MINISTRY OF HEALTH OF UKRAINE

ZAPORIZHZHIA STATE MEDICAL AND PHARMACEUTICAL UNIVERSITY

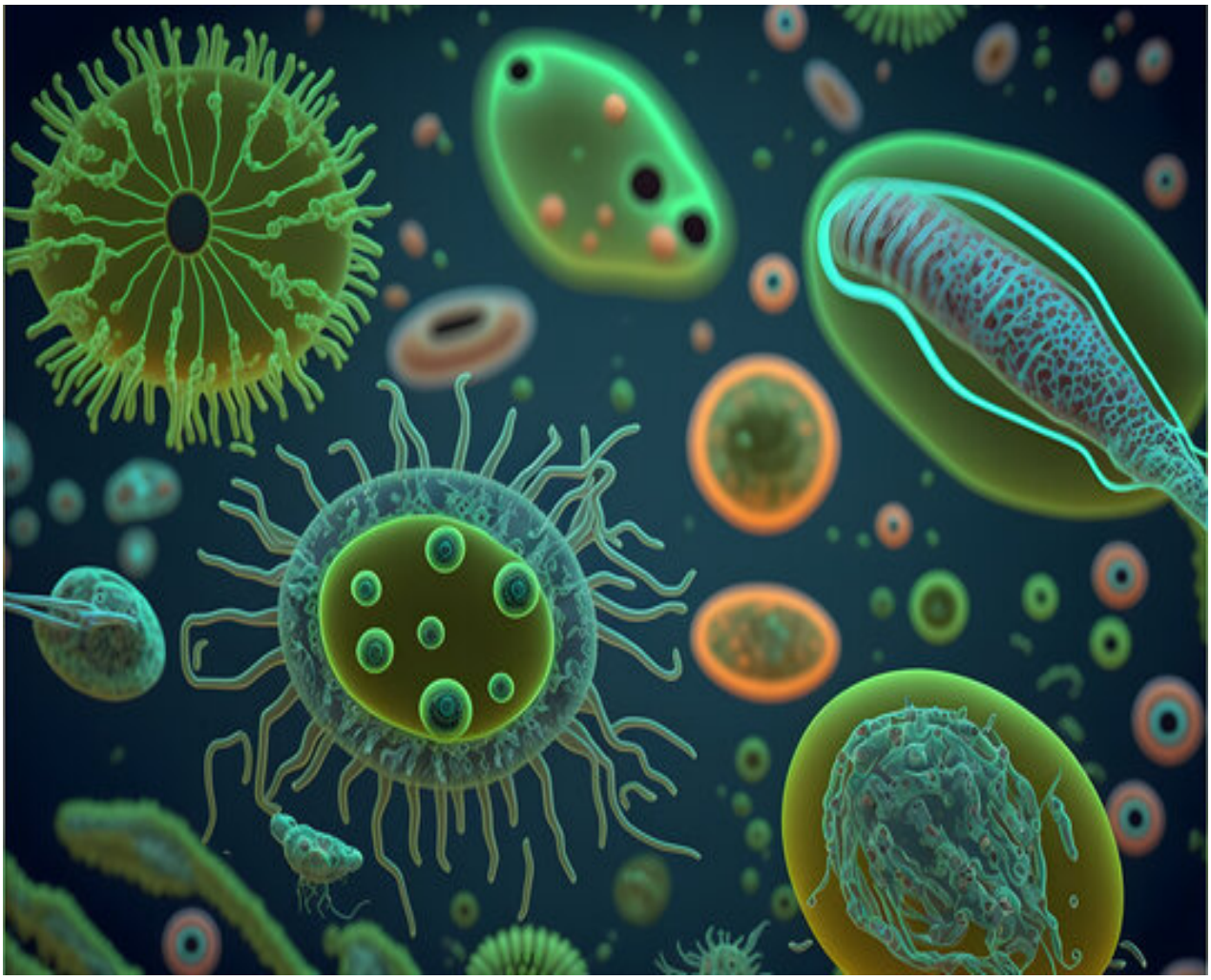
DEPARTMENT OF MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY

MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY

Part 1. Morphology and physiology of microorganisms. Infection. Immunity

WORKBOOK

for 2 nd – year students
specialty 221 " Dentistry "



Zaporizhzhia

2023

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Approved by the meeting of the Central methodical committee
of Zaporizhzhia State Medical and Pharmaceutical University
and it is recommended for the use in educational process for foreign students.
(Protocol no_1_ from__12th october___ 2023)

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W83 **Microbiology, Virology and Immunology.** Part No. 1. Morphology and physiology of microorganisms. Infection. Immunity : workbook for 2nd year Students of the II International Faculty professional training program "Master of Dentistry " in the field of knowledge 22 "Health Care" specialty 221 " Dentistry " / N. L. Kolycheva, K. S. Krupiei, A. S. Dehen, O. S. Hulina – Zaporizhzhia : [ZSMPhU], 2023. – 108 p.

Мікробіологія, вірусологія та імунологія : у 2-х ч. Ч. 1. Морфологія і фізіологія мікроорганізмів. Інфекція. Імунітет: практикум для студентів-іноземних громадян 2-го курсу ОКР "Магістр стоматології" спеціальності 221 "Стоматологія" / Н. Л. Количева, К. С. Крупєй, А. С. Деген, О. С. Гуліна. – Запоріжжя : [ЗДМФУ], 2023. – 108 с.

Практикум розроблений кафедрою мікробіології, вірусології та імунології ЗДМФУ для студентів 2 курсу II міжнародного факультету спеціальності 221 «Стоматологія» складено згідно з вимогами трансферно-модульної системи та з вимогами, що висуваються Центральною методичною радою Запорізького державного медико-фармацевтичного університету. Публікується вперше.

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CONTENTS

PREFACE

"Microbiology, Virology and Immunology" as an academic discipline occupies a leading place in the structural and logical scheme of training of future dentists and is a discipline based on the knowledge gained by students in the study of medical biology, biological chemistry, human anatomy, normal physiology, histology, cytology and embryology, integrates with these disciplines and is based on modern morphological research data.

The workbook is based on many years of experience in teaching the discipline "Microbiology, Virology and Immunology" at the Department of Zaporizhzhia State Medical and Pharmaceutical University and is intended to help students methodically and rationally organize independent work in practical classes and outside the classroom.

All the materials provided in the Workbook are the necessary teaching and methodological support for organizing students' work in the course of studying the discipline. The information is unified and presented in a logical sequence, which greatly facilitates the perception of educational material by students.

The program of the discipline "Microbiology, Virology and Immunology" is structured into two sections, each of which contains a certain number of subsections. The workbook is divided into topics in accordance with the Work Program for the discipline "Microbiology, Virology and Immunology", compiled in accordance with the educational and professional program "Master of Dentistry" in the field of knowledge 22 "Health Care", specialty 221 "Dentistry".

For each topic of the Workbook materials provided by the work program, there are tasks, some of which are performed by students independently during extracurricular time, in particular: working with biological terms and concepts, diagrams, photos and drawings of bacteria and viruses, filling out summary and comparative tables, etc. The other part is spent in practical classes, namely: conducting certain research provided for by the topic of the class, recording the results, solving test questions (from KROK-1 bases) aimed at studying the topics of the first section of the discipline "Morphology and Physiology of Microorganisms. Infection. Immunity" and justify their answers. At the end of the lesson, the teacher checks the correctness of the tasks and protocols.

After the materials of each Workbook protocol, the student can write down additional information necessary for him/her in the "For notes" section. The protocols for lessons №5, №12, and №17 contain questions that will help students better prepare for the intermediate and final control of knowledge in the section "Morphology and Physiology of Microorganisms. Infection. Immunity".

At the end of the Workbook, a list of basic immunobiological drugs is provided, as well as a short glossary of terms that will allow the student to memorize the basic concepts of medical microbiology and a list of references that will help students find the necessary information.

The cover image is from https://www.google.com/url?sa=i&url=https%3A%2F%2Fzbruc.eu%2Fnode%2F105865&psig=AOvVaw1GGgHcPEYjU31it2qv9Btr&ust=1692368061921000&source=images&cd=vfe&opi=89978449&ved=0CBAQjRxqFwoTCJjGjLvw44ADFQAAAAAdAAAAABAJ.

The Workbook uses visual materials made by an authors, otherwise the source is indicated.

Protocol 1 **Date: _____**

Theme: **Microbiological laboratory, equipment, and rules of work. The structure of the biological light microscope and the rules for working with them. Microscopy of prepared smears.**

RULES OF WORK IN THE BACTERIOLOGICAL LABORATORY

1. Clothing and footwear must be suitable for laboratory conditions (sandals). The personnel working at laboratories is supplied with medical coats and kerchiefs or caps. Special clothes protect the worker and also prevent contamination of the material to be studied with foreign microflora.

2. No smoking, eating, drinking, chewing gum or sucking confectionery, or applying cosmetics in laboratory areas, including laboratory offices. No food or drink is to be stored in laboratories (including cold rooms, refrigerators and freezers).

3. Unnecessary walking about the laboratory, sharp movements, and irrelevant conversations should be discouraged.

4. In the process of examination, the working place should be kept clean and tidy. Bacteriological loops are rendered harmless by burning them in the burner's flame; used spatulas, glass slides, pipettes, and other instruments are placed into jars with disinfectant solution.

5. Upon the completion of work, the nutrient media with inoculated cultures are placed into an incubator; museum cultures, into safe-refrigerators; devices and apparatuses are set up in places specially intended for them. Wipe tables with disinfectant solution and thoroughly wash the hands.

6. Hands should be washed after completing each task and always before leaving the laboratory. If the material to be analyzed or the culture of microorganisms is accidentally spilt onto the hands, table, coat, or shoes, they should be immediately treated with 1 percent solution of chloramine.

_____ _____
Date Signature of student

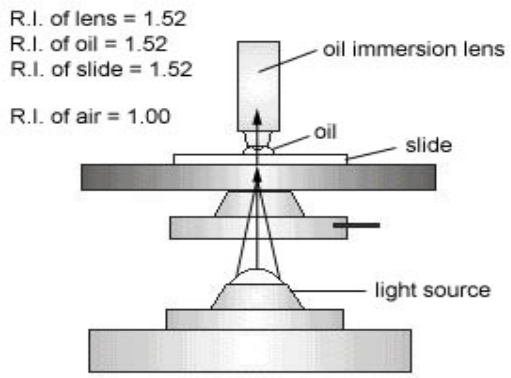
_____ _____
Date Signature of teacher

1. Name the methods of diagnostics, which are used in the microbiological (bacteriological) laboratory.

Name of method	Short characteristic

2. Name the types of microscopes and methods of microscopical examination, which are used in laboratories.

_____
_____
_____
_____
_____



3. To learn microscopy, using the immersion system of a light microscope. Explain the principle of oil-immersion objective. What special property has immersion oil?

_____

_____

_____

_____

_____

_____

_____

_____

4. Name the total magnification of the immersion microscope.

_____

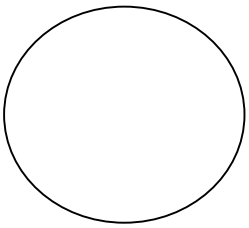
_____

5. Name the maximum resolution of the immersion microscope.

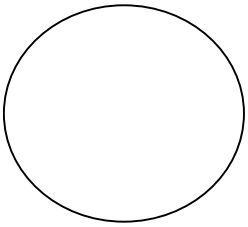
_____

_____

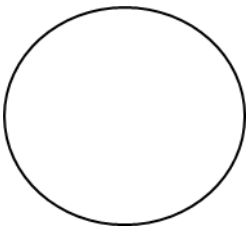
6. Microscopy demonstration smear preparations and draw in the protocol:
a) Gram-stained staphylococcus;
b) Gram-stained sarcina;
c) Gram-stained anthracoid;
d) Gram-stained Escherichia coli;
e) fungi of the genus Candida, colored methylene blue.



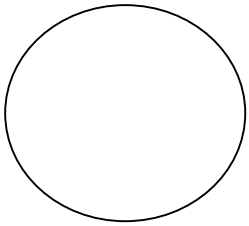
Staph. aureus



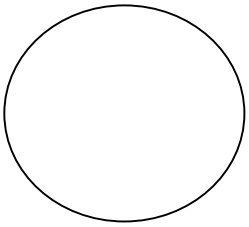
Sarcina



B. anthracoides



E.coli



Fungi of the genus Candida

7. To study the main morphological forms of bacteria.

Morphological form	Scheme	Characteristic	Example
Cocci			
Monococci			
Diplococci			
Tetracocci			
Sarcina			
Streptococci			
Staphylococci			
Rod			
Bacteria			
Bacilli			
Clostridia			
Spiral forms			
Vibrions			
Spirochetes			
Spirilla			

1. Bacteriological surveys of workers at pharmacies bacteriocarrier from one of the pharmacists were isolated from nasopharyngeal bacterial genus Staphylococcus. What morphological properties inherent in this race? A. Cells in the location of a chain B. Arrangement of cells singly C. Location of cells in grapelike clumps D. Location of cells in pairs E. Arrangement of cells tetrads	
2. In the bacteriological laboratory microscopy purulent furuncle in Gram-stained smears revealed spherical microorganisms, those are placed in grapelike clumps. What are microorganisms?	

A. Staphylococci B. Streptococci C. Micrococci D. Gonococci E. Meningococci	
3. In stained smears prepared from the pus, revealed Gram- positive cocci, arranged in the form of irregular clusters: “grapes”. What is the arrangement associated staphylococci? A. With the technique of smear preparation B. With the technique of painting C. With the effect of dyes on bacteria D. With division of bacteria in different planes E. With localization of purulent process	
4. In smears prepared from pus of a patient with inflammatory processes hand identified Gram-positive spherical bacteria, which are placed in the form of chains. What bacteria can be considered to cause disease? A. Diplococci B. Micrococci C. Saphylococci D. Sarcina E. Streptococci	
5. In smears prepared from pus of a patient with purulent inflammation of bones, identified Gram-positive spherical bacteria, which are located in the form of chains. What bacteria can be considered to cause the disease? A. Streptococci B. Gonococci C. Meningococci D. Micrococci E. Sarcina	
6. In the study micropreparations made from sputum of patients with pneumonia, identified Gram-positive capsule lancet diplococci. What is a microorganism? A. Meningococcus B. Pneumococcus C. Gonococcus D. Staphylococcus E. Enterococcus	
7. From the patient with pneumonia during bacterioscopic study was revealed Gram-positive diplococci, which are placed in a flame of a candle and surrounded by a capsule. Indicate the most likely causative agent? A. Pneumococcus B. Klebsiella C. Staphylococcus D. Gonococcus E. Meningococcus	
8. When microscopy smear student forgot to put on a slide a drop of immersion oil and did not get the picture. What is needed immersion fluid? A. To maximize the collection of light rays B. To reduce the resolution of the microscope C. To prevent damage to the ocular D. To prevent damage to smear E. To prevent damage to the lens	
9. In conducting rapid diagnosis of cholera used direct immunoflyuorescence method. What type of microscope used for	

these purposes? A. Light B. Dark field C. Phase-contrast D. Electron E. Fluorescent	
10. For morphological study of microorganisms use various types of microscopy. Specify the principle on which is based electron microscopy: A. Light rays passing through a series of magnifying lenses B. Use of the electron C. Diffraction of light in a side illumination D. Transformation of the phase differences in the amplitude E. Lighting by effects of UV rays	
11. From the patient with high fever, chills, cough, sputum was isolated Gram-positive lancet diplococci with the capsule. Name the alleged agent. A. Pneumococcus B. Staphylococcus C. Enterococcus D. Meningococcus E. Gonococcus	
12. In laboratory diagnosis of syphilis became necessary to examine the nature and extent mobility of the parasite. What type of microscope used for this purpose in the bacteriological laboratory? A. Light B. Fluorescent C. Electron D. Dark-field E. Phase-contrast	
13. Infectious agents of various ultrastructures can be etiological agents of infectious diseases. Which of the groups named below **HAS NO** cellular structure, protein synthesizing, enzyme and energy systems? A. Viruses B. Fungi C. Bacteria D. Protozoa E. Rickettsia	

For notes

Protocol 2 **Date:_____**

Theme: **Morphology of microorganisms. Structure of the bacterial cell. Simple and complex methods of staining (by Gram, Ozheshko, Neisser and Burri-Gins, Ziehl -Nielsen).**

Comparison of prokaryotic and eukaryotic cells

FEATURES OF CELLS	PROKARYOTIC	EUKARYOTIC
Cytoplasmic membrane	Yes	Yes
Nucleus containing a nuclear membrane surrounding DNA	No	Yes
DNA associated with	Polyamines	Histone proteins
Chromosome number	1	More then 1
Ribosomes	70S	80S
Cell wall containing of peptidoglican	Yes	No
Membrane-bound organelles (mitochondria, lysosomes)	No	Yes
Endoplasmic reticulum	No	Yes
Golgi apparatus	No	Yes
Mitotic division	No	Yes

1. Name the basic structural elements of bacterial cell.

Structural elements	Structure and function

2. Name the special structural elements of bacterial cell.

Structural elements	Structure and function

3. To master the technique of preparing the glass – slides from bacterial culture of Staphylococcus aureus and Escherichia coli. The main stages of preparing smear.

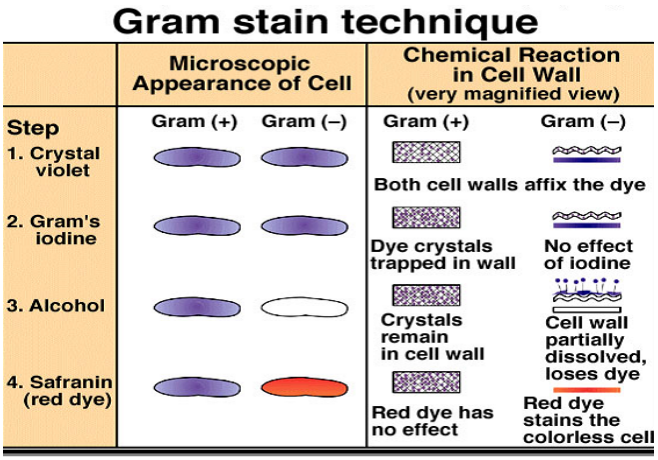
4. Name the classification of methods which are used for the fixation of preparations.

5. Name the classification of methods of staining.

6. Comparative characteristics of the cell wall of gram-positive and gram-negative bacteria.

	Gram-positive	Gram-negative
Thickness		
Lipids		
Peptidoglycan		
Teichoic acid		

7. To master the technology of staining ready preparations according to Gram. To draw the studied microorganisms in protocol.



Stage	Ingredients	Exposure
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

https://skat.ihmc.us/rid=1MM04J6YL-1Y9P8BL-335X/Bacterial%20structure%20and%20Genetics

8. Prepare smear preparations:
a) from staphylococcal culture;
b) Escherichia coli;
c) a mixture of staphylococcus and Escherichia coli, and stained by the Gram method. Carry out microscopy in the immersion system and draw to the protocol.

Staphylococcus
Gr +

Escherichia coli
Gr-

A mixture of Staphylococcus and Escherichia coli

9. Microscope a ready smear from culture of Mycobacterium tuberculosis (stained according to Ziehl -Nielsen method) for reviling acid-fast bacteria and draw in protocol.

Mycobacterium tuberculosis

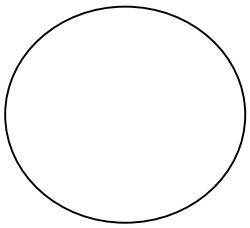
What makes a microorganism acid-fast?

_____
_____
_____
_____
_____
_____
_____

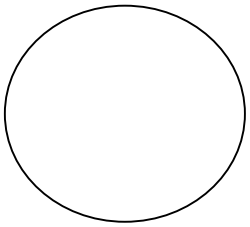
10. Prepare a smear preparation from anthracoid culture, stain according to the Ozheshko method in order to detect spores. Carry out microscopy in the immersion system and draw.

_____

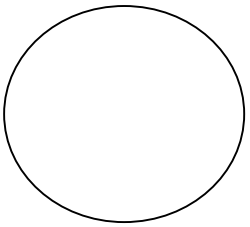
Draw the types of positions of spores in body of bacilli and clostridia.



Central position

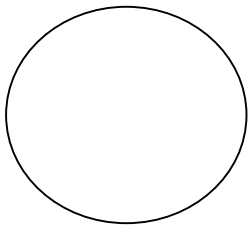


Subterminal position



Terminal position

11. Prepare a smear preparation from the culture of azotobacter, stain by the method of Burri-Gins method in order to detect capsules. Carry out microscopy in the immersion system and draw.



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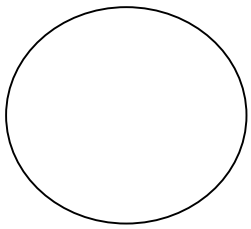
12. Carry out microscopy in the immersion system of the diphtheria bacillus preparation in order to detect volutin granules (Neisser staining) and draw.



_____

13. Name the methods of studying the mobility of microorganisms.

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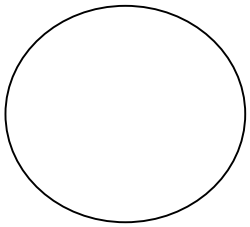
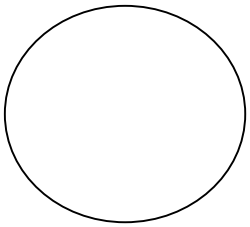
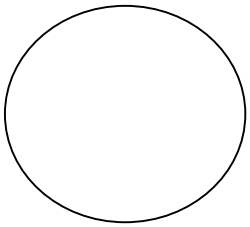
14. Motile microbes are divided into 4 groups according position of flagella. Draw it:



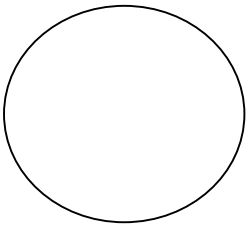
Monotrichous



Lophotrichous



Amphitrichous



Peritrichous

1. In stained smears prepared from the pus, revealed Gram- positive cocci, arranged in the form of irregular clusters: “grapes”. What is the arrangement associated staphylococci? A. With the technique of smear preparation B. With the technique of painting C. With the effect of dyes on bacteria D. With division of bacteria in different planes E. With localization of purulent process	
2. In smears prepared from pus of a patient with purulent inflammation of bones, identified Gram-positive spherical bacteria, which are located in the form of chains. What bacteria can be considered to cause the disease? A. Streptococci B. Gonococci C. Meningococci D. Micrococci E. Sarcina	
3. In the study micropreparations made from sputum of patients with pneumonia, identified Gram-positive capsule lancet diplococci. What is a microorganism? A. Meningococcus B. Pneumococcus C. Gonococcus D. Staphylococcus E. Enterococcus	
4. Necessary to make the drug from the culture of microorganisms for the study of their mobility. Which important stage of making the drug should pay attention to? A. Dry the smear B. Fix the smear C. The smear is not fixed D. Stain the smear E. Wash the smear	
5. To study the morphological characteristics of microorganisms used different staining techniques. Specify the purposes for which use simple methods: A. Identify spores B. Identify capsules C. Identification of Gram-positive and Gram-negative bacteria D. Study of shape and size of microorganisms E. Identify flagella	
6. When bacterioscopical method for laboratory diagnosis of infections use various staining agents. For what purposes using the method of Gram? A. Stain spores B. Identify capsules C. Detection of flagella D. Differentiation of bacteria E. Identify plasmids	
7. Gram staining is the main method of staining in microbiology. Why is the differentiation of Gram-positive bacteria and Gram-negative by this method? A. The structure of cell wall B. The size of cells C. The presence of ribosomes D. Structure of the cytoplasmic membrane E. Chemical composition of the capsule	
8. At microscopy of material from the festering wounds, in the smears	

were found both purple cocci and pink rods. What method of staining product used? A. Ziehl-Nielsen B. Burri -Gins C. Neisser D. Ozheshko E. Gram	
9. Bacteria differentiate to Gram-negative and Gram- positive. Indicate which of the following apply to Gram- negative: A. Meningococcus, Gonococcus B. Staphylococcus, Streptococcus C. Clostridium D. Corynebacterium E. Mycobacteria	
10. At microscopy of sputum smears from the patient revealed blue-violet lancet diplococci. What method were stained smears? A. Ozheshko B. Gram C. Burri -Gins D. Morozov E. Neisser	
11. Laboratory diagnosis of tuberculosis involves the use of microscopic method. What method of staining used to identify the causative agent of tuberculosis? A. Gram B. Ziehl-Nielsen C. Burri -Gins D. Romanovsky-Giemsa E. Neisser	
12. In the laboratory was delivered to investigate the sputum of the patient, in which the physician suspected pulmonary tuberculosis. To detect the pathogen bacteriologist used a special method of staining. Give it: A. Ziehl-Nielsen B. Ozheshko C. Burri-Gins D. Zdrodovsky E. Gram	
13. Of the patients with chronic pneumonia sputum bacteriologists prepare smear for microscopy and stain it by Ziehl-Neelsen. For which microorganisms can use this stain? A. Mobile B. Capsule-forming C. Acid -fast D. Spore-forming E. Non-mobile	
14. Infectious agents of various ultrastructures can be etiological agents of infectious diseases. Which of the groups named below **HAS NO** cellular structure, protein synthesizing, enzyme and energy systems? A. Viruses B. Fungi C. Bacteria D. Protozoa E. Rickettsia	
15. Microbiological analysis of medicinal raw materials revealed capsular bacteria. What stain method was used to detect the capsules? A. Ziehl-Neelsen's B. Gin's	

C. Neisser's D. Gram's E. Ozheshko's	
16. There are areas where humans or animals are exposed to the constant risk of contracting certain types of bacteria. What feature of these bacteria is responsible for their long viability in the soil? A. Thick cell wall B. Capsule formation C. Ability to multiply in the plant remains D. Spore formation E. Plasmids	
17. Quite often, the soil may contain a number of pathogenic microorganisms. The causative agents of the following disease may stay viable in the soil for a long time: A. Dysentery B. Diphtheria C. Viral hepatitis D. Pertussis E. Anthrax	
18. Capsuliferous bacteria has been detected during microbiological inspection of crude drugs. What method of staining has been used to detect capsules? A. Gram B. Ziehl–Neelsen C. Neisser D. Burri-Gins E. Aujeszky	
19. In course of long-term treatment of an infectious patient with penicillin, the pathogen transformed into the L-form. What changes occur in the pathogen cell in case of L-transformation? A. Absence of inclusions B. Absence of flagella C. Absence of a capsule D. Absence of a spore E. Absence of a cell wall	
20. Microbe survival in the environment is facilitated by spore formation. What microorganisms of those listed below are spore formers: A. Clostridium B. Bacteroides C. Staphylococcus D. Peptococcus E. Peptostreptococcus	
21. Bacteria rapidly become resistant to drugs in the course of antibacterial treatment. What structural components of bacteria provide for their resistance? A. Flagella B. Spores C. Capsule D. R-plasmids E. Volutine granules	
22. Different structures of a bacterial cell perform different functions. What dispensable component of a cell ensures its survival within a hostile environment? A. Spores B. Flagella C. Capsule D. Cilia E. Inclusions	
23. Microbial survival within environment is facilitated by spore	

formation. What microorganism soft those listed below are spore formers: A. Staphylococci B. Bacteroides C. Clostridia D. Peptococci E. Peptostreptococci	
24. During microscopy of a smear made from the sputum sample and stained according to the Ziehl-Neelsen technique, the medical laboratory scientist detected bright red acid-fast bacilli arranged separately and in groups. What microorganisms were detected? A. Mycobacterium tuberculosis B. Bacillus anthracis C. Salmonella typhi D. Staphylococcus aureus Bordetella pertussis	
25. There are procaryotes and eucaryotes in microbial world. It depend from the cellular structure of microorganisms. Indicate which of the following organisms are procaryotes? A. Viruses B. Protozoa C. Fungi D. Bacteria Prions	
26. The following organisms are procaryotes, except for: A. Protozoa B. Spirochetes C. Mycoplasma D. Rickettsia Chlamydia	
27. Etiological factors of infectious diseases can be bacteria with different structure. Which of the following groups of microbes are eucaryotes: A. Protozoa B. Viruses C. Viroids D. Prions Bacteria	
28. Bacteriological study of medicinal raw materials, which has become uncharacteristically odor, identified bacteria P. aeruginosa. What are the taxonomic categories used to name this type of microorganism? A. Family and species B. Genus and species C. Family and the genus D. Division and species Division and the genus	
29. From a patient with a diagnosis of "cholera" was isolated pure culture of moving vibrios. To which group of flagellated bacteria is this pathogen? A. Lofotrihous B. Amfitrihious C. Monotrihous Peritrihious	
30. Bacteria - are single-celled organisms that are capable of autonomous existence. What structures of bacteria play a major role in the process of protein synthesis? A. Ribosomes B. Cytoplasmic membrane	

C. Mesosome D. Cytoplasm Inclusions in the cytoplasm	
31. Protection of microbes from phagocytosis and antibody provides a specific structural component of the cell. What is it? A. Spore B. Pili C. Flagella D. Inclusion E. Capsule	
32. In smears of faeces patient identified Gram-negative bacteria in the comma shape. What properties are necessary to first explore with a microscope for further about the identified microbes? A. The presence of spores B. The presence of capsules C. The presence of cysts D. Mobility The presence of volutin granules	
33. Of the medicinal plants, died here clogging blood vessels, was isolated pathogenic microorganisms. There are mobile non-sporing Gram-positive bacillus, presumably Corynebacterium.To test this hypothesis, it is necessary to identify volutin granules in these bacteria. Which stain should be used for this? A. Neisser B. Ozheshko C. Burri-Gins D. Romanovsky-Giemsa Ziehl-Nielsen	
34. Microbe survival within the environment is facilitated by spore formation. What genus of microorganisms can be characterized as spore formers: A. Bacteroides B. Clostridium C. Staphylococcus D. Peptococcus Peptostreptococcus	

Protocol 3 **Date:_____**

Theme: **Morphology and structure of spirochetes, rickettsiae, fungi and protozoa.**

1. Give the characteristic of a structure of a bacterial cell of spirochetes.

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2. Name the methods of studying Spirochetes in clinical material.

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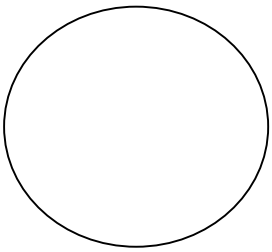
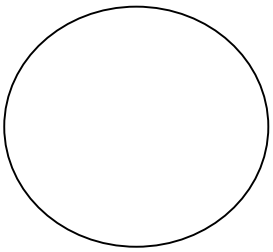
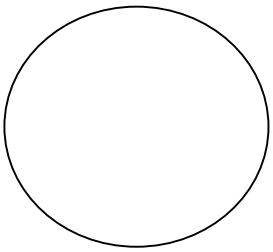
3. There are 3 genus of pathogenic spirochetes. Name and draw them. Name the method of staining, which were used.



Treponema



Borrelia



Leptospira

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4. Give the characteristic of a structure of a bacterial cell of ricketts.

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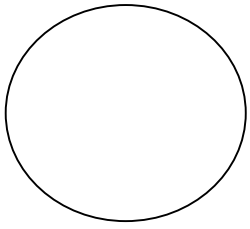
5. Stain a ready smear from ricketts according to Zdradovsky method. Microscopy and draw in protocol.



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6. According morphological properties Zdradovsky divided Ricketts in 4 groups. Name and draw them.

7. Prepare a smear of yeast-like fungi and fungi from genus Mucor, Aspergillus, Penicillium, stain them with simple method of staining. Microscopy and draw the stained smear in protocol.

Yeast-like fungi Candida | Mucor | Aspergillus | Penicillium

8. Name the methods of studying protozoa in clinical material.

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9. Study the ready smears from protozoa with a table. Draw the stained smear in protocol.

Entamoeba histolytica | Toxoplasma gondii | Trypanosoma cruzi

Leishmania donovani | Trichomonas vaginalis

1. There are procaryotes and eucaryotes in microbial world. It depend from the cellular structure of microorganisms. Indicate which of the following organisms are procaryotes? A. Viruses B. Protozoa C. Fungi D. Bacteria E. Prions	
2. The following organisms are procaryotes, except for: A. Protozoa B. Spirochetes C. Mycoplasma D. Rickettsia E. Chlamydia	

3. Etiological factors of infectious diseases can be bacteria with different structure. Which of the following groups of microbes are eucaryotes: A. Protozoa B. Viruses C. Viroids D. Prions E. Bacteria	
4. Chlamydia belong to: A. Protozoa B. Fungi C. Bacteria D. Rickettsia E. Virus	
5. Choose among these are the features of the morphological structure, in which mycoplasmas differ from the typical bacterial cells. A. Do not have a cell wall B. Cell wall contains peptidoglycan C. Cell wall contains no peptidoglycan D. Have flagella E. Do not form spores	
6. In the study of medicine plant collection in a nutrient medium grown culture in the form of black furry flying. In smears found coenocytic hyphae of mycelium with nodular thickenings on the ends. What are these microorganisms: A. Mucor B. Penicillium C. Candida D. Aspergillus E. Actinomycetes	
7. Child 13 years complained of poor appetite, pain in the right hypochondria. A microscopic examination of duodenal contents revealed large, similar to pear cells with two nuclei. Which microorganism identified? A. Giardia B. Trichomonada C. Amoeba D. Trypanosome E. Toxoplasma	
8. A 42-year-old female has foamypurulent vaginal discharges. The smear stained by Romanovsky-Giemsa's method has been found to include flagellated bacteria. What is the most likely microorganism that has been found by the doctor? A. *Trihomonas vaginalis* B. *Leishmania donovani* C. *Trypanosoma gambiense* D. *Trihomonas hominis* E. *Lamblia intestinalis*	
9. Antibiotics produsedby fungi belonging to *Penicillium* and *Aspergillus* genera are widely used in medicine. What class do these genera belong to? A. Ascomycetes B. Basidiomycetes C. Zygomycetes D. Deuteromycetes E. Chytridiomycetes	

Protocol 4 **Date:_____**

Theme: **Morphology and ultrastructure of viruses and principles of classification. Virological methods of research.**

1. Name the surname of the scientist who is the founder of virology. What is viral infection was first discovered?

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_____
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2. What properties distinguish viruses from other organisms?

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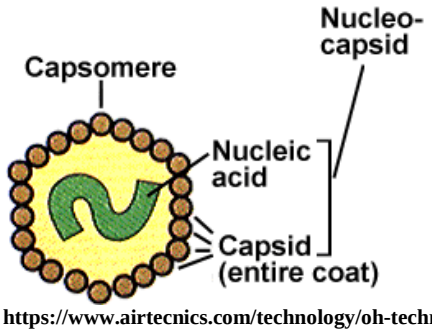
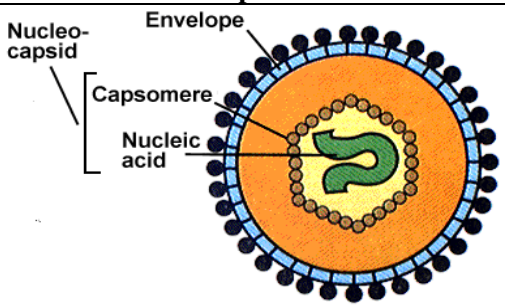
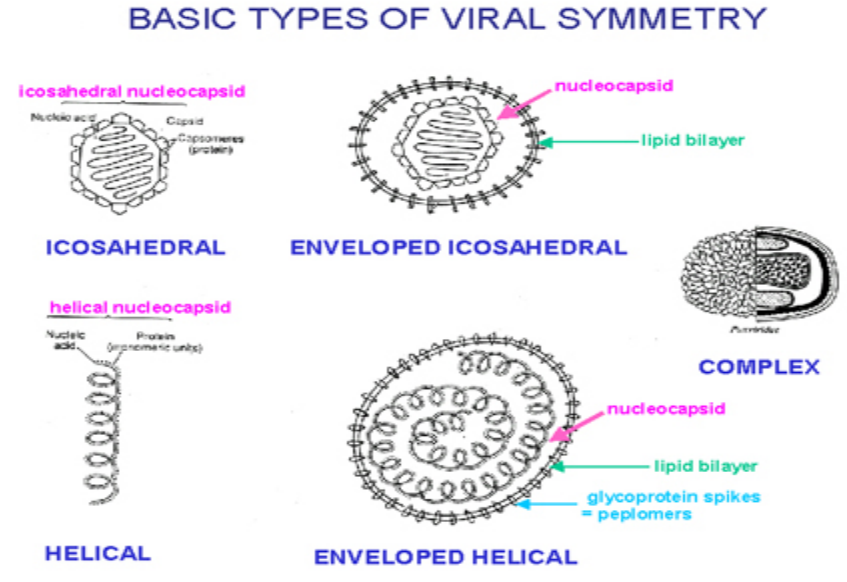
3. Describe the chemical composition and structure of viruses.

	Simple viruses	Complex viruses
Structure (scheme)	 https://www.airtecnics.com/technology/oh-technology-against-viruses-tests	 https://www.airtecnics.com/technology/oh-technology-against-viruses-tests
Chemical components		
Structural elements		
Type of symmetry	 https://www.uobabylon.edu.iq/eprints/publication_3_2579_353.pdf	

4. List the properties of viruses, which are the basis of their classification.

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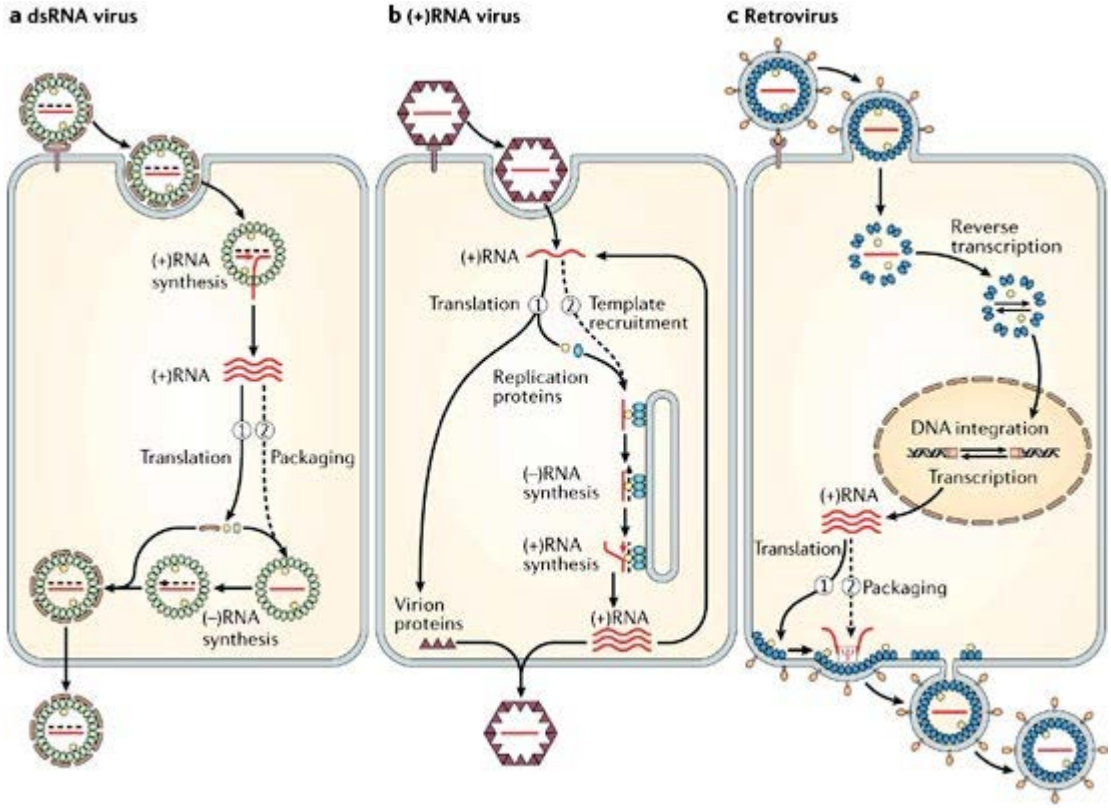
5. Describe the forms of existence of viruses in nature.

Name	Characteristic
Virion	
Virus	
Provirus	

6. Study scheme "Life cycle of the virus"



https://www.researchgate.net/publication/288827106_Reconstruction_of_Phylogenetic_Relationships_between_Nucleic_Acid_Polymerases_of_Viruses_with_RNA_Genome/figures?lo=1

Why virus reproduction method called disjunctive? _____

_____

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7. Describe the methods of laboratory diagnostic of viral diseases.

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8. Name the biological objects which are used for viral cultivation.

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1. Leaves damage by mosaic discoloration has been detected at medicinal plantations. What microorganisms are the cause? A. Plant-pathogenic viruses B. Plant-pathogenic bacteria C. Plant-pathogenic fungi D. Protozoa **E.** Rickettsia	
2. A local general practitioner recommends taking interferon for influenza prevention. What is the mechanism of action of this drug? A. Blocks virus protein synthesis B. Blocks virus stripping C. Inhibits virion exit from cells D. Prevents adsorption of virus in cell receptors **E.** Disrupts the process of virus assembly	
3. In a nursery-garden some medicinal plants developed signs of a disease: there are yellow spots and necrotic foci on the leaves. Sap of the diseased plants remained infectious even after passing through a bacteria-excluding filter. No microorganisms growth was detected on the nutrient medium. What microorganisms could be the cause of this disease? A. Fungi B. Ray fungi C. Bacteria D. Viruses E. Mycoplasma	
4. Of the virus as infectious agents is mandatory intracellular parasitism. Which object is not used for the cultivation of viruses? A. Primary cell cultures B. Susceptible laboratory animals C. Chicken embryos D. Culture media E. Continuous cell culture	
5. From patients was isolated etiologic infectious agent with these characteristics: submicroscopic size, type of nucleic acid - DNA, reproduces only in cell culture. What drugs should be applied for treatment in this case? A. Antibacterial B. Antiviral C. Antifungal D. Broad-spectrum antibiotics E. Toxoids	
6. In the virology laboratory received wipes from the nasopharynx of the patient. Which of the substrates should be used to highlight the flu virus from swabs the patient? A. Saburo medium B. Meat-peptone agar C. Meat-peptone broth D. Endo medium E. Chicken embryos	
7. To isolate influenza virus A1/57 (N2N2) from patients was used chicken embryos. What method of diagnosis is used?	

A. Virusoscopic B. Immunofluorescence C. Virologic D. Immune electron microscopy E. Biology	
8. Infectious agents of various ultrastructures can be etiological agents of infectious diseases. Which of the groups named below **HAS NO** cellular structure, protein synthesizing, enzyme and energy systems? A. Viruses B. Fungi C. Bacteria D. Protozoa E. Rickettsia	
9. Infection of chicken embryos is the main method of isolation of influenza virus. To suppress the accompanying bacterial flora in the test material (washings from the nasopharynx) to him previously added: A. Fluorescent serum B. Eubiotics C. Antibiotics D. Leukocyte interferon E. Influenza gamma globulin	
10. In 2003 a new disease, which is denoted as "atypical pneumonia" or SARS (severe acute respiratory syndrome). To which group of microbes carried her agent? A. Fungi B. Bacteria C. Protozoa D. Prions E. Viruses	
11. In viral diseases in the cytoplasm or nucleus of infected cells can be detected inclusions, revealed with the microscope with a special staining smear. Specify the method of stained for this purpose. A. Romanovsky-Giemsa B. Neisser C. Gram D. Ziehl-Neelsen E. Zdrodovskogy	
12. After infection, cell culture virus containing material in the cells appeared intranuclear inclusion. What do you call such an action of the virus? A. RIF B. CPA C. RIA D. RGA E. RN	

NOTES

Protocol 5 **Date:_____**

Topic: Intermediate control. Morphology of microorganisms.

1. Name and describe three objective usually supplied in a modern compound microscope.
2. What markings are to be found on these objectives?
3. Explain the principle of oil-immersion objective. What special property has immersion oil?
4. Outline the procedure for marking and fixing a smear.
5. Describe the actual procedure of simple stain.
6. Complex staining methods, definition.
7. Gram stain procedure and mechanism.
8. What is the structure of bacteria that cause some to stain purple and other to stain red?
9. How does the precise structure of the cell walls differ in gram positive and gram negative bacteria?
10. Name gram positive and gram negative bacteria that are causative agents of infectious diseases
11. Prokaryote and eukaryote: common properties and differences.
12. Morphology of bacteria:

• classification bacteria by the form of cocci, rods, spiral-shaped, thread-shaped;
• morphology of cocci and division, then in dependence segmentation to give examples of pathogenic ones;
• rod–shaped bacteria (bacteria, bacilli, clostridia) and their locating in staining, to give examples of pathogenic ones;
• spiral-shaped bacteria (vibrios, spirilla, spirochaetes) and give examples of pathogenic representatives.

13. Structure of microbial cell:

a. structure of nucleoid, method of revealing
b. morphology and functions of cytoplasm and inclusions;
c. structure of cytoplasmic membrane, cell's wall, capsule

14. Sporulation of bacteria:

a. difference between bacteria, bacilli and clostridia
b. functions of sporulation process of bacteria
c. chemical composition of spores;
d. spores location of pathogenic bacteria;
e. stages and conditions of sporulations; influence of environmental factor of spores;
g. method of spores staining.

15. Locomotor organoids of bacteria:

a. creeping and swimming bacteria;
b. structure of flagella, chemical composition;
c. division of bacteria by location of flagella;
d. function of flagella, mechanism of bacterial motility;
e. method of flagella examination.

16. Fimbriae (pili) of bacteria. Their types and value.
17. Classification and morphology of Spirochaetes.
18. Schematically structure of Treponema, Borrelia, Leptospira.
19. Principal diseases, which are caused by pathogenic Spirochaetes
20. Morphological feature of fungi. Classification. Difinition of a hypha, mycelium, sporangium.
21. Diseases caused by fungi in man.
22. Molds and yeasts. Differences and similarity.History of discovery and the main stages in the development of virology. The contribution of national scientists. Methods of study of viruses and their evaluation.
23. Morphology and ultrastructure of viruses. Symmetry types of viruses. Chemical composition and function of components of the virus.
24. Bacteriophage, the history of studying. Structure, classification of phages by morphology. Methods of qualitative and quantitative determination of bacteriophages. Practical use of bacteriophages.
25. Forms of interaction between bacteriophage and bacterial cell. Virulent and moderate phages. Characteristics of productive interaction. Lysogenity and phage conversion.
26. Modern views on the nature and origin of viruses. Place of viruses in the live system.
27. Principles of viruses classification. Basic properties of human and animal viruses.

Protocol 6 **Date:_____**

Topic: Nutrition of bacteria. Nutrient media for the cultivation of microorganisms. Sterilization. Features of sterilization of dental instruments.

1. Name the types of nutrition of microorganisms.

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2. Explain a term «nutrient medium».

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3. Study the classification of nutritious media using a text book of Microbiology.

Name of group	General characteristic	Example
Classification by the nature		
Natural		
Semisynthetic		
Synthetic		
Classification by the consistence		
Liquid		
Semisolid		
Solid		
Classification by the usage		
Ordinary (Simple)		
Special		
Elective		
Enrichment		
Differential-diagnostical		

4. Streak the bacterial culture on solid and liquid nutritious media.

5. Explain a term «sterilization».

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6. Study the methods and regimes of sterilization. Name the physical methods of sterilization and their regime and exposure.

Method of sterilization		Equipment	t ºC	Exposure
Dry Heat (powder, oil, metal instrument, test tubes, flask, pipettes, Petri dishes)		Hot air oven	160	1 hour
Boiling water (dishes, bedding, bedpans)			100°C	40 minutes
Compressed Steam	Ordinary nutrient mediums	Autoclave	Pressure 1,5 atm 121 °C	15-20 мин
	Bacteria cultures		Pressure 2 atm 134 °C	15-20 мин
Tyndalization or fractional sterilization (if components of nutrient mediums destroy at 80°C).		Live steam	60-65°C	1 h – 5 days
			70-80°C	1 h – 3 days
Pasterization (it destroy vitamins and does not deprive the beverages of their flavor)		By heating and then cooling it.	50-65°C	15-30 min
			70-80°C	5-10 min

7. Name the ways of controlling autoclave:

Name of method	General characteristic
Physical	
Chemical	
Biological	

8. Define the terms:

Asepsis_____

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Antisepsis_____

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Disinfection_____

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9. List the main disinfectants and antiseptics used in dental practice.

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10. Stages of disinfection of dental instruments.

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1. A dry-heat box is used for sterilization of various materials and instruments in a bacteriological laboratory. This sterilization method can be applied to the following objects: A. Glass test tubes B. Rubber gloves C. Simple nutrient medium D. Wire inoculating loops E. Physiological solution	
2. The following should be used for sterilization of laboratory glassware in a microbiological laboratory: A. Bacteria-excluding filters B. Hot-air sterilizer C. Koch's steam sterilizer D. Disinfectant E. Bactericidal lamps	
3. During examination of a patient with intestinal infection, inoculation in Endo medium resulted in multi-colored colonies: red and colorless. According to its purpose this medium can be determined as: A. Differential diagnostic B. Universal C. Special D. Selective E. –	
4. Selective medium can be used to separate various species of bacteria in a bacteriological laboratory. What medium of those listed below can be determined as selective? A. Meat infusion agar B. Meat infusion broth C. Alkaline peptone water D. Hiss' serum water medium E. Endo agar	
5. To obtain exotoxins of some microorganisms, these microorganisms are inoculated into liquid nutrient medium, where microbial cultivation occurs and toxins are produced. At a certain stage it is necessary to remove the microbial cells from the medium, that is, to separate the toxins from microbes. What method should be applied in this case? A. Disinfectants (chloramine) B. Boiling C. Autoclaving D. Ultraviolet irradiation E. Bacteria-excluding filters	
6. Many drugs must be manufactured under strictly aseptic conditions. One such possible source of microbiological contamination of drugs is laboratory glassware. What method should be used to sterilize the glassware? A. Dry heat B. Ignition C. Boiling D. Tyndallization E. Pasteurization	
7. Microorganisms in the environment are being affected by various physical factors. What is the effect of high temperature on a microbial cell? A. Mutagenic effect B. Irreversible degradation of all cellular structures C. Transition into anabiosis state D. Albuminolysis E. Fats saponification	

8. A dry-heat box is used for sterilization of various materials and instruments in a bacteriological laboratory. This sterilization method can be applied to the following objects: A. Glass test tubes B. Rubber gloves C. Simple nutrient medium D. Wire inoculating loops E. Physiological saline	
9. Preliminary disinfection of air and working surfaces of the equipment was conducted in the operating room of the surgical inpatient unit. What method of sterilization would be the most advisable in this case? A. Ultraviolet irradiation B. Irradiation sterilization C. High-frequency current D. Flowing steam E. Formaldehyde vapor	
10. A pharmacy produces a batch of vials with physiological saline for injections. How should they be sterilized? A. In a dry heat sterilizer B. In a steam-jacketed autoclave chamber C. Under pressure in an autoclave D. X-ray irradiation E. Ultraviolet irradiation	
11. Seitz filters are widely used in laboratory practice. What is their purpose? A. Sterilization by means of filtration B. Disinfection of solutions C. Measurement of water contamination D. Growing of bacteriophages E. Virus destruction	
12. Thermolabile medicinal preparation for extemporal use was heated to 65°C thrice with intervals of one day between the heatings. What method of sterilization was used in this case? A. Koch's steam sterilization B. Pasteurization C. Tyndallization D. Calcination E. Filtration	
13. Before a surgical operation, a surgeon treated his hands with an alcohol containing solution. Which group of drugs does this solution relate to? A. Surface-active substances B. Disinfectants C. Sterilizing solutions D. Detergents E. Antiseptics	
14. What method of sterilization should be used during the manufacturing of liquid dosage forms containing proteins? A. Boiling B. Filtering C. Gas sterilization D. Autoclaving E. Pasteurization	
15. Some success in reducing malaria transmission was achieved through the mass destruction of transmitting mosquitoes and their larvae. The measures aimed at the destruction of insects are called: A. Disinfection B. Disinfestation	

C. Deratization D. Sterilization E. Decontamination	
16. Meat infusion broth is prepared for sterilization in bacteriological laboratory. What sterilization method is advisable? A. Filtering B. Ignition C. Boiling D. Autoclaving E. Dry heat	
17. Production of injections in pharmacies requires srtict control of sterilization quality. What is placed in autoclave sterilization chamber to ensure proper control? A. Ampoule with microbe spores B. Ampoule with staphylococcus culture C. Ampoule with colibacillus culture D. Ampoule with fungi spores E. Ampoule with viruses	
18. The bacteria differentiate into several groups depending on the type of nutrition. Name type of nutrition of bacteria using carbon dioxide air as a carbon source. A. Heterotrophs B. Organotrophs C. Autotrophs D. Auxotrophs E. Prototrophs	
19. The enterprise, where producing the vaccine, diphtheria bacillus is cultivated to produce toxin. For the growth of a microorganism serum media is used, because the microorganism is not able to independently synthesize some amino acids and vitamins necessary for its growth. To which group of microorganisms (like metabolism) it belongs? A. Prototrophs B. Lithotrophs C. Phototrophs D. Autotrophs E. Auxotrophs	
20. For nutrition the bacteria needed molecules, which in nature structure can not pass through the cytoplasmic membrane. Name the mechanism of nutrition, in which the molecules are fragmented substances: A. Phagocytosis B. Translocation radicals C. Passive diffusion D. Active transport E. Facilitated diffusion	
21. There are different uptake mechanisms of nutrients by the bacterial cell. One of them is facilitated diffusion, which is implemented by special membrane proteins vectors. How are they called? A. Permeases B. Lyases C. Oxidoreductases D. Isomerases E. Ligases	

Protocol 7 **Date:_____**

Theme: **Growth and breeding of bacteria. Respiration of bacteria. Methods of isolation and cultivation of aerobes and anaerobes. Isolation of a pure culture of aerobic and anaerobic bacteria from the oral cavity.**

1. Determine a term «pure culture».

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2. Name the methods of isolation of pure culture of aerobic microorganisms.

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3. Mark the stages of isolation of pure culture.

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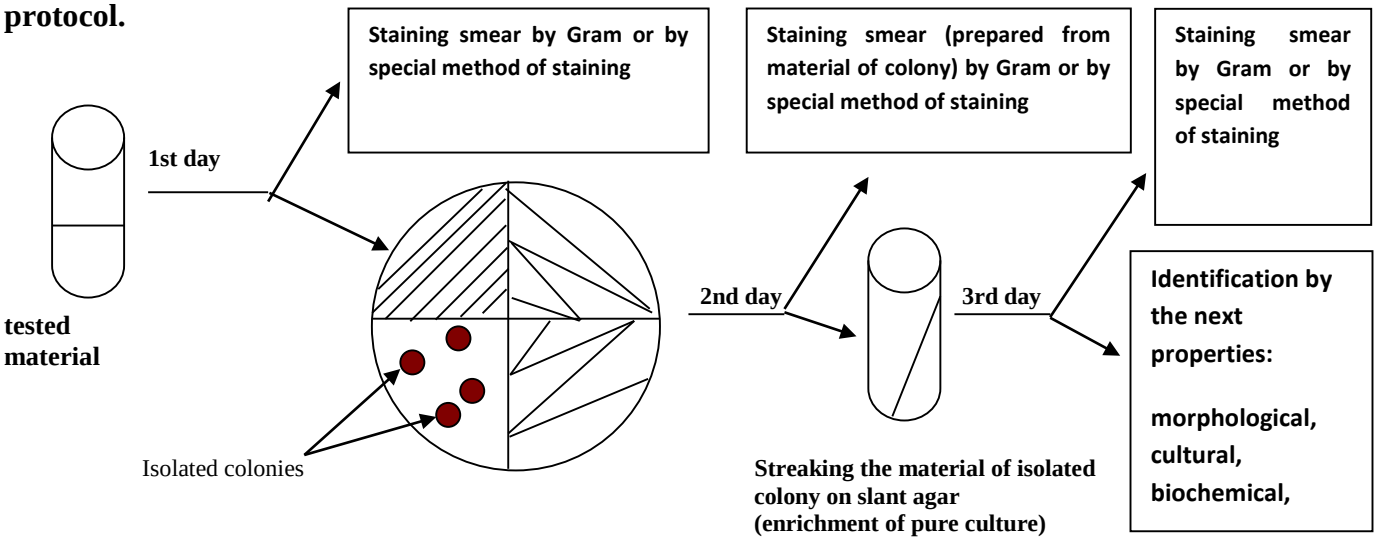
4. Streak the bacterial culture on solid nutrition media according to Drigalskiy method. Draw in protocol.



5. List the properties of the microorganism by which it can be identified.

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6. Name the types of bacterial cell division.

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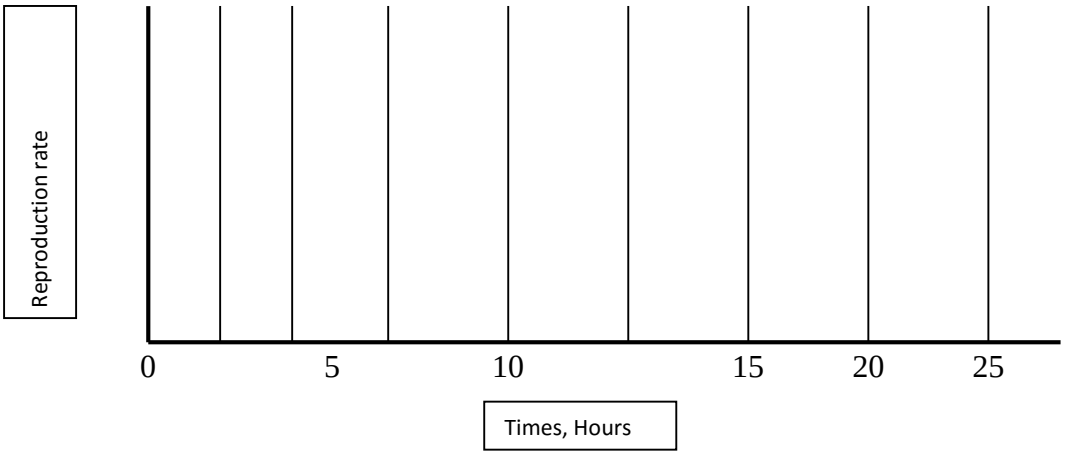
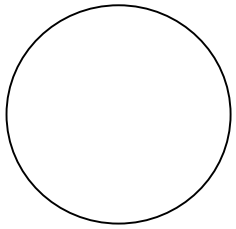
8. Name the main phases of reproduction of bacteria and draw a graph of their growth.



9. Study the morphological and cultural properties of bacteria. Turn the Petri Dish with its bottom to the eyes and examine the colonies in transient light. In the presence of various types of colonies count them and describe each of them.

Morphological properties	**Cultural properties**	
	Form	Consistence
	Size	Surface of the colony
	Color	Structure

10. Name the types of bacterial respiration.

Type of respiration	**General characteristic**	**Example of bacteria**
Obligate aerobes		
Microaerofiles		
Facultative anaerobes		
Obligate anaerobes		
Capnofiles		

Explain the toxicity of O_2 for anaerobic microorganisms.

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11. Name the methods of cultivation of anaerobic microbes.

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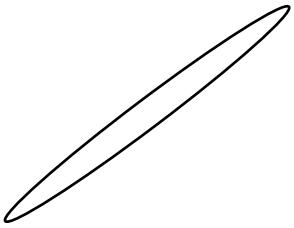
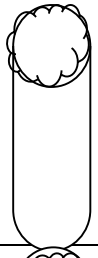
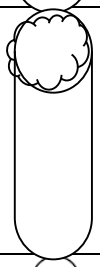
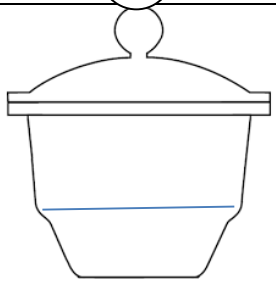
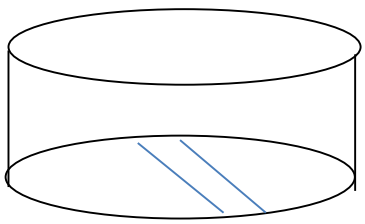
12. Name the methods of isolation of pure culture of anaerobic microbes and draw in protocol.

Method	Characteristic
 https://spectrolab.com.ua/ua/p1215985561-anaerostat-laboratornyj-ans.html	Anaerostate
	Vinieal-Veyion method
	Kitta-Tarozzi medium
	High column of sugar agar
	Chemical method
	Cultivation by Fortner method

13. Practical task.

1). Inoculate the pre-inoculated Kitta-Tarozzi medium on meat-peptone agar and place the cultures for cultivation in a thermostat in anaerobic conditions.

1. Microorganisms in the environment are being affected by various physical factors. What is the effect of high temperature on a microbial cell? A. Mutagenic effect B. Irreversible degradation of all cellular structures C. Transition into anabiosis state D. Albuminolysis E. Fats saponification	
2. In microbiology class students had been growing pure bacterial culture. Bacterial inoculation of solid medium was performed to obtain separate visible colonies, resulting in two colonies, R-type and S-type, grown in thermostat after one day of incubation. What microorganism properties were described by students? A. Antigenic B. Tinctorial C. Biochemical D. Morphologic E. Cultural	
3. For nutrition the bacteria needed molecules, which in nature structure can not pass through the cytoplasmic membrane. Name the mechanism of nutrition, in which the molecules are fragmented substances: A. Phagocytosis B. Translocation radicals C. Passive diffusion D. Active transport E. Facilitated diffusion	
4. There are different uptake mechanisms of nutrients by the bacterial cell. One of them is facilitated diffusion, which is implemented by special membrane proteins vectors. How are they called? A. Permeases B. Lyases C. Oxidoreductases D. Isomerases E. Ligases	
5. To isolate bacteria of the genus Proteus from the test material using the method Shukevich. What is it? A. Inoculating in enrichment medium B. Cultivation in anaerobic conditions C. Inoculating in medium with antibiotic D. Inoculating in the condensing water of MPA E. Infection of laboratory animals	
6 Bacterial culture obtained from patient DOES NOT grow when exposed to oxygen. Conditions suitable for bacterial culture growth can be created in: A. Serum-supplemented medium B. Anaerobic culture jar C. Pasteur oven D. Krotov apparatus E. Oxidative medium	
7. For cultivation of Brucella, pure cultures should be incubated in CO_2 enriched atmosphere. What type of breathing is typical for Brucella? A. Capnophilic B. Facultative anaerobic C. Obligate anaerobic D. Obligate aerobic E. Any	

8. In microbiology class students had been growing pure bacterial culture. Bacterial inoculation of solid medium was performed to obtain separate visible colonies, resulting in two colonies, R-type and S-type, grown in thermostat after one day of incubation. What microorganism properties were described by students? A. Morphologic B. Tinctorial C. Biochemical D. Cultural E. Antigenic	
9. We can obtain pure culture of anaerobic microorganisms with the help of: A. Fortner's method B. Shukevich's method C. Paster's method D. Weinberg's method E. Loeffler's method	
10. It is known that anaerobic microorganisms are killed in the presence of oxygen because of the destructive action of hydrogen peroxide. This is due to the lack of production of the enzyme anaerobes: A. Reductase B. Polymerase C. Catalase D. Proteases E. Lactase	
11. In the study of microbial air Pharmacies isolated pure culture of microorganisms, which grows and develops in the presence of an atmosphere of not less than 20% oxygen. To which group of microorganisms on the respiration type belongs the isolating culture? A. Obligate anaerobes B. Facultative anaerobes C. Microaerophilic D. Capnophilic	
12. The patient suspected anaerobic infection (tetanus). In what medium should be inoculate material under study? A. Endo B. Casein-carbon agar C. Kitta - Tarozzi D. loskirev E. Lowenstein-Jensen	
13. The patient was isolated culture of bacteria, which do not grow in the presence of oxygen. How to provide conditions for the growth of this culture? A. By use of serum medium B. Use of anaerobic culture apparatus C. By use of the furnace Pasteur D. Using the apparatus Krotov E. By use of an autoclave	
14. To isolate bacteria of the genus Proteus from the test material using the method Shukevich. What is it? A. Inoculating in enrichment medium B. Cultivation in anaerobic conditions C. Inoculating in medium with antibiotic D. Inoculating in the condensing water of MPA E. Infection of laboratory animals	
15. In the laboratory of the pharmaceutical companies tested medicinal raw material (Freshly plants) at insemination	

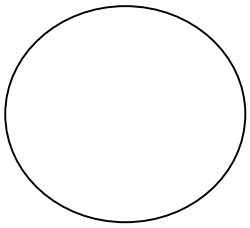
opportunistic microorganisms. To isolate bacterial cultures prepared test tubes with slant agar, and the MPA poured hot to form a condensate. Which microorganism is expected to isolate? A. Streptococcus B. Proteus C. Escherichia coli D. Klebsiella E. Staphylococcus	

Notes

Protocol 8 **Date:_____**

Theme: **Biochemical properties of microorganisms. Enzymes of bacteria. Asepsis and antiseptics. Methods and means. Disinfection.**

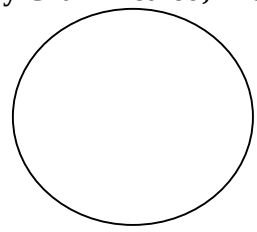
1. To continue work on isolation of pure culture of bacteria (3rd day of research). Check the purity of the culture grown on beveled agar. For this purpose, prepare a smear preparation, Gram stain, microscopy and draw to the protocol.



_____

2. Sow the culture from the slant agar on the media of the variegated row of Hiss and in peptone water. Place the indicator strips under the stopper in a test tube with peptone water. Sign the crops and put them in the thermostat.

3. Prepare smear preparations from Kitta-Tarozzi medium, sown with soil sample in the previous lesson, stain by Gram method, microscopy and draw to the protocol. Conclude.



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4. Explain a term «enzyme».

_____
_____
_____

5. Fill the table "Classification of enzymes".

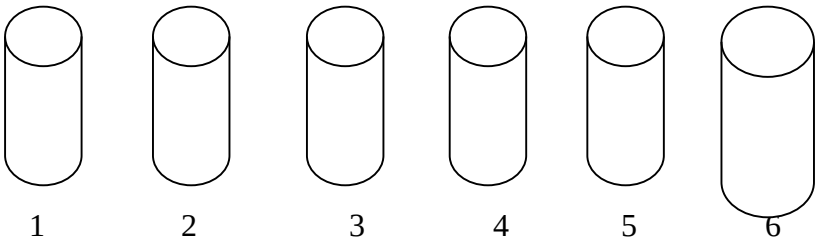
Name of group	Characteristic	Example
According to the chemical structure		
Simple		
Complex		
According to the place of action		
Exoenzymes		
Endoenzymes		
According to the presence of substrate		
Constitutive		
Inducible		

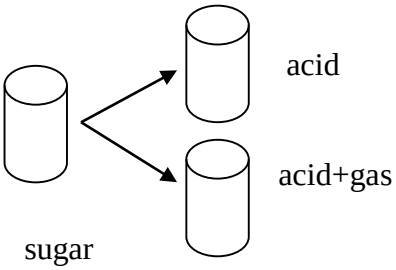
6. Name enzymes of pathogenicity of bacteria and give them characteristic.

_____
_____
_____

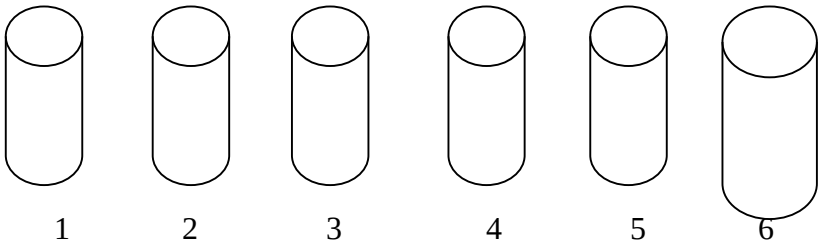
7. Learn composition and draw differential – diagnostic and special nutritious media:

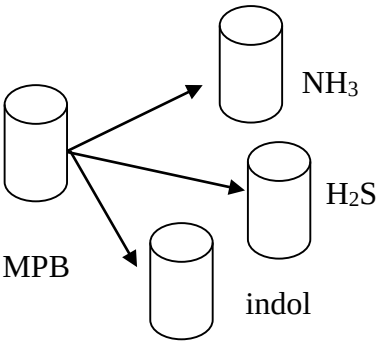
1) Hiss medium and meat-pepton broth (MPB).





Hiss medium and MPB with E.coli





1 – lactose 2 – glucose 3 – maltose 4 – mannitol 5 – sucrose 6 - MPB

Which type of biochemical activity can be determined on Hiss media and MPB?_____

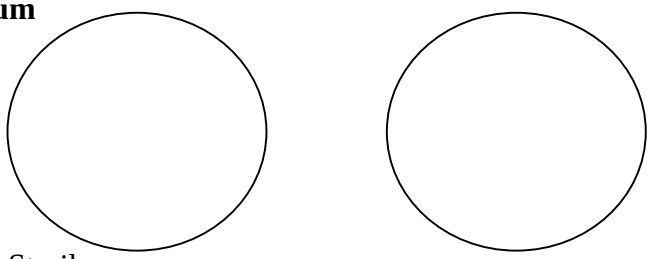
_____

_____

_____

2) Differential-diagnostic and special nutrient mediums:

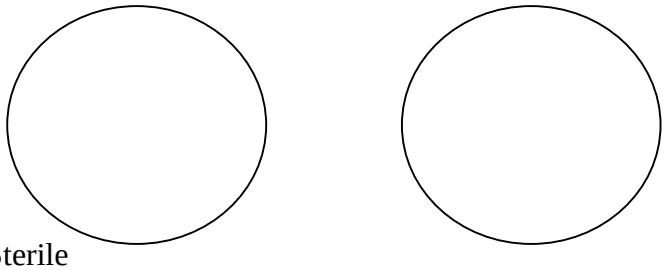
a) Endo medium



Sterile

1. Lactose-positive colonies
2. Lactose-negative colonies

b) Blood agar

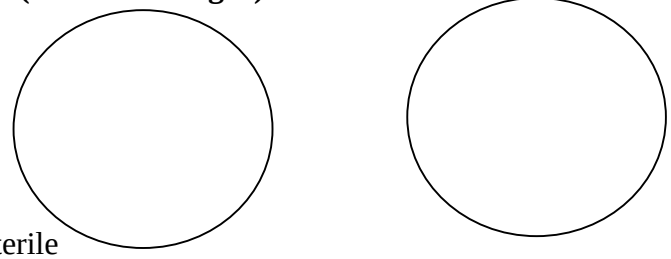


Sterile

1. α-hemolysis
2. β- hemolysis
3. γ- hemolysis

Hemolysins are _____

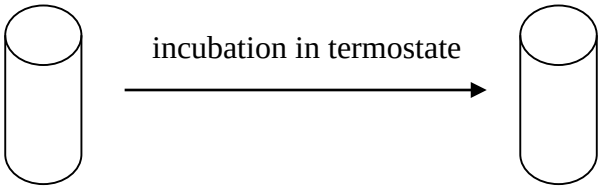
c) yolk-salt agar(Chistovich agar)



Sterile

1. Lecitinase- positive colonies
2. Lecitinase– negative colonies

d) citrate rabbit plasma



Sterile citrate rabbit plasma — positive test

Plasmocoagulase (coagulase) are _____

_____

8. List the microbial enzymes that are pathogenic enzymes:

_____

_____

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_____

9. Name the practical application of enzymes of microbial origin.

_____

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1. During feces analysis of a 3-month old child with signs of enteric infection, numerous dark-red colonies has grown on Endo agar. What microorganisms can be the cause of such enteric infection? A. Shigella B. Streptococci C. Gonococci D. Salmonellae E. Escherichia	
2. During assessment of air purity in an aseptic unit of a pharmacy, sedimentation analysis had been applied. Test resulted in growth of the small colonies with areas of hemolysis. What medium was used for inoculation? A. Endo agar B. Levine's agar (Eosin Methylene Blue agar) C. Blood agar D. Ploskirev's agar E. Egg-yolk salt agar	
3. After inoculation of the feces specimen from a patient with typhoid fever onto Endo medium colonies of different size and color – big red and medium colorless – have grown. Name the functional type of this medium. A. Selective B. Enriched C. Special D. Differential-diagnostic E. Universal (general purpose)	
4. After cultivating excreta of the patient, which is ill with typhoid fever, on Endo medium got the growth of the	

colonies. Choose nutrient medium needed to study the biochemical properties of selected culture: A. Media Hiss B. Meet-pepton agar C. Kitta-Tarozzi medium D. Alkaline peptone water E. Ploskirev medium	
5. Bacteriological study of solutions, manufactured in the pharmacy on Endo medium grew red colonies with a metallic luster. What it may be microorganisms? A. Shigella B. Escherichia C. Staphylococci D. Streptococci E. Salmonella	
6. At the air control in the pharmacy premises where manufactured injectable drugs, sedimentation method were revealed small rounded colonies, around which are clearly visible zone of hemolysis. What media was use for cultivating? A. Endo medium B. MPA C. Blood agar D. Yolk-salt agar E. Levin media	
7. Staphylococci grow well on simple media, however, the isolation of pure cultures from patients with seeding done on blood and yolk-salt agar. What purpose to use these media? A. To determine the staining properties B. To study the antigenic properties C. To determine the mobility of bacteria D. To determine the sensitivity to antibiotics E. To determine the factors of pathogenicity	
8. To identify the pathogen determine its enzymatic activity. In what medium are studying its proteolytic properties? A. Endo medium B. Meat-peptone gelatin C. Media Hiss D. Levin medium E. Ploskireva medium	
9. In the laboratory of the pharmaceutical companies tested medicinal raw material (Freshly plants) at insemination opportunistic microorganisms. To isolate bacterial cultures prepared test tubes with slant agar, and the MPA poured hot to form a condensate. Which microorganism is expected to isolate? A. Streptococcus B. Proteus C. Escherichia coli D. Klebsiella E. Staphylococcus	

Notes.

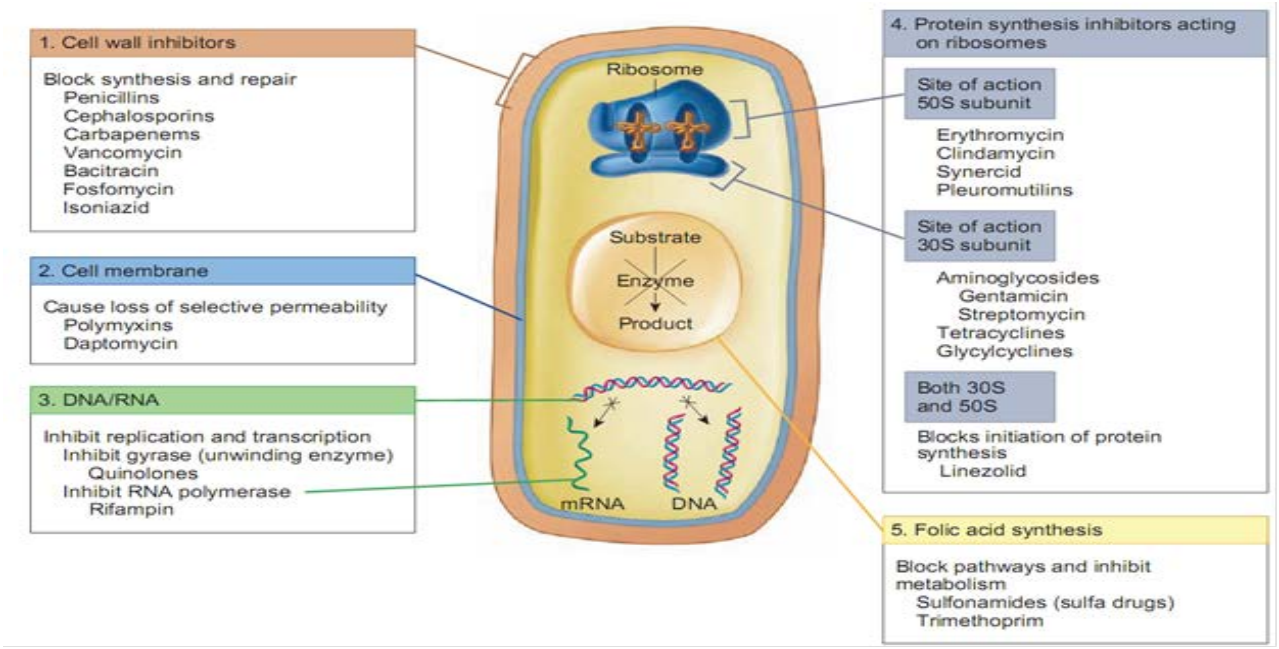
Protocol 9 **Date:_____**

Theme: **Chemotherapy. Chemotherapeutic drugs. Effect of biological factors on microorganisms. Antibiotics. Bacteriophage.**

1. Explain terms "chemotherapy" and "antibiotic".
Chemotherapy - _____
_____
Antibiotic - _____
_____

2. Write the classification of antibiotics.

Name of group	Characteristic	Example
Classification according to obtaining method		
Natural		
Semisynthetic		
Synthetic		
Classification according to origin.		
Produced by fungi		
Produced by bacteria		
Produced by actinomycetes		
Phytoncides		
Classification according to the character of action		
Bactericidal		
Bacteriostatic		
Classification according to the mechanism of action (see on the next page)		



Classification according to the mechanism of action

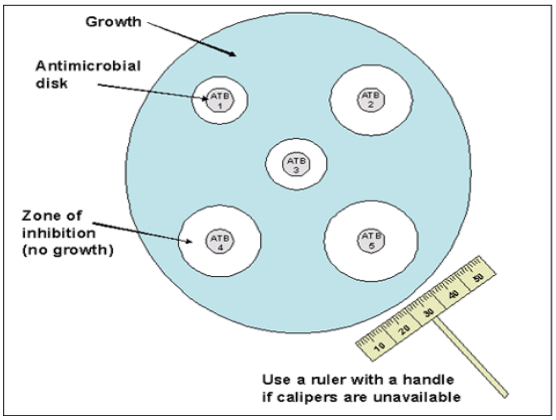
https://quizlet.com/94452059/micro-flash-cards/

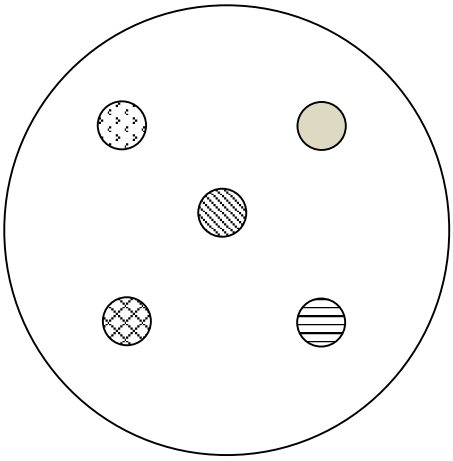
3. Give a characteristic of the negative effect of antibiotics into the human organism.

4. Master and write the methods of determining antimicrobic action of antibiotics on microorganisms:

5. Study the effect of chemotherapeutic drugs and antibiotics on test-objects containing Staphylococci (diffusion test). Draw the scheme.

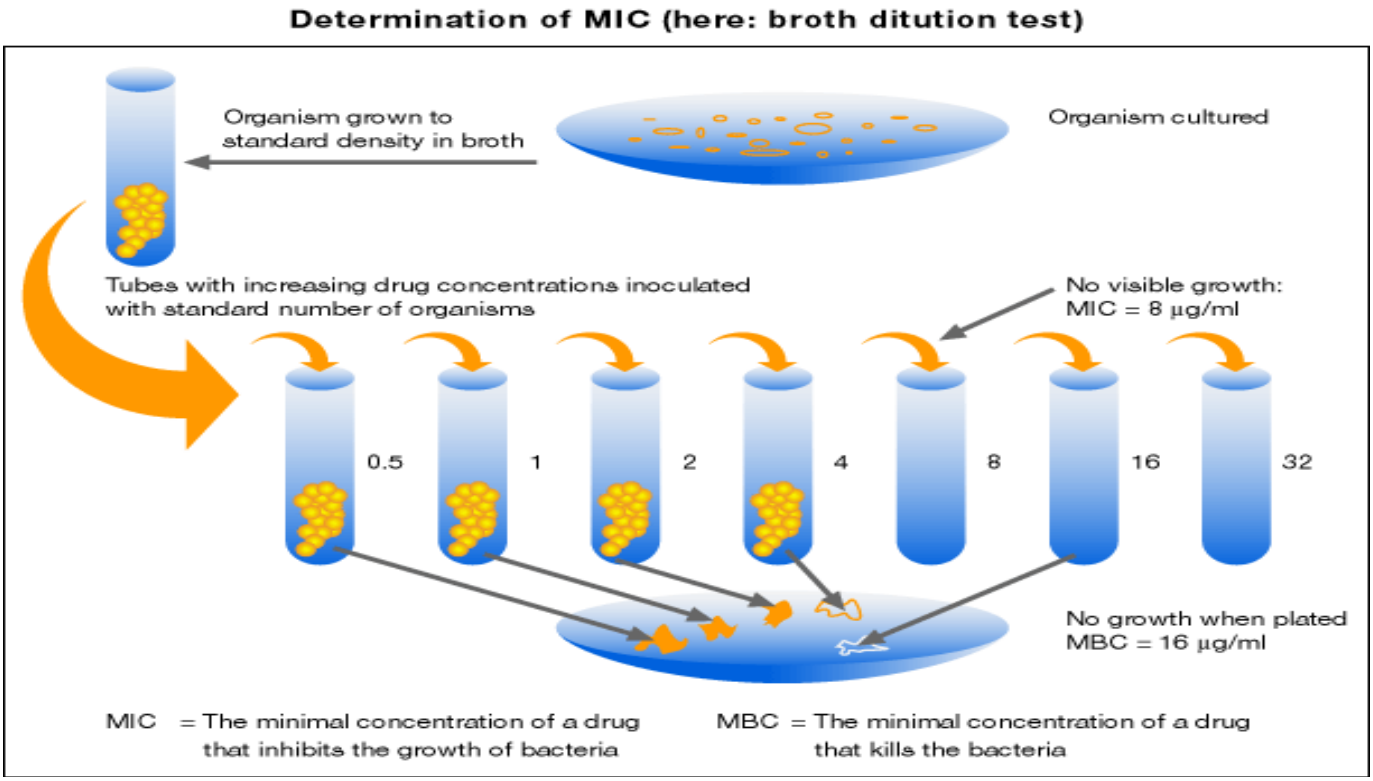
https://www.pinterest.com/pin/antibiotics-sensitivity-test-by-disc-diffusion-test--789326272161327970/



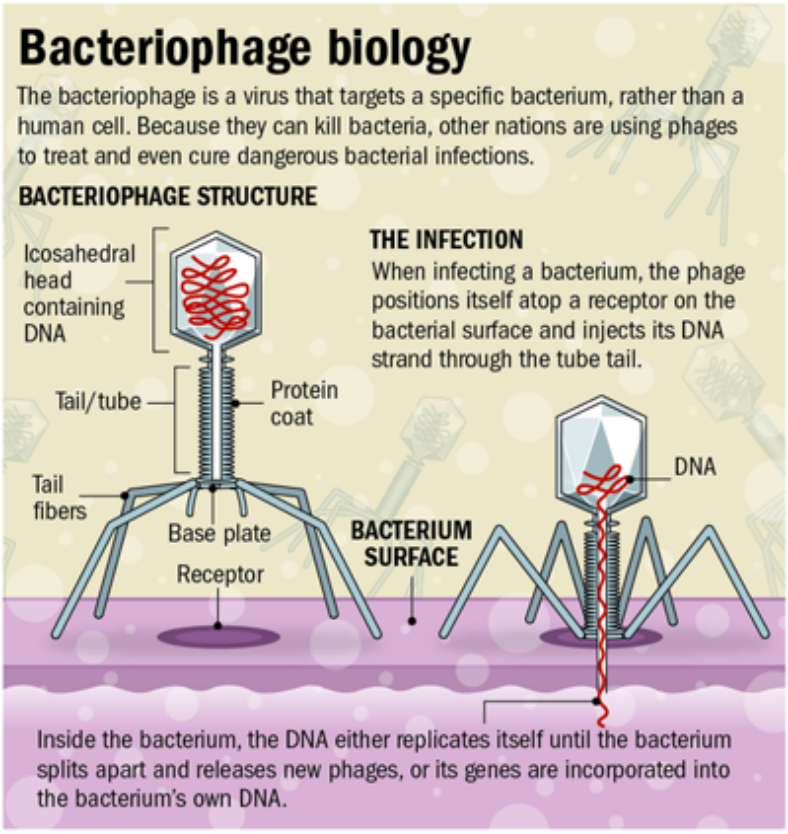


Scheme of paper disc	Name of antibiotic

6. Study the effect of chemotherapeutic drugs and antibiotics on test-objects containing Staphylococci (dilution test). Draw the scheme.



https://jpabs.org/misc/concentration-dependent-antibiotic.html



7. Study the structure and morphology of the bacteriophage, their obtaining.

https://www.ams.usda.gov/sites/default/files/media/MicroorgTechnical%20Evaluation%20Report%20(2014).pdf

8. Name the principles of classification of the bacteriophages:

Name of group	Characteristic
Classification by the effect into bacteria cells	
Virulent (Lytic)	
Avirulent (temperate)	
Classification by the specificity	
Polyvalent	
Monovalent	
Typic	

9. Study the effect of biological factors on bacteria cells. Characterize the practical using of bacteriophages.

Phagotyping - _____

_____

_____

Phagoindication - _____

_____

_____

Phagotherapy - _____

_____

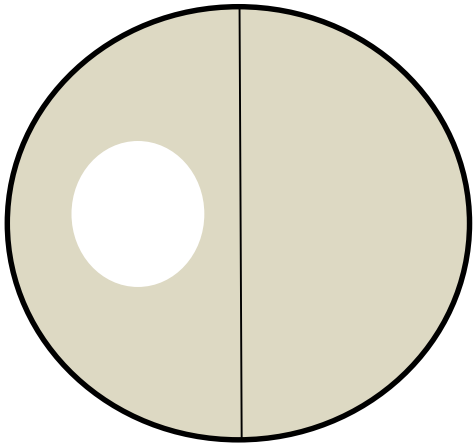
_____

Phagoprophylaxis - _____

_____

_____

10. Make the experiment on phage - indication.



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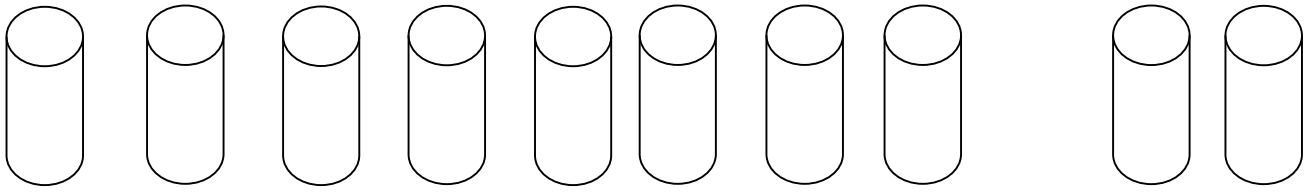
11. Learn the method of titration of the bacteriophage by Appelman. Draw in protocol.



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1. In a surgical unit an outbreak of purulent infections has been registered. The infections are caused by Staphylococcus aureus with multiple resistance to antibiotics. What plasmid has provided this property? A. R	

B. F C. Col D. Tox E. Hly	
2. A 3,5-year-old child has been diagnosed with dysbacteriosis in the form of critical reduction of gram-positive anaerobic bacteria and increased number of staphylococci and yeast fungi. What preparation should be used for the correction of dysbacteriosis? A. Furazolidone B. Colibacterin C. Coli-Proteus bacteriophage D. Bifidumbacterin E. Lactoglobulin	
3. Prolonged application of broad spectrum antibacterial drugs resulted in the patient being hospitalised with diagnosis of candidiasis. What side effect of antibiotic therapy has developed in the patient? A. Disbacteriosis B. Endotoxic reaction C. Toxic reaction D. Allergic reaction E. Formation of resistant microorganism strains	
4. A pharmaceutical enterprise offers wide range of antimicrobial agents. Select the broad spectrum antimicrobial agent: A. Tetracycline B. Rimantadine C. Nystatin D. Griseofulvin E. Phthalazolum	
5. Aurococcus culture was obtained from the nasal cavity of a child suffering from chronic tonsillitis. The causative agent's sensitivity towards a number of antibiotics was tested to choose the optimal drug. What drug WAS NOT included in antibiotic susceptibility testing? A. Nystatin B. Ampicillin C. Tetracycline D. Levomycetin (Chloramphenicol) E. Erythromycin	
6. What antiprotozoal drug can be recommended to a woman with trichomoniasis? A. Metronidazole B. Primaquine C. Chloridine D. Solusurminum (Sodium stibogluconate) E. Chiniofon	
7. A pregnant woman was diagnosed with vaginal dysbacteriosis. What drug should be prescribed in this case? A. Interferon B. Antibiotic C. Bacteriophage D. Probiotic E. Polyvitamins	
8. Antibiotics derived from various species of actinomycetes are widely used in medical practice. Point out these drugs among those listed below: A. Aminoglycosides (streptomycin, monomycin) B. Penicillin, cephalosporin, griseofulvin C. Polymyxin, bacitracin D. Chloreline, arenarinum	

E. Lysozyme, erytrinum	
9. A chemotherapeutic agent has bactericidal effect against streptococci, staphylococci, bacilli, and clostridia. According to its action spectrum this drug belongs to the following group: A. Antiviralagents B. Narrow spectrum antibacterialagents C. Broad spectrum antifungal agents D. Broad spectrum antibacterial agents E. Antituberculous agents	
10. What is the main mechanism of benzylpenicillin bactericidal action on the coccal flora? A. Disturbed cytoplasmic membrane permeability B. Inhibitionof protein synthesis C. Disturbed synthesis of microbial cell wall D. Activation of macroorganism immune system E. Increased phagocytic activity of leukocytes	
11. Bacteria eventually become resistant to antibacterial agents. Resistance of gram-positive bacteria to penicillin antibiotics is caused by: A. Protein synthesis B. Permeability of the cell wall C. Active synthesis of peptidoglycan D. Active transport of antibiotic E. Beta-lactamase production	
12. Sulfonamides are widely used as bacteriostatic agents. The mechanism of antimicrobial action of sulfonamides is based on their structural similarity to: A. Para-aminobenzoic acid B. Glutamic acid C. Folic acid D. Nucleic acid E. Antibiotics	
13. P.Ehrlich is considered to be the founder of modern chemotherapy. What chemotherapy drug was developed by this scientist? A. Calomel B. Solusurminum C. Salvarsan D. Novarsenolum E. Osarsolum	
14. Antibiotics produsedby fungi belonging to *Penicillium* and *Aspergillus* genera are widely used in medicine. What class do these genera belong to? A. Deuteromycetes B. Basidiomycetes C. Zygomycetes D. Ascomycetes E. Chytridiomycetes	
15. Microbiology examinations are carried out in the neonatal department of a maternity hospital because of the suspicion of a hospital infection. S.aureus from several children and some things was isolated. What properties of isolated cultures should be examined to determine the source of infection? A. Biochemical activity B. Chromogenesis C. Antigenic structure D. Phage type E. Antibiotic sensitivity	
16. What is the main mechanism of benzylpenicillin bactericidal action on the coccal flora?	

A. Disturbed cytoplasmic membrane permeability B. Inhibition of protein synthesis C. Disturbed synthesis of microbial cell wall D. Activation of macroorganism immune system E. Increased phagocytic activity of leukocytes	
17. Sanitary microbiological investigation of potable water has detected coliphages. What conclusion can be made about the sanitary-hygienic status of this water? A. The water is safe to drink B. Fecal contamination C. The water is safe to drink after boiling D. Artesian water E. The water is for industrial use only	
18. In a Petri dish with the MPA, which was a colony of mold Penicillium, sprayed a suspension of Staphylococcus aureus. One day the growth of staphylococcus was observed on the entire surface of the nutrient medium except 3-sm zone around the colony of Penicillium. What type of relations of microorganisms revealed in this case? A. Metabiozis B. Parasitism C. Competition D. Commensalism E. Antagonism	
19. There are various forms of coexistence (symbiosis) between microorganisms. What do you call a win-win form of symbiosis, where both the microorganism is extracted from cohabitation favor? A. Metabioz B. Satellism C. Mutualism D. Commensalism E. Parasitism	

NOTES.

Protocol 10 **Date:_____**

Theme: **The microbiota of the environment. Ecological Microbiology. Microbiological control in dental facilities.**

1. To account for the results of phagoindication of the pathogen, to draw a conclusion. Record the results.

_____

_____

_____

2. Take into account the results of the study of the sensitivity of bacterial cultures to antibiotics using the paper disc method. Write down the results in the protocol, draw a conclusion.

№	The name of the antibiotic	The diameter of the retardation growth zone
1		
2		
3		
4		
5		
6		

_____

_____

_____

3. Conduct sanitary-microbiological study of the environment and microflora of the human body:

a) to carry out research of air by a sedimentation method for the purpose of definition of quantitative and qualitative structure of its microflora;

b) inoculate a sample of drinking water on Aikman's medium (glucose-peptone medium) by two-phase fermentation method to determine the coli-titer and coli-index and on a Petri dish with MPA to determine the microbial count of water;

c) sow washes from the skin surface on a Petri dish with blood agar and Endo medium to detect Escherichia coli and pathogenic cocci;

d) sow washes from the surface of the training table on the Endo medium in order to detect Escherichia coli.

4. Name the sanitary-indicative microorganisms in the study of water.

_____

_____

5. List the sanitary-microbiological indicators in the study of water and give their definition.

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6. Name the sanitary-indicative microorganisms in the study of air.

_____

_____

7. List the sanitary-microbiological indicators in the study of air and name the methods of their determination.

8. Name the sanitary-indicative microorganisms in the study of soil.

9. Microbiological control in dental facilities.

1. Plant pathogens are represented by various microorganisms: bacteria, fungi, actinomycetales, viruses. Name the main location of plant pathogens in the natural environment: A. Water B. Soil C. Air D. Plant parts E. Plant vascular system	
2. Sedimentation analysis has been applied for assessment of air purity in an aseptic unit of a pharmacy. The test resulted in growth of the small colonies with areas of hemolysis. What medium was used for inoculation? A. Egg-yolk salt agar B. Levine's agar (Eosin Methylene Blue agar) C. Endo agar D. Ploskirev's agar E. Blood agar	
3. According to the Pharmacopoeia regulations non-sterile drugs can contain certain microorganisms. Name the microorganisms that CANNOT be present: A. Mold fungi B. Yeast fungi C. Micrococci	

D. Enterobacteriaceae E. Sarcinae	
4. Air contamination with pathological microorganisms can be anticipated by the presence of indicator bacteria. Specify the bacteria that indicate immediate epidemiologic danger: A. Micrococci B. Sarcinae C. Mold fungi D. Yeast fungi E. Hemolytic streptococci	
5. During investigation of bacterial contamination of air it is necessary to take into account both total amount of microorganisms in a certain volume and qualitative content of microflora. What microorganisms are the sanitary indicators of air contamination within enclosed spaces? A. Hay bacillus B. Colibacillus C. Staphylococcus aureus D. Yeast fungi E. Mold fungi	
6. Microbiological investigation of vaginal suppositories determined them to be CONTRARY to the Pharmacopoeia demands. What microflora was detected in the suppositories, resulting in such a conclusion? A. Blue pus bacillus B. Sarcina C. Micrococcus D. Tetracoccus E. Citrobacter	
7. Sanitary microbiological investigation of potable water has detected coliphages. What conclusion can be made about the sanitary-hygienic status of this water? A. The water is safe to drink B. Fecal contamination C. The water is safe to drink after boiling D. Artesian water E. The water is for industrial use only	
8. Sanitary-microbiological assessment of water quality in the water supply system conducted by the sanitary-epidemiological station detected microorganisms indicative of fecal contamination of water. What microorganisms were detected? A. Neisseria sicca B. Streptococcus agalactiae C. Haemophilus influenzae D. Escherichia coli E. Staphylococcus aureus	
9. Air contamination with pathological microorganisms can be anticipated by the presence of indicator bacteria. Specify the bacteria that indicate immediate epidemiologic danger: A. Micrococci B. Sarcinae C. Mold fungi D. Yeast fungi E. Hemolytic streptococci	
10. Therapeutic preparations for topical use (transdermal, vaginal, etc.) do not require sterility. However, the total permissible number of microbial cells and fungi in 1 g (ml) of a drug should not exceed: A. 100 B. 10	

C. 500 D. 1000 E. 10 0000	
11. The patient has been prescribed oral drug to treat diarrhea. In accordance with WHO and Pharmacopoeia demands 1 g (ml) of drug has to contain the following number of microorganisms: A. 1000 bacteria and 200 mold fungi B. 100 bacteria and 10 mold fungi C. 10 bacteria and no mold fungi D. No bacteria and no mold fungi E. 1000 bacteria and 100 mold fungi	
12. The following have been detected in hand lavage of the kindergarten chef: colibacilli, ray fungi, staphylococci, bacilli, mold fungi. What microbes are evidential of fecal contamination of hands? A. Bacilli B. Ray fungi C. Staphylococci D. Colibacilli E. Mold fungi	
13. During a sanitary-bacteriological tap water investigation the following results were obtained: the total amount of bacteria in 1.0 ml is 80, coli index is 3. How should the results of the investigation be evaluated? A. Quality of water is doubtful B. Water is eligible for drinking C. Quality of water is very doubtful D. Water is polluted E. Water is considerably polluted	
14. Sanitary-bacteriological investigation of water by the method of membranous filters detects two red colonies on a membranous filter (Endo medium), through which 500 ml of the explored water has been passed. What are the coli index and coli titer of the explored water? A. 4 and 250 B. 2 and 500 C. 250 and 4 D. 500 and 2 E. 250 and 2	
15. Microbiology examinations are carried out in the neonatal department of a maternity hospital because of the suspicion of a hospital infection. S.aureus from several children and some things was isolated. What properties of isolated cultures should be examined to determine the source of infection? A. Biochemical activity B. Chromogenesis C. Antigenic structure D. Phage type E. Antibiotic sensitivity	
16. Sanitary microbiological investigation of potable water has detected coliphages. What conclusion can be made about the sanitary-hygienic status of this water? A. The water is safe to drink B. Fecal contamination C. The water is safe to drink after boiling D. Artesian water E. The water is for industrial use only	
17. In a Petri dish with the MPA, which was a colony of mold Penicillium, sprayed a suspension of Staphylococcus aureus. One day the growth of staphylococcus was observed on the	

entire surface of the nutrient medium except 3-sm zone around the colony of Penicillium. What type of relations of microorganisms revealed in this case? A. Metabiozis B. Parasitism C. Competition D. Commensalism E. Antagonism	
18. There are various forms of coexistence (symbiosis) between microorganisms. What do you call a win-win form of symbiosis, where both the microorganism is extracted from cohabitation favor? A. Metabioz B. Satellism C. Mutualism D. Commensalism E. Parasitism	

NOTES.

Protocol 11 **Date:_____**

Theme: **Microbiota of the human body. Microflora of the oral cavity and age-related changes in its composition. Microbiota in pathological processes of the oral cavity.**

1. Conduct a sanitary and microbiological study of the microbiota of the human body:
a) inoculate washes from the surface of the skin of the hands on the Endo medium in order to detect pathogenic Escherichia coli; and other microorganisms;
b) inoculate material from different areas of the oral cavity on Endo, MPA and yolk-salt agar in order to assess the species composition of the microflora of different biotopes.

2. Name the sanitary-indicative microorganisms in the study of washings from hands.

3. Name the representatives of the normal microbiota of the oral cavity.

4. State the purpose of studying the microbiota of the human body.

5. The importance of normal microbiota in human life.

6. Age-related changes in the composition of the microbiota of the oral cavity.

7. Describe the changes in the qualitative and quantitative composition of the microbiota during pathological processes in the oral cavity.

1. Plant pathogens are represented by various microorganisms: bacteria, fungi, actinomycetales, viruses. Name the main location of plant pathogens in the natural environment: A. Water B. Soil C. Air D. Plant parts E. Plant vascular system	
2. Sedimentation analysis has been applied for assessment of air purity in an aseptic unit of a pharmacy. The test resulted in growth of the small colonies with areas of hemolysis. What medium was used for inoculation? A. Egg-yolk salt agar B. Levine's agar (Eosin Methylene Blue agar) C. Endo agar D. Ploskirev's agar E. Blood agar	
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NOTES.

Protocol 12 **Date:_____**

Theme: **Intermediate control. Physiology of microorganisms.**

1. Constructive and power metabolism of bacteria, their interrelation.
2. To name types of a bacteria nutrition and to give examples:

a - on a source of Carbon;

b - on a source of nitrogen;

c - on a source of energy and donors of electrons;

3. To describe the mechanism of nutrition:

a -passive diffusion, facilitated diffusion, active transport;

b -the role of permeases in metabolism of bacteria;

c - the role of cytoplasm membrane in metabolism of bacteria.

4. Main growth factors of bacteria.
5. Enzymes of bacteria, their feature:

a - classification;

b - function;

c - practical usage.

6. Physical and environmental requirements of bacterial growth:

a. effect of oxygen
b. effect of pH
c. effect of temperature

7. To describe media:

a - classification of media;

b - main demands to media.

8. Methods of a biological objects decontamination. Sterilization, pasteurization, disinfection, asepsis, antiseptic.
9. Methods of sterilization. Sterilization by moist heat (steam under pressure; live, non pressirized steam; boiling water; pasterization).Sterilization by dry heat(incineration, hot air oven). Ionizing and UV radiation. Sterilization by filtrating (“cool sterilization”).
10. Controls of sterilization.
11. Definition of species, pure culture, colony, clone
12. Objectives of pure culture isolation
13. Principles and methods of pure culture isolation.
14. Stages of pure culture isolation and objective of each stage.
15. Types and mechanism of bacterial respiration.
16. Main methods of creating anaerobic conditions for cultivation of bacteria (mechanical, chemical, biological and others).
17. Phenomenon of microbial antagonism, methods of microbial antagonism studying.
18. Main groups of chemotherapeutic drugs and demands to them.
19. Antibiotics, classification of antibiotics according to their origin, spectrum, mechanism of action, chemical structure, and mechanisms of their action
20. Antimicrobial susceptibility testing (serial dilutions, disks agar diffusion)
21. Main principles of a rational chemotherapy;
22. Side effects of antibiotics, complications of chemotherapy.
23. Mechanisms, which cause drug resistance.

NOTES.

Protocol 13 **Date:_____**

Theme: **Infection. Infectious and epidemiological processes. Virulence factors and their role in the development of dental diseases.**

1. Infect a white mouse with the anthracoid suspension intraperitoneally. Label the animal by group number.
2. Draw a diagram of the labeling of laboratory animals in the protocol.

3. Name the stages of dissection of laboratory animals.

4. Explain terms:
Infectious process - _____

Infectious disease - _____

5. Describe the differences between somatic and infectious disease.

6. Explain terms:
Pathogenicity - _____

Virulence - _____

7. Give a characteristic of enzymes which cause pathogenicity and invasive properties of bacteria. Fill the table.

Name of enzymes	Characteristic and function
Hyaluronidase	
Neuraminidase	
Fibrinolysin	
Collagenase	
Lecitinase	
Coagulase	

8. Compare endotoxins and exotoxins of bacteria. Give examples of each group. Fill the table.

	Exotoxins	Endotoxins
Characteristic		
Examples		

9. Give a characteristic of groups of infectious diseases. Fill the table.

By the origin		
Exogenic		
Endogenic		
By the localization of causative agent		
Local		
General	Bacteriemia	
	Septicemia	
	Toxinemia	
By the number of causative agents		
Monoinfection		
Mixt infection		
On repeated appearance of the disease, caused by the same agents		
Secondary		
Recidivation		
Superinfection		

Reinfection	
Coinfection	
On duration of host-microbial interaction	
Acute infection	
Chronic infection	
Microbial (bacterial, viral) carriage	

10. Characterize cyclic duration of infection disease. Fill the table.

Name of stage (period)	Characteristic of stage of infectious disease
Incubation period	
Prodromal period	
Acme	
Convalescence	

11. Explain the term "epidemic process" and characterize their parts.

Epidemic process - _____

_____

_____

Parts of epidemic process	Characteristic
Source of infection	
Mechanisms and ways (routs) of transmission	
Susceptible collective	

12. Consider classification of infectious disease by the type of source of infectious. Fill the table.

Name of group	Characteristic
Anthroponotic diseases (antroponoses)	
Anthropozoonotic (Zooanthroponotic)	
Zoonotic diseases (zoonoses)	
Sapronoses (environmental) diseases	

13. Consider table "Classification of mechanisms and ways of transmission"

Localization of causative agent in organism	Mechanism of transmission	Way (rout) of transmission		Factors of transmission
Intestinal tract	Fecal-oral	Alimentary Watery Direct contact		Food Water Dirty hands, ware
Respiratory tract	Aerogenic	Air-born droplet		Air Dust
Blood	The blood mechanism	Transmissive (through bites of blood-sucking insects) Parenteral (hemotransfusion) Sexual		Ectoparasites Blood, syringes, surgical instruments, infusion solutions, etc. Blood, sperm
Outer coverings	Contact	Direct	Through wound Sexual contact	Sharp objects, bullets, etc. Sperm, vaginal discharge
		Indirect		Through the contaminated objects
Embryo tissue	Transplacental	Vertical		

14. Consider the classification of infectious diseases in the degree of intensity of the epidemic process. Fill in the table.

Name of group	Characteristic
Sporadic infections	
Epidemic infections	
Pandemic infections	

1. Pathogenic microorganisms produce various enzymes in order to penetrate body tissues and spread there. Point out these enzymes among those named below. A. Hyaluronidase, lecithinase B. Lyase, ligase C. Transferase, nuclease D. Oxydase, catalase E. Esterase, protease	
2. During influenza epidemic a patient with severe case of disease developed hacking cough and chest pain; signs of focal pneumonia were visible on X-ray. Microscopy of sputum detected large number of pneumococci. What type of infection is it? A. Relapse B. Superinfection C. Abortive D. Secondary E. Reinfection	
3. Since 2005 in Asian and European countries there was recorded unusually high avian flu morbidity. Such spread of epidemic process can be determined as: A. Epidemic B. Pandemia C. Endemia D. Sporadic E. Epizooty	
4. On autopsy there are numerous suppurative foci within many of the internal organs. What pathological process is it characteristic of? A. Sepsis B. Septicemia	

C. Septicopyemia D. Bacteriemia E. Toxemia	
5. A child had been administered anti-diphtheric serum. What resistance was formed in the child? A. Primary B. Active C. Passive D. Pathologic E. Physiological	
6. Causative agents of infectious diseases can be carried both by humans and animals. Name the group of infections that affect animals and can be passed onto humans: A. Mixed B. Sapronoses C. Anthroponoses D. Zoonoses E. Zooanthroponoses	
7. After examination the patient was diagnosed with tick-borne encephalitis. What route of transmission is characteristic of this disease? A. Vector-borne transmission B. Vertical transmission C. Airborne droplet transmission D. Fecal-oral transmission E. Parenteral transmission	
8. After a contact with a person having an infectious diseases, the disease pathogens entered the patient's body and started to multiply, but the symptoms of the disease were not yet observable. What period of the disease is this typical for? A. Latent B. Prodromal C. Manifest illness stage D. Clinical outcome E. Relapse	
9. Stool culture revealed S.zonnei. What additional researches should be carried out to determine the source of infection? A. Drugs susceptibility test B. Phage typing test C. Precipitation test D. Complement-fixing reaction E. Neutralization reaction	
10. The bacterial cell can not exist without the normal functioning of the enzyme systems. Select among the above adaptive (inducible) enzymes of the bacterial cell. A. Lipase B. Proteases C. Penicillinase D. Isomerase E. Ligase	
11. Pathogens aggression inherent in the presence of enzymes that determine their virulence. Choose among these enzymes aggression. A. Carbohydrases B. Transferase C. Oxidase D. Hyaluronidase E. Lyase	
12. After intravenous injection of glucose in a patient showing signs of endotoxic shock. The analysis of the solution showed the presence of endotoxin of Gram-negative bacteria. What is the chemical nature of endotoxin? A. Polymer lipids B. Lipopolysaccharide C. Peptidoglycan	

D. Cell wall proteins E. Lipids	
13. In accordance with the primary localization of the causative agent in the body distinguish between the basic transmissions mechanisms of infection: airborne, contact, vector borne, fecal-oral. Specify the routes of transmissible mechanism: A. Blood-sucking insects B. Drops of mucus from the respiratory tract C. Food D. Direct contact with sick E. Contact with the objects of the environment	
14. In the village reported cases of dysentery. What is the possible mechanism of transmission from patients to health? A. Transmissible B. Aerogenic C. Vertical D. Artificial E. Fecal-oral	
15. After examining the newborn, the doctor diagnosed "Congenital rubella". Name the mechanism of transmission of this disease. A. Parenteral B. Transmissible C. Vertical D.Fecal-oral E. Airborne	
16. From the patient with pneumonia was isolated culture of bacteria, whose cells are surrounded by mucous layer, closely related to the cell wall. What explains the high virulence of culture with morphological features? A. Capsules antifagocytic action B. Toxin production of capsule bacteria C. Endotoxin of capsule bacteria D. Capsules adhesion E. Invasive properties of the capsules	
17. Pathogenic microbes and their toxins may spread in host in various ways. Which path is characteristic toxemia? A. Pathogens from the blood coming into the internal organs B. Presence of microbial toxins in the blood C. Microbes from the blood coming into the internal organs, which are formed pus formations D. The microbes from a place of introduction coming into the blood, but do not reproduce E. Presence of microbes in the lymph nodes	
18. In the host bacteria presence in the blood and in the internal organs, where they formed purulent foci. How is this condition? A. Septicemia B. Pyosepticemia C. Bacteremia D. Viremia E. Toxemia	
19. Pathogenic bacteria, once inside the body, may spread in different ways. Which state is called pyosepticemia? A. The microbes coming from an entry site in the blood, but do not breed there B. The pathogen coming from the blood in the internal organs; C. The microbes coming from the blood into the internal organs, which are formed pus formations D. Microbial toxins are in the blood E. Microbes are in the lymph nodes	
20. Patient admitted to the infectious hospital with signs of generalized infection, has diagnose “pyosepticemia”. What is it? A. The microbes coming from an entry site in the blood, but do not breed there B. Pathogens enter the blood and multiply there	

C. Pathogens coming from the blood into the internal organs, which are formed pus formations D. Exotoxins of pathogens are into the blood E. Endotoxins of pathogens are into the blood	
21. One form of infection caused by sexually transmissions is a superinfection. What is meant by this term? A. At the primary disease piling new infection by the same microbe B. For the main disease associated infection caused by other agent C. Return signs of disease D. Repeated exposure to the same microbe that caused the primary infection, after recovery E. In the body are simultaneously two or three pathogens	
22. Patient with open fracture of the shoulder admitted to hospital. After 3 days the wound was be fester. Bacteriological study revealed Pseudomonas aeruginosa and Staphylococcus. How is called this form of infection? A. Chronic infection B. Superinfection C. Mixed infection D. Reinfection E. Relapse	
23. At the 5- th day of illness the patient with influenza has new symptoms: appear fever, cough, with X-ray examination revealed pneumonia. Which type of infection is a complication? A. Mixed B. Reinfection C. Secondary D. Superinfection E. Relapse	
24. A patient with a diagnosis of gonorrhea re-enrolls in the infectious clinic. He has recently endured the infection and discharged with a diagnosis of "practically healthy". Which form of an infectious process is observed in him? A. Relapse B. Reinfection C. Superinfection D. Mixed infection E. Monoinfection	
25. Infectious diseases are contagious and can have different forms of distribution. What do you call a form in which the disease within a short span of time, several countries and continents? A. Endemic B. Epidemic C. Pandemic D. Sporadic E. Hospital	
26. Sanitation and epidemic mode pharmacies during epidemics of acute respiratory viral infections includes activities aimed at the source of the pathogen; activities aimed at breaking the mechanism of transmission and interventions aimed at improving resistance to infection. Which of the following do not apply to activities aimed at the source of infection? A. Disinfection of indoor air B. Sanitation carriers of infectious agents C. Treatment of patients with infectious diseases D. Isolation of patients and carriers of infectious agents E. A periodic medical examinations	

Notes

Protocol 14 **Date: _____**

Theme: **Immunity. Its types and forms of manifestation. Non-specific factors of protection of the human body, in particular the oral cavity. Cellular and humoral mechanisms of immunity.**

Read the demonstration material:

1. Explain the term "immunity"

Immunity - _____

_____

_____

2. List the central and peripheral organs of the immune system.

Central organs			**Peripheral organs**
1		**1**	
2		**2**	
		3	

3. Describe the types and forms of immune defense. Fill in the table.

			Characteristic	
Innate	Absolute			
	Relative			
Adaptive	Natural	passive		
		active	sterile	
			unsterile	
	Artificial	passive		
		active		

4. Name the cells providing immune defenses.

_____

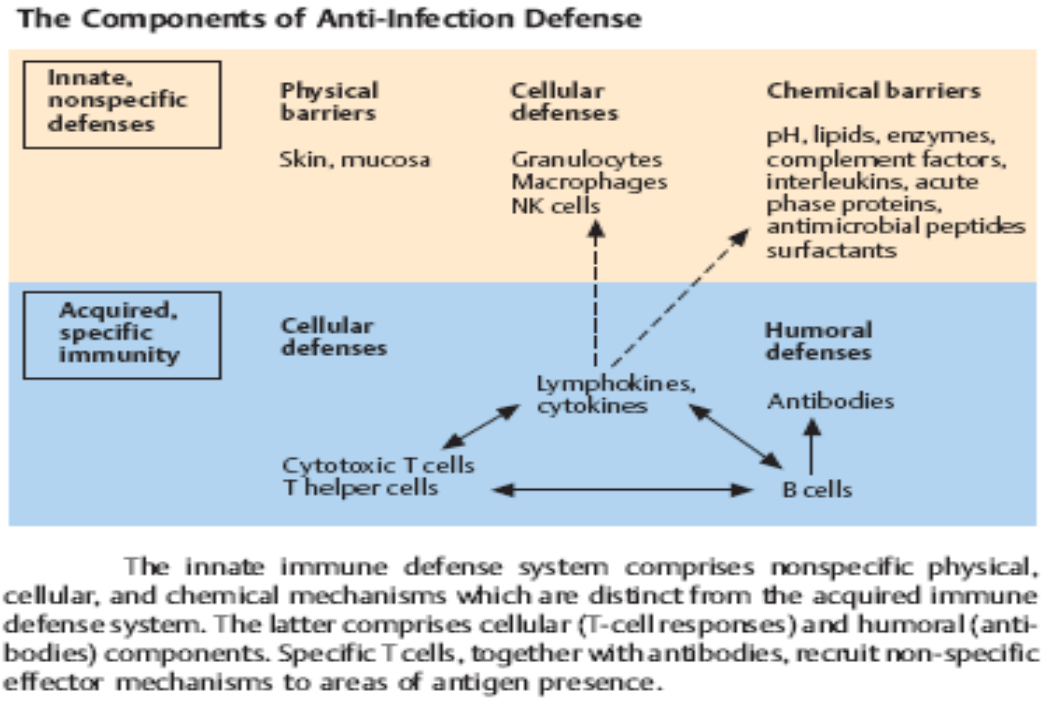
_____

_____

5. List and give the characteristic of nonspecific immunity factors. Fill the table.

Name of group	**Characteristic**	**Example**
Mechanical factors		
Physico-chemical factors		
Humoral factors		
Cellular factors		

6. Study the diagram of the immune response.



The innate immune defense system comprises nonspecific physical, cellular, and chemical mechanisms which are distinct from the acquired immune defense system. The latter comprises cellular (T-cell responses) and humoral (antibodies) components. Specific T cells, together with antibodies, recruit non-specific effector mechanisms to areas of antigen presence.

https://www.researchgate.net/publication/332794190_Agrobacterium-Mediated_Transformation_of_Rice_Constraints_and_Possible_Solutions/figures?lo=1

_____

_____

_____

7. Explain term "phagocytosis". Consider stage of phagocytosis. Give a characteristic of incomplete phagocytosis.

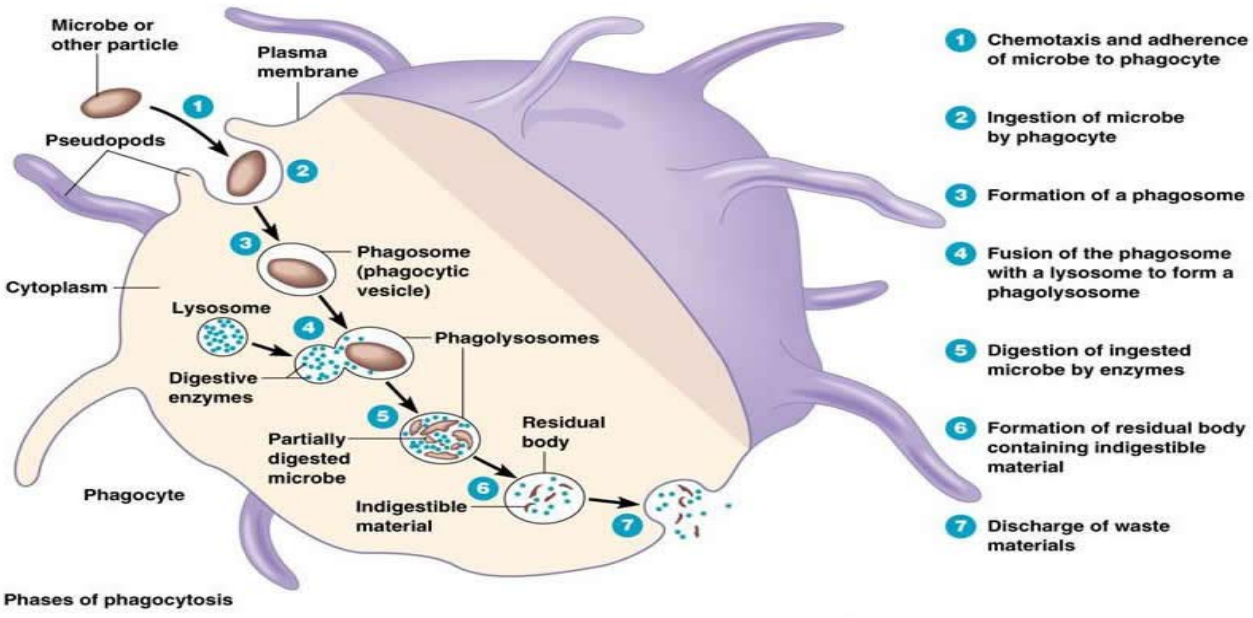
Phagocytosis - _____

_____

_____

_____

_____

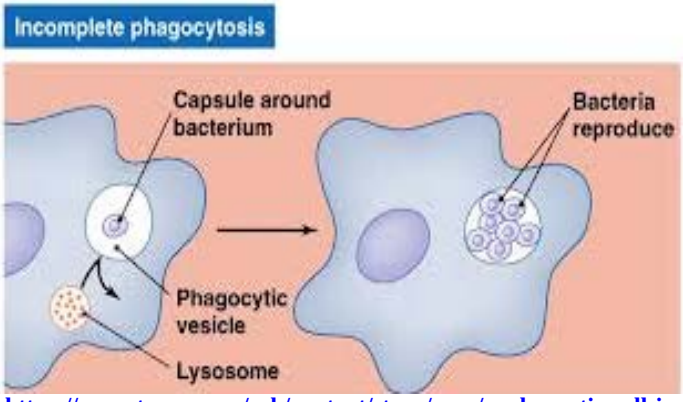


Phases of phagocytosis

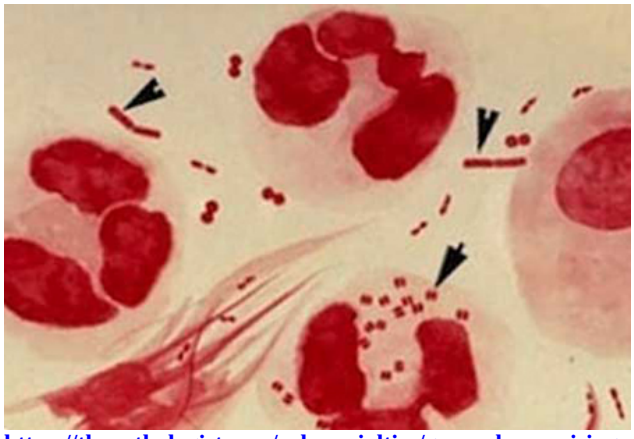
https://onlinesciencenotes.com/phagocytosis-an-example-of-endocytosis/

Stage of phagocytosis

Incomplete phagocytosis



https://www.toppr.com/ask/content/story/amp/prokaryotic-cell-i-5034/



https://thepathologist.com/subspecialties/gonorrhea-a-rising-resistance

1. For the specific prevention of influenza, the employees of an enterprise were vaccinated with "Influvac". What type of immunity will develop in the body of the vaccinated? A. Artificial active B. Innate congenital C. Artificial passive D. Natural active E. Natural passive	
2. A local general practitioner recommends taking interferon for influenza prevention. What is the mechanism of action of this drug? A. Blocks virus protein synthesis B. Blocks virus stripping C. Inhibits virion exit from cells D. Prevents adsorption of virus in cell receptors E. Disrupts the process of virus assembly	
3. The defensive mechanisms against some infectious diseases can be greatly reinforced with interferon. Interferon preparations will be the most advisable incases of the following type of infections: A. Viral B. Helminthic	

C. Protozoal D. Microbioses E. Fungal	
4. In the age of 5 months the child had measles antibodies in the blood. By the age of 1year these antibodies disappeared from the child's blood. Why were these antibodies present in the child's blood? A. Acquired natural passive immunity B. Non-specific resistance C. Acquired natural active immunity D. Innate immunity E. Artificial immunity	
5. A child had been administered anti-diphtheric serum. What resistance was formed in the child? A. Passive B. Active C. Primary D. Pathologic E. Physiological	
6. In the age of 5 months the child had measles antibodies in the blood. By the age of 1year these antibodies disappeared from the child's blood. Why were these antibodies present in the child's blood? A. Innate immunity B. Non-specific resistance C. Acquired natural active immunity D. Acquired natural passive immunity E. Artificial immunity	
7. For seroprevention and serotherapy of infections we can use immune serum and immunoglobulins. What type of immunity is formed with their help? A. Artificial active B. Artificial passive C. Natural active D. Natural passive E. Innate	
8. For seroprevention and serotherapy of infections we can use immune serum. What type of immunity is formed with their help? A. Natural passive B. Natural active C. Artificial active D. Artificial passive E. Innate	
9. Necessary to carry preventive measures in the student group. It depends with the case of measles. Which drug should be used to form artificial passive immunity? A. APDT vaccine B. The vaccine of lived bacteria C. The vaccine of killed bacteria D. Normal human immunoglobulin E. Serum anti measles	
10. Patient with severe trauma had surgical treatment and injected the tetanus toxoid. What type of immunity is formed as a result of the injection of this drug? A. Innate B. Acquired active C. Natural active D. Natural passive E. Acquired passive	
11. Immunization with vaccines forms:	

A. Artificial active immunity B. Innate immunity C. Natural active immunity D. Transplant immunity E. Artificial passive immunity	
12. Child is vaccinated against diphtheria. What type of immunity is formed as a result of vaccination? A. Acquired active B. Acquired passive C. Natural active D. Natural passive	
13. Depending on the origin of acquired immunity is divided into natural and artificial, but the mechanism of the acquisition - on the active and passive. Under what conditions is formed artificial active immunity? A. The injection of immune serum B. The injection of immunoglobulins C. The injection of vaccines D. The transferring antibodies from mother to fetus E. The infecting with virulent strains	
14. It is known that T-lymphocytes in immune function are not uniform. Indicate which of the following cells stimulate B-lymphocytes. A. T-lymphocyte effectors B. T-lymphocytes suppressor C. T-helper lymphocytes D. T-lymphocytes-killers E. T-lymphocyte memory	
15. It is known that repeated administration of antigen to the human body reacts to more intense and prolonged immune response. What kind of immune system cells are connected? A. Stem cells B. Memory cells C. T helper D. Phagocytes E. T-suppressors	
16. From the pharmacist with long experience in the pharmacy appeared: swelling of the eyelids, nasal discharge. Investigation of blood serum showed a high level of Ig E. How can we characterize this syndrome? A. Toxic effect of pharmacological agents B. Virus infection C. Chlamydiasis D. Allergy E. Inflammation of the mucous membranes	
17. In the nursing home for children at 5 day of life had a primary vaccination with BCG. What type of immunity should be formed in the body following immunization? A. Artificial passive B. Artificial antitoxic C. Artificial sterile D. Natural passive E. Artificial nonsterile	
18. Child contact elder brother with measles. A pediatrician claims that do not need to do at that age immunized against measles, even after contact with patients. What is the reason? A. High vaccine reactogenicity B. Low efficacy of vaccine C. The presence of maternal immunity D. Very small child's age	

19. Man is immune to the plague of cattle and dogs. With what kind of immunity is the reason? A. Natural activity B. Natural passive C. Innate immunity D. Artificial active E. Artificial passive	
20. In the study of the smear of the pus from patient with gonorrhea doctor revealed gram-negative diplococci pair, who are both outside and inside leukocytes. How is this phenomenon? A. Completed phagocytosis B. Infection of phagocytes C. Non-completed phagocytosis D. Pinocytosis E. Endocytosis	

Notes

Protocol 15 **Date: _____**

Theme: **Antigen characteristics. Immunoglobulins as a product of the humoral immune response. Serological reactions of agglutination, precipitation and complement fixation test. Seroprophylaxis and serotherapy. Serums and immunoglobulins. Immunoglobulins of the mouth cavity. Flocculation (neutralization) reaction. Allergy.**

1. Explain term "antigen" and characterize the main properties of antigens. Fill the table: "Classification of antigenes".

Antigen - _____

_____

_____

Properties of antigens: _____

_____

_____

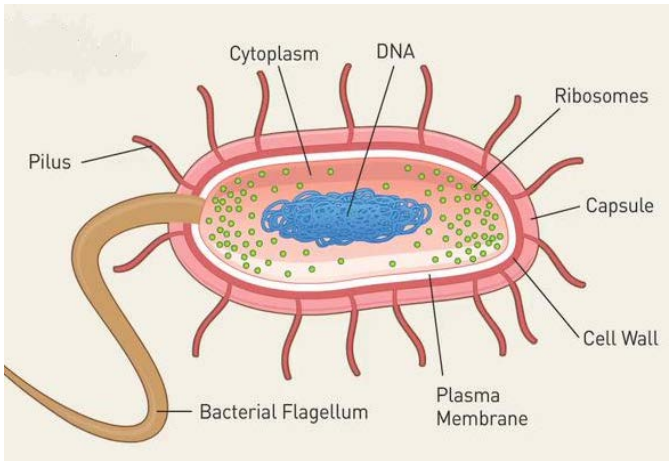
_____

_____

Classification of antigens

Name of antigens	Characteristic	Example
By the ability to induce immune response		
Complete		
Partial (haptens)		
Autoantigens		

2. Describe antigenic properties of bacteria and their topography.



H-Ag - _____

_____

_____

_____

_____

K-Ag - _____

_____

_____

_____

_____

O-Ag - _____

_____

_____

_____

_____

https://www.goconqr.com/en/p/2158339?dont_count=true&frame=true&fs=true

3. Explain the term "antibody" and describe their properties.

Antibody (immunoglobulin) - _____

_____

_____

Properties of antibodies: _____

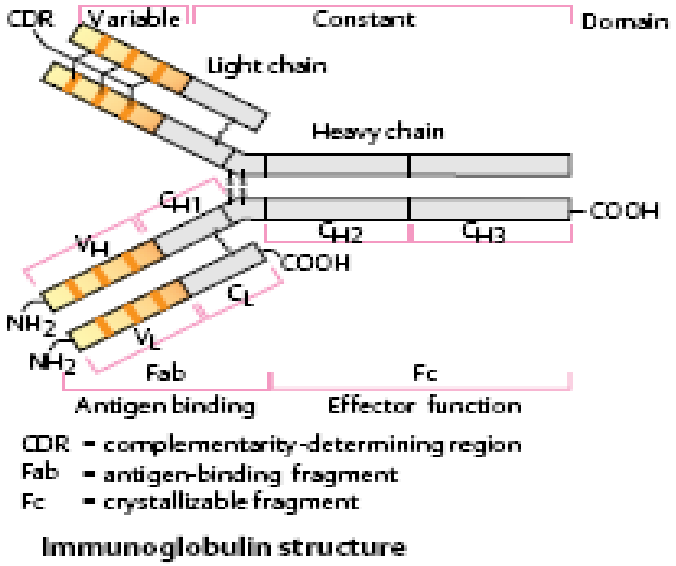
_____

_____

_____

Which cells can produce antibodies? _____

_____

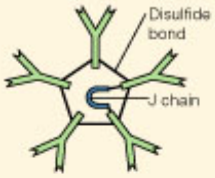
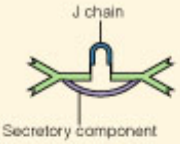


Immunoglobulin structure

https://m.facebook.com/microbenotes/photos/a.489019344546420/794065827375102/

4. Examine features and functions of the synthesis of various classes of immunoglobulins.

A Summary of Immunoglobulin Classes

Characteristics	IgG	IgM	IgA	IgD	IgE
					
Structure	Monomer	Pentamer	Dimer (with secretory component)	Monomer	Monomer
Percentage of total serum antibody	80%	5–10%	10–15%*	0.2%	0.002%
Location	Blood, lymph, intestine	Blood, lymph, B cell surface (as monomer)	Secretions (tears, saliva, mucus, intestine, milk), blood lymph	B cell surface, blood, lymph	Bound to mast and basophil cells throughout body, blood
Molecular weight	150,000	970,000	405,000	175,000	190,000
Half-life in serum	23 days	5 days	6 days	3 days	2 days
Complement fixation	Yes	Yes	No†	No	No
Placental transfer	Yes	No	No	No	No
Known functions	Enhances phagocytosis; neutralizes toxins and viruses; protects fetus and newborn	Especially effective against microorganisms and agglutinating antigens; first antibodies produced in response to initial infection	Localized protection on mucosal surfaces	Serum function not known; presence on B cells functions in initiation of immune response	Allergic reactions; possibly lysis of parasitic worms

*Percentage in serum only; if mucous membranes and body secretions are included, percentage is much higher.
†May be yes via alternate pathway.

https://onlinesciencenotes.com/five-major-classes-of-antibodies-and-their-biological-activities/

5. Give the definition of "serological reaction". For what purpose serological tests may be used in the laboratory?

Serological reaction - _____

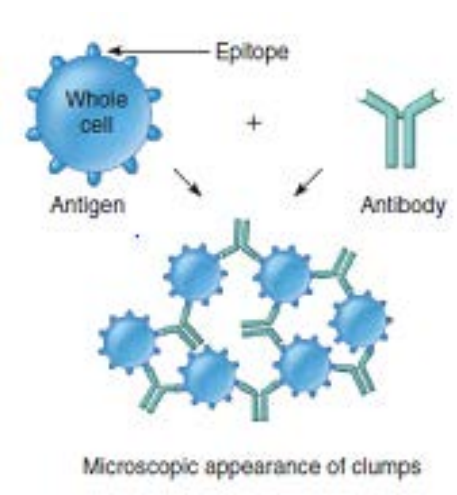
_____

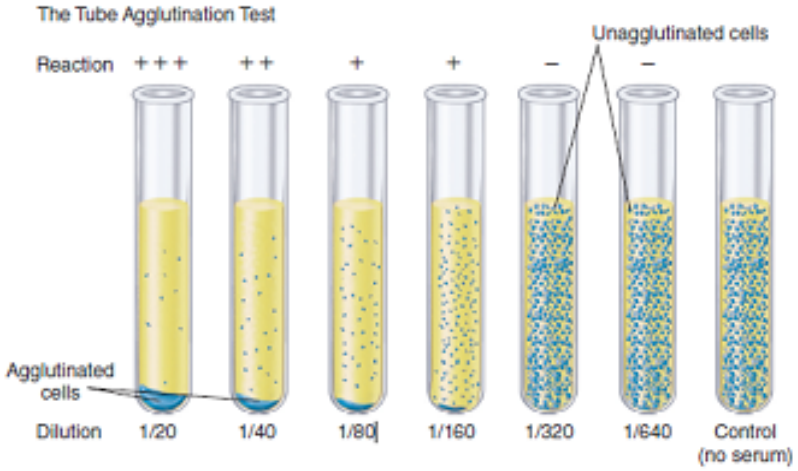
_____

_____

	Purpose of use
Serological diagnostics	
Serological identification	

6. Consider the mechanism of agglutination. Put agglutination reaction and determine antibody titer (agglutinins) in the serum of patients with typhoid fever.





(b) The tube agglutination test. A sample of patient's serum is serially diluted with saline. The dilution is made in a way that halves the number of antibodies in each subsequent tube. An equal amount of the antigen (here, blue bacterial cells) is added to each tube. The control tube has antigen, but no serum. After incubation and centrifugation,each tube is examined for agglutination clumps as compared with the control, which will be cloudy and clump-free. The titer is equivalent to the denominator of the dilution of the last tube in the series that shows agglutination.

https://www.mdpi.com/2076-393X/10/3/384 https://www.educaplay.com/learning-resources/3919333-microbiologia.html

The standard agglutination assay

Ingredient	**# of tube**						
	1	**2**	**3**	**4**	**5**	6 antigen control	7 serum control
0.9% NaCl solution, ml	0,5	0,5	0,5	0,5	0,5	-	1
The patient's serum (1:50),ml	1	→	→	→	→	1	-
Serum dilution	1:10	1:20	1:40	1:80	1:160	1:100	-
Diagnosticum, ml	0,5	0,5	0,5	0,5	0,5	-	2

Titer of serum - _____

_____

_____

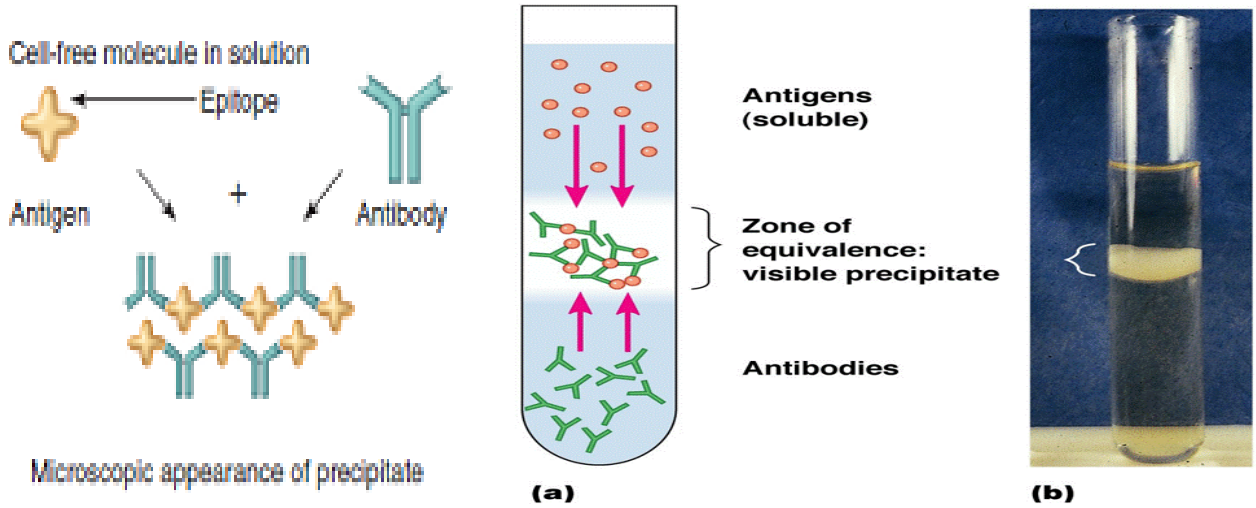
_____

_____

_____

_____

7. Consider the mechanism of precipitation. Put precipitation reaction to detect antigens of anthrax.

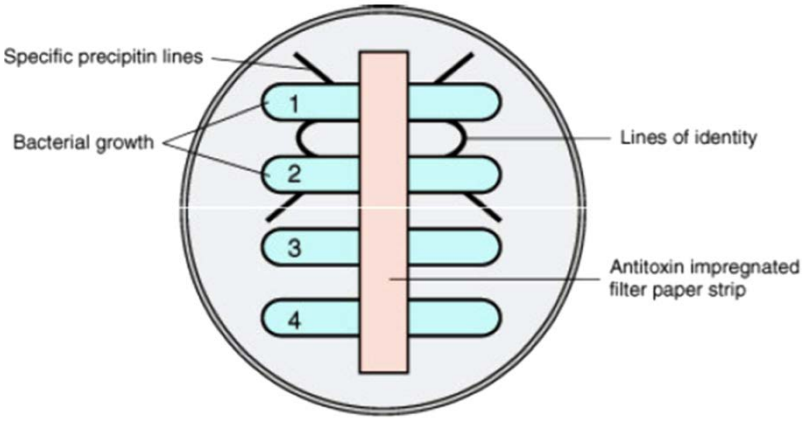


https://www.merckmillipore.com/INTL/en/products/ivd-oem-materials-reagents/bulk-and-custom-antibodies/blocking-reagents/0Uub.qB.1XwAAAE_Pfd3.Lxi,nav
https://faculty.ksu.edu.sa/sites/default/files/7_lab7_ppt.pdf

The precipitation assay

Ingredient	Control tubes			Experimental tube
	1	2	3	4
Normal serum, ml	1	1	-	-
Immune serum, ml	-	-	1	1
Positive extract, ml	-	1	1	-
Extract to be tested, ml	1	-	-	1
Results	negative	negative	positive	?

8. Consider the reaction of precipitation in gel (Elek test).



9. Give the definition of "complement system" and list its functions.

Complement system - _____

_____

_____

_____

_____

10. Name the ingredients for complement fixation test.

I system (specific)	II system (indicator, hemolytic, non-specific)

11. Determine titer and working dose of complement. Fill in the table

Scheme of complement titration

Ingredient, ml	Tubes										Controls	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11** serum control	**12** hemolytic system control
Complement in 1:10 dilution	0,05	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,45	0,5	0,5	-
0.9% NaCl solution, ml	1,45	1,4	1,35	1,3	1,25	1,2	1,15	1,1	1,05	1,0	1,0	1,5
Incubation 37ºC – 30 min												
Hemolytic system (erythrocytes)	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Incubation 37ºC - 60 min												

Complement titer - _____

_____

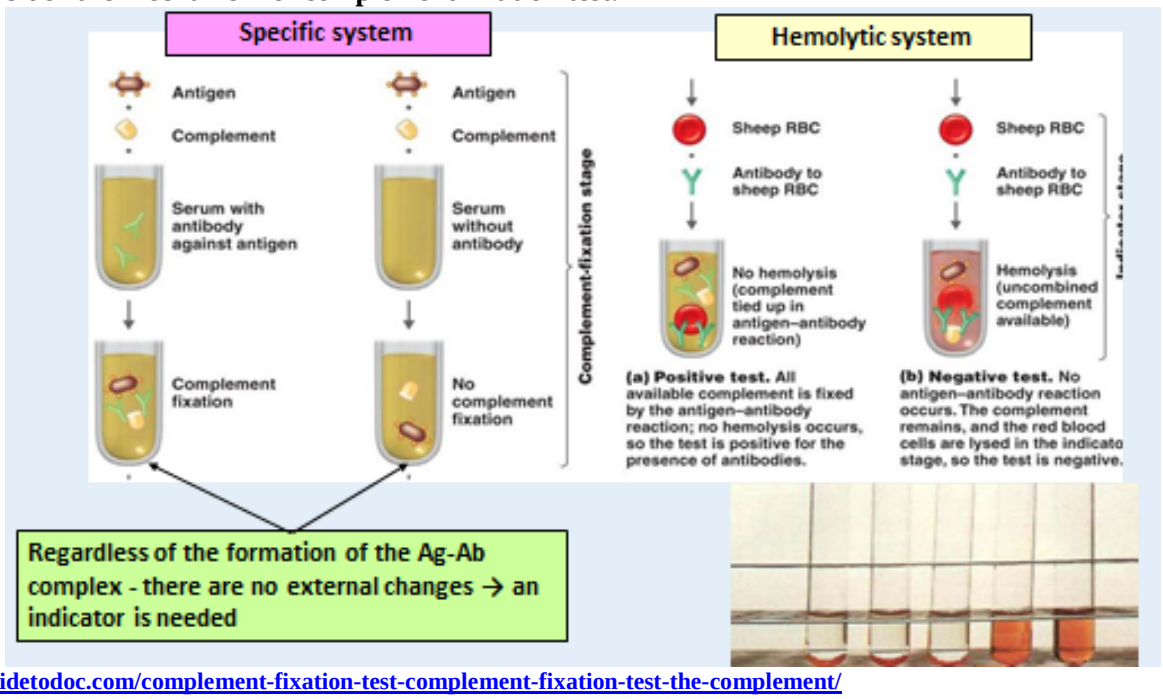
_____

Working dose - _____

_____

_____

12. Consider the mechanism of complement fixation test.



https://slidetodoc.com/complement-fixation-test-complement-fixation-test-the-complement/

Ingredient, ml	Experiment	Control		
		complement	serum	antigen
0.9% NaCl solution, ml	0,5	0,5	0,5	0,5
The patient's serum (1:50),ml	0,5	0,5	0,5	-
Specific antigen (diagnosticum), ml	0,5	0,5	-	0,5
Complement (working dose)	0,5	-	0,5	0,5
Incubation 37ºC - 60 min				
Hemolytic system (erythrocytes)	1,0	1,0	1,0	1,0
Incubation 37ºC - 60 min				
Result	?	no hemolysis	hemolysis	hemolysis

_____
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_____
_____

***Practical usage of CFT*: _____**
_____
_____
_____
_____
_____

13. Explain the terms:

Immunobiological preparation - _____
_____
_____
_____

Immune serum - _____
_____
_____
_____

Immunoglobulin - _____
_____
_____
_____

Seroprophylaxis - _____
_____
_____
_____

Serotherapy - _____
_____
_____
_____

14. Fill the table "Classification of immune serums and immunoglobulins".

Name of group		Characteristic	Example
By appointment			
For treatment and prophylaxis			
Diagnostical			
By object of action			
Antibacterial			
Antitoxic			
Antiviral			
By the specificity of action			
Monovalent			
Polyvalent			
By way of obtaining			
Heterological	Normal		
	Immune		
Homological	Normal		
	Immune		

15. Give characteristics to the immunity, which occurs by using serums and immunoglobulins

_____

_____

16. Name the main stages of production of antitoxic serums.

_____

_____

_____

_____

_____

_____

17. Name positive and negative effects of serotherapy.

Positive effects	Negative effects

18. Characterize neutralization (flocculation) reaction and their practical usage.

Ingredients, ml	№ tube						
	1	2	3	4	5	6	7
Toxin, which contain 20 Lf in 1 ml	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Tested serum	0,2	0,3	0,4	0,5	0,6	-	0,6
Incubation in thermostat 45ºC – 30 min							
Results by the initial flocculation							

_____

_____

_____

_____

_____

_____

6. Explain the term "allergy".

Allergy - _____

_____

_____

_____

_____

_____

7. Describe the types of allergic reactions by the Gell and Coombs classification (see the table on the next page).

_____

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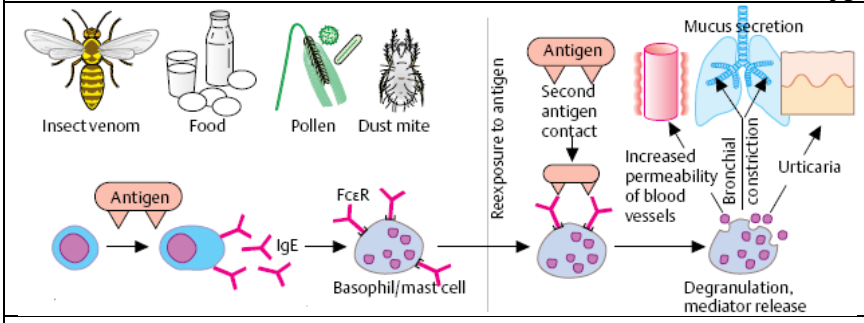
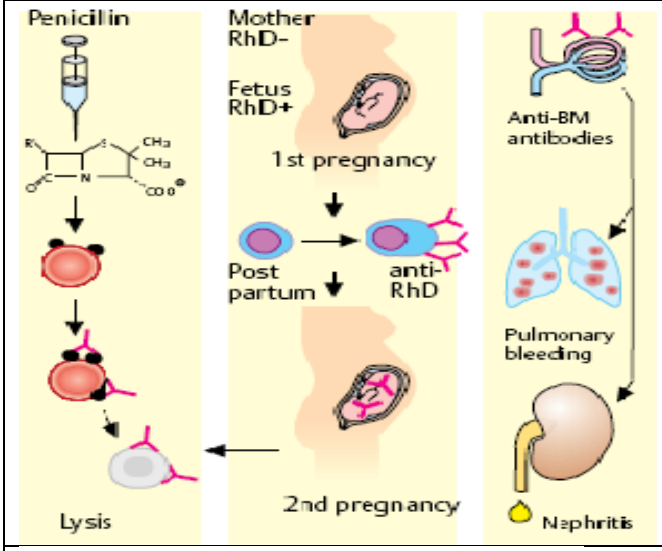
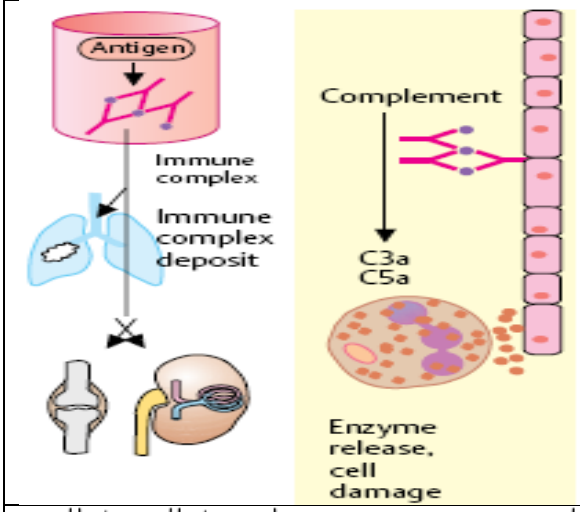
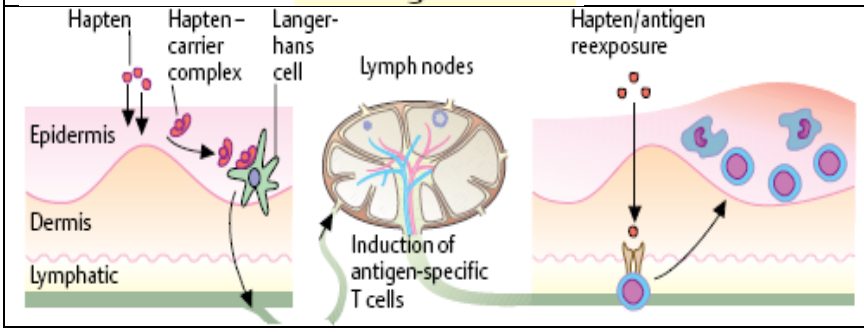
_____

Scheme	Characteristic	Example
Name of type		
		
		
		
		

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8. Describe the usage of allergological method of laboratory diagnostics and allergic-skin tests.

_____

_____

_____

It can be safely assumed that the infants born from the mothers with the history of measles will not be affected by the measles outbreak during their stay in the maternity ward. What classes of antibodies provide the infants with the resistance to this disease? A. IgG B. IgA C. IgD D. IgM E. IgE	
2. To determine activity of antitoxic serum using reaction, that is based on the combination of equal doses of immune serum and toxoid. How is this reaction? A. Hemagglutination B. Precipitation C. Flocculation D. Complement fixation E. Hemadsorption	
3. For the laboratory diagnosis of infections using serological method, based on the specific reactions of antibodies with microbial antigens. What are the reactions that lead to adhesion and formation the sediment from complex AB- AG? A. Immobilization B. Precipitation C. Neutralization D. Agglutination E. Hemolysis	
4. From the patient with suspected typhoid fever isolated pure culture of bacteria with these characteristics: Gram-negative, mobile, lactose-negative and break down glucose to acid and gas, form hydrogen sulfide. What research should be to establish the species of these bacteria? A. Identify additional biochemical properties B. Study toxin producing C. Identify flagella D. Agglutination test with the specific serum E. More to explore cultural properties	
5. For the serodiagnosis of syphilis using the Wasserman (CFT). What should be added to the first system to take into account the results of this reaction? A. Hemolytic serum and sheep erythrocytes B. Complement C. The normal serum D. Sheep erythrocytes E. Hemolytic serum	
6. In the hospital patients with a preliminary diagnosis of "syphilis" was appointed serological examination - Test Wasserman. What type of reactions it belongs? A. Immobilization B. Immunofluorescence C. Precipitation D. Agglutination E. Complement fixation	
7. From clinically healthy schoolchildren throat was sown Corynebacterium diphtheria. Which method is used to determine its toxigenic properties? A. Precipitation test B. The reaction of precipitation in gel	

C. Agglutination test D. Hemagglutination inhibition test E. Hemadsorption test	
8. The main factor for the pathogenicity of diphtheria bacilli is the production of exotoxin. With the help of some immunological reactions in microbiological laboratories determined that a sign? A. Bacteriolysis test B. Agglutination test C. Complement fixation test D. Flocculation test E. Precipitation test	
9. Modern methods of express-diagnostics make it possible to demonstrate antigen gonococci in the material from the patient. Which method should be applied to show the minimum number of such antigen? A. Precipitation test B. Immunofluorescence test C. ELISA D. Bacterioscopic method E. solation of pure culture	
10. For what purpose use diagnostic kit, containing specific antibodies linked with peroxidase? A. To determine the staining characteristics of infectious agents B. To identify the biochemical properties of bacteria C. For complement fixation test D. To determine the morphological features of infectious agents E. For antigen detection by enzyme immunoassay	
11. In the laboratory of infectious diseases hospital did a test system, adsorbed on the wall of polystyrene wells with antibodies to immunoglobulins for diagnosis of hepatitis C. What material should be to select patients for research? A. Blood B. Serum C. Feces D. Gastric washings E. Urine	
12. To indicate the virus in the contaminated allantois fluid added to a suspension of chicken embryo erythrocytes. What reaction has been used? A. Hemagglutination inhibition B. Microprecipitation C. Neutralization D. Hemagglutination E. Complement fixation	
13. In kindergarten carried routine vaccinations against diphtheria vaccine. What method can control the formation postvaccinal immunity? A. Allergic B. Serological C. Bacteriological D. Biological E. Bacterioscopical	
14. Detection in patient's serum antibodies to infectious agents can establish a diagnosis. What do you call this method of research? A. Serological	

B. Biological C. Allergical D. Microscopical E. Microbiological	
15. In 9 days after administration of a therapeutic serum the patient developed urticaria, itching, edemas, and lymph nodes enlargement. What type of allergic reaction has occurred in the patient? A. Immune complex B. Cytotoxic C. Anaphylactic D. Stimulating E. Cellular	
16. A child had been administered anti-diphtheric serum. What resistance was formed in the child? A. Physiological B. Passive C. Active D. Primary E. Pathologic	
17. In the practical application of therapeutic antitoxic serum, the patient always gets well-defined dose. What units are determined by the activity of these sera? A. Hemolytic B. International C. Bacteriostatic D. Lethal E. Units of flocculation	
18. Choose among the listed drug that is used for specific treatment Foodborne diseases caused by botulinum toxin. A. APDT vaccine B. Antitoxic botulinum antitoxin C. Botulinum toxoid D. BCG vaccine E. Antibiotics	
19. Such diseases as diphtheria, tetanus, botulism caused by pathogens that produce exotoxins. What drugs should be used to treat such infections? A. Serum people that had these diseases B. Serum obtained by immunization of horse's toxoid C. Sera from vaccinated persons D. Toxoids E. Antibiotics	
20. With what purpose to apply the drug, obtained by immunization of horses with toxoid obtained from tetanus toxin? A. For the active immunization against tetanus B. For diagnosis of tetanus C. For the treatment of tetanus D. For vaccination against tetanus E. As a component of pertussis-diphtheria-tetanus vaccine	
21. After the accident victim have provided medical care and got the immunological preparation for artificial passive immunity against anaerobic infections. Which? A. Toxoid B. Lived vaccine C. Immunotoxins D. Antitoxic serum E. Chemical vaccine	

22. Trauma patients after surgical treatment of wounds had a passive prevention of wound infection. Which drug is used for this purpose? A. Toxoid B. Antiserum C. Normal serum D. Lived vaccine E. Antibiotics	
23. It is known that before the onset of symptoms patients with hepatitis A contacted with 3-year-old child. Which medication you need to inject the child in order to prevent the infection? A. Vaccine B. Interferon C. Remantadin D. Penicillin E. Gamma globulin	
24. In the kindergarten the child got the measles. What medication can prevent this disease from contact persons? A. Measles immunoglobulin B. Measles vaccine C. Immune-modulator D. Antibiotics E. Sulfonamide	
25. In the Pharmaceutical Industry from the blood of hyperimmunized horses produce a drug that is used for specific prevention and treatment of tetanus. What is the active ingredient of this drug? A. Toxoid B. Gamma globulin C. Interferon D. Fibronectin E. Complement	
26. In the school is a registered case of hepatitis A. Which drug should be applied to specific prevention for children who have been in contact with a sick classmate? A. Inactivated vaccine B. Lived vaccine C. Immunoglobulin D. Interferon E. Ribavirin	
27. During the laboratory diagnosis of viral hepatitis in the laboratory worker broke test tube with the patient blood and cut his skin of the hand by a piece of glass. What should be injecting a drug for emergency prevention of hepatitis B? A. Specific immunoglobulin B. Killed vaccine C. Recombinant vaccine D. Chemical vaccine E. Lived vaccine	
28. For tetanus gamma globulin being donor's hyper-immunization with tetanus toxoid. What class of immunoglobulins will prevail in this drug? A. IgD B. IgA C. IgM D. IgE E. IgG	
29. A man with extensive traumatic wound shin got drug for the	

prevention of tetanus. A few minutes after the injection he had pain behind the breastbone, difficulty breathing, tachycardia, blood pressure dropped sharply. On what product you have this reaction? A. Antitetanus immunoglobulin B. Tetanus antitoxic serum C. Tetanus toxoid D. Antibiotic E. APDT vaccine	
30. The patient was an urgent need to inject diphtheria antitoxic serum. How to prevent anaphylactic shock if allergic to the serum sample is positive? A. The serum can be administered, but only after desensitization of Bezredko B. The serum can not be administered C. Serum should be administered only by intravenous D. Serum should be administered only by intramuscular E. Serum should be administered only with diphtheria toxoid	
31. The patient was an urgent need to inject diphtheria antitoxic serum. How to prevent anaphylactic shock if allergic to the serum sample is positive? A. The serum can be administered, but only after desensitization of Bezredko B. The serum can not be administered C. Serum should be administered only by intravenous D. Serum should be administered only by intramuscular E. Serum should be administered only with diphtheria toxoid	
32. Before the injection of a heterogeneous antitoxic serum patient is necessary to use the method of desensitization. What's it called? A. Pfeiffer B. Koch C. Bezredka D. Shik E. Mantoux	
33. Pharmacy company received an order for delivery to the laboratory diagnostic products used to study the antigenic properties of the parasite. What are these drugs? A. Immunoglobulins B. Allergens C. Diagnosticums D. Diagnostic sera E. Bacteriophages	
34. Microbiological Laboratory of Infectious Diseases Hospital isolates pure cultures of pathogens and carries out their serological identification. What diagnostic preparations for this necessary? A. Erythrocyte diagnostics B. Antigen-diagnostics C. Differential-diagnostic media D. Diagnostic sera E. Latex diagnostics	
35. In the infectious disease clinic was taken patient with a preliminary diagnosis of typhoid fever. During bacteriological study of blood of a patient was identified pathogen - S. typhi. What immunological preparations should be used to confirm the antigenic structure of the causative agent of typhoid fever? A. Antiglobulin serum B. Diagnostic precipitating serum	

C. Therapeutic antiserum D. Heterologous immunoglobulin E. Diagnostic agglutinating serum	
36. Pharmacy firm supplied diagnostic products to the hospital laboratory. The list of specified drugs, which are used to detect antibodies in the serum of the patient. How are they called? A. Allergens B. Diagnosticums C. Diagnostic sera D. Bacteriophages E. Immunoglobulins	
37. The hospital purchased in the pharmacy company drugs that used for the diagnosis of infectious diseases. These preparations reveal the presence of the patient's state of infectious allergy. How are those drugs? A. Allergens B. Diagnosticums C. Diagnostic sera D. Immunoglobulins E. Toxoids	

Notes

Protocol 16 **Date: _____**

Theme: **Vaccines. Principles of vaccine production and use. Immunobiological drugs. Human immune status, tests for evaluation. Evaluation of the immune status of the oral cavity.**

1. Explain the terms:

Immunotherapy - _____

_____

_____

Immunoprophylaxis - _____

_____

_____

Immunobiological preparation - _____

_____

_____

Vaccine - _____

_____

_____

Vaccination - _____

_____

_____

Revaccination - _____

_____

_____

Vaccination by plan - _____

_____

_____

Vaccination by epidemiological conditions - _____

_____

_____

2. Give characteristics to the immunity, which occurs by using vaccines.

_____

_____

3. What is the purpose of the vaccine used in medical practice?

_____

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_____

_____

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_____

_____

_____

4. Describe methods of vaccine administration and characterize them.

Name of method	Characteristic	Example
Intramuscularly		
Subcutaneously		
Intradermally		
Intranasally		
Inhalation		

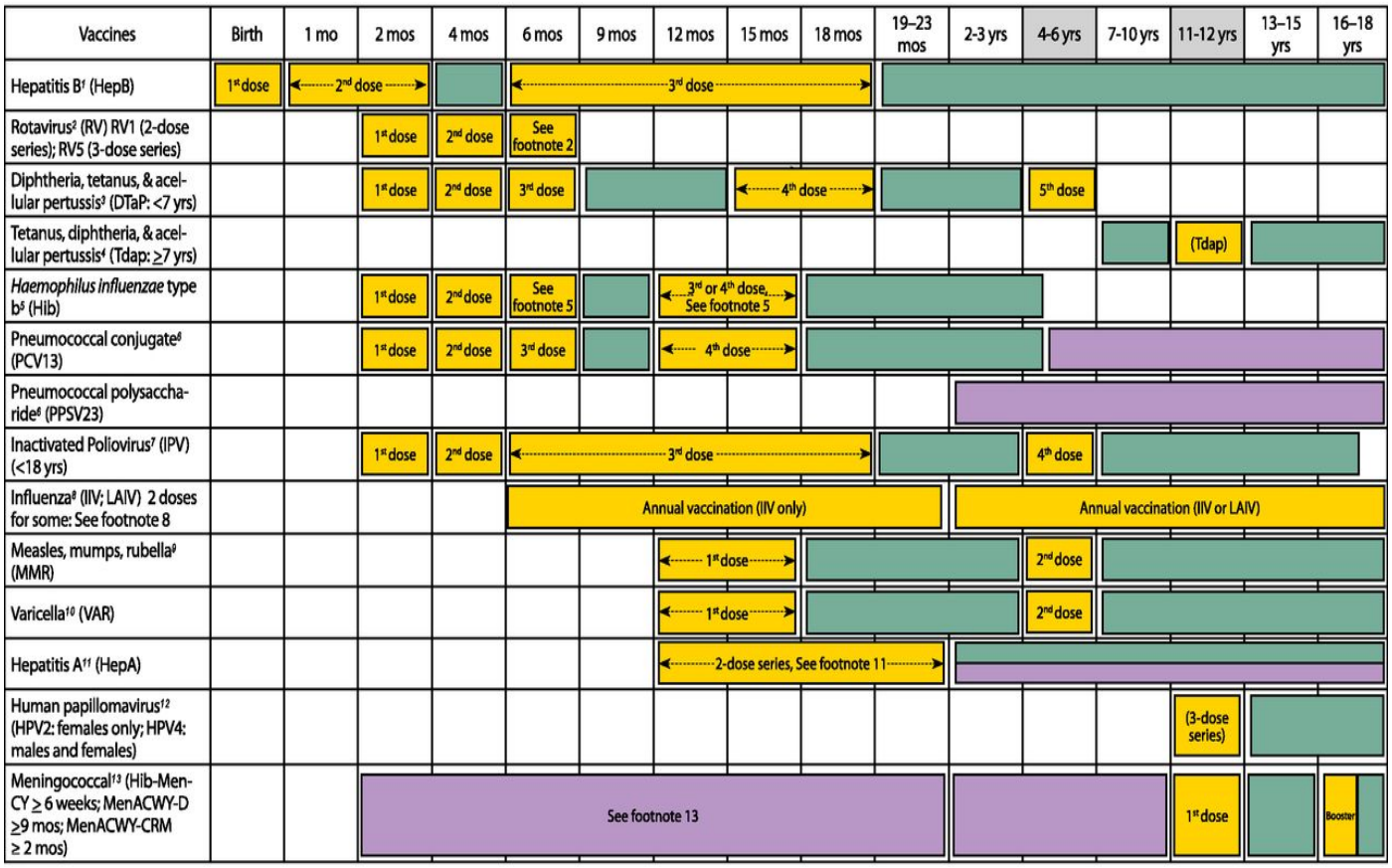
5. Fill the table "Classification of vaccines".

Name of group		Characteristic	Example
By the character of antigen			
Bacterial			
Viral			
By the type of antigens			
Corpuscular			
From components of pathogens			
According to the number of antigens			
Monovaccines			
Complex vaccines			
By the method of preparing			
Live	Attenuated		
	Divergent		
Killed	Corpuscular (from whole cells or viruses)		
	From components (subunit)		
Chemical			
Recombinant (genetically engineered)			
Molecular (toxoids)			

6. Study the plans of vaccination in different countries (plan were recommended by WHO).

USA

These recommendations must be read with the footnotes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are in bold.



This schedule includes recommendations in effect as of January 1, 2014. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement for detailed recommendations, available online at http://www.cdc.gov/vaccines/hcp/acip-recs/index.html. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://www.vaers.hhs.gov) or by telephone (800-822-7967).Suspected cases of vaccine-preventable diseases should be reported to the state or local health department. Additional information, including precautions and contraindications for vaccination, is available from CDC online (http://www.cdc.gov/vaccines) or by telephone (800-CDC-INFO [800-232-4636]).

This schedule is approved by the Advisory Committee on Immunization Practices (http://www.cdc.gov/vaccines/acip), the American Academy of Pediatrics (http://www.aap.org), the American Academy of Family Physicians (http://www.aafp.org), and the American College of Obstetricians and Gynecologists (http://www.acog.org).

NOTE: The above recommendations must be read along with the footnotes of this schedule.

https://www.in.gov/localhealth/harrisoncounty/public-health-nursing/immunization-charts/

India

National Immunization Schedule for Infants, Children and Pregnant Women				
Vaccine	**When to give**	**Dose**	**Route**	**Site**
For Pregnant Women				
TT-1	Early in pregnancy	0.5 ml	Intra-muscular	Upper Arm
TT-2	4 weeks after TT-1*	0.5 ml	Intra-muscular	Upper Arm
TT- Booster	If received 2 TT doses in a pregnancy within last 3 yrs*	0.5 ml	Intra-muscular	Upper Arm
For Infants				
BCG	At birth or as early as possible till one year of age	0.1ml (0.05ml till 1mth age)	Intra-dermal	Left Upper Arm
Hepatitis B	At birth or as early as possible within 24 hours	0.5 ml	Intra-muscular	Antero-lateral side of mid-thigh
OPV-0	At birth or as early as possible within the first 15 days	2 drops	Oral	Oral
OPV 1,2 & 3	At 6 weeks, 10 weeks & 14 weeks	2 drops	Oral	Oral
DPT 1,2 & 3	At 6 weeks 10 weeks & 14 weeks	0.5 ml	Intra-muscular	Antero-lateral side of mid-thigh
Hep B 1, 2 & 3	At 6 weeks 10 weeks & 14 weeks	0.5 ml	Intra-muscular	Antero-lateral side of mid-thigh
Measles	9 completed months-12 months.	0.5 ml	Sub-cutaneous	Right upper Arm
Vitamin-A (1stdose)	At 9 months with measles	1 ml (1 lakh IU)	Oral	Oral
For Children				
DPT booster	16-24 months	0.5 ml	Intra-muscular	Antero-lateral side of mid-thigh
Measles 2nd dose	16-24 months	0.5 ml	Sub-cutaneous	Right upper Arm
OPV Booster	16-24 months	2 drops	Oral	Oral
Japanese Encephalitis**	16-24 months	0.5 ml	Sub-cutaneous	Left Upper Arm
Vitamin-A***				
(2nd to 9th dose)	16 months. Then, one dose every 6 months up to the age of 5 years.	2ml (2 lakh IU)	Oral	Oral
DPT Booster	5-6 years	0.5 ml.	Intra-muscular	Upper Arm
TT	10 years & 16 years	0.5 ml	Intra-muscular	Upper Arm

*Give TT-2 or Booster doses before 36 weeks of pregnancy. However, give these even if more than 36 weeks have passed. Give TT to a woman in labour, if she has not previously received TT.

** JE Vaccine, in select endemic districts after the campaign.

*** The 2nd to 9th doses of Vitamin A can be administered to children 1-5 years old during biannual rounds, in collaboration with ICDS.

https://www.publichealth.com.ng/national-immunization-schedule-of-india/

Nigeria

The National Immunization Schedule in Nigeria

Vaccine	Doses	When to give (Age)	Disease Prevention	Route of Administration	Dose	Vaccination site
BCG	1	At Birth or as soon as possible till one year	Tuberculosis	Intradermal	0.05ml	Left Upper Arm
Oral Polio Vaccine (OPV)	4	At birth and at 6, 10 and 14 weeks	Poliomyelitis	Oral	2 drops	Oral
Pentavalent	3	At 6, 10 and 14 weeks	Diphtheria, Tetanus, Pertussis, Hepatitis B and Hemophilus Influenza type b	Intramuscular	0.5ml	Left Outer Thigh
Hepatitis B	1	At birth or as early as possible within 2 weeks of age	Hepatitis	Intramuscular	0.5ml	Left Outer Thigh
Measles	1	At 9 months of age	Measles	Subcutaneous	0.5ml	Right Upper Arm
Yellow Fever	1	At 9 months of age	Yellow Fever	Subcutaneous	0.5ml	Right Upper Arm
Vitamin A	2	9 months & 15 months	Improvement of Sight	Oral	100,000IU 200,000IU	Oral
Inactivated Polio Vaccine* (IPV)	1	14 weeks of age	Poliomyelitis	Intramuscular	0.5ml	Right Outer Thigh
Pneumococcal Conjugate Vaccine (PCV)	3	At 6, 10 and 14 weeks	Pneumonia	Intramuscular	0.5ml	Left Outer Thigh
Rota***	2	At 6 and 10 weeks	Diarrhoea diseases	Oral	1.2ml	Oral

IPV: For now at 14 weeks*
*Rota**: This will be introduced in the schedule by 2018*

7. Explain the term “human immune status” and methods of its studying.

8. Explain the term “autoimmune diseases” and name several examples.

9. Name the kinds of immunocorrection.

1. To obtain exotoxins of some microorganisms, these microorganisms are inoculated into liquid nutrient medium, where microbial cultivation occurs and toxins are produced. At a certain stage it is necessary to remove the microbial cells from the medium, that is, to separate the toxins from microbes. What method should be applied in this case? A. Bacteria-excluding filters B. Boiling C. Autoclaving D. Ultraviolet irradiation	

E. Disinfectants (chloramine)	
2. For tetanus prevention a certain toxins used. For 4 weeks this toxin is being neutralized with formaldehyde (0.4%) under the temperature of 39°C. Name the resulting preparation: A. Immunoglobulin B. Antitoxic serum C. Adjuvant D. Anatoxin E. Inactivated vaccine	
3. Vaccines are the artificial or natural preparations produced from bacteria, viruses and other microorganisms, their chemical components and waste products. They are used for the active immunization of humans and animals for the prevention and treatment of infectious diseases. The attenuated vaccines consist of: A. Dead microbes B. Viable microbes C. Anatoxin D. Dead microbes and toxoid E. Immunoglobulins	
4. Which one of the listed substance causes formation of acquired artificial passive immunity? A. BCG vaccine B. Tetanus serum C. Tetanus anatoxin D. DPT vaccine	
5. In a research center there is a live vaccine against dysentery being created. What property of attenuated vaccine strain should coincide with the properties of original virulent strain of dysentery bacillus? A. Antigenic structure B. Morphology C. Biochemical activity D. Antibiotic susceptibility E. Toxin production	
6. In accordance with the purpose and principles of manufacture of bacterial preparations are divided into groups. Which group includes preparations for the formation of active immunity? A. Antisera B. Immunoglobulins C. Vaccines D. Monoclonal antibodies E. Bacteriophages	
7. For mass using among children is a drug of living organisms with reduced virulence. What type of drugs it belongs? A. Immunoprotectors B. Toxoid C. Antisera D. Eubiotics E. Lived vaccines	
8. To formation of active immunity in humans should be used vaccine drugs. What medication is made of live attenuated bacteria? A. Vaccine TABTe B. ADTP vaccine C. Salk vaccine D. BCG vaccine	

E. Vaccine against hepatitis A	
9. To formation of artificial active immunity against tuberculosis in the school was conducted routine vaccination. What vaccine was used for this? A. Inactivated B. Toxoid C. Lived D. Recombinant E. Subunit	
10. In the maternity home infants at 5-7 days after birth were vaccinated against tuberculosis. Which drug is used for specific prevention of tuberculosis? A. BCG vaccine B. ADTP vaccine C. Vaccine STI D. Vaccine EV E. Vaccine TABTe	
11. In the process of abdominal-typhoid vaccine preparation virulent strain of the bacteria were cultured at an optimal nutrient medium. The cells were then separated by centrifugation from the culture fluid and treated with formalin. What type is this vaccine? A. Toxoid B. Attenuated C. Chemical D. Inactivated E. Autovaccine	
12. For specific prevention of diphtheria, pertussis and tetanus vaccine is used, which contains in its composition of microorganisms and neutralized formalin exotoxins. What type of vaccine, it belongs to? A. Toxoid B. Genetic engineering C. Associate D. Chemical E. Lived	
13. A plant of bacterial preparation produces several types of vaccines. Which refers to the mandatory use of vaccines? A. Measles B. Rabies C. Plague D. Typhoid E. Influenza	
14. To carry out preventive vaccination in children's clinic was received a number of vaccines. Which of them form non sterile immunity? A. DT B. ADTP C. BCG D. Measles's lived E. Influenza's subunit	
15. The pharmaceutical firm reported about the drug, which contains the outer envelope antigens of influenza viruses. With a purpose to applying this medicine? A. For inactivation of influenza viruses B. For active immunization against influenza C. To form an artificial passive immunity D. For treatment of influenza in the early stages	

E. For quick diagnosis of influenza	
16. In the maternity home for 5 day-children had a primary vaccination with BCG. What type of immunity should be formed in the body following immunization? A. Artificial sterile B. Artificial passive C. Artificial antitoxic D. Artificial non sterile E. Natural passive	
17. According to calendar of vaccinations for different age children should be use different vaccines for prevention of infectious diseases. Call the vaccine, which does not belong to the drugs for the mandatory application? A. Pertussis-diphtheria-tetanus vaccine B. Lived vaccine against rabies C. Lived vaccine against measles D. Lived vaccine against mumps E. Polio-vaccine	
18. For prevention of pertussis, diphtheria and tetanus should be use vaccine APDT. How is this vaccine, which consists of dead microbial cells of a pathogen and toxoids others? A. Autovaccine B. Genetic engineering C. Chemical D. Associated E. Antiidiotypic	
19. Upon receiving rabies vaccine L. Pasteur used a specific method of reducing the virulence of wild rabies virus. Give it: A. Cultivation on media with bile B. Incubation at low temperature C. Passages through the rabbit brain D. Formolation E. The impact of UV rays	
20. In technology of producing of immune sera animals immunized several times, as in the secondary immune response significantly increases the rate of formation and the amount of antibodies. How can this be explained? A. Enhancement of phagocytosis B. Decrease of T-suppressor C. Increase of macrophages D. The presence of T and B cell memory E. Decrease of NK activity	

NOTES.

Protocol 17 **Date: _____**

Theme: **Final control in Part 1 "Morphology and physiology of microorganisms. Infection. Immunity".**

Morphology and structure of bacteria.

1.The main differences between prokaryotes and eukaryotes. Forms of bacteria with a defect in cell wall synthesis. Protoplasts, spheroplasts. L-forms of bacteria.
2.Morphology and structure of bacteria. The role of particular structures for bacterial activity and in the pathogenesis of infectious diseases.
3. Morphology and classification of protozoa.
4. Classification and morphology of fungi.
5.Research methods in microbiology. Principles of organization, equipment and mode of operation of bacteriological, serological and virological laboratories.
6.Bacterioscopic method of research. Stages. Rating. The influence of R. Koch's work on the progress of microbiology.
7. History of discovery and main stages of development of virology. The contribution of domestic scientists. Methods of studying viruses, their evaluation.
8. Morphology and ultrastructure of viruses. Types of symmetry of viruses. Chemical composition, functions of components of viruses.
9. Bacteriophage, history of study. Structure, classification of phages by morphology. Methods of qualitative and quantitative determination of bacteriophages.
10. Forms of interaction of bacteriophages with a bacterial cell. Virulent and moderate phages. Characteristics of productive interaction. Lysogeny and phage conversion.
11. Modern views on the nature and origin of viruses. The place of viruses in the living system.
12. Principles of virus classification. The main properties of human and animal viruses.
13. Methods of culturing viruses and their evaluation.

Physiology of microorganisms.

1.Types and mechanisms of nutrition of microorganisms. Mechanisms of penetration of nutrients into the bacterial cell. Chemical composition of microorganisms. The value of the components. Nutrient media, requirements for them. 2. Classification of nutrient media used in microbiology.
3.Respiration of microorganisms. Aerobic and anaerobic types of respiration. Enzymes and cell structures involved in the process of respiration. Methods of growing anaerobic bacteria.
4.Enzymes of microorganisms, their role in metabolism. Use for bacterial differentiation. Pathogenicity enzymes.
5.Growth and methods of bacterial reproduction. Mechanism of cell division, phases of reproduction of bacterial culture in stationary conditions.
6.Bacteriological method of research. Principles of isolation of pure cultures of bacteria and their identification.
7.Influence of physical, chemical and biological factors on microorganisms. Sterilization methods, control of sterilization efficiency. Asepsis. Antisepsis.

Genetics and chemotherapeutic drugs.

1.Chemotherapy and chemotherapeutic drugs. Chemotherapeutic index. The role of P. Ehrlich and G. Domagko in the development of the theory of chemotherapy.
2.The phenomenon of microbial antagonism. The role of domestic microbiologists in the development of the doctrine of microbial antagonism.
3.Antibiotics, characteristics, principles of production, units of measurement. Classification by mechanism of action on microorganisms.
4.Drug resistance of microbes. The mechanism of formation of stable forms. Methods for determining the susceptibility of microbes to antibiotics. Minimum inhibitory concentration (MPC). Practical meaning. Principles of combating drug resistance of microorganisms.
5.Material bases of heredity of microorganisms. Genotype and phenotype. Types of variability. Non-hereditary variability.

6.Hereditary variability. Mutations, their varieties. Mutagens are physical, chemical, biological. Genetic recombination: transformation, transduction, conjugation.
7. Extrachromosomal factors of bacterial heredity. Plasmids, their main genetic functions. Migrating elements. The role of mutations, recombination and selection in microbial evolution. The main factors of evolution.
8. The importance of genetics in the development of general and medical microbiology, virology, molecular biology. Microbiological basis of genetic engineering. Scheme of obtaining genetic structures and hereditary altered organisms. Achievements of genetic engineering, use of genetically engineered drugs in medicine.

Evolution and classification of microorganisms.

1.Origin and evolution of microorganisms. Modern classification of prokaryotes. Basic taxa. Systematics and nomenclature of bacteria. Species as the main taxonomic unit.
2.Systematics and nomenclature of bacteria. Basic principles of taxonomy. Classification of bacteria. Characteristics of the species.

Sanitary microbiology..

1.Ecology of microorganisms. The spread of microbes in nature. The value of the work of SM Vynohradsky.
2.Normal microflora of the human body, its role in physiological processes and the occurrence of human pathology. Age features of the normal microflora of the nose, skin, mouth, genitals, intestines.
3.Gnotobiology. Dysbacteriosis and its causes
4. Probiotics and eubiotics, their characteristics, mechanism of action.
5.Sanitary microbiology, subject, tasks. The importance of sanitary microbiology in the activities of a pharmacist.
6. Sanitary-indicative microorganisms, requirements for them, their importance for the characterization of environmental objects.
7.Principles of sanitary-microbiological research of environmental objects, their evaluation. Sanitary and bacteriological control of drinking water quality. Requirements of the State standard for drinking water.
8.Water microflora. Factors of water self-purification. Survival of pathogenic microorganisms in water. The role of water in the transmission of infectious diseases.
9.Water as a habitat and storage environment for microorganisms. Indigenous and allochthonous microflora of open reservoirs. Saprobnost. Microorganisms - indicators of the process of self-purification of water.
10. Ecology of microorganisms. Microflora of the environment: air, water, soil. Research methods.
11. Sanitary-indicative microorganisms used in assessing water quality.
12. Methods of sanitary-bacteriological research of water and their estimation.
13. Soil microflora. The role of soil in the transmission of infectious diseases. Factors affecting the survival of pathogenic microorganisms in the soil.
14. Sanitary-indicative microorganisms used in the assessment of soil contamination. Methods of sanitary-microbiological research of soil.
15. Air microflora, its characteristics. The role of air in the transmission of infectious diseases.
16. Microbial count and sanitary-indicative microorganisms of indoor air, methods of determination, their evaluation.
17. Sanitary-indicative microorganisms of air, methods of their detection. Criteria for assessing the purity of indoor air.
18. Sanitary microbiology of medicinal raw materials and finished dosage forms. Methods for determining the microbial count of raw materials and finished dosage forms. Factors that affect the microbial composition. Methods of sanitary-bacteriological research. WHO and Pharmacopoeia requirements for microbial contamination of drugs.

Infection.

1. Infection. Factors that determine the occurrence of the infectious process. The role of microorganisms in the infectious process. Pathogenicity, virulence, units of measurement, methods of determination. Factors of pathogenicity of microorganisms, their characteristics.
2. Microbial toxins (exo- and endotoxins). Properties and chemical composition, production, measurement of exotoxins. Role in the pathogenesis and immunogenesis of infectious diseases.

3. The role of macroorganisms in the infectious process. Immunological reactivity of the child's body. The influence of the environment and social conditions on the emergence and development of the infectious process in humans. Persistence of bacteria and viruses. The concept of relapse, reinfection, superinfection.

The body's immune system.

1. The doctrine of immunity. Stages of development of immunology. Types of immunity and forms of its manifestation.

2. Nonspecific factors of protection of an organism against pathogenic microbes. Complement, its properties, activation pathways. Phagocytosis, types of phagocytic cells. Stages of phagocytosis. Complete and incomplete phagocytosis.

3. The body's immune system, its organs. The role of the thymus gland in the immune response. Cells of the immune system, their varieties, the interaction of T-, B-lymphocytes and macrophages. Their role in cellular and humoral immunity.

4. Patterns of the body's immune response. Phases of the immune response. Immunological reactions. Immunological tolerance, causes of its occurrence. Immunological memory, its mechanism.

5. Immediate and delayed hypersensitivity, their mechanisms, differences. Practical meaning.

6. Three-cell scheme of cooperation of the immune response. The role of individual cells of the immune system, their interaction. Interleukins.

Antigens.

1. Antigens, their characteristics. Complete and defective antigens. Antigenic structure of bacteria. The practical significance of the doctrine of microbial antigens. Autoantigens.

2. Live vaccines, principles of production. Control, practical use of live vaccines, evaluation of effectiveness.

3. Vaccines. History of receipt. Classification of vaccines. Corpuscular, chemical, synthetic, genetically engineered and anti-idiotypic vaccines.

4. Chemical vaccines and toxoids, principles of production. Associated vaccines. Adsorbed vaccines, the principle of "depot".

5. Toxins, their production, purification, units of measurement, use, evaluation.

6. Corpuscular vaccines from killed microbes. Principles of obtaining, control, evaluation of efficiency.

Antibodies.

1. Antibodies, their nature. Place of synthesis, dynamics of antibody production. Autoantibodies.

2. Antitoxins, their properties, mechanism of action. Principles of obtaining antitoxic serums. Units of measurement, practical use.

3. Serological reactions, their characteristics, main types, practical use. Agglutination reaction, its mechanism, varieties. Practical use.

4. Serological reactions. Precipitation reaction, its mechanism. Use in medical practice. Gel precipitation reaction.

5. Serological reactions. Lysis reactions. Complement reaction, its practical use.

6. Reactions with labeled antibodies or antigens. Practical use of immunofluorescence reaction (RIF), enzyme-linked immunosorbent assay and radioimmunoassay.

GLOSSARY

Acidophiles	Organisms that grow optimally at a pH below 5.5.
Actinomycetes	Filamentous bacteria; many are valuable in the production of antibiotics.
Activated macrophages	Macrophages stimulated by cytokines to enlarge and become metabolically active, with greatly increased capability to kill and degrade intracellular organisms and materials.
Activated T cell	T cell activated by exposure to antigen in conjunction with required accessory signals.
Active immunity	Protective immunity produced by an individual in response to an antigenic stimulus.
Active site	Site on an enzyme molecule to which substrate binds; also known as the catalytic site.
Active transport	Energy-consuming process by which molecules are carried across cell boundaries; can accumulate compounds against a concentration gradient.
Acute infections	Infections in which the symptoms and signs have a rapid onset and are usually severe, often with fever, but short-lived.
Adaptive immunity	Protection provided by host defenses that develop throughout life; involves B cells and T cells.
Adherence	A necessary first step in colonization and infection, in which the pathogen attaches to host cells to avoid being removed from the body.
Adhesin	Component of a microorganism that is used to bind to surfaces.
Adjuvant	Substance that increases the immune response to antigen.
Aerobic respiration	Metabolic process in which electrons are transferred from the electron transport chain to molecular oxygen (O2).
Aerotolerant anaerobes	Organisms that can grow in the presence of O2 but never use it as a terminal electron acceptor; also called obligate fermenters.
Agar	Polysaccharide extracted from marine algae; used to solidify microbiological media.
Agar slant	Microbiological medium that has been solidified with agar and stored in a tube that was held at a shallow angle as the medium solidified, creating a larger surface area.
Agglutination	Clumping together of cells or particles.
AIDS	Acquired immunodeficiency syndrome.
AIDS-related complex (ARC)	A group of symptoms–fever, fatigue, diarrhea, and weight loss–that herald the onset of AIDS.
Alkalophiles	Organisms that grow optimally at a pH above 8.5.
Allergen	Antigen that causes an allergy.
Allergy	Hypersensitivity, especially of the IgE-mediated type.
Alpha (a) hemolysis	Type of hemolysis observed on blood agar, characterized by a zone of greenish clearing around the colonies.
Anaerobic respiration	Metabolic process in which electrons are transferred from the electron transport chain to a terminal electron acceptor other than O2.
Antibiogram	Antibiotic susceptibility pattern; used to distinguish between different bacterial strains.
Antibiotic	Chemical produced by certain molds and bacteria that kills or inhibits the growth of other microorganisms.
Antibody	Immunoglobulin protein produced by the body in response to a substance; it reacts specifically with that substance.
Antigen	Molecule that reacts specifically with an antibody or immune lymphocyte.
Antigen-binding sites	Regions at the ends of the two arms of an antibody molecule that recognize a specific antigen; two identical antigen-binding sites are on each monomer of antibody.
Antigen-presenting cells (APCs)	Cells such as B cells, macrophages, and dendritic cells that can present exogenous antigen to helper T cells.
Antiserum	A preparation of serum containing protective antibodies.
Antitoxin	An antibody preparation that protects against a given toxin.
Artificially acquired immunity	Active or passive immunity acquired through artificial means such as vaccination or administration of immune serum globulin.

Autoclave	Device employing steam under pressure to sterilize materials that are stable to heat and moisture.
Autotroph	Organism that uses CO2 as its main source of carbon.
Auxotroph	A microorganism that requires an organic growth factor.
Bacteremia	Bacterial cells circulating in the bloodstream.
Bacteriophage	A virus that infects bacteria; often abbreviated to phage.
Beta- (b) hemolysis	Type of hemolysis observed on blood agar that is characterized by a clear zone around a colony.
Beta- (b) lactam drugs	Group of antimicrobial medications that inhibit peptidoglycan synthesis and have a shared chemical structure called a b -lactam ring.
Biofilm	Polysaccharide-encased community of microorganisms.
Biological vector	Organism that acts as a host for a pathogen before it is transmitted to another organism; the pathogen can multiply to high numbers within it.
Biotype	A group of strains that have a characteristic biochemical pattern different from other strains; also called a biovar.
Bright-field microscope	Type of light microscope that illuminates the field of view evenly.
Bubo	Enlarged, tender lymph node characteristic of plague and some venereal diseases.
Candle jar	Closed jar in which a lit candle converts some of the O_2 in air to CO_2 and water vapor; used to cultivate capnophiles.
Capnophiles	Organisms that require increased concentrations of CO_2 (5% to 10%) and approximately 15% O_2.
Capsid	Protein coat that surrounds the nucleic acid of a virus.
Capsule	A distinct thick gelatinous material that surrounds some types of microorganisms; sometimes correlated with an organism's ability to cause disease.
Cell envelope	The layers surrounding the contents of the cell; includes the cytoplasmic membrane, cell wall, and capsule (if present).
Cell wall	Rigid barrier that surrounds a cell, keeping the contents from bursting out; in prokaryotes, peptidoglycan provides rigidity to the cell wall.
Chemostat	Device used to grow bacteria in the laboratory that allows nutrients to be added and waste products to be removed continuously.
Chocolate agar	Type of agar medium that contains red blood cells heated under controlled conditions to lyse them, releasing their nutrients; used to culture fastidious bacteria.
Chronic infections	Infections that develop slowly and persist for months or years.
Clone	Group of cells derived from a single cell.
Coenzyme	Non-protein organic compound that assists some enzymes, acting as a loosely bound carrier of small molecules or electrons.
Cofactor	Non-protein component required for the activity of some enzymes.
Colonization	Establishment of a site of reproduction of microbes on a material, animal, or person without necessarily resulting in tissue invasion or damage.
Colony	Population of bacterial cells arising from a single cell.
Colony-forming unit	A unit that gives rise to a single colony; may be a single cell or multiple cells attached to one another.
Common-source epidemic	Outbreak of disease due to contaminated food, water, or other single source of infectious agent.
Communicable diseases	Diseases that are spread from an infected animal or person to another animal or person.
Complement system	Series of serum proteins involved with innate immunity; complement system proteins can be rapidly activated, contributing to protective outcomes including inflammation, lysis of foreign cells, and opsonization.
Contagious diseases	Diseases that are spread from one host to another very readily.
Convalescence	Period of recuperation and recovery from an illness.
Cortex	Layer of the endospore that helps maintain the core in a dehydrated state, thereby protecting it from the effects of heat.
Counterstain	In a differential staining procedure, the stain applied to impart a contrasting color to bacteria that do not retain the primary stain.
Cytopathic effect	Observable change in a cell in vitro produced by viral action such as lysis of

	the cell.
Dark-field microscope	Type of microscope that directs light toward the specimen at an angle, so that only light scattered by the specimen enters the objective lens; materials in the specimen stand out as bright objects against a dark background.
Differential staining	Type of staining procedure used to distinguish one group of bacteria from another by taking advantage of the fact that certain bacteria have distinctly different chemical structures in some of their components.
Diffusion	Movement of substances from a region of high concentration to a region of low concentration.
Direct microscopic count	Method of determining the number of microbial cells in a measured volume of liquid by counting them microscopically using special glass slides.
Droplet transmission	Transmission of infectious agents through inhalation of respiratory droplets.
Electron microscope	Microscope that uses electrons instead of light and can magnify images in excess of 100,000.
ELISA	Abbreviation for enzyme-linked immunosorbent assay. Technique used for detecting and quantifying specific antigens or antibodies by using an antibody labeled with an enzyme.
Endemic	Constantly present in a population.
Endospore	A kind of resting cell, characteristic of a limited number of bacterial species; highly resistant to heat, radiation, and disinfectants.
Endotoxic shock	Septic shock that occurs as a result of endotoxin (lipopolysaccharide) circulating in the bloodstream.
Endotoxin	Lipopolysaccharide, a toxic component of the outer membrane of Gram-negative cells that can elicit symptoms such as fever and shock; lipid A is the molecule responsible for the toxic effects of endotoxin.
Epidemic	A disease or other occurrence whose incidence is higher than expected within a region or population.
Epidemiology	The study of factors influencing the frequency and distribution of diseases.
Exfoliatin	A bacterial toxin that causes sloughing of the outer epidermis.
Extremophiles	Organisms that live under extremes of temperature, pH, or other environmental conditions.
Facilitated diffusion	Transport process that enables movement of impermeable compounds from one side of the membrane to the other by exploiting a concentration gradient; does not require expenditure of energy by the cell.
Facultative anaerobe	Organism that grows best in the presence of oxygen (O_2), but can grow in its absence.
Fertility plasmid (or F plasmid)	Plasmid found in donor cells of E. coli that codes for the F or sex pilus and makes the cell F.
Flagellin	Protein subunits that make up the filament of flagella.
Fluorescence microscope	Special type of microscope used to observe cells that have been stained or tagged with fluorescent dyes.
Fomites	Inanimate objects such as books, tools, or towels that can act as transmitters of pathogenic microorganisms or viruses.
Gram stain	Staining technique that divides bacteria into one of two groups, Gram-positive or Gram-negative, on the basis of color; among bacteria, the staining reaction correlates well with cell wall structure.
Halophile	Organism that prefers or requires a high salt (NaCl) medium to grow.
Hapten	Substance that can combine with specific antibodies but which cannot incite the production of those antibodies unless it is attached to a large carrier molecule.
Hemagglutination	Clumping of red blood cells.
Hemagglutination inhibition	Immunological test used to detect antibodies against certain viruses which naturally cause red blood cells to agglutinate; antibodies that bind the virus inhibit the usual agglutination.
Herd immunity	Phenomenon that occurs when a critical concentration of immune hosts prevents the spread of an infectious agent.
Hybridization	The annealing of two complementary strands of DNA from different sources to create a hybrid double-stranded molecule.

Hybridoma	Cell made by fusing a lymphocyte, such as an antibody-producing B cell, with a cancer cell.
Hyperthermophiles	Organisms that have an optimum growth temperature between 70°C and 110°C.
Illness	Period of time during which symptoms and signs of disease occur.
Immune complex	Complex of antigen and antibody bound together, often with some complement system components included.
Immunity	Protection against infectious agents and other substances.
Immunodiffusion tests	Precipitation reactions carried out in agarose or other gels.
Immunoelectrophoresis	Technique for separating proteins by subjecting the mixture to an electric current followed by diffusion and precipitation in gels using antibodies against the separated proteins.
Immunofluorescence	Technique used to identify particular antigens microscopically in cells by the binding of a fluorescent antibody to the antigen.
Immunogen	Antigen that induces an immune response.
Immunoglobulin	Glycoprotein molecules that react specifically with the substance that induced their formation; antibodies.
Inapparent (or subclinical) infections	Infections in which symptoms do not occur or are mild enough to go unnoticed.
Incidence rate	Number of new cases of a disease within a specific time period in a given population.
Incubation period	Interval between entrance of a pathogen into a susceptible host and the onset of illness caused by that pathogen.
Index case	First identified case of a disease in an epidemic.
In vitro	In a test tube or other container as opposed to inside a living plant or animal.
In vivo	Inside a living plant or animal as opposed to a test tube or other container.
Kirby-Bauer disc diffusion test	Procedure used to determine whether a bacterium is susceptible to concentrations of an antimicrobial compound usually present in the bloodstream of an individual receiving the antimicrobial.
Koch's Postulates	The criteria used to determine the cause of an infectious disease by culturing the agent and reproducing the disease.
Koplik spots	Lesions of the oral cavity caused by measles virus that resemble a grain of salt on a red base.
laminar flow hood	Biological safety cabinet in which laboratory personnel work with potentially dangerous airborne pathogens; a continuous flow of incoming and outgoing air is filtered through HEPA filters to contain microorganisms within the cabinet.
L-forms	Bacterial variants that have lost the ability to synthesize the peptidoglycan portion of their cell wall.
Light microscope	Microscope that uses visible light to observe objects.
Lipoteichoic acids	Component of the Gram-positive cell wall that is linked to the cytoplasmic membrane.
Localized infections	Infections limited to one site in or on the body, as a furuncle.
Lysogenic conversion	Modification of the properties of a cell resulting from expression of phage DNA integrated into a bacterial chromosome.
MALT	Abbreviation for mucosal-associated lymphoid tissue.
Microaerophiles	Organisms that require small amounts of oxygen (2% to 10%) for growth, but are inhibited by higher concentrations.
Minimum bactericidal concentration (MBC)	Lowest concentration of a specific antimicrobial medication that kills 99.9% of cells in a culture of a given strain of bacteria.
Minimum inhibitory concentration (MIC)	Lowest concentration of a specific antimicrobial medication that prevents the growth of a given strain of bacteria in vitro.
Morphology	Form or shape of a particular organism or structure.
Mycology	The study of fungi.
Naturally acquired immunity	Active or passive immunity acquired through natural means such as exposure to a disease-causing agent, breastfeeding, or transfer of IgG to a fetus in utero.
Negative staining	Staining technique that employs an acidic dye to stain the background against which colorless cells can be seen.
Negri body	Viral inclusion body characteristic of rabies.
Non-communicable diseases	Disease that cannot be transmitted from one individual to another.

Nucleoid	Region of a prokaryotic cell containing the DNA.
Nucleocapsid	Viral nucleic acid and its protein coat.
O antigen	Antigenic polysaccharide portion of lipopolysaccharide, the molecule that makes up the outer leaflet of the outer membrane of Gram-negative bacteria.
Obligate aerobes	Organisms that require oxygen for growth.
Obligate anaerobes	Organisms that cannot multiply if O_2 is present; they are often killed by traces of O_2 because of its toxic derivatives.
Opportunistic pathogen	Organism that causes disease only in hosts with impaired defense mechanisms or when introduced into an unusual location; also called an opportunist.
Opsonization	Enhanced phagocytosis, usually caused by coating of the particle to be ingested with either antibody or complement system components.
Osmosis	Movement of water across a membrane from a dilute solution to a more concentrated solution.
Osmotic pressure	Pressure exerted by water on a membrane due to a difference in the concentration of molecules on each side of the membrane.
Outbreak	Cluster of cases occurring during a brief time interval and affecting a specific population; may herald the onset of an epidemic.
Passive diffusion	Process in which molecules flow freely into and out of a cell so that the concentration of any particular molecule is the same on the inside as it is on the outside of the cell.
Passive immunity	Protective immunity resulting from the transfer of antibody-containing serum produced by other individuals or animals.
Pasteurization	Process of heating food or other substances under controlled conditions of time and temperature to kill pathogens and reduce the total number of microorganisms without damaging the substance.
Peptidoglycan	Macromolecule found only in bacteria that provides rigidity to the bacterial cell wall. The basic structure of peptidoglycan is an alternating series of two major subunits N-acetylmuramic acid (NAM) and N-acetylglucosamine (NAG); chains of these alternating subunits, are cross-linked by peptide chains.
Periplasm (or periplasmic gel)	Gel that fills the region between the outer membrane and the cytoplasmic membrane in Gram-negative bacteria.
Persistent	Refers to infection in which the causative agent remains in the body for long periods of time, often without causing symptoms of disease.
Phase-contrast microscope	Type of light microscope that employs special optical devices to amplify the difference in the refractive index of a cell and the surrounding medium, increasing the contrast of the image.
Pilus (pl. Pili)	Hairlike appendages on many Gram-negative bacteria that function in conjugation and for attachment.
Precipitation reaction	Reaction of antibody with soluble antigen to form an insoluble substance, precursor metabolites Metabolic intermediates of catabolic pathways that can be used in anabolic pathways.
Primary culture	Cells taken and grown directly from the tissues of an animal.
Primary immune response	Immune response that occurs upon first exposure to an antigen.
Primary infection	Infection in a previously healthy individual, such as measles in a child who has not had measles before.
Primer	RNA molecule that initiates the synthesis of DNA.
Promoter	Nucleotide sequence to which RNA polymerase binds to initiate transcription.
Provirus	Latent form of a virus in which the viral DNA is incorporated into the chromosome of the host.
Pseudomembranous colitis	Disease of the colon caused by Clostridium difficile in which patches called pseudomembranes, composed of dead epithelium, inflammatory cells and clotted blood, form on the intestinal lining.
Psychrophile	Microorganism that grows best between 5°C and 15°C.
Pure culture	A population of organisms descended from a single cell.
Pyogenic	Pus-producing.
Radial immunodiffusion test	Quantitative antigen-antibody precipitation in gel test in which one reactant is distributed throughout the gel and the other reactant diffuses into the gel, producing a ring of precipitation.
Receptor-mediated	Type of pinocytosis that allows cells to internalize extracellular ligands

endocytosis	that bind to the cell's receptors.
Resistance plasmid (or R plasmid)	Plasmid that carries genetic information for resistance to one or more antimicrobial medications and heavy metals.
Reverse transcriptase	Enzyme that synthesizes double-stranded DNA complementary to an RNA template.
Scanning electron microscope (SEM)	Type of electron microscope that scans a beam of electrons back and forth over the surface of a specimen; used for observing surface details, but not internal structures of cells.
Secondary response (or memory response)	Enhanced immune response that occurs upon second or subsequent exposure to specific antigen, caused by the rapid activation of long-lived
Septic shock	An array of effects including fever, drop in blood pressure, and disseminated intravascular coagulation, that results from infection of the bloodstream or circulating endotoxin.
Serial dilutions	Series of dilutions, usually twofold or tenfold, used to determine the titer or concentration of a substance in solution.
Seroconversion	Change from serum without specific antibodies to serum positive for specific antibodies.
Serogroup	Microorganisms within a species that are the same antigenically as determined by specific antisera.
Serology	The study of in vitro antibody-antigen reactions.
Serotype	A group of strains that have a characteristic antigenic structure that differs from other strains; also called a serovar.
Simple diffusion	Movement of molecules or ions in solution from a region of high concentration to a region of low concentration; does not involve transport proteins.
Simple staining	Staining technique that employs a basic dye to impart color to cells.
Smear	In a staining procedure, the film obtained by placing a drop of a liquid containing a microbe on a glass microscope slide and allowing it to air dry.
Spirillum (pl. Spirilla)	Curved rod long enough to form spirals.
Spirochetes	Long helical bacteria that have a flexible cell wall and an axial filament.
Spore	Type of differentiated, specialized cell formed by certain organisms; includes some types of dormant cells that are resistant to adverse conditions and the reproductive structures formed by fungi.
Sporulation	In bacteria, a complex, highly ordered sequence of morphological changes during which a bacterial vegetative cell produces a specialized cell greatly resistant to environmental adversity; eukaryotes can also undergo sporulation.
Sterile	Completely free of all microorganisms and viruses; an absolute term.
Strain	Population of cells descended from a single cell.
Streak plate	Simplest and most commonly used technique for isolating bacteria; a series of successive streak patterns is used to sequentially dilute an inoculum on the surface of an agar plate.
Superantigens	Molecules that stimulate T lymphocytes by binding to MHC class II molecules and to part of the T-cell receptor distinct from the antigen-binding site, resulting in activation of many T cells, overproduction of cytokines, severe reactions, and sometimes fatal shock.
Superoxide dismutase	Enzyme that degrades superoxide to produce hydrogen peroxide.
Syncytium (pl. Syncytia)	Multinucleate body formed by the fusion of cells.
Taxonomy	The science that studies organisms in order to arrange them into groups; those organisms with similar properties are grouped together and separated from those that are different. Taxonomy encompasses identification, classification, and nomenclature.
Temperate phage	Bacteriophage that can either become integrated into the host cell DNA as a prophage or replicate outside the host chromosome leading to cell lysis.
Thermophile	Organism with an optimum growth temperature between 45°C and 70°C.
Tissue culture	Culture of plant or animal cells that grows in an enriched medium outside the plant or animal.
Titer	Measure of the concentration of a substance in solution; for example, the amount of a specific antibody in serum, usually measured as the highest dilution of serum that will test positive for antibody.
Toxemia	Circulation of toxins in the bloodstream.

Toxoid	Modified form of a toxin that is no longer toxic but can stimulate the production of antibodies that will neutralize the toxin.
Tyndallization	Repeated cycles of heating and incubation to kill spore-forming bacteria, type III secretions system Mechanism by which bacterial pathogens transfer gene products directly into host cells.
Vertical transmission	Transfer of a pathogen from a pregnant woman to the fetus, or from a mother to her infant during childbirth.
Viremia	Viruses circulating in the bloodstream.
Virion	Viral particle in its inert extracellular form.
Viroid	Piece of RNA that does not have a protein coat but does replicate within living cells.
Volutin	Storage form of phosphate found inside certain bacterial cells; because granules of volutin exhibit characteristic staining with the dye methylene blue, they are called metachromatic granules.
Western blotting	Procedure that uses labeled antibody molecules to detect specific proteins whey Liquid portion that remains after milk proteins coagulate during cheese-making.
Zone of inhibition	Region around a chemical saturated disc where bacteria are unable to grow due to adverse effects of the compound in the disc.
Zoonosis (pl. Zoonoses)	Disease of animals that can be transmitted to humans.

RECOMMENDED LITERATURE

Basic

1. Medical microbiology and immunology : textbook for students of medical, dental and pharmaceutical faculties of higher medical institutions studying in English / M. Z. Tymkiv [et al.] - Vinnytsia : Nova Knyha, 2019. - 416 p.
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Additionally

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Information resources

1. Microbiology and immunology on-line. URL : http://www.microbiologybook.org/
2. On-line microbiology note. URL : http://www.microbiologyinfo.com/
3. Centers for diseases control and prevention URL : http://www.cdc.gov
4. American Society for Microbiology - URL : http://asm.org
5. ASM Journals http://journals.asm.org;
6. Collection of test tasks from microbiology, virology, immunology, approved by the CMC of the Ministry of Health of Ukraine. https://www.testcentr.org.ua/
7. Bank test tasks in microbiology, virology, immunology https://zsmu.sharepoint.com/sites/kaf_mvi2/For%20English%20speaking%20students/Forms/AllItems.aspx?ga=1&id=%2Fsites%2Fkaf%5Fmvi2%2FFor%20English%20speaking%20students%2FFor%20English%20speaking%20students%20%28Speciality%2Dstomatology%29%2FEducational%20and%20methodological%20support%20SECTION%201%2Ftests&viewid=1d884fa2%2Def31%2D4ce1%2Dbc2c%2D8e71dfdab238.