Appendix to the working program

Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation

BANK OF ASSESSMENT TOOLS FOR DISCIPLINE

MICROBIOLOGY, VIROLOGY – MICROBIOLOGY OF THE ORAL CAVITY

Training program (specialty): **31.05.03 DENTISTRY**

Department: **EPIDEMIOLOGY, MICROBIOLOGY AND EVIDENCE-BASED MEDICINE**

Mode of study: **FULL-TIME**

Nizhniy Novgorod
2021

1. Bank of assessment tools for the current monitoring of academic performance, mid-term assessment of students in the discipline / practice

This Bank of Assessment Tools (BAT) for the discipline "**MICROBIOLOGY, VIROLOGY-MICROBIOLOGY OF THE ORAL CAVITY** " is an integral appendix to the working program of the discipline " **MICROBIOLOGY, VIROLOGY - MICROBIOLOGY OF THE ORAL CAVITY**". All the details of the approval submitted in the WPD for this discipline apply to this BAT.

(Banks of assessment tools allow us to evaluate the achievement of the planned results stated in the educational program.

Assessment tools are a bank of control tasks, as well as a description of forms and procedures designed to determine the quality of mastering study material by students.)

2. List of assessment tools

The following assessment tools are used to determine the quality of mastering the academic material by students in the discipline/ practice:

No.	Assessment tool	Brief description of the assessment tool	Presentation of the assessment tool in the BAT
1	Test №1	A system of standardized tasks that allows you to automate the procedure of measuring the level of knowledge and skills of a student	Bank of test tasks
2	Test №2		
3	Abstract	The product of the student's independent work, which is a summary in writing of the results of the theoretical analysis of a certain scientific (educational and research) topic, where the author reveals the essence of the problem under study, provides various points of view, as well as his /her own views on it.	List of abstract topics
4	Situational tasks	A method of control that allows you to assess the criticality of thinking and the degree of the material comprehension, the ability to apply theoretical knowledge in practice.	List of tasks

3. A list of competencies indicating the stages of their formation in the process of mastering the educational program and the types of evaluation tools

Code and formulation of competence*	Stage of competence formation	Controlled sections of the discipline	Assessment tools
UC-1, UC-8, GPC-5, GPC-9, PC-3, PC-6	Current	**Section 1** Introduction to medical microbiology. General bacteriology General virology The basics mycology Infectious process Pathogenicity and virulence of microorganisms The normal microflora of the oral cavity	Test Abstract Situational tasks
		Section 2 Special medical microbiology	Test Abstract Situational tasks

		Section 3 Special medical virology	Test Abstract Situational tasks
UC-1, UC-8, GPC-5, GPC-9, PC-3, PC-6	Mid-term	**Section 1** General medical microbiology Introduction to medical microbiology. General bacteriology General virology The basics mycology Infectious process Pathogenicity and virulence of microorganisms The normal microflora of the oral cavity **Section 2** Special medical microbiology **Section 3** Special medical virology	Exam questions

4. The content of the assessment tools of entry, current control

Entry /current control is carried out by the discipline teacher when conducting classes in the form of: test, abstract, situational tasks

Assessment tools for current control.

1. test
2. abstract
3. situational tasks

4.1. Tests for the assessment of competence UC-1, UC-8, GPC-5, GPC-9, PC-3, PC-6*:*

1. Who was the first person to examine bacterial cells under the microscope?

1) Louis Pasteur;
2) Robert Koch;
3) Anthony van Leeuwenhoek;
4) Dmitry Ivanowsky;
5) Hans Christian Gram.

2. Prokaryotes:

1) are “prenucleus” organisms;
2) may include single-cell organisms;
3) may belong to domen Archaea / Archaebacteria;
4) may belong to domen Bacteria / Eubacteria;
5) are Eucarya (nuclear organisms).

3. Components of prokaryotes are:

1) a cytoplasm membrane;
2) peptidoglycan;
3) a single circular chromosome;
4) cell wall;
5) ribosome 80S.

4. Which group of microbial agents is eukaryotic:

1) viruses;
2) bacteria;
3) actinomycetes;
4) fungi;
5) prions.

5. Which characteristics are true for prokaryotic cells?

1) a membrane-bound nucleus;
2) a single plasma membrane between the cell wall and the cytoplasm;
3) a cell wall;
4) a nucleoid;
5) 70s ribosomes.

6. The components of a bacterial cell are:

1) a cytoplasmic membrane;
2) ribosomes;
3) mitochondria;
4) chloroplasts;
5) inclusions.

7. **Nuclear analogue/ equivalent of bacteria:**

1) contains a haploid set of genes;
2) is enclosed in a membrane;
3) is called a nucleoid;
4) contains DNA;
5) includes a single chromosome.

8. Bacteria can have:

1) a Golgi apparatus;
2) a nucleoid;
3) a cell wall;
4) pili;
5) flagella.

9. The basic structural unit of biological taxonomy (the narrowest taxon) is:

1) class;
2) order;
3) family;
4) genus;
5) species.

10. The scientist who introduced the binomial / binary ("two word naming system) nomenclature to indicate the species is:

1) Anthony van Leeuwenhoek;
2) Hans Christian Gram;
3) Carl Linnaeus;
4) Robert Koch;
5) Louis Pasteur.

11. The strains that have antigenic properties different from other strains of the same species are:

1) morphovars;
2) biovars (biotypes);
3) resistovars;
4) phagovars (phagotypes);
5) serovars (serotypes).

12. The main morphological groups of bacteria are:

1) prokaryotes;
2) eukaryotes;
3) cocci;

4) rod-shaped;
5) spiral-forms.

13. Cocci arranged in a grapelike cluster (amorphous clumps) are:
1) micrococci;
2) tetrads;
3) sarcina;
4) staphylococci;
5) streptococci.

14. Cocci arranged in chains are:
1) diplococci;
2) spirochaetes;
3) bacilli;
4) streptococci;
5) vibrios.

15. Rod-shaped bacteria arranged in chains are:
1) diplobacilli;
2) clostridia;
3) vibrios;
4) streptobacilli;
5) sarcinae.

16. Comma-shaped bacteria are:
1) bacilli;
2) spirilla;
3) vibrios;
4) clostridia;
5) spirochetes.

17. Spiral-form bacteria are called:
1) bacilli;
2) spirilla;
3) sarcinae;
4) clostridia;
5) spirochetes.

18. Spirochetes with 6 to 14 curls are called:
1) vibrios;
2) leptospires;
3) borreliae;
4) spirilla;
5) treponemes.

19. Fungi-like bacteria forming long filaments are:
1) mycoplasmas;
2) rickettsiae;
3) actinomycetes;
4) chlamydiae;
5) spirochetes.

20. The main structural components of a bacterial cell characteristic of most bacteria ("obligatory" structures) are:
1) a nucleoid;

2) a cytoplasmic membrane;
3) ribosomes;
4) a cytoplasm;
5) a cell wall.

21. The structural component containing peptidoglycan is:
1) a nucleoid;
2) a ribosome;
3) a flagellum;
4) a cell wall;
5) a plasma membrane.

22. What is true for a bacterial cell wall it?
1) determines the bacterial cell shape;
2) contains peptidoglycan;
3) always contains endotoxin;
4) determines the bacterial staining properties;
5) presents in L-forms.

23. According to the structural features of the cell wall bacteria are classified into:
1) gram-negative;
2) gram-positive;
3) protoplasts;
4) acid-fast;
5) spheroplasts.

24. Peptidoglycan consists of the following polymers:
1) N-acetylglucosamine (NAG);
2) N-acetylmuramic acid (NAM);
3) lipopolysaccharide;
4) polymetaphosphates;
5) tetrapeptide chains.

25. Gram staining is determined by:
1) the form and size of a bacterial cell;
2) the structure of a capsule;
3) the presence of a spore;
4) the structure of a bacterial cell wall;
5) the structure of a cytoplasmic membrane.

26. The components of a gram-positive bacteria cell wall are:
1) a single-layer peptidoglycan;
2) a multilayer peptidoglycan;
3) the presence of teichoic acids;
4) the presence of endotoxin;
5) the presence of outer membrane.

27. What is true for teichoic (lipoteichoic) acids?
1) typical structures of gram-positive bacteria;
2) components of a cell wall;
3) they are connected with pili;
4) they are connected with peptidoglycan (cell membrane);
5) fragments of ribosomes.

28. What is true for gram-negative bacteria?

1) the presence of a multilayered peptidoglycan;
2) the presence of an outer membrane;
3) the presence of teichoic acids;
4) the absence of a periplasm;
5) the presence of lipopolysaccharide (LPS).

29. The components of a gram-negative cell wall are:
1) teichoic acids;
2) lipopolysaccharide;
3) endotoxin;
4) teichoic acids;
5) outer membrane.

30. The specific component of gram-negative bacteria is:
1) a capsule;
2) a flagellum;
3) an endospore;
4) an outer membrane;
5) a peptidoglycan.

31. Which of the following characteristics are true for a lipopolysaccharide:
1) it is a component of a cytoplasmic membrane;
2) it is a component of a capsule;
3) it is a component of an outer membrane;
4) it is a component of a peptidoglycan;
5) it is a bacterial endotoxin.

32. What are the factors that determine the acid resistance of bacteria?
1) the structure of the cell wall;
2) the structure of the cytoplasmic membrane;
3) the presence of lipids in the cell wall;
4) the presence of peptidoglycan in the cell wall;
5) the presence of a capsule.

33. Bacteria without a cell wall/ bacteria that lack a cell wall are:
1) mycoplasmas;
2) rickettsiae;
3) actinomycetes;
4) chlamydiae;
5) spirochetes.

34. Cell wall deficient bacterial forms which can multiply are called:
1) protoplasts;
2) spheroplasts;
3) L-forms;
4) streptococci;
5) staphylococci.

35. Characteristics true for bacterial l-forms are:
1) bacteria deficient in nucleus;
2) bacteria deficient in fimbriae;
3) bacteria deficient in peptidoglycan;
4) the form of bacterial adaptation to antibiotics;
5) a multiplying protoplast /spheroplast.

36. A complex stain method:

1) is the application of a single dye for staining;
2) is the application of two or more dyes;
3) it requires several steps;
4) it permits the differentiation of cell types or cell structures;
5) is Gram stain.

37. The function of a cytoplasmic membrane is:

1) a selective transport of nutrient molecules;
2) ATP- synthesis/ energy transformation;
3) participation in a binary fission;
4) protection from UV- light;
5) adhesion.

38. The functions of bacterial fimbriae (pili) are:

1) locomotion;
2) adhesion;
3) augmentation of pathogenicity;
4) DNA replication;
5) sporulation.

39. Ecologically-dependent components of bacteria are:

1) a cytoplasmic membrane;
2) a capsula;
3) a nucleoid;
4) an endospore;
5) a flagella.

40. Characteristics which are true for a bacterial capsule are:

1) protection of bacteria from aggressive chemical and mechanical substances;
2) protection of bacteria from phagocytosis;
3) amplification of pathogenicity;
4) a variable part of a bacterium;
5) being mostly polysaccharide in nature.

41. What is the complex staining method (special stain) for capsule detection?

1) Gram stain;
2) Neisser's method;
3) Ozheshko method;
4) Ziehl-Neelsen stain;
5) Burri-Gins method.

42. The functions of a bacterial endospore are:

1) multiplication;
2) protection from environment influence;
3) protection from host immunity;
4) determinant of bacterial stability at high temperature;
5) increasing stability to drying.

43. Bacteria forming an endospore are:

1) spirochetes;
2) vibrios;
3) bacilli;
4) streptococci;
5) clostridia.

44. Rods with a spore size (diameter) more than a diameter of a vegetative part of a bacterial cell are:

1) spirochetes;
2) vibrios;
3) bacilli;
4) cocci;
5) clostridia.

45. The complex staining method (special stain) for the detection of an endospore is:

1) Gram stain;
2) Neisser's method;
3) Ozheshko method;
4) Ziehl-Neelsen stain;
5) Burri-Gins method.

46. Bacteria with two or more flagella at the cell end is called:

1) monotrichous;
2) atrichous;
3) lophotrichous;
4) amphitrichous;
5) peritrichous.

47. The chemical composition of bacterial flagella is:

1) glycoprotein;
2) glycogen;
3) protein;
4) lipopolysaccharide;
5) nucleic acid.

48. Complex staining method (special stain) for flagella detection is:

1) Gram stain;
2) Neisser's method;
3) Ozheshko method;
4) Ziehl-Neelsen stain;
5) silvering according to Morozov.

49. Bacteria that can move by reducing the axial thread are:

1) mycoplasmas;
2) rickettsiae;
3) actinomycetes;
4) chlamydiae;
5) spirochetes.

50. Which characteristics are true for volutin granules?

1) they contain polyphosphate;
2) reserve of energy-rich components;
3) methachromatic granules;
4) they protect bacteria from UV-light;
5) throphycal function.

51. What is a complex staining method for detecting volutin granules?

1) Gram stain;
2) Neisser's method;
3) Ozheshko method;

4) Ziehl-Neelsen stain;
5) silvering according to Morozov.

ANSWER KEY

1) 3. **2)** 1–4. **3)** 1–4. **4)** 4. **5)** 2–5. **6)** 1–2, 5. **7)** 1, 3–5. **8)** 2–5. **9)** 5. **10)** 3. **11)** 5. **12)** 3–5. **13)** 4. **14**) 4. **15**) 4. **16)** 3. **17)** 2, 5. **18)** 5. **19)** 3. **20)** 2–5. **21)** 4. **22)** 1, 2, 4. **23**) 1, 2, 4. **24**) 1, 2, 5. **25)** 4. **26**) 2, 3. **27**) 1, 2, 4. **28)** 2, 5. **29**) 2, 3, 5. **30)** 4. **31)** 3, 5. **32)** 1, 3. **33)** 1. **34)** 3. **35)** 3–5. **36)** 2–5. **37)** 1–3. **38)** 2, 3. **39)** 2, 4. **40)** 2–5. **41)** 5. **42)** 2, 4, 5. **43)** 3, 5. **44)** 5. **45)** 3. **46)** 3. **47)** 3. **48)** 5. **49)** 5. **50)** 1–3, 5. **51)** 2.

4.2. Abstracts for the assessment of competence " UC-1, UC-8, GPC-5, GPC-9, PC-3, PC-6"*:*

1. Place of microbiota in ecological systems
2. Peculiarities of species composition of microbiota in different ecological niches
3. Interaction of normal and pathogenic microbiota in pathological processes
4. Study of water, soil and other substrates

4.3. Tasks (assessment tools) for the credit

The full package of tasks is given *(*UC-1, UC-8, GPC-5, GPC-9, PC-3, PC-6*):*

Example 1

A 65-year-old woman consulted a dermatologist for vesicular-erosive skin rashes resembling chickenpox exanthema, the rash present in thoracic or lumbar region. From the anamnesis: she suffered from chickenpox in early childhood. First symptom that appeared a few days before exanthema and is present at the time of examination is a sharp pain along the nerves of the affected skin segment.

Questions:

1. Guess a possible pathogen based on clinical data, life history and illness. Give general characteristics it.
2. Describe the mechanism of the virus persistence? What cells did the virus end up in after childhood chickenpox? How can this disease be characterized in relation to chickenpox?
3. What is the outcome of the disease? What is characteristic for the recurrence of this infection, in comparison with other epithelial viruses?
4. Is the vaccine effective for this infection?
5. If the patient is in a satisfactory condition, is it possible to involve her in caring for a one-year-old granddaughter who has not been sick or vaccinated against chickenpox? Justify the answer.

Answers:

1. According to anamnestic and examination data, it is possible to assume that these are manifestations caused by the chickenpox virus - herpes zoster. This virus belongs to the Herpesviridae family, genus Varicellovirus, human herpesvirus - 3 (HHV-3). A large spherical virion, complex (envelope), autonomous genome presented double-stranded linear DNA. Capsid is a cubic type of symmetry. Between the capsid and the supercapsid is the tegment, an amorphous layer containing proteins for starting the replicative process.
2. After chickenpox in childhood and recovery, the virus did not leave the body (clinical, but not microbiological recovery), it entered the regional ganglia of sensory nerves and persisted in neurons in the form of a genomic molecule (persistence mechanism - non-integrative virogeny).

In relation to chickenpox (primary infection), herpes zoster is a secondary infection resulting from recurrence of an endogenous infection.

3. Clinical recovery. The process is dangerous for patients with immune defects. Relapses are less frequent compared to HSV infection, but they are more severe (very painful neuralgia may appear, as in the case of our patient).
4. No, the live attenuated vaccine provides protection against chickenpox, but does not protect against herpes zoster.
5. This is not possible, because the rash is highly contagious and the grandmother can become a source of chickenpox infection for her granddaughter. Patients are not dangerous for people who have had chickenpox, but they can infect those who have not yet encountered the virus.

Example 2

A patient with urological infection was taken urine for bacteriological examination. Round flat mucous colonies were found on the nutrient (peptone) agar after cultivation (24 h, 37°C). The medium around colonies was colored greenish.

Questions:

1. What microorganism caused the disease? Write the ecologic characteristics of the pathogen.
2. Give general characteristics of the pathogen.
3. Describe the immunity after an infection. Is there a specific prevention of the disease?
4. What kind of infection are produced by the pathogen? What factors of pathogenicity contribute to the development of disease?
5. Is it necessary to conduct a study on antibiotic sensitivity when prescribing antibiotic therapy?

Answers:

1. Pseudomonas aeruginosa. Saprophytes. Opportunistic pathogen. Ubiquitous. It can be stored for a long time in environment. It can survive in a wide range of temperatures 4 - 45 °C.
2. P. aeruginosa are gram-negative non-spore forming rods. It is mobile and has one or more polar flagella. They are obligate aerobic bacteria. There are mucous types with a capsule-like mucous layer. It can grow well on simple nutrient media. P. aeruginosa has a relatively weak saccharolytic activity, has sufficiently pronounced proteolytic properties.

P.aeruginosa has unique cultural characteristics:

1) A characteristic biological feature of Pseudomonas aeruginosa is an ability to produce pigments. There are cultures that produce the blue pigment - pyocyanin and yellow-green - fluorescin. 2) Colonies also have a specific smell. It is like a smell of blooming violets.

3. Postinfectious immunity is short-time, non-sterile (Antibody presence don`t prevent new infection). There is no specific prevention (vaccination).
4. P.aeruginosa is one of the main pathogens cause opportunistic local and systemic purulent-inflammatory processes in hospitals. It can produce wound and catheter-associated infections.

P. aeruginosa can produce wide spectrum of virulence factors.

- inflammatory factors (endotoxin, exotoxins, proteases, lecithinase, hemolysins)
- resistance to phagocytosis (extracellular mucus - alganate)
- primary resistance to antibiotics (extracellular mucus- alganate), and secondary (acquired, plasmid-dependent) resistance to antibiotics.

5. Yes, because strains of P. aeruginosa have multiresistance to antibiotics.

5. The content of the assessment tools of mid-term assessment

Mid-term assessment is carried out in the form of **a exam**.

The content of the assessment tool *https://sdo.pimunn.net/course/index.php?categoryid=743*

5.1 The list of control tasks and other materials necessary for the assessment of knowledge, skills and work experience

5.1.1. Questions for the discipline exam **MICROBIOLOGY, VIROLOGY - MICROBIOLOGY OF THE ORAL CAVITY**

Competence code (according to the WPD): UC-1, UC-8, GPC-5, GPC-9, PC-3, PC-6

Basic microbiology and principles of laboratory diagnosis.

1. Morphological classification of bacteria: shape and arrangement of bacteria. Spore-forming and non-spore forming bacteria. Taxonomy of bacteria: species, strain and clone**.**
2. Similarity and difference between prokaryotic and eukaryotic cells. Obligatory and nonobligatory bacterial components. Nature and functions of bacterial cell walls, cytoplasm membrane, capsule, endospore, flagella, pili, plasmids and bacterial inclusions.
3. The method of bacterial staining. Gram stain. Structure of gram-positive, gram-negative and acid-fast bacterial cell walls.
4. Non-typical bacteria: mycoplasma, chlamydia and rickettsia. Features of the structure and metabolism. Ecology.
5. Non-typical bacteria: mycobacteria, spirochetes and actinomycetes. Morphological classification. Features of the structure and physiology. Ecology.
6. Bacterial growth and cell division. Phases of growth in bacterial culture. Factors affecting bacterial growth. Growth temperature. Psychrophiles, mesophiles, thermophiles.

7. Types of media for bacteria culturing. Simple and complex media. Special, selective and differential media. Methods of obtaining a pure culture. Bacterial colonies. Properties of bacterial colonies. Bacterial variation and dissociation.
8. Bacterial metabolism: anabolism. Nutritional types of bacteria. Phototrophs, chemotrophs, autotrophs and heterotrophs. Auxotroph and prototroph. Ecological classification of bacteria: saprophytes, obligate parasites and facultative parasites.
9. Bacterial metabolism: catabolism. Respiration (aerobic and anaerobic) and fermentation of bacteria. Types of fermentation. Dependence on oxygen**:** obligate aerobes, obligate anaerobes, facultative anaerobes, aerotolerant anaerobes, microaerophiles.
10. Sterilization in microbiology. Differences between sterilization and desinfection. Physical, chemical, and mechanical methods of sterilization in practical microbiology.
11. Antibiotics. Differences between antibiotics and antiseptics. Principle of antibiotic selective toxicity. Natural sources of antibiotics. Basic chemical groups of antibiotics. Mode of action of antibacterial agents in dependence on bacterial targets.
12. Spectrum of antibiotic activity. Bactericidal and bacteriostatic activity. Determination of bacterial sensitivity to antimicrobial agents. Disk diffusion method.
13. Bacterial resistance to antibiotics. Mechanisms of bacterial resistance. The carrier of genes responsible for constitutive (primary) and acquired (secondary) bacterial resistance to antibiotics. Principles limiting drug resistance.
14. General characteristics of viruses. Components of a virion. Classification of viruses: naked viruses, enveloped viruses, RNA/DNA viruses, single stranded viruses, and double stranded viruses. Types of virus symmetry. Ecology of viruses. Host range of viruses. Viroids and prions.
15. General characteristic of viral replication. Replication cycle of virus. Types of viral replication for RNA and DNA viruses. Early and late viral genes and proteins. Principles of antiviral therapy: mode of antiviral agent action.
16. Principles of virus culturing. Detection of viruses in infected objects. The cytopathic effect of viruses. Phenomenon of hemagglutination. Formation of inclusion bodies.
17. The results of virus-cells interaction. Productive, abortive and persistent virus infections. Molecular basis of viral persistence (integrative and non-integrative persistence). Aggressive and non-aggressive persistence. Direct and indirect damage mechanisms of viruses.
18. Host-microbe relationships**.** Parasitism and commensalism. Pathogenic, nonpathogenic and opportunistic microorganisms. Pathogenicity and virulence of bacteria. Indirect (immunologically dependent) bacterial pathogenicity. Mechanism of bacterial persistence.
19. Virulence determinants of bacteria: Adhesion and colonization. Types of bacterial adhesins. Factors providing bacterial invasion. Bacterial enzymes of invasiveness. Antiphagocyte activity of bacteria.
20. Virulence determinants of bacteria: toxins. Types of bacterial toxins: exotoxins and endotoxins. Chemical composition of endotoxins and exotoxins. Classification and effects of exotoxins. Mechanism of action of endotoxins.
21. The infection process and infection diseases. Stages of infection diseases. Mechanisms of infection generalization: bacteremia, septicemia, toxemia, viremia.
22. Types of infection diseases: primary and secondary (opportunistic) infection, superinfection, mixed infection, re-infection, relapse. Exogenous and endogenous infections. Carrier station. Persistence.
23. Portals of entry for infections. Routes of microbe transmission. Types of infections: sporadic, epidemic, pandemic and endemic diseases. Anthroponoses, zoonoses, sapronosis (examples of infections). Properties of hospital strain of bacteria.
24. Culturing method in the laboratory diagnosis of infectious diseases. Principles of bacteria identification in culturing method. Express-method in the laboratory diagnosis of infections.
25. Immunological method in the laboratory diagnosis of infectious diseases. Serological diagnosis of infections. Titer of antibodies. Qualitative and quantitative seroconversion.
26. Antigen-antibody reactions *in vitro* (immunochemical analysis): direct and passive agglutination tests. Precipitation tests. Reaction of precipitation in a liquid phase. Gel precipitation reactions.

27. Antigen-antibody reactions *in vitro* (immunochemical analysis): neutralization reactions. Principles of method. Toxin neutralization reaction, neutralization of virus cytotoxity, hemagglutination inhibition test.
28. Antigen-antibody reactions (immunochemical analysis): reactions with labeled antibodies. Principles of method. Immunofluorescence. Radioimmunoassay. Enzyme linked immunosorbent assay (ELISA).
29. Normal human microbiota: resident and transient, obligate and facultative. Mechanisms of microbiota formation. Role of normal microflora in human physiology and pathology. Dysbiosis. Predisposive factors and principles of correction.
30. Micromycetes (fungi): structural organization and chemical composition. Yeast, mold, dimorphic and polymorphic fungi. Higher and lower micromycetes. Vegetative and sexual reproduction. Types of sex spores. Targets for antifungal therapy.

Pathogens and associated diseases

1. **Staphylococci.** Classification of pathogenic staphylococci. Morphologic and physiologic properties. Culture properties. General factors of pathogenicity (enzymes, antiphagocyte factors). Principles of laboratory diagnosis.
2. **Staphylococci.** *Staphylococcus aureus*: types of infections (pyogenic and toxin-mediated). Role of specific toxins of *S. aureus* in pathogenesis. Sources of infections and routes of transmission. *Staphylococcus epidermidis:* role in human pathology.
3. Streptococci. Classification. General (morphologic and physiologic) properties. Culture properties. Types of hemolysis. **Pneumococcus** (*Streptococcus pneumoneae)*. Morphologic and culture properties. Sources of infections and routes of transmission. Infections caused by *Str. pneumoneae.* Factors of pathogenicity of *Str. pneumoneae*. Role of a capsule in pathogenesis. Immunization. **Viridans streptococci:** classification and culture properties (types of hemolysis). Viridans streptococci as opportunistic pathogens, complications of physiologic bacteremia.
4. **Streptococci group A** (*Str. pyogenes*.). Determinants of pathogenicity. Infections caused by *Str. pyogenes*. Purulent and reactive complications. Sources of infections and routes of transmission. Principles of laboratory diagnosis.
5. **Meningococci.** Classification. General properties. Sources of infections and routes of transmission. Determinants of pathogenicity. Role a capsule in pathogenesis. Clinical manifestation of meningococcal infection. Dichotomy of immune response. Immunization. Principles of laboratory diagnosis.
6. **Gonococci.** Classification. General properties. Factors of pathogenicity. Antiphagocyte properties. Clinical manifestation of gonococcal infections. Sources of infections and routes of transmission. Gonococcal stomatitis. Principles of laboratory diagnosis.
7. ***Pseudomonas aeruginosa.*** Ecology. Cultural properties. Factors of pathogenicity in the development of pyogenic invasions. Principles of laboratory diagnosis and therapy of a pyogenic infection.
8. ***Escherichia coli.*** Classification. General (morphologic and physiologic) properties. Antigenic structure. Representation in a normal flora. *E. coli* as opportunistic pathogen. Purulent (pyogenic) infections produced by *Escherichia*. Determinants of pathogenicity of opportunistic *E. coli*. Principles of identification of *E. coli*.
9. ***Escherichia coli.*** Infections caused by diarragenic *E. coli* (enteropathogenic, enterotoxigenic, enteroinvasive and entrohaemorrhagic E. *coli*). Determinants of pathogenicity of diarrhea-associated strains.
10. ***Shigella.*** Classification. General properties. Determinants of pathogenicity. Infection caused by Shigella. Sources of infections and routes of transmission. Principles of laboratory diagnosis.
11. ***Salmonella.*** Classification. General properties. Salmonella as agents of gastroenteritis. Factors of pathogenicity. Pathogenesis of infection.
12. **Clostridia.** Classification. General properties of clostridia. Clostridial ecology. The pathogens of gas gangrene. Determinants of pathogenicity of *C. perfringens*. Factors and mechanisms supporting the gas gangrene development. Principles of prophylaxis and therapy of gas gangrene.

13. ***Clostridium tetani*:** general properties, ecology, mechanism of toxin activity and pathogenesis of infection. Immunization.
14. ***Clostridium botulinum:*** classification, general properties, *ecology*, mechanism of toxin activity and pathogenesis of infection. Specific treatment and principles of laboratory diagnosis of botulism.
15. ***Corynebacteria*.** Pathogen of diphtheria. Classification. General and cultural properties. Biotypes. Sources of infections and routes of transmission. Factors of pathogenicity. Role of a toxin in pathogenesis. Principles of laboratory diagnosis. Specific treatment and immunization.
16. ***Mycobacteria.*** Classification. *Mycobacteria* causing tuberculosis. General properties. Structure of cell wall and culture properties. Particularities of bacterial interaction with macrophages. Role of tuberculoproteins and lipids in delay hypersensitivity forming. Adjuvant activity of lipids. Principles of laboratory diagnosis of tuberculosis. Mantoux test.
17. ***Mycobacterium tuberculosis:*** sources of pathogen and routes of transmission. Nonspecific and specific granuloma development. Pathogenesis of infection: difference between primary and secondary tuberculosis. Dual role (sanogenesis and pathogenesis) of granuloma in tuberculosis. Immunology-mediated pathology. Immunization.
18. ***Chlamydia.*** Classification. General characteristics. Pathogens of urogenital tract and agent of non-typical pneumonia. Principles of laboratory diagnosis.
19. ***Mycoplasmas.*** Classification. General characteristics. Factors and mechanisms of which important in mycoplasmal pathogenesis. Mycoplasmas as urogenital and primary human pathogens. Principles of laboratory diagnosis.
20. ***Treponema pallidum*.** Classification. Factors of pathogenicity. Syphilis: sources of infections and routes of transmission. Stage of infection. Persistence of *T. pallidum*. Laboratory diagnosis of syphilis: cardiolipin (nonspecific) and specific tests.
21. **Actinomycetes:** role in the oral cavity pathology (inflammatory diseases and caries). Oral actinomycosis: predisposive factors, sources of infection and modes of transmission. Principles of laboratory diagnosis of actinomycosis.
22. **Paramyxoviruses.** Classification. General characteristics of a virion. Mechanism of virus replication. Role in human pathology. Variants of diseases: local and systemic infections. Possible complications. Immunity. Specific prevention (vaccination).
23. **Orthomyxoviruses.** Classification and nomenclature of influenza viruses. General characteristics of a virion. Functions of viral components (neuraminidase and hemagglutinin). Steps of virus replication. Epidemiology and pathogenesis of infection of influenza A. Mechanisms of gene reassortment. Shift and drift. Immunity and specific prevention.
24. **Picornaviruses.** Classification. General characteristics of a virion. Mechanism of virus replication. Polioviruses. Pathogenesis of poliomyelitis. Principles of laboratory diagnosis. Specific prevention of poliomyelitis. Coxsackie viruses and their role in human pathology.
25. **Herpesviruses.** Classification. General characteristics of a virion. Mechanism of herpesvirus persistence. Role of herpesviruses in human pathology. Pathogenesis of *Herpes simplex* viruses and *Varicella-zoster* virus infections. Principles of laboratory diagnosis of herpesviruses. .
26. **Hepatitis viruses.** Classification of hepatitis viruses. Modes of transmission of different hepatitis viruses. Variants of hepatitis virus diseases: acute and persistent infections. Hepatitis A virus (HAV). General characteristics of a virion. Replication of HAV. Pathogenesis of HAV-infection. Specific prevention and laboratory diagnosis of HAV-infection.
27. **Hepatitis B virus** (HBV). General characteristics of a virion. Viral antigens and their functions. Replication of HBV. Pathogenesis of infection. Molecular basis of HBV-persistence. Principles of laboratory diagnosis. Markers for HBV-infection and viral carriage. Specific prevention of HBV-infection.
28. **Retroviruses.** Classification. General characteristics of a virus. Antigens of a virion and their functions. Mechanism of retrovirus replication. Molecular basis of viral persistence. Mechanism of virus reception on permissive cells. Regulation of virus replication. Molecular targets for treatment of infection.
29. **Human immunodeficiency virus** (HIV). Routes of transmission. Pathogenesis of HIV-infection. The main cell targets. Factors and mechanism supporting HIV-persistence and aggressiveness of persistence. Mechanisms of cell destruction and immunodeficiency in AIDS. Main phases of

HIV-infection. AIDS-associated diseases. Principles of laboratory diagnosis of HIV-infection. Immunoblotting.

30. ***Candida:*** the main pathogenic species. *C. albicans:* general properties. Determinants of pathogenicity. Role in the oral cavity pathology. Oral c*andidiasis:* sources of infections, predesposive factors, clinical symptoms. Principles of treatment and laboratory diagnosis.

Microbiology of the oral cavity: oral microflora and its role in oral cavity diseases.

1. Microbiota of the oral cavity (genera). Obligate and facultative, aerobic and anaerobic resident representatives Mechanisms of an oral microbiota formation (adhesion, coaggragation). Antagonism and synergism in a biocenosis.
2. Stabilizing and aggressive oral microbiota (genera). The foci of endogenous infection of the oral cavity and development of somatic pathology. The oral cavity as a portal of entry of exogenous infection.
3. Dental deposit. The mechanism of a dental deposit forming and changes of species composition. Adhesion and coaggragation. Role of oral streptococci in dental deposit forming.
4. The basic predisposing factos for dental caries development: Cariogenesis: role of a dental deposit and tooth plaque in caries development.
5. Microbial etiology of dental caries. Caries-associated species. The microbial factors and mechanisms that cause enamel demineralization and dentin destruction. Bacteria of the oral cavity as antagonists of cariogenic bacteria.
6. Tooth plaque. Mechanisms of tooth plaques forming. Various localization of plaques. Prevailing microbial species of subgingival and supragingival plaques. Role in oral pathology.
7. Microbiota and periodontitis. Paradontogenic bacteria. Pathogenesis of periodontitis. Role of subgingival plaque.
8. Odontogenic, paradontal and non-odontogenic inflammation in the oral cavity. Features of inflammatory diseases of the oral cavity. Dominant groups of bacteria depending on the type of inflammation.
9. Nonspecific and specific stomatitis. Pathogens of specific stomatitis (examples). Specific symptoms in the oral cavity in generalized infections (mamps, measles, syphilis).
10. Vincent's gingivitis. Predisposing factos. The main pahogens, factors of pathogenicity. Pathogenesis. Principles of laboratory diagnosis of therapy.

6. Criteria for evaluating learning outcomes

For the exam (example)

Learning outcomes	**Assessment of competence developed**			
	unsatisfactory	**satisfactory**	**good**	**excellent**
Completeness of knowledge	The level of knowledge is below the minimum requirements. There were bad mistakes	The minimum acceptable level of knowledge. A lot of light mistakes were made	The level of knowledge in the volume corresponding to the training program. A few light mistakes were made	The level of knowledge in the volume corresponding to the training program, without errors
Availability of skills	Basic skills are not demonstrated when solving standard tasks. There were bad mistakes	Basic skills are demonstrated. Typical problems with light mistakes have been solved. All tasks have been completed, but not in full.	All basic skills are demonstrated. All the main tasks have been solved with light mistakes. All tasks have	All the basic skills were demonstrated, all the main tasks were solved with some minor shortcomings, all the tasks were completed in full

Learning outcomes	Assessment of competence developed			
	unsatisfactory	**satisfactory**	**good**	**excellent**
			been completed, in full, but some of them with shortcomings	
Availability of skills (possession of experience)	Basic skills are not demonstrated when solving standard tasks. There were bad mistakes	There is a minimal set of skills for solving standard tasks with some shortcomings	Basic skills in solving standard tasks with some shortcomings are demonstrated	Skills in solving non-standard tasks without mistakes and shortcomings are demonstrated
Characteristics of competence formation*	The competence is not fully formed. The available knowledge and skills are not enough to solve professional tasks. Repeated training is required	The formation of competence meets the minimum requirements. The available knowledge and abilities are generally sufficient to solve professional tasks, but additional practice is required for most practical tasks	The formation of competence generally meets the requirements, but there are shortcomings. The available knowledge, skills and motivation are generally sufficient to solve professional tasks, but additional practice is required for some professional tasks	The formation of competence fully meets the requirements. The available knowledge, skills and motivation are fully sufficient to solve complex professional tasks
The level of competence formation*	Low	Below average	Intermediate	High

For testing:

Mark "5" (Excellent) - points (100-90%)
Mark"4" (Good) - points (89-80%)
Mark "3" (Satisfactory) - points (79-70%)

Less than 70% – Unsatisfactory – Mark "2"

Developer(s):
Makhrova Tatyana Vladimirovna Ph.D. of Medical Sciences, Docent, Associate Professor at the Department of Epidemiology, Microbiology and EBM of FSBEI HE PRMU MOH Russia