MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

Petro Mohyla Black Sea National University

Medical Institute

Department of Medical Biology and Physics, Microbiology, Histology, Physiology and Pathophysiology

APPROVED:

First Vice-Rector

_____ Ishchenko N. M.

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WORKING EDUCATIONAL PROGRAM IN THE DISCIPLINE

MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY

Branch of knowledge 22 "Health Care"
Specialty 222 "Medicine"

Developer	Korolova O. V.
	Polovenko L. S.
Head of the Developer's Department	Korolova O. V.
Guarantor of the Educational Program	Klymenko M. O.
Director of the Medical Institute	Gryshchenko H. V.
Head of the EMD	Shkirchak S. I.

Mykolaiv 2021

1. **Description of the discipline**

Characteristic	**Characteristics of the discipline**	
Name of the discipline	Microbiology, virology, immunology	
Branch of knowledge	22 “Health care”	
Specialty	222 “Medicine”	
Specialization (if any)		
Educational program	“Medicine”	
Higher education level	Master's degree	
Discipline status	Normative	
Curriculum	2-nd, 3-rd	
Academic year	2021-2022	
Numbers of semesters:	Full-time	Part-time form
	4th, 5th	
Total ECTS credits / hours	6,5 credits (4 / 2,5) / 195 hours	
Course structure: - lectures - seminars (practical, laboratory, semi-group) - hours of independent work of students	Full-time	Part-time form
	28,5 hours (20,5/8) 93 hours (63/30) 73,5 hours (36,5/37)	
Percentage of classroom load	62%	
Teaching language	english	
Intermediate control form (if any)		
Form of final control	4th sem. - credit, 5th sem. - exam	

2. Purpose, tasks and planned learning outcomes

The purpose of teaching / studying the discipline "Microbiology, Virology and Immunology" is to provide students with knowledge of morphology, physiology, ecology, genetics, taxonomy of microorganisms, specific mechanisms of protection of the human body from pathogens, as well as the formation of skills needed in future practice skills.

Learning objectives: laying the foundations for students to study theoretical knowledge, mastering practical skills and abilities in microbiology, virology and immunology, which involves the integration of teaching with clinical departments and the formation of skills to apply knowledge and skills in professional activities; formation of a future specialist capable of solving clinical problems using the acquired knowledge and skills in the discipline, laying the foundations of a healthy lifestyle.

Prerequisites for studying the discipline (interdisciplinary links). Microbiology, virology and immunology as a discipline:

a) is based on the knowledge gained by students in the study of medical biology, medical and biological physics and computer science, biological chemistry, histology, cytology and embryology, human anatomy and physiology and integrates with these disciplines;

b) lays the foundations for students to study general hygiene, epidemiology, pathological physiology, pathomorphology, immunology and allergology, infectious diseases, internal medicine, surgical diseases, pediatrics and other clinical disciplines, providing integration of teaching with these disciplines and application of knowledge in microbiology virology and immunology in the process of further education and in professional activities;

c) provides the possibility of microbiological diagnosis of infectious diseases.

Expected learning outcomes. As a result of studying the discipline, students have:

• Evaluate diagnosis information using a standard procedure based on the results of laboratory and instrumental studies.
• Assign laboratory and / or instrumental examination of the patient, perform microbiological diagnosis of diseases, establish a preliminary and clinical diagnosis.
• Plan measures to prevent the spread of infectious diseases.
• Carry out detection and early diagnosis of infectious diseases, primary anti-epidemic measures in the center of infectious disease.
• Identify risk groups, risk areas, time of risk, risk factors and carry out epidemiological analysis of infectious diseases in the population.
• Organize the necessary level of individual safety (own and carers) in case of typical dangerous situations in the individual field of activity.

According to the requirements of the educational and professional program, students must:
- KNOW:
• structural and morphological features of bacteria and main morphological groups; features of microbial metabolism, the most commonly used nutrient media and their preparation;
• the effect of physical and chemical factors on microorganisms;
• mechanisms of drug resistance of bacteria and principles of its control;
• features of the main classes of immunoglobulins and properties of antigens.
• mechanisms of primary and secondary immune response;
• basic principles of specific prevention and treatment of infectious diseases;
• the role of viruses as an etiological factor of infectious diseases;
• biological and pathological properties of pathogens of bacterial infections;
• the role of the normal microflora of the human body in protecting the body from aggressive agents of the external and internal environment;
- BE ABLE TO:
• prepare fixed smears of bacteria and stain them by a simple method and by the Gram method;
• distinguish the morphology of different forms of bacteria in fixed stained smears;
• distinguish between microscopy gram-positive and gram-negative microorganisms;
• isolate and identify pure cultures of aerobic and anaerobic bacteria;
• interpret the results of identification of isolated pure cultures of bacteria and draw conclusions;
• use methods of asepsis, antiseptics and disinfection, determine the effectiveness of sterilization and disinfection;
• choose the best methods of disinfection for instruments, nutrient media, laboratory glassware, etc .;
• determine the sensitivity of bacteria to antibiotics by standard disks and serial dilutions;
• evaluate the antibioticogram to select an effective drug for the treatment of infectious diseases;
• test for serological agglutination, precipitation and complement fixation;
• take into account and interpret the results of serological reactions for the diagnosis of infectious diseases and identification of microorganisms;
• choose immunobiological drugs for microbiological diagnosis, specific therapy and prevention of infectious diseases;
• to interpret the main mechanisms of formation of the immune response of the human body with the introduction of vaccines and sera;
• use methods of phagodiagnostics, phagoprophylaxis and phagotherapy, choose drugs for specific prevention of viral infections;
• conduct bacterioscopic, bacteriological and serological examination of pathological material in case of suspicion of bacterial infection;
• choose drugs for the diagnosis, prevention and treatment of bacterial infections;
• apply methods of diagnosis and correction of disorders in the microbiocenoses of the human body, explain the mechanisms of action and scope of probiotics;
• assess the state of disorders in the microbiocenoses of the human body, correct these disorders with antibiotics and probiotics;

Competences and learning outcomes in accordance with the academic and professional program, the formation of which is facilitated by the discipline (integral, general, special).
According to the requirements of the standard, the discipline ensures the acquisition by students the following competencies:

- integral (IC) – **IC1** EPP:
IC1. Ability to integrate knowledge and solve complex specialized problems and problems in professional activity in the field of health care in the specialty "Medicine", or in the process of training involving research and / or innovation, in broad or multidisciplinary contexts, new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.
- general (GC) - **GC1** EPP:
Ability to abstract thinking, analysis and synthesis, the ability to learn and master modern knowledge.
- professional (PC) - **PC2, PC15** EPP:
Ability to determine the required list of laboratory and instrumental studies and evaluate their results.
Ability to plan and conduct preventive and anti-epidemic measures against infectious diseases.

According to the educational-professional program, the expected program learning outcomes (PRS) include the skills of **PRS4, PRS12, PRS29** EPP:
- Know the types and methods of adaptation, principles of action in a new situation. To be able to apply means of self-regulation, to be able to adapt to new situations (circumstances) of life and activity. Establish appropriate connections to achieve results. Be responsible for the timely use of self-regulatory methods.
- Evaluate information about the diagnosis in the health care facility, its unit, using a standard procedure, using knowledge about the person, his organs and systems, based on the results of laboratory and instrumental studies (according to list 4).
- Plan measures to prevent the spread of infectious diseases (according to list 2) in the health care facility, its unit based on the results of epidemiological surveys of infectious diseases, epidemiological analysis, using existing preventive and anti-epidemic methods.

3. The program of the discipline

The educational process is organized according to the European Credit Transfer and Accumulation System (ECTS).

The curriculum consists of two blocks:

BLOCK 1. GENERAL MICROBIOLOGY, VIRUSOLOGY AND IMMUNOLOGY
SECTIONS:
1. MORPHOLOGY AND PHYSIOLOGY OF MICROORGANISMS
2. GENETICS AND ECOLOGY OF MICROORGANISMS
3. INFECTION AND IMMUNITY

BLOCK 2. SPECIAL MICROBIOLOGY AND VIRUSOLOGY
SECTIONS:
1. PATHOGENIC PROKARYOTES
2. PATHOGENIC EUKARYOTES. FUNDAMENTALS OF CLINICAL MICROBIOLOGY
3. SPECIAL VIRUSOLOGY

BLOCK 1. GENERAL MICROBIOLOGY, VIRUSOLOGY AND IMMUNOLOGY

SECTION 1.
MORPHOLOGY AND PHYSIOLOGY OF MICROORGANISMS
Topic 1. Subject and tasks of microbiology. Methods of microbiological research. The main stages of development of microbiology.
Definition of microbiology as a science. Branches of microbiology: general, medical, veterinary, technical, agricultural, oceanic, space. Biotechnology.
Medical microbiology and its sections: bacteriology, virology, protozoology, mycology, etc.
Tasks of medical microbiology in the study of biological properties of pathogenic and non-pathogenic microorganisms, patterns of their interaction with the macroorganism, human population and the environment; development and use of methods of microbiological diagnostics, etiotropic therapy and

specific prevention of infectious diseases. Methods of microbiological research: microscopy, staining, cultivation, isolation of pure cultures, immunological methods, animal modeling, virological methods, biotechnological and genetic engineering.

The use of microbes for immunobiological, chemotherapeutic drugs and biotechnological processes.

The connection of medical microbiology with the practical activities of the doctor. Principles of organization of microbiological service, institutions of microbiological profile.

Microbes as the main object of study of microbiology. Precellular and cellular forms of microbes and infectious agents (prions, viroids, viruses, bacteria, spirochetes, rickettsiae, chlamydia, mycoplasmas, actinomycetes, fungi, protozoa). Common with higher animals and plants signs of microbes: self-organization, self-reproduction, self-regulation, ontogenetic and phylogenetic development. Specific signs of microbes. Features of microorganisms as living beings: microscopic size, relatively simple organization, high rate of reproduction, exceptional biochemical activity, plasticity and adaptability, ubiquity in the biosphere, the possibility of pathogenic properties. Non-cellular forms of parasites.

Fundamental features of modern medical microbiology and trends in its development.

Stages of development of microbiology.

The first ideas about contagion. The invention of the microscope and the discovery of microorganisms (A. Levenguk and others). Discovery of the first pathogenic microorganisms - pathogens of favus and anthrax.

The emergence and formation of microbiology as a science (second half of the 19th century). Works of L. Pasteur, R. Koch and their schools. Their significance for medical microbiology. Discovery of pathogens of major human infectious diseases. Development of methods for their cultivation and differentiation. SM Vinogradsky. Discovery of chemosynthesis.

Medical microbiology in the first half of the twentieth century. Further discoveries of infectious agents. Development of chemotherapeutic direction in microbiology and medicine (P. Ehrlich and others). Discovery of antibiotics (O. Fleming et al.).

Detection of viruses. Formation of virology as an independent science. DI Ivanovsky - the founder of virology. Virology in the first half of the twentieth century. Detection of viruses that infect animals, humans, bacteria (bacteriophages) and cause tumors in animals (oncogenic viruses). Development of methods for laboratory diagnosis of viral infections.

The modern period of development of medical microbiology (the second half of the XX century - the beginning of the XXI century). The value of scientific and technological progress in the field of molecular biology, genetics and genetic engineering, for the further development of theoretical and applied medical microbiology, virology and immunology.

The progress of virology in the second half of the twentieth century is connected with the study of the structure, biochemistry, and genetics of viruses. Discovery of new viruses - pathogens of human diseases (hepatitis viruses, HIV, hemorrhagic fevers, Ebola virus, etc.). Prions. Development of modern methods of laboratory diagnosis, prevention and treatment of viral infections.

The emergence of immunology as an independent science in the Pasteur period. L. Pasteur's development of the principles of making live vaccines. Discovery of phagocytosis as a protective reaction of the organism. Creation of the cellular theory of immunity (II Mechnikov). Discovery of humoral immune factors (P. Ehrlich, E. Bering, E. Ru, etc.). Discovery of allergies, methods of obtaining toxoids, vaccines, therapeutic sera, serological methods for diagnosing infectious diseases.

Progress of immunology in the second half of the twentieth century. Development of modern theories of immunity (F. Gaurowitz, F. Burnett, S. Tonegawa, etc.). The doctrine of the body's immune system. Discovery of immunological tolerance, immunological memory and other immunological reactions. Development of infectious and non-infectious immunology. Achievements and development of immunobiotechnology. Use of genetic and cellular engineering methods to obtain vaccines and other biologically active drugs of the latest generations.

The role of domestic scientists in the development of microbiology. Contribution of D. Samoilovich, MM Terekhovsky, DJ Ivanovsky, GN Gabrichevsky, DL Romanovsky, F. Ya. Chistovich, LS Tsenkovsky, GM Minkh, OO .Mochutkovsky, FO Lesha, II Mechnikov, MF Gamalia, DK Zabolotny, VK Vysokovych, MM Volkovych, VV Pidvysotsky, 3. V. Yermolieva, PF Zdrodovsky, VM Zhdanov, AO Smorodyntsev, MP Chumakov, LO Zilber, SM Minervin, SS Dyachenko, VS Derkach, SG Mosing, VV Smirnov in the development of medical microbiology, virology and immunology.

The current stage of development of microbiology. Molecular-biological and molecular-genetic level of research. Development of new preventive and medicinal products, development of the

microbiological industry. Achievements of medical microbiology in reducing the incidence of infectious diseases.

The importance of microbiology in the training of physicians.

Topic 2. Evolution of microorganisms. Systematics, classification and nomenclature of microorganisms.

Modern ideas about the evolution of the microbial world. Fundamental differences in structure and functions between prokaryotes (bacteria), eukaryotes (fungi, protozoa), viruses, viroids, prions. Archaebacteria and eubacteria.

History of the development of ideas about the taxonomy of microorganisms. Phylogenetic (natural) taxonomy and use of genosystematic approach.

Artificial (key, numerical) systematics. Systematics by D. Bergi.

Classification of prokaryotes, taxonomic groups. Species and its definition in microbiology. Intraspecific categories: subspecies, variants. Taxonomic value of 16 S ribosomal RNA.

The concept of population, culture, strain and clone of microorganisms. Binary nomenclature of bacteria. Classification of fungi and protozoa.

Topic 3. Organization of a bacteriological laboratory. Dyes and methods of staining of microorganisms. Microscopy.

Bacteriological laboratory, its structure and purpose. Organization of the workplace of a doctor - bacteriologist. Preparations for microscopy, methods of their manufacture. Aniline dyes, their properties. Method of manufacturing dye solutions. Simple methods of staining microorganisms.

Methods of research of morphology of microorganisms (microscopy). Light microscopy using immersion lenses. Dark-field, phase-contrast, luminescent and other methods of microscopy. Electron microscopy (transmission, scanning).

Methods of microscopy in the diagnosis of infectious diseases.

Complex methods of staining microorganisms. Gram staining technique. Factors on which Gram staining of microorganisms depends. Properties of gram-positive and gram-negative microorganisms. The practical significance of the Gram staining method.

Topic 4. Morphology and structure of bacteria and fungi.

Basic forms and sizes of bacteria. The structure of the bacterial cell. Morphophysiological features of gram-positive and gram-negative bacteria. Flagella, cilia, capsule, cell wall, periplasm, cytoplasmic membrane, cytoplasm, nucleoid, ribosomes, mesosomes, plasmids, inclusions. Chemical composition and functional significance of different structures of prokaryotes. Bacterial polymorphism. Bacterial spores. Features of chemical composition and structure, function. The process of spore formation. Subcellular forms of bacteria. Properties of L-forms of bacteria.

Complex methods of painting: Ozheshko, Ziel-Nielsen, Neisser, Buri-Gins, Lefler (for flagella), Yone.

Morphology of other representatives of prokaryotes: rickettsiae, chlamydia, mycoplasmas.

Morphology and structure of spirochetes, actinomycetes, fungi, protozoa.

Spirochetes (treponema, borrelia, leptospira). Features of morphology and structure (shell, fibrils, blepharoplast), mobility.

Actinomycetes, features of morphology. Air and substrate mycelium, friends. Spore formation.

The structure of the fungal cell. The main forms of fungi: yeast, yeast-like fungi, filamentous fungi. Hyphae, mycelium. Dimorphism of fungi. Features of the structure of the cytoplasmic membrane and cell wall. Mechanisms of fungal reproduction: budding, spore formation. Vegetative spores, endospores, exospores, sexual spores. Methods of studying the morphology of fungi.

Features of the structure of protozoa: pellicle, endoplasm, ectoplasm, cysts. Life cycles of the simplest, pathogenic to humans. Methods of studying morphology. Staining according to Romanovsky-Gimza.

Topic 5. Bacterial metabolism. Nutrient media for the cultivation of microorganisms.

The chemical composition of the bacterial cell: water, chemicals and minerals, nucleic acids, proteins, lipids, carbohydrates. Features of the chemical composition of bacteria compared with eukaryotic cells.

Features of metabolism and energy in bacteria (metabolic intensity, variety of types of metabolism, metabolic plasticity, excessive synthesis of metabolites and energy). Constructive and energy exchange, their relationship.

Bacterial nutrition. Sources of nitrogen, carbon, minerals and growth factors. Autotrophs and heterotrophs. Holophyte diet. Mechanisms of nutrient transfer into the bacterial cell: energy-independent (simple and facilitated diffusion), energy-dependent (active transport), values of periplasm enzymes and permeases. Classification of bacteria by types of food.

Bacterial respiration. Energy needs of bacteria. Sources and ways of obtaining energy in photoautotrophs, chemoautotrophs.

Types of biological oxidation of the substrate and methods of obtaining energy from heterohemoorganotrophs: oxidative metabolism; putrefaction - as a set of anaerobic and aerobic cleavage of proteins; fermentation metabolism and its products; nitrate respiration. Aerobes, anaerobes, facultative anaerobes, microaerophiles, droplet bacteria.

Bacterial enzymes and their classification. Constitutive and inductive enzymes, genetic regulation. Specificity of enzymes. Exo- and endoenzymes. Limiting factors of habitat (temperature, concentration of hydrogen ions, osmotic pressure, oxygen pressure). The concept of mesophiles, thermophiles, psychrophiles. Halophiles, acid- and alkali-loving bacteria.

Nutrient media for the cultivation of microorganisms. Requirements for nutrient media. Classification of nutrient media. Preparation and main components (peptone, agar-agar, gelatin, rolled whey, etc.). Types of nutrient media. Methods of studying the enzymatic activity of bacteria and using them to identify bacteria. Modern methods of accelerated identification of bacteria using automated indicators of enzymatic activity. The use of microbes and their enzymes in biotechnology for the production of amino acids, peptides, organic acids, vitamins, hormones, antibiotics, feed protein, for food and industrial processing, biological wastewater treatment, liquid and gaseous fuels.

Disinfection, definition. Methods (physical, chemical). Disinfectants, mechanism of action.

Topic 6. Growth and reproduction of microorganisms. Isolation and identification of pure cultures of bacteria.

Growth and reproduction of microorganisms. Simple division. Fragmentation. Periodic culture. Phases of development of microorganisms in a liquid medium in periodic culture. Methods of culturing microorganisms. Associations of microorganisms and pure cultures.

Colonies of microorganisms, features of their formation, properties. Pigments of microorganisms. Continuous cultivation, its importance in biotechnology (production of enzymes, proteins, antibiotics, etc.). Methods of culturing anaerobic bacteria (nutrient media for obligate anaerobes, anaerobic boxes, etc.).

Identification of pure cultures of microorganisms. Type of microorganisms, definition. Properties of microorganisms, which determine their species. Methods for determining the type of microorganisms. The concept of biovars, serovars, phage. Features of cultivation of rickettsiae, chlamydia, spirochetes.

The value of bacteriological (cultural) method in the diagnosis of infectious diseases.

Topic 7. Morphology and physiology of viruses. Cultivation of viruses.

Definition of virology as a science. Virology general, medical, sanitary. Tasks of medical virology. The importance of medical virology in the activities of the doctor. Features of the organization and activity of virological laboratories. Achievements of medical virology in the fight against infectious diseases. Unresolved issues.

Kingdom of viruses. Definition of viruses as special forms of living organization. Principles of structural organization of viruses. Virion and its components. Nucleocapsid, capsid,

capsomeres, supercapsids (peplos), peplomers. Simple and complex viruses, types of symmetry of nucleocapsids.

Chemical composition of viruses: nucleic acids, proteins, lipids, polysaccharides. Their features and functions. Virus enzymes, their role, classification.

Reproduction of viruses in the process of their interaction with the cell. The main stages of interaction of viruses with cells in productive infection. Integrative and abortive types of interaction of viruses with the host cell. Persistence of the virus in cells. Virus interference, defective interfering particles. Satellite viruses.

Methods of culturing viruses in chicken embryos, in the body of laboratory animals.

Indication of viral reproduction by hemagglutination (RGA) and hemadsorption.

Interferons and their inducers, the mechanism of their antiviral action.

Methods of culturing viruses in cells. Classification of cell cultures used in virology, their characteristics. Methods of detection (indication) of viral reproduction by cytopathogenic action, plaque formation under agar and bentonite coating, viral inclusions. Methods of quantitative determination (titration) of viruses. Genetic methods for determining viruses and their nucleic components.

SECTION 2.

GENETICS AND ECOLOGY OF MICROORGANISMS

Topic 8. Genetics of microorganisms.

Definition of genetics of microorganisms as a science. Its importance in the theory and practice of medicine.

The difference between the genomes of prokaryotic and eukaryotic cells. Evolution of the genome of microorganisms. Organization of bacterial cell genetic material: bacterial chromosome, plasmids, migrating elements. Chromosome structure. Genes. Principles of bacterial genome functioning. Repair system.

Plasmids of bacteria, their properties. Conjugative and nonconjugative, integrative and autonomous plasmids. Classification of plasmids by functional activity: F, R, Co1, H1y, Ent and other plasmids.

Transposons, insertion sequences. General characteristics and functions of migrating genetic elements.

The concept of gene pool, genotype and phenotype. Types of variability in bacteria. Modification variability, its mechanisms and forms of manifestation in bacteria.

Genotypic variability. Mutations of bacteria, their varieties. Mutagens, their classification. Types of mutations: deletions, translocations, inversions, duplications, insertions.

Genetic recombination and its types. Mechanisms of genetic information transfer in bacteria and their significance for obtaining bacterial strains with given properties and for compiling genetic maps. Transformation, transduction and conjugation.

The importance of mutants and recombinants in the existence of a bacterial population. Heterogeneity of the population of microorganisms, types and mechanisms of population variability. Genetic selection. The concept of dissociation of bacteria, S- and R-forms of colonies. The value of variability in the evolution of microorganisms.

Microbiological bases of genetic engineering and biotechnology. The use of enzymes (restrictase, ligase, polymerase, revertase) in genetic engineering studies. Vectors used to transfer genetic material. Features of gene expression in prokaryotic and eukaryotic cells. Practical use of the results of genetic engineering research in medicine, biology and national economy.

Genetic methods in the diagnosis of infectious diseases and in the identification of bacteria: DNA sequence, polymerase chain reaction, hybridization of nucleic acids, determination of the length of nucleic acid fragments, etc. Biochips, application in diagnostics.

The importance of viruses in the development of genetics. Genetic apparatus of viruses. Differences in the genomes of RNA and DNA-containing viruses. Modification variability of viruses: phenotypic mixing, polyploidy. Types of genotypic variability of viruses.

Mutations of viruses, their classification. Mutations are spontaneous and induced, direct and reverse. Mutagens.

Genetic relationships between viruses. Recombination, transduction. Genetic reactivation. Complementation.

Virulence of viruses as a genetic trait. Genetic markers of virulence.

Population variability of viruses. Heterogeneity of viral populations, its mechanisms and practical significance. Dissociation of viruses during reproduction in the cell. Biological properties of dissociants. Cloning of genetic variants. The role of viruses in the exchange of genetic information in the biosphere.

Morphological types and structure of bacteriophages. Chemical composition. Virulent and moderate phages. Stages of productive type of interaction of bacteriophages with bacterial cells. Lysogeny and phage conversion.

Practical use of bacteriophages in microbiology and medicine to identify bacteria, prevent and treat infectious diseases and to assess microbial contamination of the environment.

Topic 9. Antiseptics and asepsis. Methods and tools.

Antiseptics and asepsis. Development of scientific principles of antiseptics (I. Zemelweiss, D. Lister). Antiseptics, mechanisms of action. Acquired resistance of microorganisms to antiseptics.

Sterilization, definition. Thermal methods (in an autoclave, oven). Chemical method of sterilization (gas and solutions). Filtration and radiation methods. Sterilization control.

Topic 10. Chemotherapeutic drugs. Antibiotics.

History of development of ideas of antimicrobial therapy. Periods of development of chemotherapy. Works by DL Romanovsky, P. Ehrlich, G. Domagko. Discovery of sulfonamides. Basic principles of rational chemotherapy. The concept of chemotherapeutic drug, chemotherapeutic index.

Microbial antagonism, its mechanisms. Microbes-antagonists - producers of antibiotics. II Mechnikov's doctrine of the physiological role of lactic acid bacteria in the intestine. History of the discovery of the first antibiotics: O. Fleming, Z. Waxman. Antibiotics, definition, biological role in nature. Principles of obtaining antibiotics.

Classification of antibiotics by origin, chemical composition, mechanism and spectrum of antimicrobial action. Natural, semi-synthetic and synthetic antibiotics. The mechanism of action of antibiotics on the microbial cell. Antibiotics are inhibitors of cell wall peptidoglycan synthesis, protein synthesis, nucleic acids, as well as those that disrupt the function of the cytoplasmic membrane of bacteria and fungi. Bactericidal and bacteriostatic action of antibiotics. Units of measurement of antimicrobial activity of antibiotics. Methods for determining the sensitivity of bacteria to antibiotics. The concept of minimum inhibitory concentration. Antibiotic chart.

Complications of antibiotic therapy. Dysbacteriosis. Antibiotic-resistant, antibiotic-dependent and antibiotic-tolerant strains of bacteria.

Natural and acquired resistance to antibiotics. Genetic and biochemical mechanisms of antibiotic resistance. The role of plasmids and transposons in the formation of drug resistance of bacteria. Ways to prevent the formation of bacterial resistance to antibiotics. Principles of rational antibiotic therapy. Intercellular communication in bacteria ("quorum feeling") and prospects for the creation of a new generation of antimicrobial drugs based on it.

The value of the discovery of antibiotics (twentieth century) for the etiotropic therapy of bacterial, spirochetic, fungal, protozoal infections.

Antiviral chemotherapeutic drugs, their classifications: inhibitors of adsorption, penetration and deproteinization of viruses; reverse transcriptase inhibitors, DNA polymerase inhibitors of DNA-containing viruses; polymerase inhibitors of RNA and DNA-containing viruses; inhibitors of various viral mRNAs.

Topic 11. The microflora of the human body.

Normal microflora of the human body (eumicrobiocenosis). Indigenous and allochthonous microflora of the human body. Microflora of the skin, respiratory tract, digestive and urogenital systems, its anti-infective, detoxifying, immunizing, metabolic role. Methods of studying the role of normal microflora of the human body. Gnotobiology, the importance of gnotobiological principles in the clinic. Factors that affect the quantitative and qualitative composition of the microflora of the human body. The concept of colonization resistance and its role in infectious pathology. Dysbacteriosis. Methods of determination. Probiotics, prebiotics - drugs to restore the normal microflora of the human body (bifidumbacterin, lactobacterin, colibacterin, bifikol, aerococobacterin, biosporin, bactisubtil, multiprobiotics group "Symbiter", etc.). Mechanism of action. Dynamics of normal microflora in human ontogenesis. Pathogenic role of normal microflora and mechanisms of their acquisition of pathogenic properties.

The effect of chemical and physical environmental factors on microorganisms. Influence of temperature, reaction of environment, drying, radiation, ultrasound, atmospheric and osmotic pressures, chemicals of different classes. The mechanism of damaging action of these factors.

Topic 12. Fundamentals of sanitary microbiology. Sanitary microbiology of water, soil and air. Sanitary virology.

Definition of ecological microbiology. Scientific and social preconditions for the formation of ecological microbiology. Population, biotope, microbiocenosis. The main types of interspecific relationships: neutralism, symbiosis (commensalism, parasitism, mutualism), competition. Dynamics of ecological connections.

Ecological systems of microorganisms. Free-living and parasitic microbes. Microflora of soil, water and air - atmospheric and indoor (medical facilities, housing, etc.). Microbiological aspects of environmental protection. Protection of groups of microorganisms involved in the circulation of substances and energy from the damaging effects of man-made factors. Biological and man-made pollution and the role of microbes in biodegradation. Microbial degradation of economic materials, medicines. Problems of protecting the biosphere from artificial mutants and "space" microbes.

The importance of sanitary microbiology in the activities of the doctor. Tasks and methods of microbiological research. Direct methods of detection of pathogenic microorganisms in the environment and indirect methods of sanitary-microbiological research. Microbial count.

Sanitary-indicative microorganisms (SPM) of soil, water and air. Terms and conditions of survival of pathogenic microbes in the environment.

Sanitary microbiology of water. Methods of sanitary-microbiological research of water. Determination of microbial count. Determination of the number of bacteria - indicators of fecal contamination: coli-index and coli-titer (by the method of membrane filters and fermentation). Varieties of Escherichia coli and the question of their sanitary significance. Fecal coliform (PCP) bacteria of the Escherichia coli group are indicators of fresh fecal contamination. The role of water in the transmission of infectious diseases.

Sanitary microbiology of soil. Sanitary microbiology of soil in connection with the prevention of infections. Pathogenic microorganisms that are detected in the soil. Microbes for which the soil is a natural habitat. Microbes that get into the soil with human and animal feces. Methods of sanitary-microbiological research of soil. Factors that affect the qualitative and quantitative composition of soil microbes. Microbial count, coli-titer, titer-soil perfringence.

Sanitary microbiology of air. The role of air in the transmission of infectious diseases. Methods for determining the microbial count of air. Factors that affect the microbial composition. Methods of sanitary-bacteriological research of air (sedimentation and aspiration). Assessment of the sanitary condition of indoor premises by general microbial contamination, the presence of SPM (staphylococci, b - and c - hemolytic streptococci), which are indicators of air contamination by human microflora of the nasopharynx.

Subject, tasks, significance of sanitary virology in the activity of a doctor.

The role of water, soil, air in the transmission of viral infections. Viruses that are most commonly found in the environment.

Sanitary and virological examination of water. Sampling, detection methods, concentrations. Viruses, bacteriophages in drinking and sewage. Detection methods.

Methods of detection of pathogenic viruses in soil. Soil research for the presence of enteroviruses.

The role of the air environment in the spread of pathogens of respiratory viral infections. Methods of air sampling and indication of respiratory viruses.

SECTION 3.

INFECTION AND IMMUNITY

Topic 13. Infectious process, its types, conditions of origin and development.

Definition of "infection", "infectious process", "infectious disease". Development of ideas about the essence of the infectious process. Conditions of occurrence of infectious process.

The role of microorganisms in the infectious process. Pathogenicity of microbes, determination. Pathogenicity as a consequence of the evolution of parasitism. Obligatory-pathogenic, conditionally - pathogenic, non-pathogenic microorganisms.

Virulence, definition, units of measurement. Bacterial pathogenicity factors: adhesins, invasins, pathogenic enzymes, bacterial structures and substances that inhibit phagocytosis. Microbial toxins, their classification. Protein toxins (exotoxins), properties, mechanism of action. Units of exotoxin strength. Endotoxins, chemical composition, properties, differences from protein toxins. Pathogenic properties of rickettsiae, chlamydia, mycoplasmas, fungi and protozoa. Obligatory intracellular

parasitism of viruses. Genetic control of pathogenic factors of microorganisms. Heterogeneity of microbial populations on the basis of virulence.

Phases of development of infectious process. Critical doses of microorganisms that cause infectious disease. Ways of penetration of pathogens into the body. Adhesion of microorganisms, colonization, aggregation, formation of biofilms, invasion. Distribution of microbes and their toxins in the body: bacteremia, toxemia, sepsis and its consequences. Microbonosystvo. Asymptomatic infection. The dynamics of infectious disease - the periods of incubation, prodromal, exacerbation, end.

Forms of infection: exogenous and endogenous; focal and generalized; monoinfection and mixed; secondary infection, reinfection, superinfection, relapse; acute, chronic, persistent infection. The concept of wound infections, respiratory, intestinal, venereal and skin infections; anthroponotic, zoonotic, anthropozoonotic and sapronotic infections. Mechanisms of transmission of infections: fecal-oral, airborne, sexual, alimentary, transmissible, contact-household, transplacental. The concept of the pathogenesis of infectious disease.

Biological research method. Its use in the study of etiology, pathogenesis, immunogenesis, diagnosis, therapy and prevention of infectious diseases. Laboratory animals, pure genetic lines of animals.

The main stages of development of immunology. Empirical, including the receipt of E. Jenner anti-smallpox vaccine. Pasteur - the doctrine of the attenuation of microorganisms. Obtaining anti-anthrax and rabies vaccines. Development of the doctrine of cellular (II Mechnikov) and humoral (P. Ehrlich) immunity.

Modern directions of immunology development:

The role of domestic and foreign scientists in the development of immunology. Nobel laureates in the field of immunology. The main sections of modern immunology: infectious and non-infectious, clinical, transplantation, environmental; immunogenetics, immunopathology, allergology, cytoimmunology, immunohematology, etc. The role of immunology in the development of medicine and biology, its connection with other sciences. Immunological research methods.

Topic 14. Organs of the immune system. Factors of nonspecific protection of the organism from pathogenic microorganisms.

Immunity as a way to protect the body from substances that have signs of genetic alienation and is implemented by a specialized immune system.

Formation of the body's immune system.

Factors of nonspecific protection of the organism.

Barrier and antimicrobial properties of the skin, mucous membranes. Normal microflora. Areactivity of cells and tissues. Physico-chemical factors, function of excretory organs and systems.

Phagocytosis. The role of II Mechnikov in the development of the doctrine of phagocytosis. Classification of phagocytic cells. The main stages of phagocytosis. Biochemical mechanisms of bacterial damage by phagocytes. Complete and incomplete phagocytosis. Methods of studying phagocytic activity: phagocytic activity, phagocytic index. The importance of phagocytosis in the implementation of natural immunity and in the development of the immune response.

Keeling system of the human body: natural killers, large granular lymphocytes (VGL), K-cells, LAC - cells (leukinactivated killers), their role in immunological surveillance of genetically (pathologically) altered cells of the human body.

Macrophages (migrating and tissue), granulocytes - neutrophils, eosinophils, basophils (migrating and tissue).

Humoral factors of nonspecific protection: complement system, lysines, interferons, leukins, antiviral inhibitors, lysozyme, plakin, properdin, fibronectin, etc.

The main components of the complement system. The role of complement in chemotaxis, opsonization and lysis of microbes, the development of allergic and immunopathological processes. Methods of qualitative and quantitative determination of complement. Classic and alternative ways of complement activation. Interferons. Classification of interferons, inducers, mechanism of formation, biological functions of interferons (antiviral, antitumor, immunomodulatory, radioprotective). Recombinant interferons.

The structure of the immune system.

Central organs of the immune system: thymus, bone marrow. Peripheral organs of the immune system: spleen, lymph nodes and lymphoid clusters associated with the mucous membrane. Immunocompetent cells. T-lymphocytes, their ontogenesis. Subpopulations of T-lymphocytes: Th0, Th1, Th2, their comparative characteristics. Surface markers and receptors of these cells: CD4 + - lymphocytes (helpers), CD8 + - lymphocytes (cytotoxic, effector), their functions. B-lymphocytes, ontogenesis. B-lymphocyte subpopulations. Surface markers and receptors. Cooperation between immunocompetent cells in the process of forming an immune response. The concept of immunomodulators. Immunostimulants and immunosuppressants.

Topic 15. Characteristics of antigens.

Antigens as inducers of the immune response.

The structure of antigens. Antigenic determinants (epitopes). Classification of antigens. Complete antigens and haptens. Types of antigenic specificity. Adjuvants. Antigenic structure of microorganisms. Localization, chemical composition and specificity of antigens of bacteria, viruses, enzymes, toxins. The role of microbial antigens in the infectious process and the development of the immune response. Human histocompatibility antigens. Erythrocyte antigens of different blood groups, autoantigens, embryonic, tumor and human transplant antigens.

Topic 16. Antibodies as a product of humoral immune response.

Structure and functions of antibodies (immunoglobulins).

Constant and variable regions of H- and L-polypeptide chains, domains. Structure of active centers of immunoglobulins. Heterogeneity of molecules. The concept of valence of antibodies. Fc - (cellular) receptors. The mechanism of interaction of antibodies with antigens. Classes of immunoglobulins, their structure and properties. Antigenic structure of immunoglobulins: isotype, allotypic, idiotypic determinants. Antiidiotypic antibodies. Pathological immunoglobulins. Genetics of immunoglobulins. Autoantibodies. The concept of

polyclonal and monoclonal antibodies. Principles of obtaining monoclonal antibodies. Hybridomas as producers of monoclonal antibodies.

Immune response reactions. Principles of using antibodies as treatment-and-prophylactic and diagnostic drugs.

Forms and types of immune response. Humoral immune response and its stages: recognition, antigen processing, antigen presentation to T-helpers and B-lymphocytes, proliferation and differentiation of B-lymphocytes. T- and B-dependent antigens, their effect on the immune system, antibody synthesis by plasma cells. Immunological memory, memory cells. Primary and secondary immune response. Interaction of cells of the immune system in the process of immune response. Involvement of macrophages, T- and B-cells. Interleukins.

Cellular immune response and its stages: recognition, antigen processing, presentation of Th1 antigen to lymphocytes, proliferation and differentiation of effector T cells (helpers, suppressors, delayed-type hypersensitivity effectors, memory cells). Cytokines and their role in the formation of cellular immune responses.

Characteristics of the manifestations of the immune response: antibody synthesis, immediate and delayed types of hypersensitivity, immunological memory, immunological tolerance, idiotype-anti-idiotypic network interactions.

Topic 17. Serological reactions

Serological reactions, their varieties, specificity, sensitivity, two-phase nature, reversibility. The mechanism of interaction of antigens and antibodies in serological reactions. The main components of serological reactions. Practical use of serological reactions: antigen identification, diagnostic detection of antibodies. Diagnostic immune sera, classification, production, titration, increase of specificity due to adsorption of antibodies by Castellani. Use for serological identification of antigens.

Serological identification - determination of antigens of microorganisms by its reactions with diagnostic sera (in order to establish the type and serovar of microorganisms). Basic serological reactions for identification, necessary diagnostic drugs, and criteria for their accounting. Use of serological reactions for indication of antigens of microorganisms for the purpose of express diagnostics of infectious diseases.

Serological diagnosis as a diagnosis of infectious diseases by detecting antibodies to the pathogen in the patient's serum. Diagnostics, obtaining, using them for serological diagnosis of infectious diseases (detection of antibodies in the serum of a sick person). The concept of "antibody titer", "diagnostic titer", "diagnostic increase in antibody titer", "paired sera". The principle of differentiation based on the results of serological reactions of an existing infectious disease from a previous one. Criteria for serological diagnosis: detection of antibodies to the pathogen in the diagnostic titer, detection of diagnostic growth of antibody titer, detection of antibodies to the pathogen belonging to the class IgM.

Monoclonal antibodies, their use.

Phenomena of detection and methods of registration of serological reactions. Reactions based on the phenomenon of agglutination: direct and indirect agglutination, inhibition reaction of indirect hemagglutination, reverse indirect hemagglutination reaction, Coombs reaction - antiglobulin test. Reactions based on the phenomenon of precipitation: ring precipitation, flocculation, gel precipitation. Immune lysis reactions (bacteriolysis, spirochetolysis, hemolysis). Complement binding reaction. Immobilization reaction of microorganisms. Opsono-phagocytic reaction. Neutralization reaction (toxins, viruses, rickettsiae). Reactions using labeled antigens and antibodies: immunofluorescence (direct and indirect), enzyme-linked immunosorbent assay (direct, indirect, solid-phase, competitive), radioimmunoassay (competitive, reverse, indirect). Immune electron microscopy.

Therapeutic and prophylactic immune sera, principles of their production, control, classification, use. Units of measurement and dosage of sera. Rules of introduction of serums. Complications during administration (serum sickness, anaphylactic shock).

Features of serological reactions used in virology. Method of paired sera. Features of viral diagnostics. Complement binding reaction and features in virology. Reactions used exclusively in virology - hemagglutination and hemadsorption inhibition reaction, virus neutralization reaction.

Principles of using microbial antigens as prophylactic and diagnostic drugs. Development of the doctrine of immunoprophylaxis. E. Jenner, L. Pasteur, E. Bering, G. Ramon and others. Active and passive immunoprophylaxis. Drugs for active immunoprophylaxis. Modern classification of vaccines: live, inactivated, chemical, toxoids, subcomponent, genetically engineered, synthetic, anti - idiotypic, DNA - vaccines. Methods of manufacture, evaluation of efficiency and control. State control over the quality of vaccines. Associated vaccines. Adjuvants. Autovaccines, vaccine therapy.

Diagnostics. Their use for serological diagnosis of infectious diseases.

Topic 18. Immunopathology. Assessment of the immune status of the organism.

Allergy. The concept of allergies. Allergens. Classification of allergic reactions according to Jel and Coombs. Allergic reactions of humoral (immediate) type - GNT. Reagin type of GNT. Development mechanism. Clinical manifestations: anaphylactic shock, urticaria, Quincke's edema. Atopy: bronchial asthma, hay fever. Cytotoxic type of GNT. Mechanism of development, clinical detection. Ways to prevent. Immunocomplex type of GNT. Development mechanism. Clinical detection. Diagnostic tests to detect humoral allergies. Allergic reactions of cellular (delayed) type - GUT. Mechanism of development, clinical forms of detection: infectious, contact allergy. Methods of detection of GUT, skin allergy tests. Clinical detection. Immunodiagnostics. Комплексна оцінка імунного статусу організму за показниками неспецифічних факторів захисту, стану Т- і В-систем. Роль оцінки імунного статусу організму в діагностиці інфекційних захворювань та патології імунної системи організму.

Immunodeficiency states. Classification of immunodeficiency states at birth and acquired, primary and secondary.

Autoimmune processes. Autoimmune diseases associated with the violation of histohematological barriers for extrabarrier organs, cross-reactive antigens, disruption of immune tolerance due to dysfunction of the body's immune system in lymphoproliferative diseases and immune system defects. Principles and prospects of treatment of autoimmune diseases.

Immunomodulators (lipopolysaccharides - pyrogenal, prodigiosan), drugs from bacteria of the BCG strain. Lysates (bronchovax, rynovak), extracts (biostim, ribomunil, bronchomunal, imudol), yeast polysaccharides. Lymphokines.

BLOCK 2. SPECIAL MICROBIOLOGY AND VIRUSOLOGY

SECTION 4.
PATHOGENIC PROKARYOTES.

Topic 19. Pathogenic cocci.

Evolution of the coccal group of bacteria, their general characteristics.

Staphylococci and streptococci (families Micrococcaceae and Streptococcaceae). Genus Staphylococcus (Staphylococcus). Classification. Biological properties. Pathogenicity factors. The role of staphylococci in the development of human pathology. Pathogenesis of the processes caused by them. Role in the development of nosocomial infection. Immunity and its features. Drugs for specific prevention and therapy. Methods of microbiological diagnosis of staphylococcal infections.

Genus Streptococcus. Classification, biological properties. Toxins, enzymes of pathogenicity. Role in human pathology. Pathogenesis of streptococcal diseases. Immunity. Methods of microbiological diagnosis of streptococcal diseases.

Etiological and pathogenetic role of group A streptococci in respiratory infections, erysipelas, sore throat, scarlet fever, acute glomerulonephritis, rheumatism, sepsis, etc.

Streptococcus pneumoniae - pneumococcus, biological properties. Pathogenicity factors. Etiological and pathogenetic role of pneumonia streptococcus in human pathology. Microbiological diagnostics. Pathogenicity to humans and animals.

Oral streptococci, their role in caries and other dental diseases.

Meningococci and gonococci (family Neisseriaceae).

Genus Neisseria. Biological properties. Classification. Evolution of pathogenicity.

Meningococci (Neisseria menigitidis). Biological properties, classification. Pathogenesis and microbiological diagnosis of meningococcal diseases and bacteriocarriers. Differentiation of meningococci and gram-negative diplococci of the nasopharynx. Prevention of meningococcal infection.

Gonococci (Neisseria gonorrhoeae). Biological properties. Pathogenicity for humans, variability. Acute and chronic gonorrhea. Immunity. Microbiological diagnosis of gonorrhea. Prevention and specific therapy of gonorrhea and blenorrhea.

Topic 20. Enterobacteriaceae (family Enterobacteriaceae).

Classification and general characteristics of members of the family Enterobacteriaceae. Modern views on the evolution of intestinal bacteria. Antigenic structure. Virulence factors and their genetic determinism. Pathogenic and opportunistic enterobacteria. Distribution and ability to survive in the environment.

The genus Escherichia (Escherichia), their main properties. Physiological role and sanitary-indicative value. Diarrheal Escherichia coli. Classification by antigenic structure and division into categories depending on virulence factors, serological markers and clinical and epidemiological features. Parenteral Escherichia coli. Microbiological diagnosis of Escherichia coli. Genus Salmonella. General characteristics of the genus. Classification by antigenic structure (Kaufman - White). Pathogenicity to humans and animals.

Salmonella - the causative agents of generalized infections (typhoid fever and paratyphoid fever). Biological properties. Antigenic structure, pathogenicity factors. Pathogenesis and immunogenesis of diseases. Bacteriocarriers.

Salmonella - the causative agents of acute gastroenterocolitis. Features of pathogenesis.

Methods of microbiological diagnosis of salmonellosis. Specific prevention and treatment.

Genus Shigella (Shigella). Biological properties. Classification. Shigella virulence factors. Pathogenesis of shigellosis (dysentery). Immunity. Methods of microbiological diagnostics. Features of Grigoriev-Shiga dysentery. The problem of specific prevention. Specific therapy.

Other pathogenic enterobacteria. Genus Klebsiella. Characteristics and biological properties of Klebsiella. Klebsiella pneumoniae and its role in pathology. Klebsiella ozena and rhinoscleroma. Microbiological diagnosis of Klebsiella.

The genus Proteus, Moraganella and Providencia. The importance of certain species in the etiology of acute intestinal infections, purulent-inflammatory processes, mixed infections, nosocomial infections and food poisoning. Microbiological diagnosis of diseases.

Other representatives of opportunistic enterobacteria: genera Hafnia, Serratia, Enterobacter, Edwardsiella, Erwinia, Citrobacter. Biological properties. Significance in pathology. Features of microbiological diagnostics of diseases caused by opportunistic enterobacteria.

Topic 21. Gram-negative non-fermenting bacteria.

Pseudomonadaceae (family Pseudomonadaceae). Classification. Ecology. Resistance. Pseudomonas aeruginosa. Biological properties. Pathogenicity factors. Role in the occurrence of purulent-inflammatory processes and nosocomial infection. Microbiological diagnostics. Treatment. Other gram-negative non-fermenting bacteria: acinetobacteria, moraxels.

Topic 22. Vibrios. Helicobacteria.

Vibrio cholerae. Biovars (classical and El-Tor), their differentiation. The spread of cholera. Morphology. Cultural properties, enzymatic activity. Classification of Vibrios by

Heiberg. Antigenic structure. Virulence factors. Cholerogen, mechanism of action, methods of cholerogen detection. Cholera vibrios that are not agglutinated by O-1 serum, O-139 "Bengal" vibrio. Pathogenesis and immunity in cholera. Methods of microbiological diagnostics. Accelerated diagnosis of the disease and indication of Vibrio cholerae in the environment. Specific prevention and treatment of cholera.

Halophilic vibrios are pathogens of toxicoinfections. Biological properties. Pathogenicity to humans. Features of microbiological diagnostics.

Other vibrios as a cause of gastroenteritis, wound infection, inflammatory diseases of the internal organs.

Genus of Helicobacter pylori (Helicobacter). Discovery of Helicobacter pylori - the causative agent of human gastroduodenal diseases. Biological properties. Factors of colonization of the gastric mucosa. Urease activity. Pathogenesis of Helicobacter pylori infection. Methods of microbiological diagnosis: accelerated (urease and histological tests), bacteriological, polymerase chain reaction, serological diagnosis. Modern methods of treatment of Helicobacter pylori infection.

Topic 23. Corynebacteria. Bordetelli. Mycobacteria.

The causative agent of diphtheria (Corynebacterium diphtheriae). History of discovery and study. Morphology. Cultural properties. Biovars. Resistance. Pathogenicity factors. Diphtheria toxin. Toxicity as a result of phage conversion. Molecular mechanism of action of diphtheria toxin. Pathogenesis of diphtheria. Antitoxic immunity. Bacteriocarriers. Microbiological diagnosis of diphtheria. Immunological and genetic methods for determining the toxigenicity of the diphtheria pathogen. Differentiation of the diphtheria pathogen from other pathogenic and non-pathogenic for humans corynebacteria, toxigenicity control, specific prevention and treatment of diphtheria.

The causative agent of pertussis (Bordetella pertussis). Morphological, cultural, antigenic properties. Pathogenesis and immunity of the disease. Microbiological diagnostics. Differentiation of pertussis, pertussis and bronchosepticosis. Specific prevention of pertussis. Etiotropic therapy.

Pathogenic, conditionally pathogenic and saprophytic mycobacteria. Mycobacteria of tuberculosis, species, morphological, tinctorial, cultural and antigenic properties. Features of the pathogenesis of the disease. Variability of tuberculosis bacteria, pathogenicity factors. Tuberculin. Patterns of immunity, the role of cellular mechanisms. BCG vaccine. Microbiological diagnostics. Antimicrobial drugs. The problem of multiple resistance of Mycobacterium tuberculosis to chemotherapeutic drugs. Epidemic spread of tuberculosis in modern conditions. The causative agent of leprosy.

Pathogens of mycobacteriosis. Classification, properties. Role in human pathology. Mycobacteriosis as a manifestation of HIV infection.

Topic 24. Pathogens of anaerobic infections.

Genus Clostridium Classification. Ecology, properties. Evolution of clostridia. Resistance to environmental factors. Toxicity. Genetic control of toxin production.

Clostridia are the causative agents of anaerobic wound infection. See. Properties, pathogenicity factors, toxins. Pathogenesis of anaerobic wound infection. Antitoxic immunity. Microbiological diagnostics. Specific treatment and prevention.

Clostridium tetani. Properties. Pathogenicity factors, toxins. Pathogenesis of the disease. Immunity. Microbiological diagnostics. Specific treatment and prevention of tetanus.

Clostridium botulinum. Properties. Pathogenicity factors, botulinum toxins. Pathogenesis of the disease. Immunity. Microbiological diagnostics. Specific treatment and prevention of botulism.

Clostridium difficile, a role in human pathology.

Anaerobic non-clostridial bacteria. Bacteroides. Prevotella. Porphyromonas. Ecology. Biological properties. Pathogenicity to humans. Immunity. Microbiological diagnostics. Antimicrobial drugs.

Fusobacterium. Propionibacterium.

Anaerobic cocci, properties. Peptococcus. Peptostreptococcus. Veillonella. Role in human pathology.

Topic 25. Rickettsia, chlamydia, mycoplasma.

Rickettsiae (family Rickettsiaceae) General characteristics and classification of rickettsiae. Rickettsiae are the causative agents of typhus and Brill-Zinsser disease, endemic typhus, and the causative agent of Ku fever. Biological properties. Ecology. Hosts and carriers. Resistance. Antigenic structure. Toxin formation. Pathogenicity to humans. Immunity. Microbiological diagnosis of rickettsiosis. Antimicrobial drugs. Specific prevention.

Chlamydia (family Chlamydiaceae) Classification. Biological properties. Ecology. Resistance. Intracellular parasitism. Antigenic structure. Pathogenicity factors. The causative agent of ornithosis. Pathogenicity to humans and birds. Pathogenesis and immunity. Microbiological diagnostics. Antimicrobial drugs. The causative agent of trachoma. Pathogenicity to humans. Trachomaconjunctivitis of newborns (blenorrhea with inclusions). Urogenital chlamydia. Pathogenesis. Microbiological diagnostics. Principles of specific prevention and therapy.

Mycoplasmas (family Mycoplasmataceae). General characteristics of the class of molicut. Classification. Biological properties. Role in human pathology. Mycoplasmas are pathogens of pneumonia, acute respiratory diseases, urethritis, endocarditis, pregnancy pathology and fetal damage. Pathogenesis of diseases, immunity. Microbiological diagnostics. Principles of specific prevention and therapy. Mycoplasmas of the oral cavity.

Topic 26. Spirochetes and spirals.

General characteristics of the family (family Spirochaetaceae). Classification. Genus Treponema (Treponema). The causative agent of syphilis. Morphological, cultural properties. Pathogenesis and immunogenesis of syphilis. Microbiological diagnosis and specific therapy. Pathogens of yaws, pints. Properties. Ways of human infection. The course of the disease in humans. Microbiological diagnostics.

Genus Borrelia. The causative agent of epidemic recurrent typhus. Pathogenesis, immunity. Microbiological diagnostics. Specific prevention. Pathogens of endemic tick-borne spirochetosis. Pathogenesis, diagnosis. Lyme disease, pathogen, diagnosis, prevention.

Genus Leptospira (Leptospira, family Leptospiraceae). Classification. The causative agent of leptospirosis. Properties. Pathogenicity to humans and animals. Pathogenesis of leptospirosis. Immunity. Microbiological diagnostics. Specific prevention.

Genus Spirillum. The causative agent of fever from rat bites. Microbiological diagnosis of the disease.

Genus Campylobacter. Classification. Campylobacter - the causative agent of purulent-inflammatory and acute intestinal diseases. Biological properties, microbiological diagnostics.

Topic 27. Pathogens of zoonotic infections.

Genus Yersinia. Yersinia - the causative agents of intestinal yersiniosis and pseudotuberculosis. Biological properties. Psychrophilicity. Microbiological diagnosis of intestinal yersiniosis. The causative agent of plague. History of study. Biological properties. Virulence factors. Pathogenesis of plague. Methods of microbiological diagnosis of plague. Criteria for identification of the causative agent of plague. Specific prevention and treatment of plague.

Brucellae (family Brucellaceae) Classification. Biological properties. Pathogenicity factors. Types of brucellosis and their pathogenicity to humans and animals. Pathogenesis and immunity in brucellosis. Methods of microbiological diagnostics. Drugs for specific prevention and therapy.

The causative agent of tularemia (Francisella tularensis) Biological properties. Pathogenesis, immunity, methods of microbiological diagnosis. Specific prevention of tularemia.

The causative agent of anthrax (Bacillus anthracis). Properties. Resistance. Pathogenicity to humans and animals. Pathogenicity factors, toxins. Pathogenesis of the disease in humans, immunity. Microbiological diagnostics. Specific prevention and treatment of anthrax.

Other pathogenic bacteria. Legionella (family Legionellaceae). Classification. Biological properties. Cultivation of legionella. Distribution of legionella in the environment. Characteristics of legionella - the causative agent of pneumonia. Epidemiology of legionellosis. Risk groups. Pathogenesis of the disease. Clinical forms. Immunity. Microbiological diagnostics. Methods for detecting legionella in the environment. Treatment, prevention of legionellosis.

Genus Pasteurella. Taxonomic position. Classification. Biological properties of the genus. Pasteurella multocida is a causative agent of diseases in birds, cattle and humans. Characteristic. Microbiological diagnostics. Antimicrobial drugs.

Genus of hemophiles (Haemophilus). Classification. Biological properties of hemophiles. Hemophilic growth factors. Haermophilus influenza is a causative agent of acute and chronic respiratory diseases, bacterial meningitis, etc. Characteristics of the pathogen. Antigenic structure. Sensitivity to antibiotics. Haemophilus ducreyi is a causative agent of a soft chancre. Characteristics of the pathogen. Microbiological diagnosis of diseases caused by hemophiles. Antimicrobial drugs.

Genus Listeria. Classification. Biological properties. Pathogenicity to animals. Epidemiology. Pathogenesis of the disease in humans. Immunity. Microbiological diagnostics. Treatment and prevention of listeriosis.

Actinomycetes (family Actinomycetaceae) General characteristics of the genus Actinomycetes. The causative agent of actinomycosis. Ecology. Resistance. Properties. Pathogenesis of the disease. Immunity. Microbiological diagnostics. Chemotherapeutic drugs. Immunotherapy. Prevention of actinomycosis.

SECTION 5.

PATHOGENIC EUKARYOTES. FUNDAMENTALS OF CLINICAL MICROBIOLOGY.

Topic 28. Pathogenic fungi.

Pathogenic fungi. Classification. Biological properties. Resistance. Pathogenicity factors, toxins. Sensitivity to antibiotics.

Dermatophytes - pathogens of dermatomycosis (epidermophytia, trichophytia, microsporia, favus). Properties. Pathogenicity to humans. Microbiological diagnostics.

Pathogens of deep mycoses: blastomycosis, histoplasmosis, cryptococcosis. Properties. Pathogenicity to humans. Microbiological diagnostics.

Fungi of the genus Candida. Properties. Pathogenicity to humans. Factors that cause candidiasis (dysbacteriosis, etc.). Microbiological diagnostics. Antimicrobial drugs.

Pathogens of aspergillosis and penicillinosis. Properties. Pathogenicity to humans.

Pneumocystis carinii. Pneumocystis pneumonia in AIDS patients.

Nocardia Classification. Ecology. Biological properties. Pathogenesis of nocardiosis. Microbiological diagnostics. Antimicrobial drugs.

Topic 48. Pathogenic protozoa.

Classification. Ecology. Biological properties.

Plasmodia of malaria. Development cycles. Pathogenesis of malaria, immunity. Microbiological diagnostics. Antimicrobial drugs. Prevention.

Toxoplasma, amoebae, Giardia, leishmaniasis, trypanosomes, Trichomonas, balantidia. Properties. Role in pathology. Pathogenesis and microbiological diagnosis of diseases. Principles of treatment. Prevention.

Free-living amoebae (acanthamoebae, hartmanelles, negleria). Role in pathology.

Topic 30. General characteristics of clinical microbiology. Opportunistic infections.

Definition. The value of clinical microbiology in the work of the doctor.

Objects of research. Pathogenic and conditionally pathogenic microorganisms. Pathogenicity. Heterogeneity and variability of populations.

Microbiocenoses of healthy and pathologically altered habitats of the human body. Dysbacteriosis (dysmicrobiocenosis). Conditions of occurrence. Consequences of development. Classification by pathogen and localization. Methods of diagnosis and rehabilitation (rehabilitation).

Opportunistic infections. Definition. Conditions of origin, features: multiorgan tropism of pathogens, polyetiology, low specificity of clinical manifestations, tendency to generalization.

Prevalence of opportunistic infections. Exogenous opportunistic infections (legionellosis, pseudotuberculosis, listeriosis, seraciosis). Endogenous opportunistic infections, the role of the resident microflora of the organism in their occurrence. Microbiological diagnostics. Criteria for the etiological role of opportunistic pathogens isolated from the pathological focus.

Opportunistic iatrogenic infections. Etiological structure. Hospital strains and ecovars of opportunistic microbes. Opportunistic infections associated with medical intervention. Features of immunity. Microbiological bases of prevention and treatment of opportunistic infections.

Scientific substantiation of anti-epidemic measures.

Topic 31. Nosocomial infections.

Determination of nosocomial infections (hospital, hospital, nosocomial). Classification. Conditions that contribute to their occurrence and widespread in hospitals.

Microorganisms that most often cause nosocomial infection (staphylococci, streptococci, Proteus, Escherichia coli, sera, Salmonella, pseudomonads, Escherichia coli, Vibrios, Citrobacter, Branchamel, Moraxella, Cloisteriosis, Mycobacterium, Mycobacterium, Mycobacterium, Mycobacterium, Mycobacteria, etc.). The most common pathology - wound infections, purulent-inflammatory processes of the skin, subcutaneous fat, respiratory system, central nervous system, gastrointestinal tract, genitourinary system, eyes, ears, sepsis, septicemia.

Etiology, pathogenesis, clinical forms of nosocomial infection caused by obligate pathogenic microbes (nosocomial toxicoseptic salmonellosis, nosocomial cholenteritis, hepatitis B, adenoviral conjunctivitis, local and generalized forms of herpes and cytomegalovirus, cytomegalovirus and cytomegalovirus). Conditions for successful diagnosis of nosocomial infections. Criteria for the etiological role of microorganisms isolated in the bacteriological diagnosis of nosocomial infections. Prevention of nosocomial infections.

SECTION 6.

SPECIAL VIRUSOLOGY

Topic 32. RNA genomic viruses.

Orthomyxoviruses (family Orthomyxoviridae). General characteristics and classification.

Human influenza viruses. The structure of the virion. Features of the genome. Cultivation. Sensitivity to physical and chemical factors. Characteristics of antigens. Hemagglutinins, neuraminidases, functional activity. Classification of human influenza viruses. Types of antigenic variability, its mechanisms. Pathogenesis of influenza. The role of virus persistence in humans and animals in the preservation of epidemically significant strains. Immunity. Laboratory diagnostics. Specific prevention and treatment.

Paramyxoviruses (family Paramyxoviridae). General characteristics and classification. The structure of the virion. Antigens. Cultivation. Sensitivity to physical and chemical factors.

Genus of paramyxoviruses (Paramyxovirus). Human parainfluenza viruses (types 1 - 5). Mumps virus. Role in human pathology. Immunity. Specific prevention.

Genus of morbillivirus (Morbillivirus). Measles virus, biological properties Pathogenesis of the disease. Immunity and specific prevention.

Genus of pneumoviruses (Pneumovirus). Human respiratory syncytial virus. Biological properties. Pathogenesis of the disease. Immunity.

Persistence of paramyxoviruses and human pathology.

Laboratory diagnosis of paramyxovirus infections.

Reoviruses (family Reoviridae) General characteristics. Classification. Role in human pathology. Genus of rotavirus (Rotavirus). Classification, properties. Role in human pathology. Laboratory diagnostics. Arenaviruses (family Arenaviridae). General characteristics and classification. The main representatives that cause disease in humans: lymphocytic choriomeningitis viruses, Lassa, Hunin, Machupo. Laboratory diagnostics. Problems of specific prevention and therapy .. Genus Vesiculovirus. Vesicular stomatitis virus, its role in human pathology, diagnosis. Coronaviruses (family Coronaviridae). General characteristics. Role in human pathology. Laboratory diagnostics. Caliciviruses (family Caliciviridae). General characteristics. Role in human pathology. Laboratory diagnostics.

Togaviruses (family Togaviridae). Genus of rubiviruses (Rubivirus). Rubella virus. Role in human pathology. Laboratory diagnostics. Specific prevention.

Picornaviruses (family Picornaviridae). General characteristics and classification of the family. Division into genera.

Genus of enteroviruses (Enterovirus). Classification: polio viruses, Coxsackie, ECHO, enteroviruses 68 - 72nd types. Characteristics of virions. Antigens. Cultivation. Pathogenicity to animals. Sensitivity to physical and chemical factors. The value of genetic heterogeneity of enterovirus populations in the development of the disease.

The role of enteroviruses in human pathology. Pathogenesis of polio and other enterovirus infections. Immunity. Specific prevention and therapy. The problem of polio eradication worldwide.

Laboratory diagnosis of enterovirus infections.

Genus of rhinoviruses (Rinovirus). General characteristics. Classification. Pathogenesis of rhinovirus infection. Laboratory diagnostics.

Genus Aphtovirus (Aphtovirus). Foot-and-mouth disease viruses. Biological properties. Classification. Pathogenesis of infection in humans. Laboratory diagnostics, specific prevention.

Genus of cardioviruses (Cardiovirus). General characteristics. Role in human pathology.

Rhabdoviruses (family Rabdoviridae). General characteristics and classification. Genus Lyssavirus. Rabies virus. The structure of the virion. Cultivation. Sensitivity to physical and chemical factors. Pathogenicity to humans and animals. Pathogenetic features of the disease. Intracellular inclusions (Babes-Negri bodies). Laboratory diagnostics. Specific prevention

Ecological group of arboviruses. Ecological community of arboviruses.

Flaviviruses (family Flavivivridae), bunyaviruses (family Bunyaviridae), filoviruses (family Filoviridae), togaviruses (family Togaviridae, genus Alfavirus) General characteristics. Classification. Antigens. Cultivation. Sensitivity to physical and chemical factors. The main representatives of pathogenic human flaviviruses are tick-borne encephalitis viruses, yellow fever, dengue fever, Japanese encephalitis, Omsk hemorrhagic fever. Features of pathogenesis. Natural focus.

Tick-borne encephalitis virus. Biological properties, ecological variants of the pathogen. Distribution in nature. The mechanism of transmission of the pathogen to humans. Pathogenesis and immunogenesis of the disease. The role of domestic scientists in the study of flavivirus infections (LO Zilber, MP Chumakov, AK Shubladze, EN Levkovich, etc.).

Laboratory diagnosis of flavivirus infections. Specific prevention and treatment.

Pathogens of viral hepatitis.

Hepatitis A virus (family Picornaviridae), features. Approaches to specific prevention of hepatitis A. Laboratory diagnosis of hepatitis A.

Hepatitis B virus (family Hepadnaviridae). History of study. The structure of the virion. Antigens: HBs is the surface antigen of Dane particles. Internal antigens: HBc, HBe, their characteristics. Sensitivity to physical and chemical factors. Features of the pathogenesis of the

disease. Persistence. Immunity. Microbiological diagnosis, detection methods and diagnostic value of markers of hepatitis B (antigens, antibodies, nucleic acids). Specific prevention and treatment.

Other pathogens of hepatitis: C, D, E, G, TTV, SENV, their taxonomic position, properties, role in human pathology, methods of laboratory diagnosis.

Retroviruses (family Retroviridae) General characteristics. Classification. Representatives of the subfamilies Oncovirinae, Lentivirinae. Human immunodeficiency virus (HIV). Morphology and chemical composition. Features of the genome. Variability, its mechanisms. Types of HIV. Origin and evolution. Cultivation, stages of interaction with sensitive cells. Sensitivity to physical and chemical factors.

Pathogenesis of HIV infection. Target cells in the human body, characteristics of surface receptors. The mechanism of immunodeficiency development. AIDS-associated pathology (opportunistic infections and tumors). Laboratory diagnostics. Chain polymerase reaction in the diagnosis of HIV infection and Western blot (immunoblot) - test. Treatment (etiotropic, immunomodulatory, immunomodulatory agents). Prospects for specific prevention.

Topic 33. DNA genomic viruses.

Adenoviruses (family Adenoviridae). General characteristics and classification. Human adenoviruses. The structure of the virion. Antigens, their localization and specificity. Cultivation. Sensitivity to physical and chemical factors. Hemagglutinating activity. Pathogenesis of diseases. Persistence. Oncogenic serotypes of adenoviruses. Intestinal adenoviruses. Laboratory diagnosis of adenoviral infections. Specific prevention and treatment.

Herpesviruses (family Herpesviridae). General characteristics and classification. The structure of the virion. Antigens. Cultivation. Sensitivity to physical and chemical factors.

Herpes viruses pathogenic to humans: b - herpesvirus of ordinary or simple herpes of the 1st and 2nd types, b - herpesvirus of chickenpox - shingles; in - cytomegalovirus herpesvirus (CMV); g - Epstein-Barr herpesvirus (EB) - the causative agent infectious mononucleosis, human cancer. Human herpes viruses of 6, 7, 8 types. Biological properties. Role in pathology. The mechanism of persistence of herpes viruses. Laboratory diagnosis, specific prevention and treatment of herpes infections.

Poxviruses (family Poxviridae). Genus Orthopoxvirus. General characteristics and classification. Viruses of human smallpox, monkeys, cows, smallpox vaccine, ectromelia. The structure of the virion. Antigens. Cultivation. Sensitivity to chemical and physical factors. Hemagglutination, its mechanism. Pathogenetic features of the disease. Laboratory diagnostics. Intracellular inclusions (Guarnier bodies). Specific prevention of smallpox. Global eradication of smallpox. Genus Parapoxvirus. Molluscum contagious virus. Pathogenesis of infection. Laboratory diagnostics. Papilloma and polyomaviruses (families Papillomaviridae and Roluomaviridae). General characteristics and classification. Morphology of viruses. Human papilloma and polyoma viruses. Pathogenesis of diseases caused by these viruses. Oncogenicity. Laboratory diagnostics. Parvovirus (family Parvovoridae). General characteristics and classification. The structure of the virion. Antigens. Cultivation. Sensitivity to physical and chemical factors. B19 virus, its importance in human pathology. Adeno-associated viruses, their properties, use in genetic engineering.

Topic 34. Oncogenic viruses.

History of the development of ideas about the role of viruses in carcinogenesis. Signs of a transformed cell. Mechanisms of transforming action of oncogenic viruses. The concept of "oncogene". Theories of the origin of oncogenes. Viral-genetic theory of tumors by LO Zilber.

Oncogenic DNA-containing viruses from the family of papovaviruses, herpesviruses, etc. General characteristics, participation in viral carcinogenesis in humans.

Oncogenic RNA-containing viruses from the retrovirus family are members of the subfamily Oncovirinae. Morphology, classification. Role in human carcinogenesis. Oncogenic viruses of other taxonomic groups (members of the families Adenoviridae, Poxviridae, Hepadnaviridae, etc.). General characteristics. Endogenous retroviruses.

Topic 35. Prions.

Prions. Properties. Prion diseases of animals (scrapie, spongiform encephalopathy of cows) and humans (chicken, Creutzfeldt-Jakob disease, etc.). Physico-chemical properties. Mechanism of in vivo replication. Pathogenesis of prion diseases. Methods of postmorbid and lifelong diagnosis.

The structure of the discipline

Topic	Lecture	Practical classes	individual	
BLOCK 1. GENERAL MICROBIOLOGY, IMMUNOLOGY AND VIRUSOLOGY				
Section 1. MORPHOLOGY AND PHYSIOLOGY OF MICROORGANISMS				
1. Subject and tasks of microbiology. Methods of microbiological research. The main stages of development of microbiology.	1	-	1	
2. Evolution of microorganisms. Systematics, classification and nomenclature of microorganisms.	1	-	1	
3. Organization of a bacteriological laboratory. Dyes and methods of staining of microorganisms. Microscopy.	1	4	1	
4. Morphology and structure of bacteria and fungi.	3	8	2	
5. Bacterial metabolism. Nutrient media for the cultivation of microorganisms.	1	4	2	
6. Growth and reproduction of microorganisms. Isolation and identification of pure cultures of bacteria.	1	4	2	
7. Morphology and physiology of viruses. Cultivation of viruses.	2	2	1	
Workshop on section 1	-	2	2	
Section 2. GENETICS AND ECOLOGY OF MICROORGANISMS				
8. Genetics of microorganisms.	2	-	1	
9. Antiseptics and asepsis. Methods and tools.	-	4	1	
10. Chemotherapeutic drugs. Antibiotics.	-	4	2	
11. The microflora of the human body	1	4	1	
12. Fundamentals of sanitary microbiology. Sanitary microbiology of water, soil and air. Sanitary virology.	1	8	1,5	
Workshop on section 2	-	2	2	
Section 3. INFECTION AND IMMUNITY				
13. Infectious process, its types, conditions of origin and development.	2	-	2	
14. Organs of the immune system. Factors of nonspecific protection of the organism against pathogenic microorganisms.	1	4	2	
15. Characteristics of antigens.	1	-	1	
16. Antibodies as a product of the humoral immune response.	1	-	1	
17. Serological reactions.	1	4	1	

18. Immunopathology. Assessment of the immune status of the organism.	0,5	4	2	
Workshop on section 3	-	2	2	
FINAL TEST WORK BY BLOCK 1	-	1	5	
Total hours - 120. ECTS credits – 4	**20,5**	**63**	**36,5**	
BLOCK 2. SPECIAL MICROBIOLOGY AND VIROLOGY				
SECTION 4. PATHOGENIC PROKARYOTES				
19. PATHOGENIC COCCI	2	4	1	
20. ENTEROBACTERIACEAE (FAMILY ENTEROBACTERIACEAE)	2	2	2	
21. GRAM-NEGATIVE NON-FERMENTING BACTERIA.	-	-	2	
22. VIBRIOS. HELICOBACTERIA	-	2	1	
23. CORYNEBACTERIA. BROTHELS. MYCOBACTERIA	2	4	1	
24. PATHOGENS OF ANAEROBIC INFECTIONS	-	2	1	
25. RICKETTSIA, CHLAMYDIA, MYCOPLASMA	-	-	2	
26. SPIROCHETES AND SPIRALS	2	2	1	
27. PATHOGENS OF ZOONOTIC INFECTIONS	-	-	2	
WORKSHOP ON SECTION 4	-	2	2	
SECTION 5. PATHOGENIC EUKARYOTES. FUNDAMENTALS OF CLINICAL MICROBIOLOGY				
28. PATHOGENIC FUNGI	-	-	2	
29. PATHOGENIC PROTOZOA	-	-	2	
30. GENERAL CHARACTERISTICS OF CLINICAL MICROBIOLOGY. OPPORTUNISTIC INFECTIONS	-	1	1	
31. NOSOCOMIAL INFECTIONS	-	1	1	
WORKSHOP ON SECTION 5	-	2	2	
SECTION 6. SPECIAL VIRUSOLOGY				
32. RNA GENOMIC VIRUSES	-	2	2	
33. DNA GENOMIC VIRUSES	-	2	2	
34. ONCOGENIC VIRUSES	-	-	2	
35. PRIONS	-	-	1	
WORKSHOP ON SECTION 6	-	2	2	
FINAL TEST WORK ON BLOCK 2	-	2	5	
TOTAL HOURS - 75 ECTS CREDITS - 2.5	**8**	**30**	**37**	

4. The content of the discipline

4.1. Lecture plan

BLOCK 1

№ z.p.	TOPIC	Quantity hours
1.	Topic 1. Introduction to microbiology. 1. Microbiology as a science. 2. Systematics of microorganisms. 3. Stages of development of microbiology. 4. Methods of microscopic examinations.	**2**
2.	Topic 2. Morphology of bacteria 1. The shape and location of bacterial cells. 2. The structure of the bacterial cell. 3 Cell wall structure and Gram stain. 4. Spore formation.	**2**
3.	Topic 3. Physiology of microorganisms 1. General idea of bacterial metabolism. 2. Energy and plastic metabolism. 3. Growth and reproduction of bacteria	**2**
4.	Topic 4. Morphology, physiology and classification of fungi 1. The structure and features of the physiology of fungi. 2. Classification of the kingdom of Fungi and the place of pathogenic micromycetes in it. 3. Pathogens of fungal infections	**2**
5.	Topic 5. Morphology and physiology of viruses 1. The structure of viruses 2. Reproduction of viruses 3. Culture of viruses 4. Bacteriophages	**2**
6.	6. Topic 6. Genetics of microorganisms 1. Genetic material of bacteria. 2. Mutations and DNA repair of bacteria. 3. Transfer of genetic material. 4. Genetics of viruses. 2	**2**
7.	Topic 7. Ecology of microorganisms 1. Types of relationships of microorganisms in biocenoses 2. Microflora of soil, water, air. 3. The role of microorganisms in the processes of the cycle of substances. 4. Normal human microflora	**2**
8.	Topic 8. The doctrine of infection. 1. Pathogenicity of microorganisms. Pathogenicity factors. 2. Infectious process. 3. Epidemiology of the infectious process	**2**
9.	Topic 9. The doctrine of immunity	**4,5**

	1. Types of immunity. Factors of protection of an organism. 2. Antigens and antibodies. 3. Immunological methods for diagnosing infectious diseases 4. Immune system. Immune response 5. Immunoprophylaxis and immunotherapy of infectious diseases	
TOTAL		**20,5**

BLOCK 2

№ Z.P.	TOPIC	QUANTITY HOURS
1.	Topic 10. Pathogenic cocci. 1. General characteristics of the families Micrococcaceae, Streptococcaceae, Neisseriaceae. 2. Staphylococci (Staphyllococcus). 3. Streptococcus. 4. Neisseria	**2**
2.	Topic 11. Pathogens of bacterial intestinal infections. 1. General characteristics of pathogens of intestinal infections. 2. Microbiology of Escherichia coli. 3. Microbiology of shigellosis. 4. Microbiology of salmonellosis (typhoid fever, paratyphoid fever A, B, salmonellosis toxin infections). 5. Microbiology of cholera (Vibrionaceae)	**2**
3.	Topic 12. Pathogens of diphtheria, tuberculosis, pertussis. 1. Pathogenic corynebacteria. Diphtheria. 2. Brothels. Whooping cough. Parakashlyuk. 3. Pathogenic mycobacteria. Tuberculosis	**2**
4.	Topic. 13. Pathogenic spirochetes. 1. General characteristics of pathogenic spirochetes 2. Pathogens of borreliosis. Typhoid fever. 3. Ixodes tick-borne borreliosis (Lyme disease) 4. The causative agent of leptospirosis. 5. The causative agent of syphilis	**2**
Total		**8**

4.2. Plan of practical classes
BLOCK 1

№ z.p.	TOPIC	Quantity hours
1.	Topic 1. Organization of a bacteriological laboratory. Microscopy. For a lesson plan, see under the table note. *	2
	Dyes and simple methods of painting.	2
2.	Topic 2. Morphology and structure of bacteria.	2
	Staining of bacteria by the Gram method.	2
3.	Topic 3. Morphology and structure of spirochetes, actinomycetes, fungi.	2

	Sophisticated painting methods.	2
4.	Topic 4. Physiology of microorganisms.	2
	Isolation of pure cultures of aerobic and anaerobic bacteria.	2
5.	Topic 5. Identification of pure cultures of microorganisms.	2
	Features of cultivation of rickettsiae, chlamydia, spirochetes.	2
6.	Topic 6. Morphology and physiology of viruses. Bacteriophages.	2
	Cultivation and indication of viruses.	2
7.	Seminar № 1 "Morphology and physiology of microorganisms".	2
8.	Topic 7. Microbiological basis of sterilization and disinfection.	2
	The concept of asepsis and antiseptics.	2
9.	Topic 8. Chemotherapeutic drugs.	2
	Antibiotics.	2
10.	Topic 9. Normal microflora of the human body.	2
	Dysbacteriosis. Probiotics.	2
11.	Topic 10. Sanitary microbiology of water and air. Sanitary virology.	2
	Isolation and identification of indoor air microorganisms.	2
12.	Topic 11. Soil microflora.	2
	Isolation and identification of soil microorganisms.	2
13.	Seminar №2. "Ecology of microorganisms".	2
14.	Topic 12. Factors of non-specific protection of the organism from microorganisms.	2
	Humoral factors of nonspecific protection.	2
15.	Topic 13. Serological reactions.	2
	Serological identification and diagnosis.	2
16.	Topic 14. Immune status of the organism.	2
	Vaccines and immune sera.	2
17.	Seminar №3. "Infection and immunity. Immunopathology".	2
18.	FINAL TEST WORK ON THE BLOCK 1	1
Total		**63**

BLOCK 2

№ Z.P.	TOPIC	QUANTITY HOURS
1.	Topic 15. Pathogenic cocci. Staphylococci and streptococci. Microbiological diagnosis of diseases caused by staphylococci and streptococci.	2
	Meningococci and gonococci. Microbiological diagnosis of diseases caused by meningococci and gonococci	2
2.	Topic 16. Escherichia. Microbiological diagnosis of Escherichia coli diseases. Shigella. Microbiological diagnosis of dysentery. Salmonella. Microbiological diagnosis of typhoid-paratyphoid diseases and salmonellosis gastroenteritis	2
3.	Topic 17. Microbiological diagnosis of food poisoning and intoxication. Vibrios. Microbiological diagnosis of cholera. Helicobacter pylori. Microbiological diagnosis of Helicobacter pylori	2

4.	Topic 18. Corynebacteria. Microbiological diagnosis of diphtheria. Brothels. Microbiological diagnosis of pertussis	2
5.	Topic 19. Mycobacteria. Microbiological diagnosis of tuberculosis and mycobacteriosis	2
6.	Topic 20. Pathogens of anaerobic infections. Microbiological diagnosis of gas gangrene, tetanus, botulism	2
7.	Topic 21. Spirochetes. Microbiological diagnosis of syphilis, leptospirosis, typhoid fever, Lyme disease	2
8.	Seminar №4. Pathogens of bacterial infections	2
9.	Topic 22. Clinical microbiology. Pathogens of opportunistic infections	2
10.	Seminar №5. Pathogenic fungi and actinomycetes. Pathogenic protozoa	2
11.	Topic 23. Orthomyxoviruses. Laboratory diagnosis of influenza. Paramyxoviruses. Laboratory diagnosis of measles	2
12.	Topic 24. Picornaviruses. Laboratory diagnosis of enterovirus infection. Rhabdoviruses. Laboratory diagnosis of rabies	2
13.	Seminar №6. Pathogens of viral infections	2
14.	FINAL TEST WORK ON BLOCK 2	2
TOTAL		**30**

Note. * - Plan of each practical lesson:

1) Written solution of test problems "Step-1" on the topic.

2) Group work on errors, knowledge assessment.

3) Execution of practical tasks according to methodical recommendations for practical classes.

4) Consolidation of practical skills, summarizing the lesson.

4.3. Tasks for independent work

№ z.p.	**TOPIC**	**Number of hours**
BLOCK 1: GENERAL MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY		
1.	Preparation for practical classes (theoretical training, development of practical skills)	**14**
2.	Passing on-line testing	**5,5**
3.	Independent elaboration of topics that are not included in the classroom plan Block 1 (list attached)	**6**
4.	Preparation for seminars	**6**
5.	Preparation for the final test	**5**
Total		**36,5**
BLOCK 2: SPECIAL MICROBIOLOGY AND VIROLOGY		
1.	Preparation for practical classes (theoretical training, development of practical skills)	**10**
2.	Passing on-line testing	**5**
3.	Independent elaboration of topics that are not included in the lesson plan Block 2 (list attached)	**11**
4.	Preparation for seminars	**6**
5.	Preparation for the final test	**5**

TOTAL	37

BLOCK 1

1) History of microbiology. Modern directions of microbiology, topical issues of modern microbiology.
2) Principles of classification of microorganisms.
3) The structure of the cell of fungi. The main forms of mushrooms. Mechanisms of reproduction of fungi.
4) Features of metabolism and energy in bacteria. Bacterial enzymes and their classification. Nutrient media for the cultivation of microorganisms. Bacteriological (cultural) method in the diagnosis of infectious diseases.
5) The mechanism of action on microbes of physical and chemical factors. The concept of sterilization, asepsis, antiseptics and disinfection.
6) Preservation and transmission of hereditary traits in bacteria. The genetic apparatus of the prokaryotic cell.
7) Properties of chemotherapeutic drugs. Classification of antibiotics. Microbiological bases of rational antibiotic therapy.
8) Forms of the infectious process. Pathogenicity and virulence of bacteria. Factors of non-specific protection.
9) Building an immune system. Classes of immunoglobulins. Properties of antigens. Immune response.
10) Classification of vaccines. Therapeutic and prophylactic serums.
11) The immune status of the organism. Indicators of the state of the immune system.
12) Structural organization of viruses. Reproduction of viruses. Methods of cultivation, indication and identification of viruses.
13) Sanitary-indicative microorganisms, requirements for them, their importance for the characterization of environmental objects. Sanitary and microbiological control of water, soil, air.

BLOCK 2

1) Reoviruses (family Reoviridae). Genus of rotavirus (Rotavirus). Classification, properties. Role in human pathology. Laboratory diagnostics.

2) Arenaviruses (family Arenaviridae). General characteristics and classification. The main representatives that cause disease in humans: lymphocytic choriomeningitis viruses, Lassa, Hunin, Machupo.

3) Genus Vesiculovirus. Vesicular stomatitis virus, its role in human pathology, diagnosis.

4) Caliciviruses (family Caliciviridae). General characteristics. Role in human pathology. Laboratory diagnostics.

5) Togaviruses (family Togaviridae). Genus of rubiviruses (Rubivirus). Rubella virus. Role in human pathology. Laboratory diagnostics. Specific prevention.

6) Poxviruses (family Poxviridae). Genus Orthopoxvirus. General characteristics and classification. Viruses of human smallpox, monkeys, cows, smallpox vaccine, ectromelia.

7) Genus Parapoxvirus. Molluscum contagious virus. Papilloma and polyomaviruses (families Papillomaviridae and Roluomaviridae). Pathogenesis of diseases caused by these viruses. Oncogenicity. Laboratory diagnostics.

8) Parvovirus (family Parvovoridae). B19 virus, its importance in human pathology. Adeno-associated viruses, their properties, use in genetic engineering.

9) Flaviviruses (family Flavivivridae), bunyaviruses (family Bunyaviridae), filoviruses (family Filoviridae). The role of domestic scientists in the study of flavivirus infections (LO Zilber, MP Chumakov, AK Shubladze, EN Levkovich, etc.). Laboratory diagnosis of flavivirus infections. Specific prevention and treatment.

10) History of ideas about the role of viruses in carcinogenesis. Signs of a transformed cell. Mechanisms of transforming action of oncogenic viruses. The concept of "oncogene". Theories of the origin of oncogenes. Viral-genetic theory of tumors by LO Zilber.

11) Oncogenic DNA-containing viruses from the family of papovaviruses, herpesviruses. General characteristics, participation in viral carcinogenesis in humans.

12) Oncogenic RNA-containing viruses from the family of retroviruses - members of the subfamily Oncovirinae. Role in human carcinogenesis.

Questions for seminars

Questions for seminar 1 (4 semester)

"Morphology and physiology of microorganisms"

1. The place of microorganisms in the system of the organic world. Classification of prokaryotes by D. Bergi.
2. Comparative characteristics of prokaryotic and eukaryotic cells.
3. The structure of the bacterial cell.
4. Cytoplasmic membrane and mesosomes. Plasmolysis. Deplasmolysis.
5. Features of the structure of the cell wall of bacteria.
6. Morphology of bacteria.
7. Morphological features of spirochetes, rickettsiae, chlamydia and mycoplasmas.
8. The chemical composition of the bacterial cell.
9. Classification of bacteria by types of food and methods of obtaining energy
10. Classification of bacteria by types of respiration.
11. Bacterial enzymes and their classification.
12. Types of nutrient media. Requirements for artificial environments.
13. Growth and reproduction of microorganisms.
14. Colonies of microorganisms. Isolation of pure cultures of anaerobic bacteria.
15. Identification of pure cultures of microorganisms.

Questions for seminar 2 (4 semester)

"Ecology of microorganisms"

1. The spread of microorganisms in nature.
2. Types of relationships of microorganisms in biocenoses.
3. Soil microflora.
4. Microflora of water.
5. Air microphore.
6. The role of microorganisms in the carbon cycle.
7. The role of microorganisms in the nitrogen cycle.
8. The role of microorganisms in the sulfur cycle.
9. Microorganisms of the human oral cavity.
10. Microorganisms of the human gastrointestinal tract.
11. Microorganisms of human skin.
12. Microorganisms of the human respiratory system.
13. The role of normal human microflora.
14. Eubiosis and dysbiosis.
15. The influence of physical environmental factors on microorganisms.
16. The influence of chemical environmental factors on microorganisms.

Questions for seminar 3 (4 semester)

"The doctrine of infection. The doctrine of immunity "

1. Pathogenicity of microorganisms. Pathogenicity factors.
2. Infectious process.
3. Epidemiology of the infectious process.
4. The concept of immunity. Types of immunity.

5. Factors of non-specific protection of the organism.
6. Cellular factors of nonspecific protection.
7. Phagocytosis.
8. Humoral factors of nonspecific protection.
9. Interferons.
10. Antigens as inducers of the immune response.
11. Structure and functions of antibodies (immunoglobulins).
12. The body's immune response.
13. Serological reactions. Serological identification and serological diagnosis.
14. Reactions based on the phenomenon of agglutination.
15. Reactions based on the phenomenon of precipitation.
16. Immune lysis reactions (bacteriolysis, spirochetolysis, hemolysis). Complement binding reaction.

Questions for seminar 4 (5 semester)

1. Classification of bacterial infections. Pathogens of bacterial infections.
2. Comparative characteristics of morphological features of bacteria that cause bacterial infections.
3. Comparative characteristics of tinctorial properties of bacteria causing bacterial infections.
4. Cultural properties of bacteria causing bacterial infections. Elective, selective and differential diagnostic media.
5. Methods of rapid diagnosis of bacterial infections. Direct and indirect RIF. PCR.
6. Methods of serodiagnosis of bacterial infections. Agglutination reaction, its mechanism. Vidal's reaction. Wright's reaction.
7. Precipitation reaction, its mechanism. Ascoli precipitation reaction. Ouchterlon double diffusion reaction.
8. RZK, its mechanism. Wasserman's reaction.
9. RNGA, its mechanism.
10. Allergy test method in the diagnosis of bacterial infections.
11. Pathogenic factors of Vibrio cholerae. Pathogenesis of cholera.
12. Particularly dangerous infections. Plague.
13. Anthrax.
14. Tularemia.
15. Brucellosis.
16. Prevention of bacterial infections. Vaccines.
17. Treatment of bacterial infections. Serums and immunoglobulins.

Questions for seminar 5 (5 semester)

1. Superficial mycoses. Keratomycosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.
2. Dermatomycoses. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.
3. Subcutaneous mycoses. Sporotrichosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.
4. Chromoblastomycosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.
5. Deep mycoses. Histoplasmosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.
6. Cryptococcosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

7. Blastomycosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

8. Coccidioidomycosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

9. Paracoccidioidomycosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

10. Opportunistic mycoses. Candidiasis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

11. Aspergillosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

12. Pathogens of protozoal infections. Spores. Malaria. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

13. Toxoplasmosis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

14. Sarcoids. Amoebic dysentery. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

15. Juticonos. Trichomoniasis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

16. Giardiasis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

18. Leishmaniasis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment ..

19. Trypanosomiasis. Characteristics of pathogens, pathogenesis, microbiological diagnosis, prevention and treatment.

Questions for seminar 6 (5 semester)

"Viruses"

1. Viruses, the structure of the virion. Classification of viruses. Features of viral infections.

2. Reproduction of viruses. Methods of culturing viruses.

3. Orthomyxoviruses. Influenza virus and flu.

4. Paramyxoviruses. Parainfluenza viruses and their role in the occurrence of acute respiratory diseases.

5. Paramyxoviruses. Mumps and its causative agent.

6. Paramyxoviruses. Measles and its causative agent.

7. Reoviruses. Rotavirus infection.

8. Adenoviruses. Adenovirus infection.

9. Picornaviruses. Poliomyelitis and its pathogens.

10. Rhabdoviruses. Rabies and its causative agents.

11. Flaviviruses. Tick-borne encephalitis.

12. Pathogens of viral hepatitis.

13. Retroviruses. HIV infection (AIDS) and its causative agent. HIV-associated infections.

14. Coronaviruses and their role in the occurrence of acute respiratory diseases.

14. Bacterial viruses - bacteriophages, their biological characteristics, scientific and practical significance and use.

15. The concept of prions. Slow infections - prionosis.

Typical test problems to be solved in practical classes

1. A child with a diagnosis of "staphylococcal sepsis" was admitted to the hospital. On

what nutrient medium should the patient's blood be sown in order to isolate the pathogen?

A. Sugar-peptone broth
B. Meat-peptone agar
C. Ploskirev environment
D. Buchin's environment
E. Bile-salt agar

2. A smear of plaque on the tonsils of a patient with suspected diphtheria revealed blue sticks with thickenings on the poles. What method of staining was used?

A. Leffler
B. Burry
C. Gins
D. Gram
E. Neisser

3. In a patient with signs of colitis, a pure culture of bacteria was isolated, which according to morphological, cultural and biochemical properties belongs to the genus Shigella. Which of these reactions should be used for serological identification of the culture?

A. Agglutination with diagnostic sera
B. Complement binding
C. Indirect hemagglutination
D. Precipitation
E. Hemagglutination delays

4. A 20-year-old patient was diagnosed with AIDS. Which cell populations are most susceptible to human immunodeficiency virus?

A. T-helpers
B. Hepatocytes
C. Endotheliocytes
D. Epitheliocytes
E. B-lymphocytes

5. A 10-year-old boy is in hospital with a suspected food poisoning. When sowing the patient's feces on the environment of Endo, a large number of colorless colonies grew. Which microorganism can be most likely excluded from the number of possible pathogens?

A. Escherichia coli
B. Salmonella enteritidis
C. Proteus vulgaris
D. Pseudomonas aeruginosa
E. Yersinia enterocolitica

4.4. Ensuring the educational process

1. Multimedia projectors, computers, screens for multimedia presentations, lecture presentations.

2. Demonstration screens, laptops, files in Power Point and Word with tasks "Step-1" for practical and final classes.

3. Exam tickets.

4. Final control

List of questions before the test

1. The place of microorganisms in the system of the organic world. Classification of prokaryotes by D. Bergi.
2. Comparative characteristics of prokaryotic and eukaryotic cells.

3. The structure of the bacterial cell: a brief description of the required structures.
4. The structure of the bacterial cell: a brief description of the optional structures.
5. Cytoplasmic membrane and mesosomes. Plasmolysis. Deplasmolysis.
6. Features of the structure of the cell wall of bacteria.
7. Morphology of bacteria.
8. Morphological features of spirochetes, rickettsiae, chlamydia and mycoplasmas.
9. The chemical composition of the bacterial cell.
10. Classification of bacteria by types of food and methods of energy production
11. Classification of bacteria by types of respiration.
12. Bacterial enzymes and their classification.
13. Types of nutrient media. Requirements for artificial environments.
14. Growth and reproduction of microorganisms.
15. Colonies of microorganisms. Isolation of pure cultures of anaerobic bacteria.
16. Identification of pure cultures of microorganisms.
17. Simple methods of painting.
18. Complex methods of painting.
19. Microscopy in the immersion system.
20. General idea of bacterial metabolism.
21. Energy metabolism of bacteria.
22. Plastic metabolism of bacteria.
23. Growth and reproduction of bacteria.
24. The structure of fungi.
25. Growth and reproduction of fungi.
26. Classification of the kingdom of Fungi and the place of pathogenic micromycetes in it.
27. Structure and activity of pathogenic protozoa.
28. The structure of viruses
29. Reproduction of viruses
30. Cultivation of viruses
31. Bacteriophages
32. Genetic material of bacteria.
33. Mutations and DNA repair of bacteria.
34. Transfer of genetic material.
35. Genetics of viruses.
36. Types of relationships between microorganisms in biocenoses.
37. Soil microflora.
38. Water microflora.
39. Air microphore.
40. The role of microorganisms in the processes of the carbon cycle.
41. The role of microorganisms in the nitrogen cycle.
42. Microorganisms of the human oral cavity.
43. Microorganisms of the human gastrointestinal tract.
44. Microorganisms of human skin.
45. Microorganisms of the human respiratory system.
46. Eubiosis and dysbiosis.
47. The influence of physical environmental factors on microorganisms.
48. Influence of chemical environmental factors on microorganisms.
49. Antiseptics and asepsis. Methods and tools.
50. Chemotherapeutic drugs. Antibiotics.
51. Infectious process, its types, conditions of origin and development.
52. Factors of nonspecific protection of the organism from pathogenic microorganisms.
53. Phagocytosis.

54. The structure of the immune system.
55. Characteristics of antigens.
56. Antibodies as a product of the humoral immune response.
57. Immune response reactions. Principles of using antibodies as treatment-and-prophylactic and diagnostic drugs.
58. Serological reactions used in virology.
59. Principles of using microbial antigens as prophylactic and diagnostic drugs.
60. Immunopathology. Assessment of the immune status of the organism.

List of questions for the exam

1. Classification of bacterial infections. Pathogens of bacterial infections.
2. Comparative characteristics of morphological features of bacteria causing pathogens.
3. Comparative characteristics of tinctorial properties of bacteria causing pathogens. Differential-diagnostic value of tinctorial properties.
4. Cultural properties of bacteria causing pathogens. Elective, selective and differential diagnostic environments.
5. Staphylococci. Staphylococcal infections.
6. Streptococcus. Streptococcal infections.
7. Meningococci. Meningococcal infection.
8. Gonococci. Gonococcal infection.
9. Escherichia. Escherichia coli.
10. Salmonella. Salmonellosis (typhoid fever, paratyphoid fever).
11. Shigella. Shigellosis.
12. Pathogenic yersinia, their role in human pathology.
13. Klebsiella and the diseases they cause.
14. Pseudomonas (Pseudomonas aeruginosa), its role in human pathology.
15. Vibrio cholerae. Cholera is a particularly dangerous infection.
16. Helicobacter pylori. Helicobacter pylori, its role in human pathology.
17. Pathogenic corynebacteria. Diphtheria.
18. Brothels. Bordetellosis (pertussis and pertussis).
19. Pathogenic mycobacteria. The causative agent of tuberculosis. Tuberculosis.
20. Pathogenic mycobacteria. The causative agent of leprosy.
21. Pathogenic clostridia. Pathogens of gas gangrene.
22. Pathogenic clostridia. The causative agent of tetanus.
23. Pathogenic clostridia. The causative agent of botulism.
24. Pathogenic rickettsiae and epidemic typhus.
25. Pathogenic mycoplasmas and diseases caused by them.
26. Pathogenic chlamydia and chlamydia.
27. Spirochetes, classification, features of microbiological diagnostics.
28. Pathogenic spirochetes. Lyme disease. Epidemic and endemic relapsing typhus.
29. Pathogenic spirochetes. Lyme disease. Lyme disease.
30. Pathogenic spirochetes. Leptospirosis.
31. Pathogenic spirochetes. Syphilis.
32. Pathogens of especially dangerous infections. Plague.
33. Pathogens of especially dangerous infections. Anthrax.
34. Pathogens of especially dangerous infections. Tularemia.
35. Pathogens of especially dangerous infections. Brucellosis.
36. Fungi, classification, pathogenic and opportunistic species. Classification of mycoses. Methods of detecting mycoses.
37. Pathogenic fungi - pathogens of occupational and household mycoses (mucoromycosis, aspergillosis, penicillosis, ergotism, etc.).
38. Conditionally pathogenic fungi - pathogens of candidiasis.

39. Pathogenic fungi - pathogens of superficial dermatomycoses (trichophytia, microsporia, scabies, epidermophytia).
40. Pathogenic fungi - pathogens of deep mycoses (histoplasmosis, cryptococcosis, etc.).
41. Pathogenic protozoa, classification, biological properties, detection methods.
42. Plasmodium falciparum. Malaria.
43. Pathogenic amoebae. Amoebiasis.
44. Leishmania. Leishmaniasis.
45. Toxoplasma. Toxoplasmosis.
46. Trypanosomes. Trypanosomiasis.
47. Trichomonas. Trichomoniasis.
48. Balantidia. Giardia. Their role in human pathology.
49. Viruses. The structure of the virion. Classification of viruses.
50. Reproduction of viruses. Methods of culturing viruses.
51. Orthomyxoviruses. Influenza virus. Flu.
52. Paramyxoviruses. Parainfluenza virus. Parainfluenza.
53. Paramyxoviruses. Mumps virus. Parotitis.
54. Paramyxoviruses. Measles virus. Measles.
55. Reoviruses. Rotavirus infection.
56. Adenoviruses. Adenovirus infection.
57. Rhabdoviruses. Rabies virus. Rabies.
58. Flaviviruses. Tick-borne encephalitis virus. Tick-borne encephalitis.
59. Poxviruses. Smallpox, its causative agent.
60. Herpesviruses. Herpes simplex virus (HSV).
61. Herpesviruses. Chickenpox and shingles viruses.
62. Herpesviruses. Epstein-Barr virus, cytomegalovirus.
63. Coronaviruses. SARS.
64. Togaviruses. Rubella virus.
65. Papovaviruses. Human papillomaviruses.
66. Picornaviruses. Polio virus. Poliomyelitis.
67. Pathogens of viral hepatitis.
68. Retroviruses. HIV infection. AIDS. HIV-associated infections.
69. Bacteriophages, their biological characteristics, scientific and practical significance and use.
70. The concept of prions. Slow infections - prionosis.
71. Agglutination reaction, its essence, technique, application.
72. Hemagglutination reaction, passive hemagglutination, hemagglutination inhibition reaction, their diagnostic value.
73. Hemadsorption reaction, hemadsorption inhibition reaction, their diagnostic value in viral infections.
74. Complement binding reaction, its essence, technique, application.
75. The reaction of precipitation, its essence, technique, application.
76. Neutralization reaction: its essence, technique, application in vitro and in vivo.
77. Immunofluorescence reaction (direct, indirect) as a method of rapid diagnosis of infectious diseases.
78. Enzyme-linked immunosorbent assay, essence, technique, application.
79. Polymerase chain reaction (PCR), essence, technique, application.
80. Biological method for diagnosing infectious diseases.
81. The method of allergy testing in the diagnosis of infectious diseases.
82. Vaccine prophylaxis. Basic principles of vaccine use. Autovaccines, manufacture, quality control, purpose.
83. Chemical vaccines, their types, methods of manufacture.
84. Sorbed vaccines, associated vaccines.

85. Anatoxin, its manufacture, purpose, determination of strength and quality, control.
86. The concept of polyvaccines. Requirements that determine the effectiveness of immunoprophylaxis.
87. Live vaccines, methods of attenuation of vaccine strains and features of their use.
88. Killed vaccines, technique of their production, quality control.
89. Nosocomial infections, their causative agents.
90. Pathogens of opportunistic infections.

"0" version of the exam ticket

Petro Mohyla Black Sea National University
Level of higher education - master
Area of knowledge: 22 Health
Specialty 222 Medicine

Course - MICROBIOLOGY, VIRUSOLOGY AND IMMUNOLOGY
Option № 0

1. Streptococcus. Streptococcal infections. - maximum number of points - 25.
2. Pathogenic protozoa, classification, biological properties, detection methods. - maximum number of points - 25.
3. Complement binding reaction, its essence, technique, application. - maximum number of points - 30.

Approved at the meeting of the Department of "Medical Biology and Chemistry, Biochemistry, Microbiology, Physiology, Pathophysiology and Pharmacology", the protocol № ___ from "__" _____ 2021.

The head of the department is Associate Professor Korolova O.V.
Examiner Associate Professor Korolova O.V.

Example of the final control work on block 1

Solving problems Step-1

1. In a patient with bronchial asthma, skin allergy sensitization of poplar down has been established with the help of skin allergy tests. What factor of the immune system plays a crucial role in the development of this immunopathological condition?
   A. IgE
   B. IgD
   C. IgM
   D. Sensitized T lymphocytes
   E. IgG
2. During the sanitary-bacteriological examination of water by the method of membrane filters, two red colonies were found on the membrane filter (Endo medium), through which 500 ml of the investigated water was passed. Calculate the coli-index and coli-titer of the test water:
   A. 4 and 250
   B. 2 and 500
   C. 250 and 4
   D. 500 and 2
   E. 250 and 2
3. In order to establish the toxigenicity of diphtheria pathogens isolated from patients, cultures were sown on a Petri dish with nutrient agar on both sides of the centrally located strip of filter

paper soaked in diphtheria antitoxic serum. After incubation of the crops in agar between individual cultures and a strip of filter paper, striped areas of turbidity of the medium were detected. What immunological reaction was performed?

A. Gel precipitation reaction
B. Coombs' reaction
C. Agglutination reaction
D. Reaction of ring precipitation
E. Opsonization reaction

4. A patient with complaints of nausea, loose stools with mucus and streaks of blood, fever, weakness was hospitalized in the infectious department of the hospital. The doctor suspected dysentery. Which method of laboratory diagnosis is most appropriate to prescribe to confirm the diagnosis?

A. Bacteriological
B. Serological
C. Mycological
D. Microscopic
E. Protozoological

5. The patient after long-term use of antibiotics developed intestinal dysbiosis. What drugs should be prescribed to restore the normal microflora?

A. Eubiotics (probiotics)
B. Sulfanilamides
C. Interferon
D. Antifungal drugs
E. Nitrofurans

And so 30 problems with the subsequent analysis of typical errors.

An example of the final control work on block 2

Solving problems Step-1

1. Examining a 6-year-old child, the doctor noticed a grayish film on the pharyngeal tonsils, when trying to remove which there was moderate bleeding. Bacterioscopy of smears from the tonsils showed the presence of gram-positive mace-shaped bacteria. What symptoms may a child have in the coming days if no specific treatment is given?

A. Toxic lesions of the heart muscle, liver, kidneys
B. Pulmonary edema
C. Very strong paroxysmal cough
D. Papular rash on the skin
E. Wavy fever

2. In the micropreparation made from the punctate of the patient's regional lymph node, stained according to Romanovsky-Gimza, the doctor found thin microorganisms with 12-14 uniform curls with sharp ends, length 10-13 μm pale pink. What infectious disease pathogen can we talk about in this case?

A. Syphilis
B. Trypanosomiasis
C. Leptospirosis
D. Typhoid fever
E. Leishmaniasis

3. At bacteriological research of washing waters of the patient with food poisoning pure culture of bacteria with such properties was sown: gram-negative mobile stick, on the Endo environment grows in the form of colorless colonies. What kind of disease caused the disease?

A. Salmonella
B. Shigella
C. Iersinia
D. Esherichia

E. Citrobacter

4. The child has whitish spots on the mucous membrane of the cheeks and tongue, resembling boiled milk. Gram-positive oval yeast-like cells were found in the prepared smear preparations. What are these pathogens?

A. Fungi of the genus Candida
B. Staphylococci
C. Diphtheria bacillus
D. Actinomycetes
E. Fusobacteria

5. In a 25-year-old patient, Staphylococcus aureus is sown from numerous skin pustules in association with epidermal staphylococcus. In the analysis of sputum, a pneumocyst of carinia was found, in feces - cryptosporidium, vulgar proteus and fungi of the genus Candida. In what disease does such multiple infections with opportunistic pathogens occur?

A. AIDS
B. Diabetes mellitus
C. Sepsis
D. Dysbacteriosis
E. Drug agranulocytosis

And so 30 problems with the subsequent analysis of typical errors.

6. Evaluation criteria and diagnostic tools for learning outcomes

Control methods

• Survey (testing of theoretical knowledge and practical skills).
• Test control.

Current control. Testing in practical classes of theoretical knowledge and the acquisition of practical skills, as well as the results of independent work of students. Supervised by teachers according to the specific purpose of the curriculum. Assessment of the level of students' preparation is carried out by: interviewing students, solving and analyzing situational tasks and test tasks, interpreting the results of microbiological, virological and immunological research, monitoring the acquisition of practical skills. Current control is carried out on each topic.

Intermediate control. As an intermediate control over the sections, a seminar on the topics of the section is held. According to the list of questions previously provided to students, the obtained theoretical knowledge and practical skills on all studied topics of the section, as well as the results of independent work of students are tested.

The final test is carried out at the end of the study of all topics of the block at the last test of the semester.

The student receives credit in the spring semester on the basis of enrollment in all established forms of work, provided that he scores at least 120 points.

The final control in the autumn semester (exam) is allowed to students who have attended all the lectures, classroom classes, performed full independent work and in the learning process scored the number of points, not less than the minimum - 70 points.

Distribution of points received by students

In the spring semester, within block 1, a positive assessment for the topic (when performing practical tasks, as well as for answering the seminar) can be from 4 to 7 points. A score below 4 points means "unsatisfactory", the lesson is not credited and is subject to practice in the prescribed manner. For the current educational activity (PND) in the spring semester on block 1 the student receives from 70 to 120 points. At the final test on block 1 (RCC 1) the student can get a minimum of 50 points, a maximum of 80 points. The student receives credit in

the spring semester on the basis of enrollment in all established forms of work (minimum score - 120 points; maximum score - 200 points).

In the autumn semester, within block 2, a positive assessment for the topic (when performing practical tasks, as well as for answering the seminar) can be from 3 to 6 points. A score below 3 points means "unsatisfactory", the lesson is not credited and is subject to practice in the prescribed manner. For the current educational activity (PND) in the autumn semester on block 2 the student receives an ox of 40 to 80 points. At the final control work on block 2 (PKR 2) the student receives an ox of 30 to 40 points. At the exam the student has the opportunity to score from 50 to 80 points.

Assessment of student performance

Block 1

Type of activity (task)	**Maximum number of points**
Блок 1	
Topic 1	7
Topic 2	7
Topic 3	7
Topic 4	7
Topic 5	7
Topic 6	7
Seminar	7
Topic 7	7
Topic 8	7
Topic 9	7
Topic 10	7
Topic 11	7
Seminar	7
Topic 12	7
Topic 13	7
Topic 14	7
Seminar	7
Total	*120*
Control work 1	*80*
Tota1 block 1	**200**
Block 2	
Topic 15	6
Topic 16	6
Topic 17	6
Topic 18	6
Topic 19	6
Topic 20	6
Topic 21	6
Seminar	6
Topic 22	6
Seminar	6
Topic 23	6
Topic 24	6
Seminar	6
Total	*80*
Control work 2	*40*

Tota1 block 2	**120**
Exam	**80**
Total	**200**

Criteria for assessing knowledge

Score 6.1-7 points per topic in the spring semester, 5.1-6 points in the fall semester, 71-80 points on the RCC № 1, 38-40 points on the RCC № 2 and 71-80 points on the exam (And for ECTS scale and 5 on the national scale) the student's answer is evaluated if it demonstrates a deep knowledge of all theoretical principles and the ability to apply theoretical material for practical analysis and has no inaccuracies.

Score 5.1-6 points per topic in the spring semester, 4.1-5 points in the autumn semester, 61-70 points on the RCC № 1, 35-37 points on the RCC № 2 and 61-70 points on the exam (B and C on the ECTS scale and 4 on the national scale) the answer is evaluated if it shows knowledge of all theoretical principles, the ability to apply them in practice, but some fundamental inaccuracies are allowed.

Scoring 4-5 points per topic in the spring semester, 3-4 points in the autumn semester, 50-60 points on the RCC № 1, 30-34 points on the RCC № 2 and 50-60 points on the exam (D and E on the ECTS scale and 3 on a national scale) the student's response is assessed provided that he knows the main theoretical principles and can use them in practice.

7. Recommended sources of information

7.1. Basic

Shirobokov VP etc. Medical Microbiology, Virology and Immunology. – Vinnitsa: Nova kniga, 2019. – 744 p.

Apurba Sankar Sastry, Sandhya Bhat K. Essentials of Medical Microbiology. First Edition. – Jaypee Brothers Medical Publishers (P) Ltd, 2016. – 638 p.

7.2. Auxiliary

1. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A., Mietzner T.A. Jawetz, Melnick & Adelberg's Medical Microbiology 26th Edition. - McGrow Hill Medical, 2013. - 864 p.

2. Forbes B.A., Sahm D.E., Weissfeld A.S. Bailey & Scott's Diagnostic Microbiology 12th Edition.- Philadelphia: Mosby Elsevier, 2007. - 983 p.

3. Gladwin M., Trattler W., Mahan C.S. Clinical microbiology made ridiculously simple. Edition 6. – Miami: MedMaster, 2014. – 403 p.

4. Kapoor K. Illustrated Dictionary of Microbiology - New Delhi: Oxford Book Company, 2010. - 299 p.

7.3. Information resources on the Internet

1. TO "Testing Center": [official. site]. - URL: testcentr.org.ua

2. Website of the American Society for Microbiology - http://asm.org.

3. Site of the European Society of Clinical Microbiology and Infectious Diseases (European Society of Clinical Microbiology and Infections Diseases) - http: // www. escmid.org/sites/index.asp.

4. Journal of "Microbiology" - http: // mic. sgmjournals.org/