination test for serological differentiation of primary epidemic typhus and Brill-Zinsser disease.**

Reagents	Serum dilutions						Control
	1:10	1:20	1:40	1:80	1:160	1:320	
	1	2	3	4	5	6	
Saline	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Patient’s serum I without cysteine, 1/5	0,2	0,2	0,2	0,2	0,2	0,2	
Patient’s serum II treated with cysteine, 1/5	0,2	0,2	0,2	0,2	0,2	0,2	
Erythrocyte rickettsial antigenic diagnosticum	0,2	0,2	0,2	0,2	0,2	0,2	0,2
<b>Incubation</b>	at 37°C for 1 h						
<b>Results:</b>							
Serum I							
Serum II							
<b>Conclusion:</b>							



## **Laboratory class №11**

**The topic: *General virology: morphology and physiology of viruses. Bacteriophages***

### **The main aim and the tasks of the work:**

1. To learn the theoretical knowledge of the topic.
2. To get acquaintance with structure and physiology of viruses.
3. To know the methods of virus cultivation.
4. To know the methods of virus detection in the embryonated chicken eggs and in the cell cultures.
5. To get skills of hemagglutination test for viral indication and titration.
6. To get skills of viral detection in the cell cultures by hemadsorption, symplast formation and by “color reaction”.
7. To get acquaintance with structure and physiology of bacteriophages.
8. To be able to evaluate laboratory tests for the detection of bacteriophage activities.

### **The questions to the topic:**

1. General characteristics of viruses.
2. Classification of viruses.
3. Structure of viruses.
4. Viral genomic organization.
5. Virus replication cycle.
6. Outcomes of viral infections
7. Laboratory diagnosis of viral infections, basic groups of laboratory tests. Molecular genetic methods of identification of viruses.
8. Different types of cell cultures. Indication and identification of viruses in the cell cultures.
9. Indication and identification of viruses in the embryonated chicken eggs. Serological diagnosis of viral infections.
10. Structure of bacteriophages.
11. Interaction of phages with bacterial cells. Outcomes of phage infections.
12. Laboratory determination of bacteriophage activity. Practical applications of phages in biology and medicine.

### ***THE LITERATURE:***

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 232-255.

## Personal work of students:

### 1. Hemagglutination test for the indication and titration of the virus

Reagents	Allantoic fluid dilutions					Control
	1:10	1:20	1:40	1:80	1:160	
Saline	0,1	0,1	0,4	0,1	0,1	0,1
Allantoic liquid	0,1 →	0,1 →	0,4 →	0,1 →	0,1	-
Erythrocyte suspension	0,1	0,1	0,4	0,1	0,1	0,1
<b>Incubation</b>	at 37°C for 1 h					
<b>Results:</b>						
<b>Conclusion:</b>						

**2. Demonstration:** microscopy of the cell culture smears with symplast in measles.

**3. Demonstration:** microscopy of the hemadsorption reaction.

**4. Demonstration:** titration of bacteriophages in liquid and solid nutrient media.

## Laboratory class №12

**The topic:** *Orthomyxoviruses. Paramyxoviruses. Coronaviruses*

### The main aim and the tasks of the work:

1. To learn the theoretical knowledge of the topic.
2. To get acquaintance with the methods of laboratory diagnosis of influenza, parainfluenza, mumps, measles, respiratory syncytial viral infections and SARS.
3. To know biomedical products for diagnostics, specific prophylaxis and treatment of viral diseases.

### The questions to the topic:

1. Influenza viruses, classification, structure and properties, viral replication cycle.
2. Pathogenesis and clinical findings in influenza. Laboratory diagnosis of disease.
3. Specific prophylaxis and treatment of influenza.
4. Paramyxoviruses. Classification, general characteristics, replication cycle.
5. Pathogenesis and clinical findings in parainfluenza. Laboratory diagnosis of disease, specific prophylaxis and treatment.

6. Pathogenesis and clinical findings in measles. Laboratory diagnosis of the diseases, specific prophylaxis and treatment.
7. Pathogenesis and clinical findings in mumps. Laboratory diagnosis of the diseases, specific prophylaxis and treatment.
8. Pneumoviruses, classification, structure and replication cycle.
9. General characteristics of infections, caused by pneumoviruses. RSV-infection – pathogenesis, clinical findings, laboratory diagnosis, prophylaxis and treatment.
10. Coronaviruses, classification, and general characteristics. Coronaviral infections in humans.
11. Structure and properties of SARS-associated coronavirus.
12. Pathogenesis and clinical findings in SARS. Laboratory diagnosis of SARS, prophylaxis and treatment.

***THE LITERATURE:***

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 256-274, 278-284.

**Original work of students:**

***1. Hemagglutination inhibition test for the identification of influenza virus***

Reagents	Serum dilutions						Control
	1:10	1:20	1:40	1:80	1:160	1:320	
	1	2	3	4	5	6	
Saline	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Anti-influenza serum (H <sub>2</sub> N <sub>2</sub> ), 1/5	0,1 →	0,1 →	0,1 →	0,1 →	0,1 →	0,1	
Anti-influenza serum (H <sub>3</sub> N <sub>2</sub> ), 1/5	0,1 →	0,1 →	0,1 →	0,1 →	0,1 →	0,1	
Allantoic fluid (4 HAU)	0,1	0,1	0,1	0,1	0,1	0,1	0,1
<b>Incubation</b>	at 37°C for 1 h						
Erythrocyte suspension	0,1	0,1	0,1	0,1	0,1	0,1	0,1
<b>Incubation</b>	at 37°C for 1 h						
<b>Results:</b>							↓
Anti-influenza serum (H <sub>2</sub> N <sub>2</sub> ), 1/5							
Anti-influenza serum (H <sub>3</sub> N <sub>2</sub> ), 1/5							
<b>Conclusion:</b>							

***2. Demonstration:*** microscopy of the cell culture preparation with measles virus symplasts.

**3. Demonstration:** microscopy of the cell culture preparation with adenoviral inclusions.

### **Laboratory class №13**

**The topic:** *Picornaviruses (enteroviruses, polioviruses, coxsackieviruses, echoviruses). Reoviruses and rotaviruses. Adenoviruses*

#### **The main aim and the tasks of the work:**

1. To learn the theoretical knowledge of the topic.
2. To get acquaintance with the laboratory diagnosis of poliomyelitis, enteroviral rotaviral, and adenoviral infections.
3. To know biomedical products for diagnostics, specific prophylaxis and treatment of above viral infections.

#### **The questions to the topic:**

1. Picornaviruses: classification and general characteristics.
2. Polioviruses. Pathogenesis and clinical findings in poliomyelitis. Laboratory diagnosis and specific prophylaxis of disease.
3. Coxsackieviruses of A and B groups. Clinical forms of coxsackievirus infection. Laboratory diagnosis and prophylaxis of coxsackievirus infection.
4. ECHOviruses and other pathogenic enteroviruses. Clinical findings in echovirus infection. Laboratory diagnosis and prophylaxis of echovirus infections.
5. Reoviruses and rotaviruses. Classification and general characteristics.
6. Pathogenesis, clinical findings, laboratory diagnosis and prophylaxis of rotaviral infections.
7. Adenoviruses, classification, structure, viral replication cycle.
8. Pathogenesis of infections, caused by adenoviruses, laboratory diagnosis, specific prophylaxis and treatment.

#### ***THE LITERATURE:***

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 285-301.

## Personal work of students:

### 1. *Detection of rotaviral antigens by ELISA test*

	1	2	3	4	5	6	7	8	9	10	11	12
A											C(+)	C(+)
B											C(-)	C(-)
C												
D												
Conclusion												

A11 and A12 – the cells with positive control specimen

B11 and B12 – the cells with negative control specimen

**2. Demonstration:** indication and identification of polioviruses by “color” neutralization reaction of viral cytopathic effect.

## Laboratory class №14

**The topic:** *Retroviruses and human immunodeficiency virus (HIV). Hepatotropic viruses (causative agents of hepatites A, B, C, D, E)*

### The main aim and the tasks of the work:

1. To learn the theoretical knowledge of the topic.
2. To get acquaintance with laboratory diagnosis of HIV-infection.
3. To get acquaintance with laboratory diagnosis of viral hepatites.
4. To get skills of HIV laboratory diagnosis by ELISA test.
5. To get skills of laboratory diagnosis of hepatitis B virus by PCR test

### The questions to the topic:

1. Retroviruses, their classification. Structure of HIV. Virion resistance
2. HIV replication cycle. Pathogenesis of HIV infection.
3. Epidemiology and clinical findings in HIV infection. AIDS progressing.
4. Laboratory diagnosis, specific treatment and prophylaxis of HIV infection.
5. Hepatitis A virus. Pathogenesis and clinical findings in hepatitis A. Laboratory diagnosis of disease, specific prophylaxis and treatment.
6. Hepatitis B virus. Classification, structure and properties, HBV replication cycle. Pathogenesis and clinical findings in hepatitis B. Laboratory diagnosis, specific prophylaxis and treatment.
7. Hepatitis D virus. Classification, structure and properties. Clinical findings in delta-infection. Laboratory diagnosis of hepatitis D.



8. Hepatitis C virus. Classification, structure and properties. Clinical findings in hepatitis C. Prognosis of HCV infection. Laboratory diagnosis, prophylaxis and treatment.
9. Hepatitis E virus. Structure and properties. Clinical findings in hepatitis E. Laboratory diagnosis of HEV infection.

***THE LITERATURE:***

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 302-331.

**Personal work of students:**

**1. *Demonstration of immunoblotting*** analysis for serological diagnosis of HIV infection.

**2. *Evaluation of PCR test*** for molecular genetics diagnosis of hepatitis B.

**Laboratory class №15**

**The topic: *Herpesviruses. Rubella virus. Rabies virus***

**The main aim and the tasks of the work:**

1. To learn the theoretical knowledge of the topic.
2. To get acquaintance with pathogenesis and clinical findings in herpes viral infections, rubella, and rabies
3. To be able to analyze the results of serological tests (ELISA) and molecular genetic tests (PCR) for laboratory diagnosis of herpes viral infections and rubella.
4. To get skills of rabies diagnosis by the microscopy of tissue specimens.

**The questions to the topic:**

1. Herpesviruses. Classification and general characteristics.
2. Herpes simplex viruses of 1 and 2 type. Pathogenesis and clinical findings in herpetic infection. Laboratory diagnosis, treatment and prophylaxis of disease.
3. Varicella-zoster herpesvirus infections. Pathogenesis and clinical findings in chickenpox and herpes zoster. Laboratory diagnosis, prophylaxis and treatment of chickenpox and shingles.
4. Cytomegalovirus infection. Pathogenesis and clinical findings in CMV infection. Laboratory diagnosis, prophylaxis and treatment.

5. Epstein-Barr virus infection. Clinical findings in EBV infection. Laboratory diagnosis, prophylaxis and treatment. Burkitt's lymphoma and nasopharyngeal carcinoma.
6. Herpesvirus infection of HV types 6, 7 and 8. General characteristics. Laboratory diagnosis of infections.
7. Rubella virus. Classification, structure and properties.
8. Clinical findings in rubella. Congenital rubella syndrome. Laboratory diagnosis, specific prophylaxis and treatment of rubella.
9. Rabdoviruses, classification and general characteristics. Rabies virus. Structure and properties.
10. Pathogenesis and clinical findings in rabies. Laboratory diagnosis, specific passive and active prophylaxis of rabies.

***THE LITERATURE:***

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 274-278, 332-347, 365-370.

**Personal work of students:**

**1. Demonstration:** cytoplasmic inclusions in epithelial cells of salivary glands in CMV infection.

**2. Evaluation of ELISA test for serological diagnosis of infectious mononucleosis (EBV infection)**

	1	2	3	4	5	6	7	8	9	10	11	12
<b>A</b>											C(+)	C(+)
<b>B</b>											C(-)	C(-)
<b>C</b>												
<b>D</b>												
<b>Conclusion</b>												

A11 and A12 – the cells with positive control sera

B11 and B12 – the cells with negative control sera

**3. Demonstration:** microscopy of Babes-Negri bodies in hippocampus section in rabies.

## Laboratory class №16

### The topic: *final classes of the section “Medical virology”*

#### **The main aim and the tasks of the work:**

To summarize the essential data of medical virology, to revise the knowledge of major viral infections and methods of their laboratory diagnosis, prophylaxis and treatment.

#### **The questions to the topic:**

1. Classification and structure of viruses. Viral genomic organization.
2. Virus replication cycle. Outcomes of viral infections.
3. Laboratory diagnosis of viral infections, basic groups of laboratory tests. Molecular genetic methods of identification of viruses. Serological diagnosis of viral infections.
4. Different types of cell cultures. Indication and identification of viruses in the cell cultures. Indication and identification of viruses in embryonated chicken eggs.
5. Influenza viruses, classification, structure and properties, viral replication cycle.
6. Pathogenesis and clinical findings in influenza. Laboratory diagnosis of influenza. Specific prophylaxis and treatment of the disease.
7. Paramyxoviruses. Classification, general characteristics, replication cycle.
  1. Pathogenesis and clinical findings in parainfluenza. Laboratory diagnosis of disease, specific prophylaxis and treatment.
8. Measles virus, classification, structure and properties. Pathogenesis and clinical findings in measles. Laboratory diagnosis of disease, specific prophylaxis and treatment.
9. Mumps virus, classification, structure and properties. Pathogenesis and clinical findings in mumps. Laboratory diagnosis of disease, specific prophylaxis and treatment.
10. General characteristics of infections, caused by pneumoviruses. Respiratory syncytial virus (RSV) – structure and properties. RSV infection – pathogenesis, clinical findings, laboratory diagnosis, prophylaxis and treatment.
12. Human coronaviruses, classification, structure and properties. Coronaviral infections in humans. SARS-associated virus. Pathogenesis and clinical findings in severe acute respiratory syndrome. Laboratory diagnosis, prophylaxis and treatment.
13. Adenoviruses, classification, structure and properties. Pathogenesis and clinical findings in adenoviral infections. Laboratory diagnosis of adenoviral diseases, specific prophylaxis and treatment.
14. Picornaviruses: classification and general characteristics. Polioviruses. Pathogenesis and clinical findings in poliomyelitis. Laboratory diagnosis and specific prophylaxis of disease.

15. Coxsackieviruses of A and B groups. Classification and general characteristics. Clinical forms of coxsackieviral infection. Laboratory diagnosis and prophylaxis of coxsackieviral infection. Human infections, caused by ECHO-viruses.
16. Reoviruses and rotaviruses. Classification and general characteristics. Pathogenesis and clinical findings in rotaviral infections. Laboratory diagnosis, treatment and prophylaxis of rotaviral infections.
17. Hepatitis A virus. Pathogenesis and clinical findings in hepatitis A. Laboratory diagnosis of disease, specific prophylaxis and treatment.
18. Hepatitis B virus. Classification, structure and properties, HBV replication cycle. Pathogenesis and clinical findings in hepatitis B. Laboratory diagnosis, specific prophylaxis and treatment.
19. Hepatitis D virus, structure and properties. Clinical findings in hepatitis D. Laboratory diagnosis of delta-infection, prophylaxis and treatment.
20. Hepatitis C virus. Classification, structure and properties. Clinical findings in hepatitis C. Prognosis of HCV infection. Laboratory diagnosis, prophylaxis and treatment.
21. Hepatitis E virus. Structure and properties. Clinical findings in hepatitis E. Laboratory diagnosis of HEV infection, prophylaxis and treatment.
22. Retroviruses, their classification. Structure of HIV. Virion resistance. HIV replication cycle. Pathogenesis of HIV infection.
23. Epidemiology and clinical findings in HIV infection. AIDS progression. Laboratory diagnosis, prophylaxis and specific treatment of HIV infection.
24. Herpesviruses. Classification and general characteristics. Herpes simplex viruses of 1 and 2 type. Pathogenesis and clinical findings in herpetic infection. Laboratory diagnosis, treatment and prophylaxis of diseases.
25. Varicella-zoster herpesvirus infections. Pathogenesis and clinical findings in chickenpox and shingles. Laboratory diagnosis, prophylaxis and treatment of infections.
26. Cytomegalovirus infection. Pathogenesis and clinical findings in CMV infection. Laboratory diagnosis, prophylaxis and treatment. Herpesviral infections of HV types 6, 7 and 8. General characteristics. Laboratory diagnosis.
27. Epstein-Barr virus infection. Clinical findings in infectious mononucleosis. Laboratory diagnosis, prophylaxis and treatment. Burkitt's lymphoma and nasopharyngeal carcinoma.
28. Rubella virus. Classification, structure and properties. Clinical findings in rubella. Congenital rubella syndrome. Laboratory diagnosis, specific prophylaxis and treatment of rubella.
29. Rabdoviruses, classification and general characteristics. Rabies virus – structure and properties, virus replication cycle.
30. Pathogenesis and clinical findings in rabies. Laboratory diagnosis, specific passive and active prophylaxis of rabies.
31. Structure of bacteriophages.
32. Interaction of phages with bacterial cells. Outcomes of phage infections.
33. Laboratory determination of bacteriophage activity. Practical applications of phages in biology and medicine.

## ***THE LITERATURE:***

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 232-248, 256-347, 365-370.

**Demonstration materials:** hemagglutination inhibition test and enzyme-linked immunosorbent assay (ELISA) tests for serological diagnosis of viral infections, anti-rabies gamma-globulin, anti-measles gamma-globulin, influenza serum A (H<sub>3</sub>N<sub>2</sub>), influenza diagnosticum type A (H<sub>3</sub>N<sub>2</sub>), HBs-vaccine, poliovaccine, MMR vaccine.

## **Laboratory class №17**

**The topic:** *Causative agents of zoonotic viral infections. Prions and prion diseases*

### **The main aim and the tasks of the work:**

1. To learn the theoretical knowledge of the topic.
2. To deliver the reports and presentations about acute hemorrhagic fevers and other emerging viral zoonotic infections of global surveillance.
3. To get acquaintance with the activities of WHO and Global Outbreak Alert and Response Network (GOARN) coordinating efforts for the rapid identification and response to viral outbreaks of international importance.
4. To get acquaintance with modern methods of laboratory diagnosis of prion infections.

### **The questions to the topic:**

1. Arthropod-borne and rodent-borne viruses: general characteristics.
2. Flaviviruses, classification, structure and properties of tick-borne encephalitis virus.
3. Pathogenesis and clinical findings in tick-borne encephalitis. Laboratory diagnosis of the disease, prophylaxis and treatment.
4. Filoviruses, classification and general characteristics. Causative agents of Marburg and Ebola hemorrhagic fevers – structure and properties.
5. Pathogenesis and clinical findings in Ebola virus acute hemorrhagic fever. Laboratory diagnosis, treatment and prophylaxis of Ebola virus infection.
6. Arenaviruses, classification and general characteristics. Viral replication cycle.

7. Pathogenesis and clinical findings in Lassa hemorrhagic fever. Laboratory diagnosis, principles of prophylaxis and treatment of arenaviral infections.
8. General characteristics of prion agents. The history of prion discovery.
9. Pathogenesis of prion infections: the role of PrP<sup>c</sup> and PrP<sup>sc</sup> proteins.
10. Clinical manifestations of prion diseases: Creutzfeldt-Jacob disease, Gerstmann-Straussler-Scheinker syndrome, fatal familial insomnia, kuru disease.
11. Laboratory diagnosis, principles of prophylaxis of prion infections.

### ***THE LITERATURE:***

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 348-365, 371-375.

### **Personal work of students::**

**1. Discussion** on the reports of acute hemorrhagic fevers and other emerging viral zoonotic infections of global interest.

**2. Evaluation of protein misfolding cyclic amplification (PMCA)** test for molecular diagnosis of prions.

### **Laboratory class №18**

**The topic: *Clinical microbiology. Basics on clinical mycology and medical protozoology***

### **The main aim and the tasks of the work:**

1. To learn the theoretical knowledge of the topic.
2. To get acquaintance with major microbial pathogens causing opportunistic and hospital-acquired infections, fungal and protozoan diseases.
3. To get knowledge of the techniques of microbiological specimen collection.
4. To know etiology, pathogenesis, principles of laboratory diagnosis, treatment and prophylaxis of systemic bacterial infection (sepsis).
5. To be able to evaluate laboratory tests for the detection of antimicrobial resistance.
6. To get acquaintance with international cooperative activities for urgent prevention of global spread of antimicrobial resistance.

### **The questions to the topic:**

1. General characteristic of opportunistic and hospital-acquired infections (HAI).
2. Major bacterial pathogens causing opportunistic and hospital-acquired infections (respiratory, urogenital, suppurative and wound infections, bacterial meningitis, infectious endocarditis and others).
3. Laboratory diagnosis of opportunistic and hospital-acquired infections. Basic methods of microbiological specimen collection and transport. The criteria of etiological role of opportunistic microbial pathogens in hospital-acquired infections.
4. Principles of prophylaxis and treatment of opportunistic and hospital-acquired infections. The critical problem of rising antimicrobial resistance. WHO Global Action Plan on antimicrobial resistance.
5. Generalized systemic bacterial infection (sepsis and septic shock) – etiology and pathogenesis.
6. Principles of laboratory diagnosis, treatment and prophylaxis of sepsis.
7. General characteristics of major fungal pathogens. Superficial and deep mycoses.
8. *Candida albicans* and candidiasis. Pathogenesis, manifestations, principles of laboratory diagnosis, treatment and prophylaxis of candidiasis.
9. Causative agents of the most common protozoan diseases (malaria, toxoplasmosis, trichomoniasis, amoebiasis, giardiasis).

### **THE LITERATURE:**

1. Lecture contents.
2. “Medical Microbiology, Virology & Immunology: Lecture Course” Part 1. I. I. Generalov, Vitebsk, 2016. P. 48-52, 154-159, 160-162.
3. “Medical Microbiology, Virology & Immunology: Lecture Course”. Part 2. I. I. Generalov, 2016. P. 8-15, 21-31, 41-50, 221-229, 382-385.

### **Personal work of students::**

**1. Discussion** on the reports of major causative agents of hospital-acquired opportunistic infections, fungal and protozoan diseases.

**2. Demonstration of double disc synergy test (DDST)** for detection of extended-spectrum beta-lactamase (*ESBL*) production.

**3. Demonstration of broth microdilution test** for assessment of microbial resistance to antibiotics

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**INSTRUCTIONS FOR LABORATORY TRAINING**  
**in Special Microbiology & Immunology**  
**for Students of the Faculty of General Medicine**  
**(English Medium)**

**МЕТОДИЧЕСКИЕ РЕКОМЕНДАЦИИ**  
**К ЛАБОРАТОРНЫМ ЗАНЯТИЯМ**  
**ПО ЧАСТНОЙ МИКРОБИОЛОГИИ И ИММУНОЛОГИИ**  
Методические рекомендации

**для студентов лечебного факультета**  
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