MINISTRY OF EUCATION AND SCIENCE OF UKRAINE

V.N. KARAZIN KHARKIV NATIONAL UNIVERSITY

SCHOOL OF MEDICINE

Department of general and clinical immunology and allergology

"APPROVED"

Vice-President for Research and Education

_____A.V. Panteleimonov

"___" _____2020year

SYLLABUS

Discipline: «MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY»

Educational qualification	«Master of medicine»
branch of learning	22 «Health care»
specialty	222 «Medicine»
educational program professional qualification: « "Doctor»	
kind of discipline	obligatory discipline

2020 /2021 year of studies

Working program of the discipline «Microbiology, virology and immunology» for applicants for educational qualification "Master of medicine" professional qualification "Doctor" branch of learning 22 "Health care" specialty 222 "Medicine". V.N. Karazin Kharkiv National University, school of medicine «13» 05 2020 year.- 47 p.

Working program of the discipline «Microbiology, virology and immunology» for applicants for educational qualification «Master of medicine» professional qualification «Doctor» branch of learning 22 «Health care» specialty 222 «Medicine» on the school of medicine of V.N. Karazin Kharkiv National University is prepared on the basis of the typical (exemplary) program of the discipline, composed by Government institution «Central methodic department for higher medical education of the Ministry of Healthcare of Ukraine» authorized with the Head of the Government institution «Central methodic department for higher medical education of the Ministry of Healthcare of Ukraine» I. Melnik on the 28th of April 2017, authorized with the Acting Head of the Education and Science department of the Ministry of Healthcare of Ukraine N. Oleksina on the 3rd of May 2017 and approved by the Vice-minister of the Ministry of Healthcare of Ukraine O. Linchevskiy on the3rd of May 2017.

Authors of the working program of the discipline « Microbiology, virology and immunology»:

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Working program was reviewed and approved at a meeting of the Department of general and clinical immunology and allergology of the school of medicine of V.N. Karazin Kharkiv National University, protocol № 10 «04» 05 2020 year.

Head of Department _____ Doctor of Sciences (Medicine), T.I .Liadova

"04" 05 2020 year

Working program was reviewed and approved at a meeting of the Methodical committee of the school of medicine of V.N. Karazin Kharkiv National University, protocol № 9 «06» 05 2020 year.

The program is agreed with the guarantor of the educational (professional / scientific) program (project team leader)

"222 Medicine"

(the name of the educational program)

Guarantor of educational (professional / scientific) program (project team leader) full prof. MD. Nikolenko Ye. Ya.

_____ (Signature)

Nikolenko Ye. Ya. (last name and first name)

Working program was reviewed and approved at a meeting of the Methodical committee of the school of medicine of V.N. Karazin Kharkiv National University, protocol № 9 «06» 05 2020 year.

Head of the Methodical committee_____Candidate of Medicine, Associate Professor,

"06" 05 2020 year

O.L. Govalenkova

I. EXPLANATORY NOTE

Working program of the discipline «Microbiology, virology and immunology» for applicants for educational qualification “Master of medicine” professional qualification “Doctor” branch of learning 22 “Health care” specialty 222 “Medicine” on the school of medicine of V.N. Karazin Kharkiv National University is prepared on the basis of the typical (exemplary) program of the discipline, composed by Government institution “Central methodic department for higher medical education of the Ministry of Healthcare of Ukraine” authorized with the Head of the Government institution “Central methodic department for higher medical education of the Ministry of Healthcare of Ukraine” I. Melnik on the 28th of April 2017, authorized with the Acting Head of the Education and Science department of the Ministry of Healthcare of Ukraine N. Oleksina on the 3rd of May 2017 and approved by the Vice-minister of the Ministry of Healthcare of Ukraine O. Linchevskiy on the 3rd of May 2017.

Working program of the discipline «Microbiology, virology and immunology» is prepared according to the Project of a Standard of the higher medical education of Ukraine of the second (master’s) program branch of learning 22 “Health care” specialty 222 “Medicine” for applicants for educational qualification “Master of medicine”, professional qualification “Doctor”, discussed at the XIII All-Ukrainian research and practical conference with an international participation "Topical issues of quality of medical education" (12-13 of May 2016 year, Ternopil, Ukraine), and an approximate educational plan for applicants for educational qualification “Master of medicine” professional qualification “Doctor” branch of learning 22 “Health care” specialty 222 “Medicine”, approved by the Acting Minister of Healthcare of Ukraine V. Shafranskiy on the 26th of July 2016, taking into account conditions of the Protocol for grading the learning activity of applicants for higher medical education in conditions of an introduction to the European Credit Transfer System (ECTS)of the organization of the educational process, approved by the Ministry of Healthcare of Ukraine on the 15th of April 2014 year; Act of Ukraine “On higher education” № 2443-VIII from the 22nd o may 2018; Statute of the organization of the educational process in V.N. Karazin Kharkiv National University, approved on the meeting of the Academic Board of the University (protocol of the meeting №5 from the 27th of march 2017), and put into action by the order of the President of the University (order № 0202-1/155 from the 21st of April 2017) in the revised version from the 5th of September 2018; educational plan of training for applicants for educational qualification “Master of medicine” professional qualification “Doctor” branch of learning 22 “Health care” specialty 222 “Medicine” on the school of medicine, approved by the Academic Board and put into action by the order of the President of V.N. Karazin Kharkiv National University, Educational and professional program of the higher education training for applicants for educational qualification “Master of medicine” professional qualification “Doctor” branch of learning 22 “Health care” specialty 222 “Medicine” on the school of medicine, approved by the Academic Board of V.N. Karazin Kharkiv National University (protocol № 13 from 31st of October 2016); the Statute of V.N. Karazin Kharkiv National University, approved by the order of the Ministry of Education and Science of Ukraine (order №644 from 13th of June 2018); The codex of values of V.N. Karazin Kharkiv National University and other regulatory acts.

The study of the discipline “Microbiology, virology and immunology” is supposed to go on for 3 semesters (III-V) of the 2 and 3 academic years, general number of hours comprises 255 hours (8,5 credits ECTS), from which 30 hours – lectures, 120 hours – practical lessons, 105 hours – independent work (IW). Distribution of hours allotted for the study of the discipline “Microbiology, virology and immunology” according to the semesters during which its studying takes place is presented in the following table (table. 1).

Table 1.1

Distribution of academic hours allotted for the study of the discipline «Microbiology, virology and immunology» by semesters

Structural sections of the discipline	Number of hours				Credits of ECTS	Year and semester	Type of control
	Lectures	Practical classes	IW	Total			
Module 1 (9 modules)	10	36	14	60	2	2 course, III semester	Final semester control
Module 2 (2 modules)	10	34	61	105	3,5	2 course, IV semester	Final semester control
Module 3 (3 modules)	10	50	30	90	3	3 course, V semester	Examina-tion
TOTAL	**30**	**120**	**105**	**255**	**8,5**		

Notes: 1 credit of ECTS – 30 study hours; teaching load – 58,8%; IW – 41,2%; average weekly load – 4,63 hours a week (including IW); average weekly teaching load – 2,72 hours a week.

1.1. PURPOSE OF TEACHING THE COURSE

The purpose of studying the discipline "Microbiology, Virology and Immunology" - the ultimate goals - are set on the basis of OPP and OKH training of a specialist in accordance with the block of its content module (scientific training) and is the basis for building the content of the discipline. The description of goals is formulated through skills in the form of target tasks (actions). On the basis of the ultimate goals for each module or content module, specific goals are formulated in the form of certain skills (actions), target tasks that ensure the achievement of the ultimate goal of the discipline. Thus, the ultimate goals of studying the discipline are the ability of applicants:

- ✓ interpret the biological properties of pathogenic and non-pathogenic microorganisms and viruses and the patterns of their interaction with the human macroorganism and with the human population and the environment;
- ✓ determine methods of microbiological and virological diagnostics, etiotropic therapy and specific prevention of infectious diseases;
- ✓ explain the structure of the immune system of the human body;
- ✓ to interpret the main mechanisms of formation of the immune response of the human body;
- ✓ to determine the main types of pathological reactions of the human immune system and their connection with the occurrence of the most common diseases.

1.2. MAIN TASKS OF STUDYING THE DISCIPLINE

The discipline «Microbiology, Virology and Immunology» as a discipline is the science of the origin, evolution and properties of pathogenic microorganisms, normal microflora of the human body, patterns of interaction of microorganisms with macroorganisms, immune system and mechanisms against infectious immunity, diagnostic methods, principles specific prevention of infectious diseases. "Microbiology, virology and immunology" as a discipline:

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

b) lays the foundations for the study of general hygiene, epidemiology, pathological physiology, pathological anatomy, immunology and allergology, infectious diseases, internal medicine, surgical diseases and pediatrics and other clinical disciplines, which involves the integration of teaching with

these disciplines and knowledge skills in microbiology, virology and immunology in the process of further education and in professional activities;

c) lays the foundations of the doctrine of the physiological role of microorganisms in the human body and the prevention of violations of these functions in the process of drug interventions.

The organization of the educational process in the study of the discipline «Microbiology, Virology and Immunology» is carried out on a credit-module system of education in accordance with the requirements of the Bologna process. The main types of educational work in the process of studying the discipline «Microbiology, Virology and Immunology» are lectures and practical classes, independent work of applicants, consultations according to the schedule drawn up and approved at the beginning of each semester at the Department of General and Clinical Immunology and Allergology. If necessary, consultations with the use of Internet technologies, distance learning technologies, webinars, conferences, research, etc. are used). The topics of the lecture course of the discipline «Microbiology, Virology and Immunology» reveal the problematic issues of the relevant sections of the discipline and allow applicants to provide information on the most relevant issues of the discipline.

The amount of study load of applicants is described in ECTS credits, which are credited to applicants upon successful completion of the relevant module (credit). The credit-modular system of organization of the educational process encourages applicants to systematically study during the academic year while studying the discipline.

The Academic Council of the Medical Faculty at the request of the Department of General and Clinical Immunology and Allergology may change the number of hours in the discipline "Microbiology, Virology and Immunology" by no more than 10% of their number. The current worksig program fully meets the above requirements.

The current educational activities of applicants are monitored in practical classes in accordance with specific objectives. It is recommended to use such means of diagnosing the level of preparation of applicants as testing, written or oral answer to control questions, solving situational problems, conducting laboratory tests, interpretation and evaluation of their results, monitoring the level of practical skills. Final control of mastering of modules is carried out on their completion. The assessment of the applicant's success in the discipline is a rating and is set on a multi-point scale as the arithmetic mean of the mastery of the relevant modules and is determined by the ECTS system and the scale adopted in Ukraine. The method of evaluating the current educational activity and the results of the module control is described in more detail in the relevant section of the current work program.

Competences and learning outcomes, the formation of which is facilitated by the discipline (relationship with the normative content of training of higher education, formulated in terms of learning outcomes in the Standard).

In accordance with the requirements of the standard, the discipline provides the acquisition of higher education competencies:

- integral:

Ability to solve typical and complex specialized problems and practical problems in a professional health care activity, or in a learning process that involves research and / or innovation and is characterized by the complexity and uncertainty of conditions and requirements.

- general:

Ability to apply knowledge in practical situations.

Ability to exercise self-regulation, lead a healthy lifestyle, ability to adapt and act in a new situation.

Ability to choose a communication strategy; ability to work in a team; interpersonal skills.

Skills in the use of information and communication technologies.

Ability to abstract thinking, analysis and synthesis, the ability to learn and be modernly trained.

Definiteness and perseverance in terms of tasks and responsibilities.

Ability to act socially responsible and public consciousness.

The desire to preserve the environment.

- special (professional, subject):

Ability to carry out medical and evacuation measures.

Ability to carry out preventive and anti-epidemic measures against infectious diseases.

Ability to process state, social, economic and medical information.

Ability to conduct epidemiological and medical-statistical studies of public health.

Ability to assess the impact of the environment on the health of the population (individual, family, population).

Ability to assess the impact of socio-economic and biological determinants on the health of the individual, family, population.

1.3. NUMBER OF CREDITS

The study of the discipline "Microbiology, Virology and Immunology" is provided for 3 semesters (III-V) 2 and 3 years of study, the total number of hours is 255 hours (8.5 ECTS credits), of which 30 hours - lectures, 120 hours - practical classes, 105 hours - independent work of applicants (IW).

1.4. TOTAL NUMBER OF HOURS

The distribution of hours devoted to the study of the discipline "Microbiology, Virology and Immunology", according to the semesters during which it is studied, is given below (Table 1.2).

Table 1.2

Curriculum for studying the discipline "Microbiology, Virology and Immunology" for applicants of the School of Medicine of V.N. Karazin Kharkiv National University

1.5. Characteristics of the discipline	
Obligatory	
Full-time education	
YEAR OF TRAINING	
2-3-th	
semester	
III-V- th	
lectures	
30 h.	
Practical, seminar classes	
120 h.	
Laboratory classes	
–	
Independent work	
105 h	

1.6. THE FINAL GOALS OF THE DISCIPLINE

The ultimate goals of the discipline. The applicant for higher education must be able to:

- ✓ evaluate the results of laboratory and instrumental research;
- ✓ anticipate the negative effects of dangerous factors on the human body;
- ✓ master modern methods of microbiological research in infectious diseases;
- ✓ analyze the principles of obtaining vaccines and immune sera, methods of their standardization and control, practical use;
- ✓ interpret the development of medicine in historical retrospect.

II. THEMATIC PLAN OF THE DISCIPLINE

The work program of study by applicants of the discipline «Microbiology, Virology and Immunology» is structured in 3 modules, the study of materials of each of which allows applicants to fully master the theoretical part and master practical skills in a particular section of the discipline. Each module is divided into content modules (module 1 - 9 content modules, module 2 - 2 content modules, module 3 - 3 content modules) according to the scheme below:

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

- Information module 1. Introduction to microbiology
- Informative module 2. Morphology and structure of prokaryotes and parasitic unicellular eukaryotes. Staining of microorganisms. Microscopy.
- Informative module 3. Physiology of bacteria. Evolution and classification of microorganisms
- Informative module 4. Microorganisms genetics
- Informative module 5. Microbiological basis of antimicrobial chemotherapy and antiseptics
- Informative module 6. Infection
- Informative module 7. Human body immune system. Reactions of non-specific protection against infectious agents
- Informative module 8. Antigens and antibodies
- Informative module 9. Immune system reactions. Immunopathology

Module 2. General and special virology

- Informative module 10. General virology
- Informative module 11. Special virology

Module 3. Special, clinical and ecological microbiology

- Informative module 12. Pathogenic prokaryotes and eukaryotes
- Informative module 13. Fundamentals of microbiology
- Informative module 14. Sanitary microbiology and virology

MODULE 1. MORPHOLOGY AND PHYSIOLOGY OF MICROORGANISMS. INFECTION. IMMUNITY

Informative module 1. Introduction to microbiology

Specific goals:

- ⇨ to analyze stages of microbiology development as fundamental and applied discipline of medicine and contribution of separate scientists on each of its stages;
- ⇨ to interpret peculiarities of structure, morphology, physiology of separate groups of microbes.

Topic 1. Subject and goals of medical microbiology. Original methods of microbiological investigation. Principal features of modern medical microbiology. Tendencies of its development.

Definition of the microbiology as a science. Fields of microbiology: general, medical, veterinary, technical, agricultural, oceanic, space. Biotechnology. Medical microbiology and its sections: bacteriology, virusology, protozoology, mycology, etc. Goals of medical microbiology in the study of biological properties of pathogenic and non-pathogenic microorganisms, patterns of their interaction with the macroorganism, people population and environment; working out and application of the methods of microbiological diagnostics, etiotropic therapy and specific prophylactics of infectious diseases. Methods of microbiological research: microscopy, staining, culturing, isolation of pure crops, immunologic methods, modeling on animals, virological methods, biotechnological and genetically engineered. The use of microbes for getting of immunobiological, chemotherapeutic remedies and biotechnological processes. Interaction between medical microbiology and practical work of the

physician. Principles of microbiological service organization, institutions of microbiological profile. Microbes is the basic object of microbiology study. Precellular and cellular forms of microbes and infectious agents (prions, viroids, viruses bacteria, spirochetes, rickettsia, chlamydia mycoplasmas, actinomycetes, fungi, protozoa). Mutual with higher animals and plants signs of microbes: self-organization, self-reproduction, self-regulation, ontogenetic and phylogenetic development. Specific signs of microbes. Peculiarities of microorganisms as living beings: microscopic size, relatively pure organization, high rate of reproduction, casual biochemical activity, plasticity and adaptability, wide spreading in biosphere, abilities of pathogenic properties. Principal features of modern medical microbiology and tendencies of their development.

Topic 2. Stages of microbiology development

First views about contagions. Microscope invention and microorganisms discovery (A. Leeuwenhoek and others). Discovery of first pathogen microorganisms – pathogens of favus and anthrax. Appearance and formation of microbiology as a science (the second part of the XIXth century). Works by L. Paster, R. Koh and representatives of their school. Their importance for microbiology. Discovery of pathogens of the main human infectious diseases. Working out the methods of their cultivation and differentiation. S.M.Vinogradsky. Chemosynthesis discovery. Medical microbiology in the first half of the XXth century. Further discoveries of infectious diseases pathogens. Development of chemotherapeutic direction in microbiology and medicine (P. Erlich and others). Antibiotics discovery (O. Fleming and others). Discovery of viruses. Formation of virology as an independent science. D.I.Ivanovsky –the founder of virology. Virology in the first half of the XXth century. Discovery of the viruses affecting animals, people, bacteria (bacteriophages) and causing tumors in animals (oncogenic viruses). Development of the methods of laboratory virus infections diagnostics. Modern period in the development of medical microbiology (the second half of the XXth century – the beginning of the XXIst century). Importance of scientific-technical progress in the sphere of molecular biology, genetics and genetic engineering for further development of theoretical and applied medical microbiology, virology and immunology. Virology progress in the second half of the XXth century, connected with viruses structure, biochemistry, genetics study. Discovery of new viruses – pathogens of human diseases (hepatitis viruses, HIV, hemorrhagic fever, Ebola virus and others). Prions. Working out of modern laboratory diagnostics methods, prophylactics and therapy of virus infections. Incipience of immunology as an independent science in Paster period. Working out of live vaccines preparations by L.Paster. discovery of phagocytosis as an organism defensive reaction. Creation of cellular immunity theory (I.I. Mechnikov). Discovery of humoral immunity factors (P. Erlich, E. Bering, E. Roe and others). Discovery of allergy, methods of getting toxoids, vaccines, therapy serums, serologic methods of infection diseases diagnostics. Immunology progress in the second half of the XXth century. Working out of modern immunity theories (F. Gauriwitz, F. Bernet, C. Tonegawa and others). Doctrine about immune system of the organism. Discovery of immune tolerance, immune memory and other immune reactions. Development of infectious and non-infectious immunology. Achievements and development of immunobiotechnology. Application of methods of genetic and cellular engineering for receiving vaccines and other biologically active preparations of the recent generations. Role of Ukrainian scientists in the development of microbiology. Contribution of D.Samoilovich, M.M. Terechovsky, D.I.Ivanovsky, G.N.Gabrichevsky, D.L. Romanovsky, F.Ya.Chistovich, L.S.Tsenkovsky, G.M.Minch, O.O. Motchutkovsky, F.O. Lesha, I.I. Mechnikov, M.F. Gamaliya, D.K. Zabolotny, V.K. Vysokovich, M.M. Volkovich, V.V. Podvisotsky, Z.V. Yermolayeva, P.F. Zdrodovsky, V.M. Zhdanov, A.O. Smorodintsev, M.P. Tchumakov, L.O. Zilber, S.M. Minervin, S.S. Dyachnko, V.S. Derkach, S.G. Mosing, V.V. Smirnov in the development of microbiology, virology and immunology. Working out of new prophylactic and therapy means, development of microbiological industry. Achievement of medical microbiology in the decrease of infectious diseases incidence. Importance of microbiology in the physician's training.

Informative module 2. Morphology and structure of prokaryotes and parasitic unicellular eukaryotes.

Specific goals:

- ⇨ to choose methods of bacteriological preparation making;
- ⇨ to draw conclusions about the microscopy of bacteriological preparations while using the immersion lens;
- ⇨ to describe morphologic forms of bacteria;
- ⇨ to explain the structure of bacterial cell, constant and inconstant elements;
- ⇨ to explain the connection between chemical constitution, structure and function of structural elements of bacterial cell;
- ⇨ to interpret the results of microscopic study of microorganisms;
- ⇨ to analyze morphology and structure of spirochetes, actinomycetes, fungi and protozoa;
- ⇨ to explain main distinctions between pro- and eukaryotes.

Topic 3. Bacteriological laboratory organization. Colorants and simple methods of microorganisms staining. Microscopy

Bacteriological laboratory, its structure and purpose. Organization of the working place of the physician - bacteriologist. Preparations for microscopy, methods of their preparation. Aniline dyes, their properties. Methods of staining solutions preparations. Simple methods of microorganisms staining. Methods of microorganisms morphology investigation (microscopy). Light microscopy with immersion lens application. Dark field, phase-contrast, luminescent and other methods of microscopy. Electronic microscopy (translucent, raster). Methods of microscopy in diagnostics of infectious diseases.

Topic 4. Bacteria staining by Gram

Complex methods of microorganisms staining. Staining by Gram method. Factors affecting microorganisms staining by Gram. Properties of gram-positive and gram-negative bacteria. Practical value of staining by Gram method.

Topic 5. Bactria morphology and structure

Main forms and sizes of bacteria. Structure of bacterial cell. Morphophysiological peculiarities of gram-positive and gram-negative bacteria. Flagella, cilia, capsules, cellular wall, periplasm, cytoplasmatic membrane, cytoplasm, nucleotide, ribosome, mesosomes, plasmid, inclusions. Chemical composition and functional meaning of various prokaryotes structures. Bacteria polymorphism. Bacteria spores. Properties of L-forms of bacteria. Complex staining methods: Ozheshko, Cil-Nilson, Neiser, Boury-Hyns, Lefler (for fragelliar), Jone. Morphology of other agents of prokaryotes: rickettsia, chlamydia, mycoplasma.

Topic 6. Morphology and structure of spirochetes, actinomycetes, fungi, protozoa.

Spirochetes (treponema, borrelia, leptospira). Peculiarities of morphology and structure (membrane, fibriles, blepharoplasts), activity. Actinomycetes, morphology peculiarities. Aerial and substrate mycelium, druses. Sporulation. Fungi cell structure. Main forms of fungi: yeasts, yeast-like fungi, filamentous fungi. gyphae, mycelium. Fungi dimorphism. Cytoplasmatic membrane and cellular wall structural peculiarities. Fungi propagation mechanism: budding, spores formation. Vegetative spores, endospores, exospores, sexual spores. Methods of fungi morphology study. Peculiarities of protozoa structure: pellicle, endoplasm, ectoplasm, cysts. Vital cycle of protozoa pathogenic for people. Methods of morphology study. Staining by Romanovsky-Gimza.

Informative module 3. Bacteria physiology. Microorganisms evolution and classification

Specific goals:

- ⇨ to describe most common culture media and their preparation;
- ⇨ to explain changes in differential-diagnostic media during bacteria growth;
- ⇨ to draw conclusions about ways of sterilization and operation mode of sterilizing equipment;
- ⇨ to assess methods of pure crops isolation of aerobic and anaerobic bacteria;
- ⇨ to interpret the results of isolated pure crops cultures results and draw a conclusion.

Topic 7. Bacteria metabolism. Cultural media for microorganisms

Chemical composition of bacterial cell: water, chemical elements and mineral substances, nucleic acids, proteins, lipids, carbohydrates. Peculiarities of chemical composition of bacteria in comparison with eukaryotic cells. Peculiarities of metabolism and energies in bacteria (metabolism intensity, variety of metabolism types, metabolic plasticity, excessive metabolites and energy synthesis). Constructive and energy metathesis, their interconnection. Bacteria nutrition. Nitrogen, carbon, mineral substances and growth factors source. Autotrophs and heterotrophs. Holofit way of nutrition. Mechanism of nutrient transfer into bacterial cell: energo-independent (pure and light diffusion), energo-dependent (active transport), significance of enzymes of periplasm and permiasis bacteria classification according to nutrition types. Bacteria breathing. Bacteria energy needs. Sources and ways of getting energy in photoautotrophs, chemoautotrophs. Types of biological substrate oxidation and ways of getting energy in heterochemoorganotrophs: oxidative metabolism; rotting as a complex of anaerobic and aerobic protein cleavage; fermentative metabolism and its products; nitrate breathing. Aerobes, anaerobes, elective anaerobes, microaeriphiles, bacteria. Bacteria enzymes and their classification. Constitutive and inductive enzymes, genetic regulation. Specificity of enzymes activity. Exo- and endoenzymes. Limiting factors of living environment (temperature, water ion concentration, osmotic pressure, oxygen pressure). Notion of mesophils, thermophils, psychropjils. Halophils, acidophils and alkalinephils bacteria. Culture media for microorganisms culturing. Requirements to culture media. Culture media classification. Getting and main components (peptone, agar-agar, gelatin, coagulated serum, etc). Types of culture media. Methods of enzyme bacteria activity study and their application for bacteria identification. Modern methods of accelerated bacteria identification with the help of automatized indicators of enzymatic activity. Microbes and their enzymes application in biotechnology for getting aminoacids, peptides, organic acids, vitamins, hormones, antibiotics, feed protein, for food-staff and industrial products processing, biologic wastewater treatment, getting liquid and gas-like fuel.

Topic 8. Antiseptics and aseptics. Methods and means

Antiseptics and aseptics. Elaboration of scientific principles of aseptics (I.Zemmelwais, D. Lister). Antiseptic ways, mechanism of action. Acquired persistence of microorganisms to antiseptics. Sterilization, definition. Thermal methods (in autoclave, dry heat cabinet). Chemical method of sterilization gas and with solutions). By filtration and radiation methods. Sterilization control. Disinfection, definition methods (physical, chemical). Disinfectants, mechanism of action.

Topic 9. Growth and reproduction of microorganisms. Isolation of clear bacterial cultures

Microorganisms growth and reproduction. Simple segmentation. Fragmentation. Periodic culture. Microorganisms evolution phases in liquid media in periodic culture. Microorganisms cultivation methods. Microorganisms associations and pure cultures.

Topic 10. Microorganisms colonies. Isolation of pure cultures of anaerobic bacteria

Microorganisms colonies, peculiarities of their formation, properties. Microorganisms pigments. Continuous cultivation, its significance in biotechnology (getting enzymes, proteins, antibiotics, etc.) methods of anaerobic bacteria cultivation (cultural media for obligate anaerobes, anaerobe boxes, etc.)

Topic 11. Microorganisms pure cultures identification

Types of microorganisms, definitions. Properties of microorganisms after which their typical affiliation is defined. Methods of microorganisms type definition. Concept of biovars, serovars, phagovars. Peculiarities of rikettsia, chlamydia, spirochetes culturing. Significance of bacteriological (cultural) method in infectious diseases diagnostics.

Topic 12. Microorganisms evolution. Systematization, classification nomenclature of microorganisms

Modern views on microbes world evolution. Principal differences in structure and function between prokaryotes (bacteria), eukaryotes (fungi, protozoa), viruses, viroids, prions. Archebacteria and eubacteria. Ideas development history about systematics of microorganisms. Phylogenetic (natural) systematics and application of genosystematic approach. Artificial (key, numerical) systematics. Systematics by D.Bergey. Prokaryotes classification, taxonomic groups. Species and its significance in microbiology. Intraspecific categories: subspecies, variants. Taxonomic significance of gene 16S of ribosomal RNA. Concept of population, culture, strain and clone in microorganisms. Binary nomenclature of bacteria. Classification of fungi and protozoa.

Informative module 4. Microorganisms genetics

Specific goals:

- ⇨ to explain the mechanism of operon work;
- ⇨ to explain the mechanism of various forms of genotype variability i (mutations and recombinations);
- ⇨ to draw conclusions about the affiliation of bacteria colonies to S- and R-forms;
- ⇨ to know and be able to explain the mechanism of genetic methods of bacteria diagnostics and identification;
- ⇨ to draw conclusion about the affiliation of the microorganism under study to pro- or eukaryotes;
- ⇨ to explain the connection between genetic structures and bacteria virulence factors.

Topic 13. Microorganisms genetics

Definition of microorganisms genetics as a science. Its significance in medical theory and practice. Prokaryotic and eukaryotic cells genomes distinguishing. Microorganisms genome evolution. Bacterial cell genetic material organization: bacterial chromosome, plasmids, migrating elements. Chromosome structure. Genes. Bacterial genome functioning principles. Reparation system. Bacteria plasmids, their properties. Conjugative and non-conjugative, integrative and autonomous plasmids. Plasmids classification according to functional activity: F, R, Co1, H1y, Ent and other plasmids. Transposons, sequences-inserts. General characteristics and function of migrating genetic elements. Concept of genetic fund, genotype and phenotype. Bacteria variability types. Modification variability, its mechanism and manifestations in bacteria. Genotype variability. Bacteria mutations, their varieties. Mutagens, their classification. Types of mutations: deletion, translocation, inversion, duplication, insertion. Genetic recombination and its types. Genetic information transfer in bacteria and its significance for genetic maps establishment. Transformation, transduction and conjugation. Proportion of mutants and recombinants. Screening. Heterogeneity of microorganisms population, types and mechanisms of population variability. Concept of bacteria dissociation, S- and R-forms of colonies. Importance of variability in microorganisms evolution. Microbiological basis of genetic engineering and biotechnology. Application of enzymes (restriction enzyme, ligase, polymerase, revertase) in genetic engineering research. Vectors used for transfer of genetic material. Peculiarities of genes expression in prokaryotic and eukaryotic cells. Practical use of genetic engineering research results in medicine, biology and national economy. Genetic methods in infectious diseases diagnostics and in bacteria identification: DNA sequence, polymerase chain reaction, nucleic acid hybridization, definition of length of nucleic acids fragments, etc. Biochips, application in diagnostics.

Informative module 5. Microbiological foundations of antimicrobial chemotherapy

Specific goals:

- ⇨ to analyze the phenomenon of microbial antagonism;
- ⇨ to explain the mechanism of antibiotics activity on microbial cell;
- ⇨ to draw conclusions of microorganisms persistence to antibiotics;
- ⇨ to explain the mechanism of antibiotics therapy complications.

Topic 14. Chemotherapeutic preparations. Antibiotics

History of antimicrobial therapy ideas development, periods of chemotherapy development. Works by D.L. Romanovsky, P. Erlich, G. Domagk. Investigation of sulfanilamides. Main principles of rational chemotherapy. Essence of chemotherapeutic preparation, chemotherapeutic index. Microbial antagonism, its mechanisms. Microbes-antagonists – antibiotics producers. Doctrine of I.I. Mechnikov about physiological role of intestinal lactic acid bacteria. History of first antibiotics discovery: O. Fleming, Z. Vaxman. Antibiotics, definition, biological role in nature. Principles of antibiotics getting. Antibiotics classification according to origin, chemical content, mechanism and spectrum of antimicrobial activity. Natural, semisynthetic and synthetic antibiotics. Mechanism of antibiotic activity on microbial cell. Antibiotics as synthesis inhibitors of cellular wall peptidoglycan, protein synthesis, nucleic acids as well as those which violate the function of bacteria and fungi cytoplasmic membrane. Bactericidal and bacteriostatic activity of antibiotics. Antibiotics antimicrobial activity units of measurement. Concept of minimal suppressing concentration. Antibioticogram. Complicated antibiotic therapy. Dysbacteriosis. Antibiotic resistant, antibiotic dependent and tolerant to antibiotics strains of bacteria. Natural and acquired persistence to antibiotics. Genetic and biochemical mechanisms of resistance to antibiotics. Role of plasmids and transposons in the formation of medication bacterial resistance. Ways of prevention of bacteria resistance formation to antibiotics. Principles of rational antibiotic therapy. Intracellular communication in bacteria («quorum sensation») and formation perspectives of new generation antimicrobial preparations on their bases. Importance of antibiotics discovery (XXth century) for etiotropic therapy of bacterial, spirochetosis, protozoa infections.

Informative module 6. Infection

Specific goals:

- ⇨ to interpret the concept “infectious process”.
- ⇨ to analyze forms of infectious process, its characteristics and conditions of occurrence.
- ⇨ to characterize the concepts “pathogenicity” and “virulence”.
- ⇨ to analyze the mechanism of infectious process development (pathogenesis).

Topic 15. Infectious process, its types, conditions of occurrence and development

Definition of the concept “infection”, “infectious process”, “infectious disease”. Development of the ideas about nature of infectious process. Conditions of infectious process occurrence. Monocausalosm. Conditionalism. Microorganisms role in infectious process. Microbes pathogenicity, definition. Pathogenicity as a consequence of parasitism evolution. Obligate pathogenic, opportunistic, non-pathogenic microorganisms. Virulence, definition, units of measure. Bacteria pathogenicity factors: adhesins, invazins, pathogenicity enzymes, bacteria structures and substance, which suppress phagocytosis. Microbial toxins, their classification. Protein toxins (exotoxins), properties, activity mechanism. Exotoxins power units of measure. Endotoxins, chemical constitution, properties, differences from protein toxins. Pathogenic properties of rickettsia, chlamydia, mycoplasmas, fungi and protozoa. Obligate intracellular viruses parasitism. Genetic control of microorganisms pathogenicity factors. Microbe populations heterogeneity on the basis of virulence. Infection process development phases. Microorganisms critical dozes, which cause infectious disease. Ways of disease pathogens penetration to the organism. Microorganisms adhesion, colonization, aggregation, biofilms formation, invasion. Spreading of microbes and their toxins in the organism: bacteremia, toxemia, sepsis and its consequences. Micro-carriage. Symptomless infection. Dynamics of infectious disease development – incubation, prodromal, climax, final period. Forms of infection: exogenic and endogenic; focal and generalized; mono-infection and compound; secondary infection, re-infection, superinfection, relapse; acute, chronic, persisting infection. Concept of wounds infection, respiratory, intestine, venereal and skin infections; anthroponotic, zoonotic, anthropozoonotic sapronose infections. Mechanism of infection transmission: fecal-oral, airborne, sexual, alimentary, transmissive, contact-household, transplacental. Concept of infectious disease pathogenesis. Biological research method. Its application in etiology, pathogenesis, immunogenesis, diagnostics, therapy and prophylactics of infectious diseases study. Laboratory animals, pure genetic lines of animals.

Informative module 7. Organism immune system. Reaction of non-specific protection against infectious agents

Specific goals:

- ⇨ to analyze stages of immunology formation and contribution of separate scientists on each stage;
- ⇨ to interpret the concept "immune system of the organism";
- ⇨ to explain the role and mechanism of non-specific anti-infectious protection of human organism.

Topic 16. Main stages of immunology development

Empirical, including receiving of smallpox vaccine by E.Jenner. Pasternatsky – doctrine about microorganisms attenuation. Receiving of anthrax and rabies vaccines, development of the doctrine about the cellular (I.I. Mechnikov) and humoral (П. Erlich) immunity. Modern directions of immunology development. Role of native and foreign scientists in immunology progress. Nobel laureates in immunology. Main sections of modern immunology: infectious and non-infectious, clinical, transplantation, ecological; immunogenetics, immunopathology, allergology, cytoimmunology, immunohematology, etc. Role of immunology in the development of medicine and biology, its interaction with other sciences. Immunologic methods of research.

Topic 17. Immune system of the organism. Factors of organism non-specific protection from microorganisms

Immunity as the way of organism protection from substances having signs of genetic alienty and being realized by specialized immune system. Formation of organism immune system. Factors of non-specific organism protection. Barrier and antimicrobial properties of skin, mucosa. Normal microflora. Cells and tissues non-reactivity. Physics-chemical factors, function of excretory organs and systems. Phagocytosis. Role of I.I. Mechnikov in the development of the doctrine about phagocytosis. Phagocytic cells classification. Phagocytosis main stages. Biochemical mechanisms of bacteria violation by phagocytes. Methods of phagocytic activity study: phagocytic indicator, phagocytic activity, phagocytic index. Importance of phagocytosis in natural immunity realization and immune response development. Killing system of human organism: natural killers, large granular lymphocytes (LGL), K-cells, LAK – cells (leucine activated killers), their role in immunologic supervision after genetically (pathologically) changed human organism cells. Macrophages (migrating and tissue), granulocytes – neutrophils, eosinophils, basophils (migrating and tissue). Humoral factors of non-specific protection: compliment system, lysine, interferons, leukyns, antivirus inhibitors, lysozymes, plakins, properdins, fibronectin, etc. main component of compliment system. Role of compliment in chemotaxis, opsonization and lysis of microbes, development of allergic and immunopathological processes. Methods of qualitative and quantitative compliment definition. Classical and alternative ways of compliment activation. Interferons. Interferons classification, inductor, mechanism of formation, biological function of interferons (antivirus, anti-tumoral, immunomodulating, radioprotective). Recombinant interferons. Immune system structure. Central immune system organs: thymus, medulla. Immune system periphery organs: spleen, lymphatic nods lymphoid accumulations, associated with mucosa. Immunocompetent cells. T-lymphocytes, 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. Subpopulations of B-lymphocytes. Surface markers and receptors. Cooperation between immunocompetent cells in the process of immune response formation. Concept of immunomodulators. Immunostimulators and immunosuppressors.

Informative module 8. Antigens. Antibodies

Specific goals:

- ⇨ to explain the role of antigens as inductors of immune response;
- ⇨ to describe the antigens structure, including microorganism antigens;
- ⇨ to explain the role of antibodies in immune response;
- ⇨ to describe the antibodies structure (various classes of immunoglobulins);
- ⇨ to analyze mechanism of interaction between antibodies and antigens;

⇨ to interpret the role of immune system cells in immune response and phases of immune response.

Topic 18. Antigens characteristics

Antigens as inducers of immune response. Structure of antigens. Antigen determinants (epitops). Classification of antigens. Sterling antigens and haptens. Types of antigen specificity. Adjuvants. Antigen structure of microorganisms. Localization, chemical composition and specificity of bacteria, viruses, ferments and toxins antigens. Role of microbial antigens in infectious process and immune response development. Antigens of human histocompatibility. Erythrocytes antigens of carious blood groups, autoantibodies, embryonal, tumorous and transplantation human antibodies.

Topic 19. Antibodies as a product of humoral immune response

Structure and functions of antibodies (immunoglobulins). Constant and variable areas of H- and L-polypeptide links, domains. Structure of active centers of immunoglobulins. Heterogeneity of molecules. Concept of valence of antibodies. Fc - (cellular) receptors. Mechanism of interaction between antibodies and antigens. Classes of imunoglobulins, their structure and properties. Antigen structure of immunoglobulins: isotopic, allotopic, idiotopic determinants. Antiidiotopic antibodies. Pathologic immunoglobulins. Immunoglobulins genetics. Autoantibodies. Concept of polyclonal and mononclonal antibodies. Principles of monoclonal antibodies obtaining. Crossbreeds as producers of monoclonal antibodies.

Informative module 9. Immunity reactions. Immunopathology

Specific goals:

⇨ to analyze forms and types of immune response;
⇨ to interpret phases of immune response development;
⇨ to draw conclusions about application of antibodies in medical practice.

Topic 20. Immune response reactions. Antibodies application principles for therapy-prophylactics and diagnostic preparations

Forms and types of immune response. Humoral immune response and its stages: recognition, antigen processing, presentation of antigen to T-helpers and B-lymphocytes, proliferation and differentiation of B-lymphocytes. T- and B-dependent antigens, their influence at the immune system, antibodies syntheses by plasmocytes. Immunological memory, memorial cells. Primarily and secondary immune memory. Immune system cells interaction during immune response. Macrophage, T- and B- cells involvement. Interleukins. Cellular immune response and its stages: recognition, antigen processing, antigen presentation to Th1 lymphocytes, proliferation and differentiation of effector T-cells (helpers, suppressors, effectors of hypersensitivity of delayed type, memory cells). Cytokines and their role in the formation of cellular immunity reactions. Characteristics of immune response manifestations: antibodies synthesis, hypersensitivity of immediate and delayed types, immunological memory, immunological tolerance, idiotype-anti-ideotype net interactions. Serologic reactions, their varieties, specificity, sensitivity, byphasic character, negotiability. Mechanism of antigens and antibodies interaction in serologic reactions. Main component of serologic reactions. Practical application of serologic reactions: antigen identification, antibodies diagnostic differentiation. Diagnostic immune serum, classification, getting, titration, increase of specificity due to antibodies absorption by Castellani. Application for serologic antigens identification. Serologic identification – definition of microorganisms antigens according to its reactions with diagnostic serum (with the aim to identify the microorganisms type and serovar). Main serologic reactions for identification and criteria for their registration. The use of serologic reactions for microorganisms antigens indication with the aim of express-diagnostics of infectious diseases. Serologic diagnostics as diagnostics of infectious diseases by definition of antibodies to pathogen in the sick person serum. Diagnostics, receiving, application of them for serologic diagnostics of infectious diseases (antibodies detection in the serum of a sick person). Notion “antibody titer”, “diagnostic titer”. “diagnostic growth of antibody titer”, “paired sera”. Differentiation principle on the basis of serologic reactions results of the available infectious diseases from previously existing. Serologic diagnosis criteria: detection of

antibodies to the pathogen in diagnostic titer, detection of diagnostic growth of antibodies titer, detection of antibodies to the pathogen of the class IgM. Monoclonal antibodies, their application. Detection phenomena and ways of serologic reactions registration. Reactions based on agglutination phenomenon: direct and indirect agglutination, inhibition reaction of indirect hemagglutination, reaction of reverse indirect hemagglutination, Kumbas reaction – antiglobulin test. Reactions based on precipitation phenomenon: ring precipitation, flocculation, precipitation in gel. Reaction of immune lysis (bacteriolysis, spirochetolysis, hemolysis). Compliment fixation reaction. Microorganisms immobilization reaction. Opson-phagocytic reaction. Neutralization reaction (toxins, viruses, rickettsia). Reaction with application of marked antigens and antibodies: immunofluorescence (directi and indirect). Immunoenzymatic method (direct, indirect, solid phase, competitive), radioimmune analysis (competitive, reverse, indirect). Immunoelectronic microscopy. Treatment and prophylactic immune serum, principles of their getting, control, classification, application.

Topic 21. Principles of microbial antigens application as prophylactic and diagnostic preparations

Development of immunoprophylactic doctrine. E. Genner, L. Paster, E. Bering, G. Ramon and others. Active and passive immonoprophylactic. Preparations for immonoprophylactic . modern classification of vaccines: alive, inactivated, chemical, anatoxines, subcomponent, genetic engineering, synthetic, antiidiotype, DNA – vaccines. Ways of preparation, efficiency assessment and control. Associated vaccines. Adjuvant. autovaccines, vaccine therapy. Diagnostics. Their application for serologic diagnostics of infectious diseases.

Topic 22. Immunopathology. Assessment of the immune status of the organism

Allergy. Concept of allergy. Allergens. Classification of allergic reactions by Jell and cumbas. Allergic reaction of humoral (immediate) type – HIT. Reagent type of HIY. Development mechanism. Clinical manifestations: anaphylactic shock, hives, Quincke's edema. Atopies: bronchial asthma, pollinosis. Cytotoxic type of HIT. Development mechanism, clinical detection. Preventive methods. Immunocomplex type of HIT. Development mechanism. Clinical detection. Diagnostic tests for humoral type of allergy detection. Allergic reactions of cellular (delayed) type – HDT. Development mechanism, clinical forms of detection: infectious, contact allergy. Methods of detection of HDT, skin-allergic probes. Clinical detection. Immunodiagnostics. Complex assessment of immune status of the organism according to the indices of non-specific protective factors, condition of T- and B-systems. The role of the immune status of the organism assessment in diagnostics of infectious diseases and immune system pathology of the organism. Immunodeficiency states. Classification of immunodeficiency states on congenital and acquired, primary and secondary. Autoimmune processes. Autoimmune diseases, connected with violations of histo-hematic barriers for non-barrier organs under cross-reactive antigenes intrusion, under disruption of immune tolerance in connection with immune system of the organism function violation under lymphoproliferative diseases and immune system defects. Principles and perspectives of autoimmune diseases therapy.

MODULE 2. GENERAL AND SPECIAL VIROLOGY

Informative module 10. General virology

Specific goals:

- ⇨ to interpret viruses morphology and ultrastructure;
- ⇨ to analyze peculiarities of viruses interaction with living systems;
- ⇨ to assess results of viruses reproduc6tion in living systems;
- ⇨ to analyze methods of viruses cultivation in the conditions of a laboratory;
- ⇨ to characterize antivirus chemotherapeutic preparations and their activity mechanisms.

Topic 1. Viruses morphology and ultrastructure. Viruses cultivation in chicken embryo and laboratory animals organism

Definition of virology as a science. General, medical sanitary virology. Tasks of medical virology. Importance of medical virology in a physician work. Peculiarities of virology laboratories organization and work. Achievements of medical virology in the fight against infectious diseases. Unsolved problems. World of viruses. Definition of viruses as special forms of living world organization principles of viruses structural organization. Viron and its components. Nucleocapsid, capsid, capsomers, supercapsid (peplos), peplomers. Pure and compound viruses, types of nucleocapsids symmetry. Viruses chemical composition: nucleic acids, proteins, lipids, polysaccharides. Their peculiarities and functions. Viruses enzymes, their role, classification. Viruses reproduction in process of their interaction with the cell. Main stages of viruses interaction with cells under productive infection. Integrative and abortive types of viruses interaction with the host cell. Virus persistency in cells. Viruses interference, defective interfering particles. Viruses-satellites. Methods of viruses cultivation in chicken embrio, in laboratory animals organism. Virus reproduction indication with the help of hemagglutination test (HHT) and hemadsorption. Antivirus chemotherapeutic preparations, their classification: adsorption inhibitors, viruses penetration and deproteinization; reverse transcriptase inhibitors, DNA-polymerase inhibitors of DNA –containing viruses; viruses RNA- and DNA-containing polymerases inhibitors; m-RNA various viruses inhibitors. Interferons and their inductors, mechanism of their antivirus activity.

Topic 2. Cellular cultures in virology. Methods of viruses cultivation in cellular cultures and chicken embrio. Indication of virus reproduction

Methods of viruses cultivation in cells. Classification of cellular cultures used in virology, their characteristics. Methods of virus reproduction detection (indication) on cytopathogenic action, plaque formation under agar and bentonite coating, virus inclusion. Methods of numerical definition (titration) of viruses. Genetic methods of viruses definition and their nucleic components.

Topic 3. Serologic reactions used in virology

Peculiarities of serologic reactions used in virology. Method of paired sera. Peculiarities of virus diagnostics. Reaction of complement connection and its application in virology. Reactions used exclusively in virology – hemagglutination and hemabsorption reactions inhibition, virus neutralization reaction.

Topic 4. Viruses genetics. Bacteriophages, practical application

Viruses significance in genetics development. Viruses genetic apparatus. Differences between RNA- and DNA-containing viruses. Viruses variability modification: phenotypic mixing, polyploidy. Types of viruses genotype variability. Viruses mutation, their classification. Spontaneous and induced mutations, direct and reverse. Mutagenic. Genetic interaction between viruses. Recombination, transduction. Genetic reactivation. Complementation. Viruses virulence as a genetic sign. Genetic virulence markers. Population viruses variability. Heterogeneity of virus populations, their mechanism and practical significance. Viruses dissociation during reproduction in cell. Biological properties of dessociants. Cloning of genetic variants. Viruses role in genetic information exchange in biosphere. Morphologic type and structure of bacteriophages. Chemical component. Virulent and moderate phages. Bacteriophages interaction productive type stages with bacterial cells. Lysogenic and phage conversion. Practical application of bacteriophages in microbiology and medicine with the aim of bacteria identification, prophylactics and therapy of infectious diseases and assessment of microbial environmental pollution.

Informative module 11. Special virology

Specific goals:

- ⇨ to analyze biological properties of pathogenic for people viruses;
- ⇨ to explain viruses role in human pathology;

- ⇨ to interpret methods of virus infections diagnostics, to draw conclusions on research results;
- ⇨ to analyze preparations used for specific virus diseases prophylactics.

Topic 5. Orthomixoviruses

Orthomixoviruses (family Orthomyxoviridae). General characteristics and classification. Human flu viruses. Viron structure. Genome peculiarities. Culturing. Sensitivity to physical and chemical factors. Antigens characteristics. Hemagglutinins, neuraminidase, functional activity. Human flu viruses classification. Types of antigen variability, its mechanism. Flu pathogenesis. Role of virus persistency in human and animal organism in preservation of epidemically significant strains. Immunity. Laboratory diagnostics. Specific prophylactics and treatment.

Topic 6. Paramixoviruses

Paramixoviruses (family Paramyxoviridae). General characteristics and classification. Viron structure, Antigens. Culturing. Sensitivity to physical and chemical factors. Paramixovirus genes (Paramyxovirus). Human parainfluenza virus (1-5th types). Parotitis virus. Role in human pathology. Immunity. Specific prophylactics. Morbillivirus genes (Morbillivirus). Measles virus, biological properties. Disease pathogenesis. Immunity and specific prophylactics. Pneumoviruses genes (Pneumovirus). Human respiratory-syncytial virus. Biological peculiarities. Disease pathogenesis. Immunity. Paramixoviruses persistency and human pathology. Laboratory diagnostics of paramixovirus infections.

Topic 7. Picormaviruses

Family division into genes. Enterovirus genes (Enterovirus). Classification: poliomyelitis viruses, Coxsackie, ECHO, enteroviruses of the 68-72 types. Virons characteristics. Antigens. Culturing. Pathogenicity for animals. Sensitivity to physical and chemical factors. Significance of genetic heterogeneity of enteroviruses population in the disease development. Enteroviruses role in human pathology. Poliomyelitis and other enterovirus infections pathogenesis. Immunity. Specific prophylactics and therapy. Problem of poliomyelitis liquidation all over the world. Enterovirus infections laboratory diagnostics. Rhinoviruses genes (Rinovirus). General characteristics. Classification. Rhinovirus infection pathogenesis. Laboratory diagnostics. Aphtoviruses genes (Aphtovirus). Murrain. Biological peculiarities. Classification. Human infection pathogenesis. Laboratory diagnostics, specific prophylactics. Cardioviruses genes (Cardiovirus). General characteristics. Role in human pathology.

Topic 8. Retroviruses. HIV

Retroviruses (family Retroviridae). General characteristics. Classification. Subspecies representatives. Oncovirinae, Lentivirinae. Human immunodeficiency virus (HIV). Morphology and chemical composition. Genome peculiarities. Variability, its mechanisms. Types of HIV. Origin and evolution. Culturing, stages of interaction with sensitive cells. Sensitivity ot physical and chemical factors. HIV-infe4ction pathogenesis. Target-cells in human organism, characteristics of surface receptors. Immunodeficiency development mechanism. AIDS-associated pathology opportunistic infections and tumors). Laboratory diagnostics. Chain polymerase reaction in HIV-infection diagnostics and westernblot (immunoblot)-test. Therapy (etiotropic, immunomodulating, immunosuppressive means). Perspectives of specific prophylactics.

Topic 9. Other viruses RNA-genomes

Reoviruses (family Reoviridae). General characteristics. classification. Role in human pathology. Rotavirus gene (Rotavirus). Classification, peculiarities. Role in human pathology. Laboratory diagnostics. Arenaviruses (family Arenaviridae). General characteristics and classification. Main representatives causing human diseases: viruses of lymphocytic choreomeningitis, Lassa, Junin, Machupo. Laboratory diagnostics. Specific prophylactics and therapy problems. Rabdoviruses (family Rabdoviridae). General characteristics and classification. Lyssavirus gene. Rabies virus. Viron structure. Culturing. Sensitivity to physical and chemical factors. Human and animal pathogenicity.

Disease pathogenic peculiarities. Intracellular insertions (Babesh-Negri bodies). Laboratory diagnostics. Specific prophylactics. Vesiculovirus gene. Vesicular stomatitis virus, its role in human pathology, diagnostics. 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). Rubiviruses gene (Rubivirus). Rubella virus. Role in human pathology. Laboratory diagnostics. Specific prophylactics.

Topic 10. Poxviruses, papovaviruses, parvoviruses

Poxviruses (family Poxviridae). Family Orthopoxvirus. General characteristics and classification. Human, monkeys, caws natural smallpox viruses, smallpox vaccines, ectromelia. Viron structure. Antigens. Cultivation. Sensitivity to chemical and physical factors activity. Hemagglutination, its mechanism. Pathogenic peculiarities of the disease. Laboratory diagnostics. Intracellular insertions (Guerniery calves). Specific prophylactics of smallpox. Global eradication of smallpox. amily Parapoxvirus. Molluscum contagious virus. Infection pathogenesis. Laboratory diagnostics. Papoviruses (family Papovaviridae). General characteristics and classification. Viruses morphology. Human papilloma and polyoma viruses. Pathogenesis of the diseases caused by these viruses. Oncogenicity. Laboratory diagnostics. Parvovirus (family Parvovoridae). General characteristics and classification. Viron structure. Antigens. Cultivation. Sensitivity to chemical and physical factors activity. Virus B19, its significance in human pathology. Adenoassociated viruses, their peculiarities, application in genetic engineering.

Topic 11. Herpesviruses

Herpesviruses (family Herpesviridae). General characteristics and classification. Viron structure. Antigens. Cultivation. Sensitivity to chemical and physical factors activity. Herpes viruses, pathogenic for human: α-herpesvirus of common or pure herpes of the 1-st and 2-nd types, α-herpesvirus of chickenpox [varicella] – shingles [zoster]; β-herpesvirus of cytomegaly (CMV); γ-herpesvirus of Epstein Barr (EB) – pathogen of infectious mononucleosis, human oncologic diseases. Human herpes viruses of the 6, 7, 8-th types. Biologic peculiarities. Role in human pathology. Mechanism of herpes viruses persistence. Laboratory diagnostics, specific propylacrics and therapy of herpes infections.

Topic 12. Adenoviruses

Adenoviruses (family Adenoviridae). General characteristics and classification. Human adenoviruses. Viron structure. Antigens, their localization and specificity. Cultivation. Sensitivity to chemical and physical factors activity. Hemagglutinating activity. Pathogenesis of the diseases. Persistency. Adenoviruses oncogenic serotypes. Intestinal adenoviruses. Laboratory diagnostics of adenovirus infections. Specific prophylactics and therapy.

Topic 13. Virus hepatitis pathogens

Hepatitis A virus (family Picornaviridae), peculiarities. Approaches to specific hepatitis A prophylactics. Laboratory diagnostics of hepatitis A. Hepatitis B virus (family Hepadnaviridae). History of study. Viron structure. Antigens: HBs – Dane particles superficial antigen. Enteral antigens: HBc, HBe, their characteristics. Sensitivity to chemical and physical factors activity. Pathogenic peculiarities of the disease. Persistency. Immunity. Microbiologic diagnostics, methods of detection and diagnostic meaning of hepatitis B markers (antigens, antibodies, nucleic acids). Specific prophylactics and therapy. Other pathogens of hepatitis: C, D, E, G, TTV, SENV, their taxonomic location, peculiarities, role in human pathology, methods of laboratory diagnostics.

Topic 14. Arboviruses ecologic group

Ecologic alliance of arboviruses. Flaviviruses (family Flavivivridae), Bunyaviruses (family Bunyaviridae), Filoviruses (family Filoviridae), Togoviruses (family Togaviridae, family Alfavirus). General characteristics. Classification. Antigens. Cultivation. Sensitivity to chemical and physical factors activity. Main representatives of pathogenic for human flavoviruses – tick-borne encephalitis,

yellow fever, dengue fever, Japanese encephalitis, Omsk hemorrhagic fever viruses. Pathogenesis peculiarities. Natural focality. Tick-borne encephalitis virus. Biological peculiarities, pathogen ecologic variants. Occurrence in nature. Mechanism of human pathogen transmission. Pathogenesis and immunogeneses of the disease. Role of Ukrainian scientists in flavovirus infections study (L.O. Zilber, M.P. Chumakov, A.K. Shubladze, U.N. Levkovich and others). Laboratory diagnostics of flavivirus infections. Specific prophylactics and therapy.

Topic 15. Oncogenic viruses

History of ideas about viruses role in carcinogenesis development. Signs of transformed cell. Mechanisms of transforming activity of oncogenic viruses. Concept "oncogene". Theories of oncogenes origin. Virus-genetic theory of tumors occurrence by L.O. Zilber. Oncogenic DNA-containing viruses from the family of papoviruses, herpesviruses, etc. General characteristics, participation in human virus carcinogenesis. Oncogenic RNA-containing viruses from the family of retroviruses – representatives of the sub- family Oncovirinae. Morphology, classification. Role in human cancerogenesis. General characteristics. Endogenic retroviruses.

Topic 16. Prions

Prions. Peculiarities. Prion diseases of animals (scrapie, caw spongiform encephalopathy) and human (kuru, Creutzfeldt-Jakob disease). Physicochemical peculiarities. Mechanism of replication in vivo. Pathogenesis of prion diseases. Methods of post morbid and lifetime diagnostics.

MODULE 3. SPECIAL, CLINICAL AND ECOLOGICAL MICROBIOLOGY

Informative module 12. Pathogenic prokaryotes and eukaryotes

Specific goals:

- ⇨ to interpret infectious diseases pathogens biological properties;
- ⇨ to explain pathogenic pattern of infectious processes caused by pathogenic prokaryotes and eukaryotes;
- ⇨ to define methods of microbiological diagnostics, etiotropic therapy and prophylactics of the infections caused by pathogenic prokaryotes and eukaryotes.

Topic 1. Staphylococcus (Micrococcaceae and Streptococcaceae family)

Evolution of cocci group of bacteria, their general characteristics. Staphylococcus family (Staphylococcus). Classification. Biological properties. Pathogenicity factors. Role of Staphylococcus in human pathology development. Pathogenesis of processes caused by them. Role in nosocomial infection development. Immunity and its peculiarities. Preparations for specific prophylactics and therapy. Methods of staphylococcus infection microbiological diagnostics. Streptococcus family (Streptococcus). Classification, biological properties. Toxins, pathogenicity enzymes. Role in human pathology. Pathogenesis of streptococcus diseases. Immunity. Methods of microbiological diagnostics of staphylococcus diseases. Etiologic and pathogenic role of streptococcus of A group at respiratory infections, erysipeloid, angina, scarlet fever, acute glomerulonephritis, rheumatism, sepsis, etc. streptococcus pneumoniae (Streptococcus pneumoniae) – pneumococcus, biological peculiarities. Pathogenicity factors. Etiologic and pathogenic role of pneumonia streptococcus in human pathology. Microbiological diagnostics. Human and animal pathogenicity. Oral streptococcus, their role at caries and other stomatology diseases.

Topic 2. Meningococci and Gonococci (Neisseriaceae family)

Neisseria family (Neisseria). Biological properties. Classification. Pathogenicity evolution. Meningococci (Neisseria menigitidis). Biological properties, classification. Pathogenesis and microbiological diagnostics of meningococcal diseases and bacteria carrying. Meningococcal differentiation from gram-negative nasopharynx diplococcus. Meningococcal infection prophylactics. Gonococci (Neisseria gonorrhoeae). Biological properties. Human pathogenicity, variability. Acute and

chronic gonorrhea. Immunity. Gonorrhea microbiological diagnostics. Prophylactics and specific therapy of gonorrhea and blenorea.

Topic 3. Enterobacteria (Enterobacteriaceae family). Escherichia

Classificaqtion and general characteristics of enterobacteria family representatives (Enterobacteriaceae). Modern views on intestinal bacteria evolution. Antigen structure. Virulence factors and their genetic determinism. Pathogenic and opportunistic enterobacteria. Spreading and ability to be used in environment. Escherichia family (Escherichia), their main properties. Physiological role and sanitary expository meaning. Diarrheagenic escherichia. Classification according to antigen structure and devision into categories depending on virulence factors, serologic markers and clinico-epidemiologic peculiarities. Parenteral eschirykozes. Eschirykozes microbiological diagnostics.

Topic 4. Salmonella

Salmonella family (Salmonella). General characteristics of the family. Classification according to biochemical characteristics and antigen structure (Kaufmann-White). Human and animal pathogenicity. Salmonella – pathogens of generalized infections (typhoid fever and paratyphoids). Biological properties. Antigen structure, pathogenicity factorsi. Pathogenesis and immunogenesis of the disease. Bacteriacarrier.

Topic 5. Salmonella – pathogens of gastroenterocolitis

Salmonella – pathogens of acute gasrtroenterocolitis. Pathogenesis peculiarities. Methods of microbiological diagnostics of salmonellosis. Specific prophlactics and treatment.

Topic 6. Shigella

Shigella family (Shigella). Biological properties. Classification. Shigella virulence factors. Shigellosis pathogenesis (dysenteries). Immunity. Methods of microbiological diagnostics. Grigoryev-Shig dysentery peculiarities. Specific prophylactics problem. Specific therapy.

Topic 7. Other pathogenic enterobacteria

Klebsiella family (Klebsiella). Klebsiella characteristics and biological properties. Pneumonia klebsiella and their role in pathology. Atrophic rhinitis and rhinoscleroma. Klebsielosis microbiological characteristics. Protei (Proteus), morganella (Moraganella) and providencia (Providencia) family. Importance of separate family in acute intestinal infections, purulent-inflammatory processes, mixed-infections, nosocomial infections and food toxicoinfection etiology. Microbiological diagnostics of the diseases. Other representatives of opportunistic enterobacteria: Hafnia (Hafnia), Serratia (Serratia), Enterobacter (Enterobacter), Edwardsiella (Edwardsiella), Erwinia (Erwinia), Citrobacter (Citrobacter) family. Biological properties. Importance in pathology. Microbiological peculiarities of the disease caused by opportunistic enterobacteria.

Topic 8. Vibrios (Vibrionaceae family)

Cholera vibrios (Vibrio cholerae). Biovars (classical and El-Torah), their differentiation. Cholera spreading. Morphology. Cultural peculiarities, enzymatic activity. Vibrio classification according to Heiberg. Antigen structure. Virulence factors. Cholerogen, mechanism of activity, methods of cholerogen identification. Cholera vibrio, which are not agglutinated by O-1 serum, O-139 «bengali» vibrion. Pathogenesis and immunity at cholera. Microbiological diagnostics methods. Accelerated diagnostics of the disease and cholera vibrio identification in the environment. Cholera specific prophylactics and therapy. Halophilic vibrio – toxicoinfection pathogens. Biological peculiarities. Human pqthogenicity. Morphological diagnostics peculiarities. Other vibrios as a cause of gastroenteritis, wound infection, inflammatory diseases of internal organs.

Topic 9. Corynebacteria (Corynebacteriaceae family)

Diphtheria pathogen (Corynebacterium diphtheriae). Discovery and study history morphology. Cultural properties. Biovars. Resistance. Pathogenicity factors. Diptheria toxin. Toxigenicity as a result of phage conversion. Molecular mechanism of diphtheria toxin activity. Diphtheria pathogenesis. Antitoxic immunity. Bacteriacarrier. Diphtheria microbiological diagnostics. Immunological and genetic methods of diphtheria pathogen toxigenicity identification. Diphtheria pathogen differentiation with other pathogenic and non-pathogenic for people corinebacteria, toxigenicity control, diphtheria specific prophylactics and therapy.

Topic 10. Mycobacteria (Mycobacteriaceae family)

Pathogenic opportunistic and saprophyte mycobacteria. Tuberculosis mycobacteria, types, morphological, tinctorial, cultural and antigen properties. Disease pathogenesis properties. Tuberculosis bacteria variability, pathogenicity factors. Tuberculin. Immunity patterns, role of cellular mechanisms. BCG vaccine. Microbiological diagnostics. Antimicrobial preparations. Problem of numerical resistance of tuberculosis bacteria to chemotherapeutical preparations. Tuberculosis epidemic spreading in modern conditions. Leprosy pathogen. Mycobacteriosis pathogens. Classification, properties. Role in human pathology. Mycobacteriosis as a manifestation of HIV-infection signs.

Topic 11. Anaerobic infections pathogens (Bacillaceae family)

Clostridia family (Clostridium). Classification. Ecology, properties. Clostridia evolution. Resistance to environmental factors. Toxigenity. Toxin production control. Clostridia – pathogens of anaerobic infectious wound. Types. Properties. Pathogenicity factors, toxins. Pathogenesis of anaerobic wound infection. Antitoxic immunity. Microbiological diagnostics. Specific therapy and prophylactics. Tetanus clostridia (Clostridium tetani). Properties. Pathogenicity factors, toxins. Disease pathogenesis. Immunity. Microbiological diagnostics. Tetanus specific prophylactics and therapy. Botulism clostridia (Clostridium botulinum). Properties. Pathogenicity factors, botulotoxins. Disease pathogenesis. Immunity. Microbiological diagnostics. Botulism specific therapy and prophylactics. Clostridium difficile, role in human pathology.

Topic 12. Zoonotic infections pathogens

Yersinia family (Yersinia). Yersinia – pathogens of intestine yersiniosis and pseudotuberculosis. Biological propertiesi. Psychrophilic. Intestine yersiniosis microbiological diagnostics. Plague pathogen. Study history. Biological properties. Virulence factors. Plague pathogenesis. Plague microbiological diagnostics factors. Plague pathogen identification criteria. Plague specific prophylactics and therapy. Brucella (Brucellaceae family). Classification. Biological peculiarities. Pathogenicity factors. Types of brucella and their human and animal pathogenicitybrucellosis pathogenicity and immunity. Methods of microbiological diagnostics. Preparations for specific prophylactics and therapy. Tularemia pathogen (Francisella tularensis). Biological properties. Pathogenesis, immunity, methods of microbiological diagnostics. Tularemia specific prophylactics. Anthrax pathogen (Bacillus anthracis). Properties. Resistance. Human and animal pathogenicity. Pathogenicity factors, toxins. Human disease pathogenesis, immunity. Microbiological diagnostics. Anthrax specific prophylactics and therapy.

Topic 13. Rickettsia, chlamydia, mycoplasmas

Rickettsia (Rickettsiaceae family) rickettsia general characteristics and classification. Rickettsia – pathogens of epidemic cryptosporidiosis and Brill-Zinsser disease, epidemic sryptosporidiosis, Q-fever pathogen. Biological properties. Ecology. Hosts and transmitters. Resistance. Antigen structure. Toxin production. Human pathogenicity. Immunity. Rickettsiosis microbiological diagnostics. Antimicrobial preparations. Specific prophylactics. Chlamydia (Chlamydiaceae family) Classification. Biological properties. Ecology. Resistance. Intracellular parasitism. Antigen structure. Pathogenicity factors. Ornithosis pathogen. Human and birds pathogenicity. Pathogenesis and immunity. Microbiological diagnostics. Antimicrobial preparations. Trachoma pathogen. Human pathogenicity.

Trachomoconjunctivitis of new-born children (blenorea with insertions). Urogenital chlamidiosis. Pathogenesis. Microbiological diagnostics. Principles of specific prophylactics and therapy. Mycoplasma (Mycoplasmataceae family). Mollicutes class general characteristics. Classification. Biological properties. Role in human pathology. Mycoplasma – pneumonia, acute respiratory diseases, urethritis, endocarditis, pregnancy pathology and fetus violation pathogens. Diseases pathogenesis, immunity. Microbiological diagnostics. Principles of specific prophylactics and therapy. Oral cavity mycoplasma.

Topic 14. Spirochetes

General characteristics of the family (Spirochaetaceae family). Classification. Treponema family (Treponema). Syphilis pathogen. Morphological, cultural properties. Syphilis pathogenesis and imunogenesis. Microbiological diagnostics and specific therapy. Yaws pathogens, pints. properties. Ways of human infection. Disease course in human. Microbiological diagnostics. Borrelia family (Borrelia). Epidemic relapsing fever pathogen. Pathogenesis, immunity. Microbiological diagnostics. Specific prophylactics. Endemic tick-borne spirochetosis pathogens. Pathogenesis, diagnostics. Lime disease, pathogen, diagnostics, prophylactics. Leptospira family (Leptospira, Leptospiraceae family). Classification. Leptospirosis pathogen. Properties. Human and animals pathogenicity. Leptospirosis pathogenesis. Immunity. Microbiological diagnostics. Specific prophylactics.

Topic 15. Pathogenic spirilla

Spirilla family (Spirillum). Rats bite fever pathogen. Microbiological diagnostics of the disease. Campylobacters family (Campylobacter). Classification. Campylobacters – pathogens of purulent-inflammatory and acute intestinal diseases. Biological properties, microbiological diagnostics. Helicobacters family (Helicobacter). Discovery of Helicobacter pylori – pathogen of human gastroduodenal diseases. Biological properties. Factors of the stomach mucosa colonization. Urease activity. Helicobacter infection pathogenesis. Methods of microbiological diagnostics: accelerated (urease and histological tests), bacteriological, chain polymerase reaction, serologic diagnostics. Modern methods of helicobacter infection therapy.

Topic 16. Anaerobic non-clostridia bacteria

Bacteroids (Bacteroides). Prevotella (Prevotella). Porphyromanes (Porphyromonas). Ecology. Biological properties. Human pathogenicity. Immunity. Microbiological diagnostics. Antimicrobial preparations. Fusobacteria (Fusobacterium). Propionobacteria (Propionibacterium). Anaerobic cocci, properties. Peptococci (Peptococcus). Peptostreptococci (Peptostreptococcus). Veilonella (Veillonella). Role in human pathology.

Topic 17. Whooping cough pathogen

Whooping cough (Bordetella pertussis). Morphological, cultural, antigen properties. Pathogenesis and immunity of the disease. Microbiological diagnostics. Differentiation of whooping cough, paracocklussum and bronchosepticosis. Specific prophylactics of whooping cough. Etiotropic therapy.

Topic 18. Gram-negative non-fermentative bacteria

Pseudomonada (Pseudomonadaceae family). Classification. Ecology. Resistance. Pseudomonas aerugtinosa (Pseudomonas aeruginosa). Biological properties. Pathogenicity factors. Role in purulent-inflammaroty processes and nosocomial infection occurrence. Microbiological diagnostics. Therapy. Other gram-negative non-fermentative bacteria: acinitobacteria, moraxella.

Topic 19. Other pathogenic bacteria

Legionella (Legionellaceae family). Classification. Biological properties. Ligionella culturing. Legionella spreading in the environment. Legionella characteristics as pneumonia pathogen. Legionellosis pathogenesis. Groups of risk. Pathogenesis of the disease. Clinical forms. Immunity. Microbiological diagnostics. Methods of legionella identificaqtion in the environment. Treatment

prophylactics of leginellosis. Pasteurella family. Taxonomic position. Classification. Biological properties of the family. Pasterella multicida – pathogen of birds diseases, cattle and people. Characteristics. Microbiological diagnostics. Antimicrobial preparations. Haemophilus family. Classification. Biologic properties of haemophilus. Haemophilus growth factors. Haemophilic influenza – pathogen of acute and chronic diseases of respiratory system, bacterial meningitis, etc. Pathogen characteristics. Antigen structure. Sensitivity to antibiotics. Haemophilus ducreyi – pathogen of venereal disease - chancroid. Pathogen characteristics. Microbiological diagnostics of the diseases caused by hemophilia. Antimicrobial preparations. Listeria family. Classification. Biological properties. Pathogenicity in animals. epidemiology. Human disease pathogenesis. Immunity. Microbiological diagnostics. Therapy and prophylactics of listeriosis. Erisipelotrix. Biological properties of erysipeloid. Microbiological diagnostics.

Topic 20. Pathogenic fungi and actinomycetes

Pathogenic fungi. Classification. Biological properties. Resistance. Pathogenicity factors, toxins. Sensitivity to antibiotics. Dermatophytes – pathogens of dermatomycosis (athlete's disease, trichophytosis, microsporia, faus). Properties. Human pathogenicity. Microbiological diagnostics. Pathogens of deep mycosis: blastomycosis, histoplasmosis, cryptococcosis. Properties. Human pathogenicity. Microbiological diagnostics. Fungi of Candida family. Properties. Human pathogenicity. Factors causing candidiasis occurrence (disbacteriosis, etc.). Microbiological diagnostics. Antimicrobial preparations. Pathogens of aspergillosis and penicillinosis. Properties. Human pathgenicity. Pneumocycts (Pneumocystis carinii). Pneumocystis pneumonia in AIDS patients. Actinomycetes (Actinomycetaceae family). General characteristics of actinomycetes family. Actinomycosis pathogen. Ecology. Resistance. Properties. Disease pathogenesis. Immunity. Microbiological diagnostics. Chemotherapeutic preparations. Immunotherapy. Prophylactics of actinomycosis. Nocardia. Classification. Ecology. Biologic properties. Nocardiosis pathogenesis. Microbiological diagnostics. Antimicrobial preparations.

Topic 21. Medical protozoology

Pathogenic protozoa. Classification. Ecology. Biologic properties. Malaria plasmodias. Development cycles. Malaria pathogenesis, immunity. Microbiological diagnostics. Antimicrobial preparations. Prophylactics. Toxoplasma, amoeba, giardia, leishmania, trypanosomes, trichomonas, balantidia. Properties. Role in pathology. Pathogenesis and microbiological diagnostics of the disease. Principles of therapy. Prophylactics.

Informative module 13. Fundamentals of clinical and ecological microbiology

Specific goals:

- ⇨ to interpret biological properties of pathogenic and opportunistic microorganisms and patterns of their interaction with human organism and environment;
- ⇨ to study microbiological, virology diagnostics methods, etiotropic therapy and prophylactics of opportunistic and nosocomial infections.

Topic 22. General characteristics of clinical microbiology

Definition. Importance of clinical microbiology in a physician's work. Objects of study. Pathogenic and opportunistic microorganisms. Pathogenicity. Heterogenicity and variability of populations. Microbiocenosis of healthy and pathologically changes biotopes of human body. Dysbacteriosis (dysmycobiocenosis). Conditions of occurrence. Development implications. Classification according to the pathogen and localization. Methods of diagnostics and sanitation (rehabilitation).

Topic 23. Opportunistic infections

Definition. Conditions of occurrence, peculiarities: polyorganic tropism of pathogens, polyetiologicity, small specificity of clinical manifestations tendencies to generalization. Spreading of

opportunistic infections. Exogenous opportunistic infections (legioneliosis, pseudotuberculosis, listeriosis, seratioz). Endogenous opportunistic infections, role of representatives of organism resistant microflora and their occurrence. Microbiological diagnostics. Etiological role of opportunistic microbes isolated from pathological focus criteria. Microbiological diagnostics. Criteria of etiological role of opportunistic microbes isolated from pathological focus. Opportunistic iatrogenic infections. Etiological structure. Hospital strains and ecovars of opportunistic microbes. Opportunistic infections connected with medical intrusions. Immunity peculiarities. Microbiological foundations of prophylactics and therapy of opportunistic infections. Scientific background of anti-epidemical means.

Topic 24. Nosocomial infections (sanitary, hospital, nosocomial)

Definition. Classification. Conditions contributing to the emergence and wide spreading in the hospital conditions. Microorganisms which more often cause nosocomial infection (staphylococci, streptococci, protea, Escherichia, seratsii, salmonella, pseudomonads, escherichia, vibrions, cytrobacter, brahchamella, moraxella, listeria, mycobacteria, bacteroids, fusobacteria, peptostreptococci, clostridia, mycoplasma, fungi of Candida kind and others). The most widely spread pathology – wound infection, skin purulent-inflammatory processes, subcutaneous fatty tissue, respiratory system organs, central nervous system, gastrointestinal tract, urogenital system, eyes, ears, sepsis, septicopiemia. Etiology, pathogenesis, clinical forms of nosocomial infection caused by obligately pathogenic microbes (nasocomial toxicoseptic salmonellosis, hospital colienteritis, hepatitis B, adenovirus conjunctivitis, local and generalized forms of herpetic and cytomegalovirus infection, chlamydial and mycoplasma urethritis, dermatomycosis etc.). Conditions of nosocomial infections successful diagnostics. Criteria of etiological role of microorganisms isolated at bacteriological diagnostics of nosocomial infections. Prophylactics of nosocomial infections.

Topic 25. Ecological microbiology

Definition. Scientific and social prerequisites of ecological microbiology formation. Populations, biotope, microbiocenosis. Main types of interspecific relationships: neutralism, symbiosis (commensalism, parasitism, mutualism), competition. Dynamicity of ecological connections. Microorganisms ecological systems. Free-living and parasitic microbes. Microflora of soil, water and air – atmosphere and closed rooms (medical institutions, living apartments, etc.). Microbiological aspects of environmental security. Security of microorganisms groups taking part in circulation of substances and energies from damaging action of man-made factors. Biological and man-made pollution of the environment and microbes role in biodegradation. Microbial degradation of national economic materials, pharmaceutical products. Problems of biosphere protection from artificial mutants and “cosmic” microbes. Normal microflora of the human body (eumicrobiocynosis). Autochthonous and allochthonous microflora of human body. Skin, respiratory system, digestive and urinary systems microflora, its antiinfectionous, detoxifying, immunisational, metabolic role. Methods of human body normal microflora study. Gnotobiology, importance of gnotobiological principles in a hospital. Factors affecting qualitative and quantitative composition of human body microflora. Essence of colonization resistance and its role in infectious pathology. Disbacteriosis. Methods of identification. Eubyotics and probyotics – preparations for human body normal microflora revitalization (bifidumbacterin, lactobacterin, colibacterin, bificol, aerococcobacterin, biosporin, bactisubtil and others). Mechanism of action. Dynamics of normal microflora in human ontogenesis. Pathogenic role of normal microflora and mechanism of their pathological properties acquisition. Activity of chemical and physical ecological factors on microorganisms. Influence of temperature, media reaction, drying, irradiation, ultrasound, atmospheric and osmotic pressures, chemical substances of various classes. Mechanism of damaging effect of the mentioned above factors.

Informative module 14. Sanitary microbiology and virology

Specific goals:

- ⇨ to interpret concepts «sanitary-indicative microorganisms» and their role as indicators in assessment of contamination level of objects of the environment by pathogenic microorganisms: water, soil, air;
- ⇨ to analyze qualitative and quantitative composition of water, soli, air microbes and draw a conclusion about their safety in epidemic sense;
- ⇨ to interpret sanitary-virological and bacteriological assessment criteria of water objects, soil and closed rooms air.

Topic 26. Fundamentals of sanitary microbiology. Sanitary microbiology of water, soil and air

Importance of sanitary microbiology in a physician's work. Tasks and methods of microbiological studies. Direct methods of pathogenic microorganisms indication in the environment and indirect methods of sanitary-microbiological study. Microbial count. Sanitary-indicative microorganisms (CIM) of soil, water and air. Terms and conditions of pathogenic microbes survival in the environment. Sanitary microbiology of water. Methods of sanitary-microbiological study of water. Microbial count identification. Identification of quantitative bacteria – indices of fecal pollution: coli-index and coli-titer (method of membrane and fermentative filters). E.coli varieties and problems about its sanitary importance. Fecal coliforms (FCF) bacteria of E.coli group - indices of fresh fecal pollution. Role of water in infectious diseases pathogens transmission. Sanitary microbiology of soil. Sanitary microbiology of soil in connection with infection prophylactics. Pathogenic microorganisms identified in soil. Microbe for which soli is a natural biotope. Microbes which come into soil with human and animal feces. Methods of sanitary-microbiological study of soil. Factors affecting qualitative and quantitative composition of soil microbes. Microbial count, coli-titre, perfringens-titre of soil. Sanitary microbiology of air. Role of air in infectious diseases transmission. Methods of aerial microbial count identification. Factors affecting microbial composition. Methods of sanitary-bacteriological study of the air (sedimentary and aspiration). Assessment of sanitary state of closed rooms according to the general microbial contamination, presence of SPM (staphylococci, α- i β-hemolytic streptococci), which are indices of air contamination by human nasopharynx microflora.

Topic 27. Sanitary virology

Subject, tasks, importance of sanitary virology in a physician's work. Role of water, soil, air in pathogens of virus infection transmission. Viruses which are most often found in objects of environment. Sanitary-virological studies of water. Choice of samples, methods of identification and concentration. Viruses, bacteriophages in drinking water and wastewater. Methods of identification. Methods of pathogenic microorganisms identification in soil. Enteroviruses testing of soil. Role of air environment in virus infections pathogens spreading. Methods of air samples choice and respiratory viruses indication.

3. STRUCTURE OF THE DISCIPLINE

Table 3.1

MODULE 1 «Morphology and physiology of microorganisms. Infection. Immunity»

№ №	Topics	Lectures	Practice	IW
Informative module 1. Introduction to microbiology				
1	Subject and tasks of medical microbiology. Original methods of microbiological research. Principal features of modern medical microbiology. Their development tendencies	1	1	–

2	Stages of microbiology development	–	–	1
Informative module 2. Morphology and structure of prokaryotes and parasitic unicellular eukaryotes				
3	Organization of bacteriological laboratory. Colorants and simple methods of microorganisms staining. Microscopy	–	1	1
4	Bacteria staining by Gram	–	2	1
5	Bacterial morphology and structure	1	2	–
6	Morphology and structure of spirochetes, actinomycetes, fungi, protozoa	–	2	1
Informative module 3. Bacteria physiology. Microorganisms evolution and classification				
7	Bacteria metabolism. Cultural media for microorganisms	1	2	–
8	Antiseptics and aseptics. Methods and means	–	2	1
9	Growth and reproduction of microorganisms. Isolation of pure bacterial cultures	0,5	2	–
10	Microorganisms colonies. Isolation of pure cultures of anaerobic bacteria	–	2	1
11	Microorganisms pure cultures identification	–	2	1
12	Microorganisms evolution. Systematization, classification nomenclature of microorganisms	0,5	2	–
Informative module 4. Microorganisms genetics				
13	Microorganisms genetics	0,5	2	–
Informative module 5. Microbiological foundations of antimicrobial chemotherapy				
14	Chemotherapy preparations. Antibiotics	0,5	2	1
Informative module 6. Infection				
15	Infectious process, its types, conditions of occurrence and development	0,5	2	1
Informative module 7. Organism immune system. Reaction of non-specific protection against infectious agents				
16	Main stages of immunology development	0,5	–	1
17	Immune system organs. Factors of organism non-specific protection from microorganisms	0,5	2	1
Informative module 8. Antigens. Antibodies				
18	Antigens characteristic	0,5	2	–
19	Antibodies as a product of humoral immune response	1	1	–
Informative module 9. Immunity reactions. Immunopathology				
20	Immune response reactions. Antibodies application principles for therapy-prophylactics and diagnostic preparations	1	1	1
21	Principles of microbial antigens application as prophylactic and diagnostic preparations	1	1	1
22	Immunopathology. Assessment of the immune status of the organism	–	1	1
23	**Final semester knowledge control of module 1 "Morphology and physiology of microorganisms. Infection. Immunity"**	–	2	–
TOTAL		**10**	**36**	**14**

Note : hours – 60, credits of ECTS – 2; scheduling – 76,7%, IW – 23,3%

Table 3.2

Topical plan of lectures to module 1 «Morphology and physiology of microorganisms. Infection. Immunity»

№№	Topic of the lecture	Hours
1	Subject and tasks of medical microbiology. Original methods of microbiological research. Principal features of modern medical microbiology. Their development tendencies	1
2	Bacterial morphology and structure	1
3	Bacteria metabolism. Cultural media for microorganisms	1

4	Growth and reproduction of microorganisms. Isolation of clear bacterial cultures	0,5
5	Microorganisms evolution. Systematization, classification nomenclature of microorganisms	0,5
6	Microorganisms genetics	0,5
7	Chemotherapy preparations. Antibiotics	0,5
8	Infectious process, its types, conditions of occurrence and development	0,5
9	Main stages of immunology development	0,5
10	Immune system organs. Factors of organism non-specific protection from microorganisms	0,5
11	Antigens characteristic	0,5
12	Antibodies as a product of humoral immune response	1
13	Immune response reactions. Antibodies application principles for therapy-prophylactics and diagnostic preparations	1
14	Principles of microbial antigens application as prophylactic and diagnostic preparations	1
TOTAL		**10**

Table 3.3

Topical plan of practical lesson
to module 1 «Morphology and physiology of microorganisms. Infection. Immunity»

№ №	Topic of practical lessons	Hours
1	Subject and tasks of medical microbiology. Original methods of microbiological research. Principal features of modern medical microbiology. Their development tendencies	1
2	Organization of bacteriological laboratory. Colorants and simple methods of microorganisms staining. Microscopy	1
3	Bacteria staining by Gram	2
4	Bacterial morphology and structure	2
5	Morphology and structure of spirochetes, actinomycetes, fungi, protozoa	2
6	Bacteria metabolism. Cultural media for microorganisms	2
7	Antiseptics and aseptics. Methods and means	2
8	Growth and reproduction of microorganisms. Isolation of pure bacterial cultures	2
9	Microorganisms colonies. Isolation of pure cultures of anaerobic bacteria	2
10	Microorganisms pure cultures identification	2
11	Microorganisms evolution. Systematization, classification nomenclature of microorganisms	2
12	Microorganisms genetics	2
13	Chemotherapy preparations. Antibiotics	2
14	Infectious process, its types, conditions of occurrence and development	2
15	Immune system organs. Factors of organism non-specific protection from microorganisms	2
16	Antigens characteristic	2
17	Antibodies as a product of humoral immune response	1
18	Immune response reactions. Antibodies application principles for therapy-prophylactics and diagnostic preparations	1
19	Principles of microbial antigens application as prophylactic and diagnostic preparations	1
20	Immunopathology. Assessment of the immune status of the organism	1

Final semester knowledge control of module 1 «Morphology and physiology of microorganisms. Infection. Immunity»	2
TOTAL	**36**

Table 3.4

Types of IW and its control during the study of module 1 «Morphology and physiology of microorganisms. Infection. Immunity»

№№	Type of IW	Hours	Type of control
1	Preparation for practical lessons – self-skill and theoretical training	13	Flow control at practical lessons
2	Self-training of the topics not included into the plan of the lessons	–	–
2.1	Stages of microbiology development	1	Final module control
3	Preparation for final semester module 1 control	–	
TOTAL		**14**	

Table 3.5

Oriented structure of the test credit – module 2 «General and special virology»

№№	Topic	Lectures	Practical lessons	IW
	Informative module 10. General virology			
1	Viruses morphology and ultrastructure. Viruses cultivation in chicken embryo and laboratory animals organism	0,5	2	3
2	Cellular cultures in virology. Methods of viruses cultivation in cellular cultures and chicken embrio. Indication of virus reproduction	0,5	2	3
3	Serologic reactions used in virology	–	2	3
4	Viruses genetics. Bacteriophages, practical application	–	–	4
	Informative module 11. Special virology			
5	Orthomixoviruses	1	4	4
6	Paramixoviruses	1	4	4
7	Picormaviruses	1	2	4
8	Retroviruses. HIV	1	4	4
9	Other RNA-genome viruses	–	–	4
10	Poxviruses, papovaviruses, parvoviruses	1	2	4
11	Herpesviruses	1	4	4
12	Adenoviruses	1	2	4
13	Virus hepatitis pathogens	1	2	4
14	Arboviruses ecologic group	–	–	4
15	Oncogenic viruses	0,5	2	4
16	Prions	0,5	–	4
17	**Final semester knowledge control of module 2 «General and specific virology»**	–	2	–
РАЗОМ		**10**	**34**	**61**

Notes: hours – 105, credits ECTS – 3,5; scheduling – 41,9%, IW – 58,1%

Table 3.6

Topical plan of lectures for module 2 «General and special virology»

№ №	Topic of lecture	Hours
1	Viruses morphology and ultrostructure. Viruses cultivation in chicken embryo and laboratory animals organism	0,5
2	Cellular cultures in virology. Methods of viruses cultivation in cellular cultures and chicken embrio. Indication of virus reproduction	0,5
3	Orthomixoviruses	1
4	Paramixoviruses	1
5	Picormaviruses	1
6	Retroviruses. HIV	1
7	Poxviruses, papovaviruses, parvoviruses	1
8	Herpesviruses	1
9	Adenoviruses	1
10	Virus hepatitis pathogens	1
11	Oncogenic viruses	0,5
12	Prions	0,5
TOTAL		**10**

Table 3.7

Topical plan of practical lesson for module 2 «General and special virology»

№ №	Topic of practical lesson	Hours
1	Viruses morphology and ultrostructure. Viruses cultivation in chicken embryo and laboratory animals organism	2
2	Cellular cultures in virology. Methods of viruses cultivation in cellular cultures and chicken embrio. Indication of virus reproduction	2
3	Serologic reactions used in virology	2
4	Orthomixoviruses	4
5	Paramixoviruses	4
6	Picormaviruses	2
7	Retroviruses. HIV	4
8	Poxviruses, papovaviruses, parvoviruses	2
9	Herpesviruses	4
10	Adenoviruses	2
11	Virus hepatitis pathogens	2
12	Oncogenic viruses	2
Final semester control of module 2 «General and special virology»		2
TOTAL		**34**

Table 3.8

Types of IW and its control during the study of module 2 «General and special virology»

№ №	Type of IW	Hours	Type of control
1	Preparation for practical lessons – individual skill and theoretical training	49	Flow control at practical lessons

2	Individual training of the material not included into the curriculum	–	–
2.1	Viruses genetics. Bacteriophages, practical application	4	Final module control
2.2	Other RNA-genome viruses	4	
2.3	Arboviruses ecologic group	4	
TOTAL		**61**	

Table 3.9

Oriented structure of the test credit – module 3 «Special, clinical and ecological microbiology»

№ №	Topic	Lectures	Practical lessons	IW
Informative module 12. Introduction to microbiology				
1	Staphylococci and streptococci (Micrococcaceae and Streptococcaceae families)	1	4	2
2	Meningococci and gonococci (Neisseriaceae family)	1	2	1
3	Enterobacteria (Enterobacteriaceae family). Escherichia	0,5	2	1
4	Salmonellas	0,5	2	1
5	Salmonellas – gastroenterocolitis pathogens	0,5	2	1
6	Shigella	0,5	2	1
7	Other pathogenic enterobacteria	0,5	2	2
8	Vibrions (Vibrionaceae family)	0,5	2	1
9	Corynobacteria (Corynebacteriaceae family)	0,5	2	1
10	Mycobacteria (Mycobacteriaceae family)	0,5	2	1
11	Anaerobic infections pathogens (Bacillaceae family)	–	2	1
12	Zoonotic infections pathogens	–	2	1
13	Rickettsia, chlamydia, mycoplasma	–	4	1
14	Spirochetes	1	4	1
15	Pathogenic spirilla	1	2	1
16	Anaerobic non-clostridia bacteria	–	–	1
17	Whooping cough pathogen	–	–	1
18	Gram-negative non-fermenting bacteria	–	–	1
19	Other pathogenic bacteria	–	–	1
20	Pathogen fungi and actinomycetes	–	–	1
21	Medical protozoology	–	–	1
Informative module 13. Prokaryotes and parasitic unicellular eukaryotes				
22	General characteristics of clinical microbiology	0,5	4	2
23	Opportunistic infection	0,5	2	1
24	Nosocomial infections (sanitary, hospital, nosocomial)	0,5	2	1
25	Ecological microbiology	–	–	1
Informative module 14. Bacteria physiology. Microorganisms evolution and classification				
26	Fundamentals of sanitary microbiology. Sanitary microbiology of water, soil and air	0,5	2	1
27	Sanitary virology	–	2	1

28	**Final learning semester control of module 3 «Special, clinical and ecological microbiology»**	–	2	–
TOTAL		**10**	**50**	**30**

Notes: hours – 90, ECTS credits ECTS – 3; scheduling – 66,7%, IW – 33,3%

Table 3.10

Topic plan of lectures to module 3 «Special, clinical and ecological microbiology»

№ №	Topic of lecture	Hours
1	Staphylococci and streptococci (Micrococcaceae and Streptococcaceae families)	1
2	Meningococci and gonococci (Neisseriaceae family)	1
3	Enterobacteria (Enterobacteriaceae family). Escherichia	0,5
4	Salmonellas	0,5
5	Salmonellas – gastroenterocolitis pathogens	0,5
6	Shigella	0,5
7	Other pathogenic enterobacteria	0,5
8	Vibrions (Vibrionaceae family)	0,5
9	Corynobacteria (Corynebacteriaceae family)	0,5
10	Mycobacteria (Mycobacteriaceae family)	0,5
11	Spirochetes	1
12	Pathogenic spirilla	1
13	General characteristics of clinical microbiology	0,5
14	Opportunistic infections	0,5
15	Nosocomial infections (sanitary, hospital, nosocomial)	0,5
16	Fundamentals of sanitary microbiology. Sanitary microbiology of water, soil and air	0,5
TOTAL		**10**

Table 3.11

Topical plan of practical lesson to module 3 «Special, clinical and ecological microbiology»

№ №	Topic of practical lesson	Hours
1	Staphylococci and streptococci (Micrococcaceae and Streptococcaceae families)	4
2	Meningococci and gonococci (Neisseriaceae family)	2
3	Enterobacteria (Enterobacteriaceae family). Escherichia	2
4	Salmonellas	2
5	Salmonellas – gastroenterocolitis pathogens	2
6	Shigella	2
7	Other pathogenic enterobacteria	2
8	Vibrions (Vibrionaceae family)	2
9	Corynobacteria (Corynebacteriaceae family)	2
10	Mycobacteria (Mycobacteriaceae family)	2
11	Anaerobic infections pathogens (Bacillaceae family)	2
12	Zoonotic infections pathogens	2
13	Rickettsia, chlamydia, mycoplasma	4
14	Spirochetes	4

15	Pathogenic spirilla	2
16	General characteristics of clinical microbiology	4
17	Opportunistic infections	2
18	Nosocomial infections (sanitary, hospital, nosocomial)	2
19	Fundamentals of sanitary microbiology. Sanitary microbiology of water, soil and air	2
20	Sanitary virology	2
Final semester control of module 3 «Special, clinical and ecological microbiology»		2
TOTAL		**50**

Table 3.12

Types of IW and its control during the study of module 3 «Special, clinical and ecological microbiology»

№ №	Types of IW	Hours	Type of control
1	Preparation for practical lessons – individual learning of practical skills and theoretic preparation	20	Flow control at practical lessons
2	Individual learning of material not included into the curriculum	–	–
2.1	Anaerobic non-clostridia bacteria	1	Final semester control
2.2	Whooping cough pathogen	1	
2.3	Gram-negative non-fermenting bacteria	1	
2.4	Other pathogenic bacteria	1	
2.5	Pathogen fungi and actinomycetes	1	
2.6	Medical protozoology	1	
2.7	Ecological microbiology	1	
3	Preparation for final semester control of module 3	3	
TOTAL		**30**	

VI. INDIVIDUAL CLASSES

Not provided by the working proram

VII. TEACHING METHODS

Among the teaching methods in the study of the discipline "Microbiology, Virology, Immunology" depending on the stage of training use the method of preparation for the study of new material and study of new material, its consolidation in the form of questions for self-control, as well as the method of explaining the teacher can be used explanatory-illustrative, reproductive, partial-search, research methods, and independent work, where the teacher's guidance is indirect.

VIII. METHODS OF CONTROL

Among the main methods of control in practical classes after self-study of new material for its consolidation are used tasks in the form of control exercises with their assessment (input (previous), current, boundary), which in the form can be: oral interview (both individual and frontal), or written, or programmable, or test, or practical control. Among modern technologies, situational modeling technologies (role, game, etc.) or algorithmization / standardization technologies can be used. Among

the interactive methods used: the method of analysis of specific, problematic situations; group discussion method; method of competitive groups, etc.

At the department, the assessment of the applicant for higher medical education for work in the classroom is comprehensive, according to the "four-point" system and includes theoretical knowledge, work at the patient's bedside, practical skills.

Excellent - the applicant of higher medical education has deeply and steadily mastered the program material; exhaustively, consistently, competently and logically teaches it. The answers are closely linked to theory and practice; fluently reads the results of analysis and instrumental research and solves situational problems of increased complexity; well acquainted with the basic literature and methods of research of the patient in the volume necessary for practical activity of the doctor; demonstrates the ability to connect theoretical aspects of the subject with practical health problems.

Good - the applicant of higher medical education firmly knows the program material, competently and in fact teaches it; does not allow significant inaccuracies in the answers to the questions; correctly applies theoretical positions in solving practical issues and problems; has the necessary skills and techniques to perform them; is able to solve light and medium situational problems; possesses methods of laboratory and clinical researches in the volume exceeding duties a minimum; able on the basis of the specific content of the answer is enough to show enough logical thinking.

Satisfactory - the applicant of higher medical education knows only the basic material, but has not mastered it in detail, admits inaccuracies, insufficiently correct wording, violation of the sequence in the coverage of the program material. Applicants for higher medical education are able to solve only the easiest problems, has only a mandatory minimum of research methods; insufficiently oriented in matters of methodology, poorly aware of the basic principles of deontology.

Unsatisfactory - the applicant of higher medical education does not know a significant part of the program material, makes significant mistakes, is not sure, with great difficulty performs practical work.

After completing the full course of the program (completed all classes and protected academic history, etc.), the applicant for higher medical education can not be admitted to the final module control without the appropriate knowledge and skills. The future doctor must be erudite and cultured, have high moral qualities, be merciful, compassionate, constantly follow the rules of medical ethics and deontology.

Independent work of applicants, which is provided in the topic along with the classroom, is assessed during the current control of the topic in the relevant lesson. Assimilation of topics that are submitted only for independent work is monitored during the exam.

The applicants of higher medical education can work out the missed topics for a positive assessment of the teacher during his consultations during the study of the discipline, thus gaining a number of points not less than the minimum to be admitted to the final module control. The semester test can be rescheduled no more than 3 times. Applicants who have successfully passed 3 modules in the discipline «Microbiology, Virology, Immunology» can be admitted to the exam.

IX. SCORING SCHEME

During the assessment of mastering of each topic for the current educational activity, the applicants are given grades on a 4-point (traditional) scale, taking into account the approved evaluation criteria for the respective discipline. This takes into account all types of work provided by the curriculum. Higher education providers should receive a grade on each topic. Forms of assessment of current learning activities should be standardized and include control of theoretical and practical training. Traded scores are converted into points. The maximum number of points that an applicant can earn for his / her current educational activity in the study of discipline is 200 points. The minimum number of points that an applicant must earn for his / her current educational activities to enroll in the discipline is 120 points.

Assessment of success in the discipline is given only to applicants who have enrolled all the lessons in the discipline. The mark obtained by the higher medical education applicant from the

discipline is defined as the arithmetic mean of all the lessons of the discipline (by the formula given). The objectivity of evaluating the learning activities of applicants must be verified by statistical methods (the correlation coefficient between current performance and the results of final control). The maximum number of points that a higher medical education applicant can earn in the current semester for admission to final control is 120 points. The minimum number of points that an applicant must earn for the current academic activity per semester is 72 points.

The calculation of the number of points is made on the basis of the scores obtained by the applicant on the traditional scale during the study of the discipline, by calculating the arithmetic mean (CA), rounded to two decimal places. The resulting value is converted to scores on a multicolor scale as follows:

$$\frac{x = CA \times 120}{5}$$

For convenience, the table is calculated on a 200-point scale:

Recalculation of the average score for current activity into a multi-scale scale for disciplines ending in differential credit.

Table 9.1

4 - point scale	**200 - point scale**								
5	120	4.54	109	4.08	98	3.62	87	3.2	77
4.95	119	4.5	108	4.04	97	3.58	86	3.16	76
4.91	118	4.45	107	3.99	96	3.54	85	3.15	
4.87	117	4.41	106	3.95	95	3.49	84	3.12	75
4.83	116	4.37	105	3.91	94	3.45	83	3.1	
4.8	115	4.33	104	3.87	93	3.41	82	3.08	74
4.75	114	4.29	103	3.83	92	3.37	81	3.04	73
4.7	113	4.25	102	3.79	91	3.33	80	3	72
4.66	112	4.2	101	3.74	90	3.29	79	Less 3	not enough
4.62	111	4.16	100	3.7	89	3.25	78		
4.58	**110**	**4.12**	**99**	**3.66**	**88**	**3.22**			

Independent work of applicants, which is provided in the subject along with the classroom, is evaluated during the ongoing control of the topic in the relevant lesson.

The maximum number of points that an applicant can earn while studying the module is 200, including for the current educational activity - from 72 to 120 points, according to the results of the final module control - from 48 to 80 points.

The minimum number of points that an applicant must earn for his / her current learning activities when studying a module is 72 points and is determined by multiplying the number of topics of the module by the equivalent score for a "satisfactory" rating by the formula given.

The final assessment of the discipline «Microbiology, Virology, Immunology» ends with a state exam, the form of which is decided at a meeting of the Department of General and Clinical Immunology and Allergology. Points from the discipline are independently converted into both the ECTS scale and the 4-point scale.

During the study of the discipline «Microbiology, Virology and Immunology» applicants assess the knowledge and skills of applicants during the current and final semester tests, while the assessment uses various forms of control, namely an oral interview on the topic of classes, tests and solutions. linking situational tasks that complement each other in order to achieve the most complete and objective assessment of knowledge and skills of applicants. After studying and successfully completing three final semester tests on the topics of the three modules of the discipline, applicants pass the final exam in the discipline, which is regulated by the Regulations on the organization of the educational process at V.N. Karazin Kharkiv National University.

CRITERIA FOR ASSESSING INDIVIDUAL MODULES OF THE DISCIPLINE

After the final semester tests, a final assessment of the level of mastering theoretical material and mastering practical skills by students of the relevant module of the discipline, while the number of ECTS points that the applicant received during the current academic activity, added ECTS points that the applicant gained during the final semester.

Encouragement points by the decision of the Academic Council of the Medical Faculty may be added to the number of points for studying individual modules of the discipline to applicants who have scientific publications, took an active part in the scientific circle of the department or won prizes for participating in the Olympiad in higher medical institutions of Ukraine. .

The obtained sum of ECTS points for the study of each of the modules of the discipline is transformed into an assessment for the study of the module on a two-level scale in accordance with table 9.2.

Table 9.2

The scheme of conversion of ECTS points for the study of individual modules of the discipline into grades on a traditional 4-point scale

Number of ECTS points for studying the module	Score on a two-level scale
120 – 200	«Credited»
119 and less, of which 60 points or more for current educational activities	«Not credited» with the possibility of re-assembly
59 points for current educational activities and less	«Not credited» without the possibility of re-assembly

Applicants who received a grade of «not credited» during the final semester control, have the right to re-take the final semester control by the end of the examination session within the period provided by the curriculum for higher education, a teacher who conducted practical classes in the discipline, and more once, the third, a commission created by the order of the rector (first vice-rector) of the university on the proposal of the dean of the medical faculty. The evaluation of the commission is final.

An applicant for higher education, who scored less than 120 points as a result of the final semester control, is expelled from the university by the order of the rector (first vice-rector) as not having fulfilled the curriculum.

Final exam

The semester exam is a component of the final semester control, which consists in assessing the mastering by the higher education student of the study material of three modules of the discipline, the learning outcomes of which are evaluated on two-point and traditional 4-point grading scales. The semester exam is held during the examination session at the end of the study of the discipline in the V semester of the 3rd year of study for applicants who have met the requirements of the work program and passed three final semester tests. The schedule of examination sessions is approved by the first vice-rector and is communicated to scientific and pedagogical workers and applicants for higher education not later than one month before the beginning of the session. 2-4 days are provided for the preparation of higher education students for the semester exam. Teachers of the discipline are consulted before each exam. Assessment of knowledge and skills of applicants during the final semester exam is conducted by a commission consisting of three research and teaching staff of the Department of General and Clinical Immunology and Allergology, the composition of which is approved in advance by the educational part of the university.

The exam is conducted by testing, with test tasks are formed into variants (100 test tasks in each variant) in the amount proportional to the number of academic hours devoted to the study of the topic by thematic plans of three modules of the work program, from test banks for current, final semester and exam controls.

The test tasks of the final examination control options have five answer options, of which only one is correct. For the correct answer the applicant is awarded 2 ECTS points, for the incorrect one - 0 ECTS points. The total number of points obtained by the applicant during the final examination control is transformed into a grade according to the traditional rating scale.

Table 9.3

The scheme of transformation of the points gained by the applicant during the final examination control into ECTS points and assessment according to the traditional 4-point rating scale

Number of correct answers	Accrued points ECTS	Score on the traditional 4-point scale
59 and less	118 and less	«Unsatisfactorily»
60-74	120-148	«Satisfactorily»
75-89	150-178	«Good»
90 and more	180 and more	«Excellent»

The refusal of the higher education applicant to perform the examination task is certified as an unsatisfactory answer.

Applicants for higher education must be acquainted with the results of their examination (final test) written work no later than five working days after its writing. The applicant of higher education has the right to get acquainted with the tested work and to receive explanations concerning the received estimation.

In case of disagreement with the assessment, the applicant has the right to submit a written appeal to the head of the department on the day of the announcement of the assessment or the next working day, indicating the specific reasons for disagreement with the assessment. The head of the department together with the examiners, involving, if necessary, other specialists, within three days considers the appeal and orally notifies the applicant of the results of the examination.

If the results of the higher education student according to the results of the final semester exam are evaluated with less than 120 points, he has the right to retake the semester exam before the end of the examination session. Re-passing (re-passing) of the semester exam is allowed no more than three times: the first two times - commissions of three scientific and pedagogical staff of the Department of General and Clinical Immunology and Allergology, the third re-assembly - a commission created by order of the rector medical faculty. The evaluation of the commission is final.

An applicant for higher education who scores less than 120 points as a result of passing and all retaking of the final semester exam is expelled from the university by order of the rector (first vice-rector) as not having fulfilled the curriculum.

COMPLIANCE WITH THE CODE OF ACADEMIC INTEGRITY

During the study of the discipline, applicants of the second educational and scientific level in medicine must adhere to the Code of Academic Integrity of Kharkiv National University named after V.N. Karazina. For this purpose of performance of independent work, control works, work on offset has to be carried out individually. When doing independent work, applicants can consult with teachers and other applicants, but must do the task themselves, guided by their own knowledge, skills and abilities. References to all resources and resources used by the applicant in the performance of tasks must be clearly defined and designed in accordance with existing rules and standards. In the case of joint work with other applicants on the tasks, the applicant must indicate the degree of his involvement in the work.

LIST OF CONTROL QUESTIONS AND PRACTICAL SKILLS FOR FLOW AND FINAL CONTROL MODULES OF APPLICANTS KNOWLEDGE AND SKILLS

List of control questions

Control questions to the module 1 «Morphology and physiology of microorganisms. Infection. Immunity»

Informative module 1. Introduction to microbiology

1. Definition of the microbiology as a science. Fields of microbiology. Subjects and tasks of medical microbiology. Main features and tendencies of modern microbiology development.
2. Discovery of microorganisms by A. Leeuwenhoec. Stages of microbiology development. Contribution of L. Paster, R. Koh to microbiology.
3. The formation of main microbiological science directions. Contribution of D.Samoilovich, E. Jener, I.I. Mechnikov, D.I.Ivanovsky, P. Erlich, S.M.Vinogradsky E. Bering, G. Ramon, G. Domagk, O. Fleming, D.K. Zabolotny, L.O. Zilber, V.M. Zhdanov,M.P. Chumakov, F. Bernet and other scientists. Development of Ukrainian microbiology.

Informative module 2. Morphology and structure of prokaryotes and parasitic unicellular eukaryotes.
Microorganisms staining. Microscopy

1. Main distinctions of prokaryotes from eukaryotes, bacteria forms with cellular wall synthesis defect, protoplasts, spheroplasts. L-forms of bacteria.
2. Bacteria morphology and structure. Role of separate structures for bacteria vital functions and in pathogenesis of infectious diseases. Vegetative forms and spores.
3. Protozoa morphology and classification.
4. Fungi classification and morphology.
5. Microscopy methods. Making of bacterial preparations. Colorants and staining solutions, pure and complicated ways of staining.
6. Organization principles, equipment and working regime of bacteriological, serological and virological laboratories.
7. Bacterioscopic method of research. Stages.

Informative module 3. Microorganisms physiology (prokaryote). Microorganisms evolution and classification

1. Types and mechanisms of microorganisms nutrition. Mechanism of nutrient permeation into bacterial cell. Microorganisms chemical composition. Meaning of components. Culture media and requirements for them. Classification of culture media ,used in microbiology.
2. Microorganisms breathing. Aerobic and anaerobic types of breathing. Cell enzymes and structures taking part in the process of breathing. Methods of anaerobic bacteria growing.
3. Microorganisms enzymes, their role in metabolism. Application for bacteria differentiation. Pathogenicity enzymes.
4. Growth and ways of bacteria reproduction. Mechanism of cellular division, phases of bacteria cultures reproduction in stationary conditions.
5. Bacteriological method of research. Principles of pure bacteria cultures and their identification
6. Influence of physical, chemical and biological factors on microorganisms. Sterilization, methods, effective sterilization control. Aseptics and antiseptics.
7. Microorganisms origin and evolution. Modern classification of prokaryotes. Main taxons. Systematization and nomenclature of bacteria. Kind as a main taxonomic unit.
8. Systematization and nomenclature of bacteria. Systematization main principles. Bacteria classification. Characteristics of a kind.

Informative module 4. Microorganisms genetics

1. Material basis of microorganisms heredity. Genotype and phenotype. Types of variability. Non-hereditary variability.
2. Hereditary variability. Mutations, their varieties. Physical, chemical, biological mutagens. Genetic recombinations: transformation, transduction, conjugation.
3. Extrachromosomal factors of bacteria heredity. Plasmids, their main genetic functions. Migrating elements. Role of mutations, recombinations and selections in microbes evolution. Main factors of evolution.
4. Genetics importance in general and medical microbiology, virology, molecular biology. Microbiological fundamentals of genetic engineering. Scheme of genetic structures getting and hereditarily changed organisms. Achievement of genetic engineering, use of genetic engineering preparations in medicine.

Informative module 5. Microbiological foundations of antimicrobial chemotherapy

1. Chemotherapy and chemotherapeutical preparations, chemotherapeutical index. Mechanism of sulfanilamides antibacterial activity. Role of Erlich and G.Domagk in chemotherapy doctrine development.
2. Microbes antagonism phenomenon. Role of Ukrainian microbiologists in the development of the doctrine of microbe antagonism. Antibiotics, characteristics, principles of getting, units of measure. Classification according to mechanism of action on microorganisms.
3. Medicinal resistance of microorganisms, mechanism of resistant forms formation. Methods of microbes sensitivity identification to antibiotics. Minimal suppressing (MSC) and maximal bactericidal concentrations (MBC). Practical significance. Principles of fighting with medicinal resistance of microorganisms.

Informative module 6. Infection

1. Infection. Factors determining occurrence of infectious process. Role of microorganisms in infectious process. Pathogenicity, virulence, units of measure, methods of identification. Factors of microorganisms pathogenicity, their characteristics.
2. Microbes toxins (exso- and endotoxins). Properties and chemical combination, getting, force of exotoxins measurement. Role in pathogenesis and immunogenesis of infectious diseases.
3. Infectious process development stages. Pathogenic microorganisms means of transmission. Bacteremia, toxemia, sepsis. Periods of infectious disease..
4. Role of macroorganism in infectious process. Immunologic reactivity of the organism of a child. Environmental social conditions influence on the occurrence and development of human infectious process. Bacteria and viruses persistency. Content of relapse, re-infection, super-infection.

Informative module 7. Organism immune system. Reactions of non-specific organism protection from microorganisms

1. Doctrine about immunity. Immunology stages of development. Types of immunity and forms of manifestation.
2. Non-specific factors of organism protection from pathogenic microbes. Complement, its properties, ways of activation. Phagocytosis, types of phagocytic cells. Phagocytosis stages. Completed and unfinished phagocytosis.
3. Organism immune system, its organs. Role of thymus in immune response. Immune system cells their variety, interaction of T-, B-lymphocytes and macrophages. Their role in cellular and humoral immunity.
4. Patterns of organism immune response. Phases of immune response. Immunological reactions. Immunological tolerance, reasons for its occurrence. Immunological memory, its mechanism.
5. Hypersensitivity of immediate and delayed types, their mechanisms, differences. Practical meaning.
6. Three-cell cooperation of immune response. Role of separate immune system cells, their interaction. Interleukins.

Informative module 8. Antigens. Antibodies

1. Antigens, their characteristics. Full and defective antigens. Bacteria antigen structure. Practical meaning of the doctrine of microbes antigens. Autoantigens.
2. Antibodies, their nature. Synthesis place, dynamics of antibodies production. Autoantibodies.
3. Antitoxins, their properties, mechanism of action. Principles of getting of antitoxic sera. Assessments of measurement, practical application.
4. Serologic reactions, their characteristics, main types, practical application. Agglutination reaction, its mechanism, variety. Practical application.
5. Serologic reactions. Precipitation reaction, its mechanism. Application in medical practicei. Precipitation reaction in gel.
6. Serologic reactions. Lysis reactions. Compliment fixation test, its practical application.
7. Reactions with marked antibodies and antigens. Practical application of immunofluorescence reaction (IFR), immune enzymatic and radioimmune analysis.

Informative module 9. Immunity reactions. Immunopathology

1. Forms and types of immune reaction. Humoral immune response and its stages.
2. Primary and secondary immune response. Interaction of immune system cells in the process of immune response..
3. Immune response reactions, their characteristics. Cellular immune response.
4. Hypersensitivity of immediate and delayed type. Mechanism of these reactions development.
5. Monoclonal antibodies, their getting and application in medical practice. Monoclonal antibodies, their getting and application in medical practice.
6. Immune deficit states, autoimmune processes. Complex assessment of organism immune status.
7. Live vaccines, principles of getting. Control, practical application of live vaccines, efficiency assessment.
8. Vaccines. History of getting. Vaccines classification. Corpuscular, chemical, synthetic, genetic engineering and antiidiotype vaccines.
9. Chemical vaccines and antitoxins, principles of getting. Associated vaccines. Adsorbed vaccines, «depot» principle.
10. Antitoxins, their getting, cleansing, units of measure, application, assessment.
11. Corpuscular vaccines from killed microbes. Principles of getting, control, efficiency assessment.

Control questions to the module 2 «General and special virology»

Informative module 10. General virology

1. History of discovery and main stages of virology development. Contribution of Ukrainian scientists. Methods of viruses study, their assessment.
2. Viruses morphology and ultrastructure. Types of viruses symmetry. Chemical composition, functions of viruses component parts.
3. Bacteriophage, history of study. Structure, classification of the plaghs according to morphology. Methods of quantitative and qualitative bacteriophages identification. Practical application of bacteriophages.
4. Forms of bacteriophages interaction with bacterial cell. Virulent and moderate phages. Characteristics of productive interaction. Isogeny and phage conversion.
5. Modern views on viruses nature and origin. Viruses place in live system.
6. Principles of viruses classification. Main properties of human and animal viruses.
7. Methods of viruses cultivation and their assessment.
8. Reactions of virus hemagglutination and hemadsorption. Mechanism, practical meaning, application, diagnostic value.
9. Serologic reactions used in virology. Reaction of virus neutralization, mechanism, application principles, diagnostic value.

10. Reaction of hemagglutination inhibition, its mechanism, performance conditions, principles of application, diagnostic value.
11. Reaction of compliment fixation, its essence, assessment. Peculiarities of compliment fixation reaction presentation in virus infections.
12. Reactions with marked antibodies and antigens in virology. Immune fluorescence reaction (IFR).
13. Application of cellular cultures in virology. Cells cultures classification. Culture media for cells cultivation.
14. Types of viruses and cells interaction. Characteristics of productive interaction, stages.
15. Peculiarities of virus infections pathogenesis. Acute and persistent virus infections.
16. Immunologic peculiarities of virus infections. Factors of antivirus immunity.
17. Methods of viruses indication in cells cultures and their assessment. Cytopathogenic activity of viruses, its types.
18. Non-specific factors of microorganisms protection from virus agents, their characteristics. Interferons, mechanism of activity, interferon genes.
19. Virus vaccines, classification, principles of getting, requirements for them, control, efficiency assessment.

Informative module 11. Special virology

1. Orthomixoviruses family. History of discovery, biologic properties, classification.
2. Methods of laboratory diagnostics of influenza and their assessment.
3. Antigen formation and types of antigen influenza virus variability modern hypothesis explaining antigen variability of orthomixoviruses.
4. Pathogenesis and immunity with flu. Role of specific and non-specific mechanisms in anti-influenza immunity.
5. Problems of specific prophylactics and therapy of influenza. Preparations and their assessment.
6. Paramixaviruses family, general characteristics of the kind. Parainfluenza viruses, their biologic properties. Role in human pathology development. Laboratory diagnostics of parainfluenza infections.
7. Measles virus, biologic properties, culturing. Infection pathogenesis. Laboratory diagnostics, specific prophylaxis.
8. Epidemic parotids virus. Infection pathogenesis. Laboratory diagnostics, parotid's specific prophylactics.
9. Paramixoviruses family. General characteristics. Respiratory-syncytial virus. Biologic properties, role in human pathogenesis development. Diagnostic methods of the disease caused by RC-viruses.
10. Picornavirus family, general characteristics. Antigen foundation. Biologic peculiarities of Coxsackie viruses, properties. Significance in human pathology development.
11. Poliomyelitis viruses, characteristics, classification. Infection pathogenesis and imunogenesis. Laboratory diagnostics, specific prophylactics. Poliomyelitis liquidation problems all over the world.
12. Enteroviruses family, general characteristics, classification. Laboratory diagnostics of enterovirus infections.
13. Rhinovirus family, biological properties. Classification. Role in human pathology. Methods of infections caused by rhinoviruses laboratory diagnostics.
14. Rabdoviruses family. Rabies virus, biological properties. Disease pathogenesis. Specific prophylactics of rabies.
15. General characteristics of arboviruses ecologic group. Viruses of tick-borne and Japanese encephalitis. These viruses discovery and study history. Biological properties, methods of laboratory diagnostics, specific prophylactics.
16. Rubiviruses family. Rubella virus. Biological properties. Disease pathogenesis, immunity. Laboratory diagnostics, specific prophylactics.
17. Retroviruses family, biologic properties. Classification. Mechanism of virus carcinogenesis.
18. Herpesviruses family, biologic properties, significance in human pathology development. Laboratory diagnostics of the diseases. Genetic methods of diagnostics.

19. Kind of adenoviruses. Biologic properties. Antigen structure. Culturing. Pathogenesis and laboratory diagnostics of adenovirus infections. Immunity. Specific prophylactics.
20. Natural smallpox virus. Infection pathogenesis. Methods of diagnostics and specific prophylactics. Smallpox vaccine virus. Liquidation of smallpox all over the world.
21. Pathogens of virus hepatitis, properties and classification of viruses. The diseases pathogenesis. Laboratory diagnostics. Perspectives of specific prophylactics.
22. Oncogenic viruses, classification. Virus-genetic theory of tumors occurrence by L.O. Zilber mechanisms of virus carcinogenesis.
23. Human immune deficiency viruses (HIV). Properties. Role in human pathology. AIDS pathogenesis. Methods of laboratory diagnostics (immunologic, genetic). Perspectives of specific prophylactics and therapy.
24. Cardioviruses. General characteristics.
25. Prions. Properties. Prion diseases of animals (scrappy, caw spongiform encephalopathy) and human (kuru, Creutzfeldt-Jakob disease and others). Pathogenesis of prion diseases. Diagnostics.

Control questions to the module 3 «Special clinical and ecological microbiology»
Informative module 13. Pathogenic prokaryotes and eukaryotes

1. Coccus evolution, their general characteristics, staphylococcus, biological properties, classification, practical meaning.
2. Staphylococcus role in human pathology development, pathogenesis of the processes caused by them. Toxins characteristics and pathogenicity enzymes. Role in occurrence of hospital-acquired infection.
3. Methods of microbiological diagnostics of staphylococcus processes and their assessment, immunity at staphylococcus diseases. Preparation for specific prophylactics and therapy, assessment.
4. Streptococcus, biological properties, classification. Toxins, pathogenicity enzymes.
5. Pneumonias streptococcus, biological properties. Human and animal pathogenicity. Microbiological diagnostics of pneumococcus diseases.
6. Streptococcus role in human pathology development. Pathogenesis of streptococcus diseases. Toxins and enzymes of streptococcus pathogenicity. Immunity. Methods of microbiological diagnostics of streptococcus diseases.
7. Meningococcus, biologic properties, classification. Pathogenesis and microbiological diagnostics of meningococcal diseases and bacteria carrying. Meningococcal differentiation from gram-negative nasopharynx diplococcus.
8. Gonococcus. Biological properties, pathogenesis and microbiological diagnostics of diseases. Prophylactics and specific therapy of gonorrhea and blenorea.
9. Enterobacteria, their evolution. Role in human pathology development. Microbiological diagnostics of colienteritis. Escherichia, their properties. Pathogen serovars of Echerichia, their differentiation. Microbiological diagnostics of colienteritis.
10. Pathogenic foundations of typhoid fever and paratyphoid A and B microbiological diagnostics. Methods of microbiological diagnostics, their assessment.
11. Salmonella – pathogens of typhoid fever and paratyphoid A and B. biological properties, antigen basis. Disease pathogenesis. Immunity. Specific prophylactics and therapy.
12. Salmonella – pathogens of acute gastroenteritis, their propertiesi. Classification principle. Pathogenesis of foodborne toxicoinfections of salmonella origin. Microbiological diagnostics.
13. Shigella family, biological properties, classification. Dysentery pathogenesis.
14. Shigella. Role in human pathology. Dysentery pathogenesis, role of pathogenicity toxins and enzymes. Immunity. Microbiological diagnostics of dysentery methods, their assessment.
15. Cholera vibrios, biologic properties, biovars. Pathogenesis and immunity at cholera. Microbiological diagnostics of cholera methods and their assessment. Cholera specific prophylactics and therapy.
16. Yersinia. Pathogen of plague. Pathogen of plague, the study history, biological properties. Role of the Ukrainian scientists in plague study. Pathogenesis, immunity, Патогенез, імунітет,

microbiological diagnostics methods and specific prophylactics of plague. Yersinia – pathogens of pseudotuberculosis and enterocolitis, properties, Microbiological diagnostics of yersiniosis.

17. Pathogen of tularemia, biological properties. Pathogenesis, immunity, Microbiological diagnostics methods and specific prophylactics of tularemia.
18. Brucella, types, differentiation. Pathogenesis and immunity at brucellosis. Microbiological diagnostics of brucellosis methods, their assessment. Preparations for specific prophylactics and therapy.
19. Klebsiella, their role in human pathology. Characteristics of Klebsiella pneumonia, rhinoscleroma. Microbiological diagnostics, specific prophylactics.
20. Bordetella, their properties. Pathogen of whooping cough, morphological, cultural, antigen properties. Microbiological diagnostics and specific prophylactics of whooping cough.
21. Anthrax bacilli. Biological peculiarities, pathogenesis, microbiological diagnostics and specific prophylactics of anthrax. Role of the Ukrainian scientists in getting preparations for specific prophylactics of anthrax.
22. General comparative characteristics of anaerobic bacteria, their role in human pathology development. Peculiarities of microbiological diagnostics of the diseases caused by anaerobes. Anaerobia non-clostridial bacteria (bacteroids and others), their biological properties.
23. Clostridia tetanus, properties. Toxin production. Human tetanus pathogenesis. Microbiological diagnostics, specific prophylactics and therapy, their theoretical justification and assessment.
24. Clostridia botulinum. Microbiological and cultural peculiarities, antigen structure, toxin production, classification. Pathogenesis, botulism microbiological diagnostics and therapy.
25. Pathogens of anaerobe wounds infection, properties, classification. Pathogenesis and microbiological diagnostics. Methods of specific prophylactics and therapy of anaerobic wound infection.
26. Corynebacteria, characteristics. Corynebacteria evolution. Biovars of diphtheria bacillus. Toxins production, toxigenicity of genetic determinants. Measurement of toxin strength.
27. Stages of the doctrine of diphtheria pathogen. Theoretic backgrounds of diphtheria specific prophylactics. Anti-diphtheria preparations.
28. Diphtheria pathogenesis, immunity. Microbiological diagnostics of diphtheria carrier. Diphtheria and saprophytic corynebacteria pathogen differentiation.
29. Diphtheria pathogen, biological properties. Exotoxin characteristics. Diphtheria specific prophylactics and therapy. Antitoxic immunity identification.
30. Pathogen mycobacteria, role in human pathology development. Tuberculosis pathogens, properties. Types of tuberculosis bacteria. Pathogenesis and microbiological diagnostics of tuberculosis.
31. Microbiological diagnostics of tuberculosis. Immunity at tuberculosis. Tuberculosis specific prophylactics and therapy. Leprosy pathogen, biological peculiarities.
32. Tuberculosis mycobacteria, properties. Types of tuberculosis bacteria. Tinctorial and cultural properties. Tuberculosis pathogens differentiation. Atypical mycobacteria. Role in human pathology development.
33. Pathogen fungi and actinomycetes (candidiasis, dermatomycosis, actinomycosis pathogens, their characteristics). Principles of microbiological diagnostics of mycosis.
34. Syphilis pathogen. Morphological, cultural properties. Pathogenesis and immunity. Microbiological diagnostics of specific therapy of syphilis.
35. Leptospireas, their characteristics, classification. Pathogenesis, immunity and microbiological diagnostics of leptospirosis. Specific prophylactics and therapy.
36. Borrelia, biological properties. Role in human pathology development. Epidemic and endemic relapsing fever pathogens. Pathogenesis, immunity and microbiological diagnostics of relapsing fever. Specific prophylactics and therapy of relapsing fever. Lime disease pathogen. Disease pathogenesis, microbiological diagnostics, therapy and prophylactics.
37. Rickettsia, biological properties. Classification. Rickettsia – pathogens of human diseases. Q-fever pathogen. Disease pathogenesis, laboratory diagnostics, specific prophylactics.

38. Typhus pathogens, properties. Disease pathogenesis, methods assessment. Specific prophylactics, preparations assessment. Laboratory diagnosticsa.
39. Mycoplasmas, classification. Biological properties, methods of cultivation. Role in human pathology development. Microbiological diagnostics of mycoplasmosis.
40. Chlamydia, classification, biological properties. Methods of cultivation. Role in human pathology development. Microbiological diagnostics of chlamydiosis.
41. Malaria plasmodium, characteristics. Malaria pathogenesis. Microbiological diagnostics of. Specific prophylactics and therapy.
42. Toxoplasma, morphology, culturing peculiarities. Diseases pathogenesis. Microbiological diagnostics of. Specific therapy.
43. Pathogenic protozoa, biological properties. Classification. Role in human pathology development. Leishmania, properties, disease pathogenesis. Microbiological diagnostics of leishmaniosis.
44. Pathogenic spirilla. Rate bite fever pathogen. Microbiological diagnostics of the disease.
45. Campilobacteria – pathogens of acute intestinal diseases. Biological properties, microbiological diagnostics.
46. Helicobacter pillory – pathogen of human hastroduodenal diseases. Discovery, biological properties, pathogenesis. Methods of microbiological diagnostics. Modern helicobacter infection therapy methods.
47. Erizipelotrix. biological properties of erysipeloid pathogen. Microbiological diagnostics.
48. Modern methods of infectious diseases laboratory diagnostics.

Informative module 14. Fundamentals of clinical and ecological microbiology

1. Opportunistic microorganisms, biological properties, etiological role in opportunistic infections development. Characteristics of the diseases caused by opportunistic microorganisms.
2. Nosocomial infection, conditions of occurrence. Properties of hospital microorganisms ecovars. Microbiological diagnostics of purulent-inflammatory, burn infections and infectious wounds caused by nosocomial strains.
3. Clinical microbiology. Object of study. Subject, tasks, methods. Etiologic role criteria of opportunistic microbes isolated from pathologic focus.

Informative module 15. Sanitary microbiology and virology

1. Microorganisms ecology. Spreading of microbes in nature. Significance of works by S.M.Vinogradsky.
2. Normal microflora of a human body, its role in physiological processes and human pathology occurrence. Age peculiarities of nose, skin, oral cavity, genitals, intestine normal microflora. Germ-free biology. Disbacteriosis and its causes.
3. Probiotics and eubiotics, their characteristics, mechanism of action.
4. Sanitary microbiology, subject, tasks. Importance of sanitary microbiology in a physician's work.
5. Sanitary indicative microorganisms, requirements to them, their importance for environmental objects characteristics.
6. Principles of sanitary-microbiological studies of the objects of environment, their assessment. Sanitary-bacteriological drinking water quality control. State standard requirement to drinking water.
7. Water microflora. Self-cleaning factors of water. Survival of pathogen microorganisms in water. Role of water in infectious diseases transmission.
8. Water as a living environment and preservation of microorganisms. Autochthonous and allochthonous microflora of open water. Saprophytes. Microorganisms – indices of water self-cleaning process.
9. Microorganisms ecology. Environmental microflora: air, water, soil. Methods of study.
10. Sanitary indicative microorganisms which are used in water quality assessment.
11. Methods of sanitary-bacteriological study of water and their assessment.
12. Soil microflora. Role of soil in infectious diseases transmission. Factors which influence on the survival of pathogen microorganisms in soil.

13. Sanitary indicative microorganisms which are used in soil pollution assessment. Methods of soil sanitary-microbiological study.
14. Air microflora, its characteristics. Role of air in infectious diseases transmission.
15. Bacterial count and sanitary indicative microorganisms of closed rooms air, methods of indication, their assessment.
16. Sanitary indicative air microorganisms, methods of their indication. Closed rooms air purity assessment criteria.
17. Food poisoning of microbial etiology. Food poisoning and pathogens, causing it classification.
18. Food toxicoinfection pathogens. Principles of sanitary-bacteriological food products testing.
19. Sanitary-bacteriological botulotoxin food products testing.
20. Sanitary-bacteriological salmonella – pathogen of acute gastroenteritis food products testing.
21. Sanitary-bacteriological pathogen staphylococcus food products testing.
22. Sanitary virology, subject, tasks, importance of sanitary virology in the physician's work.
23. Role of water, soil, air in pathogens of virus infection transmission. Viruses which are most often found in objects of environment.
24. Methods of pathogenic microorganisms identification in soil. Enteroviruses testing of soil.
25. Sanitary-virological studies of water. Choice of samples, methods of concentration. Viruses, bacteriophages in drinking water and wastewater. Methods of identification.
26. Role of air environment in virus infections pathogens spreading. Methods of air samples choice and respiratory viruses indication.

5. LIST OF PRACTICAL SKILLS

Practical skills to the module 1 «Microorganisms morphology and physiology. Infection. Immunity»

1. Carry on microscopy of the preparation with the use of immersion lens, draw a conclusion about morphological properties of microorganisms under study.
2. Prepare bacterial preparation, stain according to Gram, made microscopy with the use of immersion lens, draw a conclusion about purity of microorganisms culture under study.
3. Describe cultural properties of microorganisms colonies which have grown on MPA surface. Justify further research progress.
4. Describe properties of microorganisms colonies which have grown on Endo culture medium. Find colonies specific for E. coli. Explain the essence of differential-diagnostic media with carbohydrates application.
5. Justify essence of vaccines prophylactics. Line up 2-3 live vaccines, explain principles of their preparation and application.
6. Justify the essence of vaccines prophylactics. Line up 2-3 killed vaccines, explain principles of their preparation and application.
7. Explain the essence of antitoxic immunity. Choose preparations for creation of active antitoxic immunity.
8. Explain the essence of antitoxic immunity. Пояснити суть антитоксичного імунітету. Choose preparations for creation of passive antitoxic immunity.
9. Choose preparations which are used for specific prophylactics and therapy of diphtheria, explain aspects of their application.
10. Explain the essence of immune-enzyme method of research. Carry out accounting of IEA with the aim of serologic diagnostics of HIV-infection.
11. Explain the essence of serologic identification of microorganisms. Choose preparations used with this aim. Principles of their getting.
12. Explain the essence of serologic diagnostics of infectious diseases. Choose preparations used with this aim, their getting.

Practical skills to the module 2 «General and special virology»

1. Explain the essence of virological diagnostics of influenza. Carry out accounting of hemagglutination reaction (HA) put with the aim of virus identification. Draw a conclusion about virus presence and titer.
2. Explain the essence of virological diagnostics of influenza. Carry out accounting of hemagglutination inhibition reaction (HAI), put with the aim of isolated virus serologic identification. Draw a conclusion about virus type.
3. Make serologic diagnostics of influenza. Carry out accounting of hemagglutination inhibition reaction (HAI), put with paired sera of the sick person. Draw a valid conclusion.
4. Explain the essence of virological diagnostics of poliomyelitis. Determine the existence of virus in cellular cultures, infected by material from the sick according to cytopathic effect (CPE) and plaque formation. Draw a conclusion.
5. Explain the essence of virological diagnostics of poliomyelitis. Carry out accounting of virus neutralization reaction (NR), put with the aim of serologic identification of the virus allocated from the sick person. Draw a conclusion about the virus type.
6. Explain the essence of virological diagnostics of viroscopic diagnostics of virus diseases. Carry out microscopy of the preparation get from brain tissue for Babesh-Negri inclusions identification.

Practical skills to the module 3 «Special, clinical and ecological microbiology»

1. Carry out bacterioscopic diagnostics of acute gonorrhea. Carry out microscopy of stained preparation from a sick person material and draw a conclusion.
2. Carry out bacterioscopic diagnostics of tuberculosis. Carry out microscopy of stained by special method preparation from a sick person material. Draw a conclusion.
3. Carry out bacterioscopic diagnostics of diphtheria. Carry out microscopy of stained by special method preparation from a sick person material. Draw a conclusion.
4. Carry out serologic diagnostics of typhoid fever and paratyphoids. Make an account of indirect hemagglutination reaction (IH), draw a conclusion.
5. Carry out serologic diagnostics of typhoid fever and paratyphoids. Make an account of Widal reaction, draw a conclusion.
6. Carry out serologic diagnostics of syphilis. Make an account of Wasserman reaction (WR), draw a conclusion.
7. Explain the essence of bacteriological diagnostics of typhoid fever and paratyphoids. Make an account of biochemical and carry out serologic identification of hemoculture isolated from a sick person. Draw a conclusion.
8. Explain the essence of bacteriological diagnostics of dysentery. Make an account of biochemical and carry out serologic identification of coproculture isolated from a sick person. Draw a conclusion.
9. Carry out serologic diagnostics of brucellosis. Make an account of Write's reaction. Draw a conclusion.

X. RECOMMENDED LEARNING SOURCES

Basic:

1. C.AND. Klimnyuk, IO Sitnik, MS Tvorko, VP Широбоков. Practical microbiology. Ternopil, Ukrmedknyha .– 2004.
2. "Medical microbiology, virology, immunology", edited by Academician of NAMSU prof. Shirobokova VP, Vinnytsia, "New Book". - 2011.
3. L.B. Borisov. Medical microbiology, virology, immunology - M .: LLC "Medical Information Agency", 2001.
4. O.K. Pozdeev Medical microbiology - M .: GEOTAR-MED, 2001.
5. Atlas of medical microbiology, virology and immunology: Uch. Manual for students of medical universities / Edited by AA Воробьева, A.C. Bykova.– M .: Medical Information Agency, 2003.
6. Microbiology: A guide in three parts. Part one "General medical microbiology" / Deyneka SE,

Patratiy VK, Sidorchuk IY etc. - Chernivtsi: Medic, 2007. - 237 p.
7. Pyatkin KD, Krivoshein YS Microbiology.- Kyiv: Higher School. - 1992.
8. Timakov VD, Levashov VS, Borisov LB Microbiology. M .: Medicine. 1983
9. Dyachenko SS, Sinyak KM, Dyachenko NS Human pathogenic viruses.- K .: Health. 1980.
10. Bukrinskaya AG Virology. M .: Medicine. 1986
11. Krivoshein Yu.S. et al. Guide to practical classes on medical microbiology and laboratory diagnosis of infectious diseases.- Kiev: Higher school. 1986
12. Borisov LB et al. A guide to practical classes in microbiology. - M .: Medicine. 1984.
13. Handbook of microbiological and virological research methods / Ed. OM Birger / - M .: Medicine. 1982

Additional:

14. A.E. Vershigora. General microbiology.– K., 2002.
15. G.N. Drannik Clinical immunology and allergology. - Odessa: AstroPrint.– 1999.
16. R.M. Khaitov, GI, Ignatieva, IG Sidorovich. Immunology - M .: Medicine, 2000.
17. M. Jacobisyak. Immunology. - New book, 2004.
18. Krasilnikov AP, Romanovskaya TR Microbiological dictionary-reference book.– Minsk: Asar, 1999.
19. A. Royt. Immunology.– M., 2000. 7. Immunobiological drugs. Handbook. – K .: Morion, 2001.
20. Frolov AF, Shevchenko LF, Shirobokov VP Practical virology. - K .: Health, 1989.
21. Javets E., Melnik J.L., Eidelberg E.A. Guide to medical microbiology.- M .: Medicine. 1982. In three volumes.
22. Topchiy MK, Kornyushenko NP Guide to practical classes in virology. - K .: КГУ, 1967.
23. Enterobacteriaceae: (Guide for physicians) Author. IV Golubeva, VA Kile¬so, BS Kiseleva et al. Ed. VI Pokrovsky. - M .: Medicine. 1985
24. Circassian FK Guide to practical classes on microbiological research. - M .: Medicine. 1980.

List of learning-methodical literature published by the Department of general and clinical immunology and allergology and is used in the learning process:

1. N.N. Popov, A.P. Kozlov, T.I .Lyadova, O.V. Volobueva, S.G. Malanchuk. General microbiology. V.N. Karazin Kharkiv National University. - 2017. - 114 p.
2. N.N. Popov, A.P. Kozlov, T.I. Lyadova, O.V. Volobueva, S.G. Malanchuk. General immunology. V.N. Karazin Kharkiv National University. - 2017. - 90 p.
3. N.N .Popov, A.P. Kozlov, T.I. Lyadova, O.V. Volobueva, S.G. Malanchuk. Private bacteriology. V.N. Karazin Kharkiv National University. - 2017. - 142 p.
4. N.N. Popov, A.P. Kozlov, T.I. Lyadova, O.V. Volobueva, S.G. Malanchuk. Fundamentals of medical mycology and protozoology. V.N. Karazin Kharkiv National University. - 2017. - 86 p.

XI. INTERNET RESOURCES

1. Website of the Ministry of Health of Ukraine: www.moz.gov.ua.
2. Centers for Disease Control and Prevention »http://www.cdc.gov/