Ministry of Health of the Republic of Belarus
EI «Grodno State Medical University»

Department of Microbiology, Virology and Immunology named after S.I. Gelberg

MICROBIOLOGY. VIROLOGY. IMMUOLOGY

Course Syllabus for Medical Faculty for International Students (English medium)
Specialty 1 – 79 01 01 «General Medicine»

DESCRIPTION OF THE COURSE

"Microbiology, Virology and Immunology" – is an educational branch of science containing systematized scientific information about pathogenic microorganisms and normal human micro-flora, the etiology of infections, mechanisms of their pathogenesis, specific prophylaxis, therapy and methods of laboratory diagnostics of bacterial, viral, fungal and protozoan infections as well as the information about composition and function of human immune system.

COURSE OBJECTIVES

The main purpose of the teaching the Academic Discipline "Microbiology, Virology and Immunology" is cognition of patterns of the structure and function of microbial cells and viral particles as well as obtaining by students the scientific knowledge of the mechanisms of pathogenesis and the main algorithms of microbiological, virological and immunological methods of laboratory diagnostics.

The main tasks of the study of the Academic Discipline are:

- to learn patterns of the structure and function of microbial cells and viral particles;
- to consider the general patterns of the mechanisms of microbial pathogenesis;
- to reveal the interrelation of the basic concepts of Microbiology, Virology and Immunology and their significance for theoretical, diagnostic and clinical Medicine;
- to teach students in understanding the basics of microbiological, virological and immunological methods of laboratory diagnostics;
- to reveal the understanding of the role of knowledge of the subject in the subsequent general medical and professional training of a specialist.

PROFESSIONAL COMPETENCY REQUIREMENTS

Students must

know:

- The place and the role of microorganisms in biosphere, the main principles of their systematics and nomenclature.
- Sensitivity or resistance of microbes to the effects of environment and methods of sterilization, disinfection, asepsis and antiseptics, which are necessary to know in medical practice.
- Morphology, physiology, genetics, ecology and evolution of bacteria, viruses, fungi and protozoan.
- Main mechanisms of appearance, mechanisms of transmission and conditions for development of bacterial, viral, fungal and protozoan infections.
- Factors of pathogenicity of microorganisms and molecular mechanisms of pathogenesis of human infectious diseases.
- Opportunistic infections and the pathogens producing them.
- Main groups of anti-microbial chemotherapeutic preparations and the mechanisms of their action on the microorganisms.

- Mechanisms of appearance of microbial resistance to anti-microbial preparations and the methods of detection of resistant strains.
- The main rules of getting, labelling, transportation and study of pathological material obtained from the patients having infectious diseases.
- Microbiological, immunological and molecular-biological methods of diagnostics of bacterial, viral, fungal and protozoan infections.
- The composition and mechanisms of function of human immune system.
- Humoral and cell-mediated immune response, main characteristics of immune defence of human organism against infections.
- Immune pathogenic reactions: allergic, infectious allergy; autoimmune diseases, immune deficiencies, immune pathologies and the approaches to their correction.
- Methods of immune- and chemotherapy, using of antiseptics and prophylaxis of infectious diseases.

Students must

be able to:

- issue a referral application form for microbiological, immunological and molecular-biological examination;
- determine bacterial susceptibility to antibiotics using disk-diffusion tests;
- perform the serological reactions, agglutination reactions (passive- and latex-agglutination reactions, complement fixation reaction, immune fluorescence reaction and ELISA;
- carry out PCR;
- evaluate the results of immunograms;
- evaluate the results of microbiological, immunological and molecular-biological tests.

Students must

be proficient in:

- material sampling skills for performing microbiological, immunological and molecular biological tests;
- skills of safe work with biomaterial and life cultures of microorganisms;
- modern approaches to sterilization and disinfection of waste biomaterial and objects of the external environment contaminated with microorganisms;
- skills of making microbiological specimens and their staining with simple staining or Gram staining techniques;
- light immersion microscopy techniques with following performance of the results;
- skills of seeding of the biomaterial using nutritive media to isolate pure culture of a microbe.

ACADEMIC COMPETENCY REQUIREMENTS

Students must

know:

- how to apply basic scientific and theoretical knowledge to solve theoretical and practical problems;
- possess the skills of the system and comparative analysis;
- possess the skills of the scientific research;
- be able to work independently;
- possess the skills of manipulation with technical devices and of computer work;
- be able to study and to improve own skills throughout the whole live.

PROFESSIONAL COMPETENCY REQUIREMENTS

Students must

be able to:

- use the knowledge of basic physical, chemical, biological and physiological patterns of vital activity of the human body in normal state and in pathology;
- use the knowledge of general professional and special disciplines to maintain one's own health and promote a healthy lifestyle.

COURSE TOPICS OF THE STUDY MATERIAL

1. **INTRODUCTION TO THE ACADEMIC DISCIPLINE. METHODS OF STUDY**
2. **GENERAL MICROBIOLOGY**

LESSON 1

1. Definition of the terms "microbiology" and "microorganism". Classification of microbiological sciences according to the topic (object) of research and according to their application. Tasks of medical microbiology.
2. Microbiological methods of research (diagnostics): microscopy, cultivation, experimental (biological) and immunological (immunobiological) methods.
3. History of microbiology: the descriptive, physiological (Pasteur's), immunological and modern periods.
4. Scientific contribution of Pasteur. Scientific contribution of Koch. Scientific contribution of Metchnikoff and Ehrlich. Development of microbiological science in Belarus.
5. Taxonomy of living organisms: types of taxonomy, principals of composition and areas of application. Properties used as a basis in modern taxonomy of microorganisms and their application in bacteriology and virology. Hierarchical system of taxons used in Bacteriology and Virology.
6. Methods of microscopy: electron microscopy and light microscopy (basic light, immersion and dark field microscopy), phase contrast and fluorescent microscopy: using microscope, the principal of the method and application in microbiology.
7. Simple staining techniques. Differential staining techniques.

LESSON 2

1. Morphology and ultrastructure of bacterial cell. Principles of organization and function of bacterial cell. Main differences between prokaryotic and eukaryotic cells. Organelles of bacterial cell: basic and facultative ones.
2. Composition of bacterial cell wall. Defective forms of bacteria. Morphological features of bacteria.
3. Shape of bacteria: bacteria having certain shape and bacteria without certain shape.
4. Size of bacteria: cocci and rods. Arrangement of bacterial cells in a smear: cocci and rods.
5. Gram staining technique: main steps and characteristics of bacteria belonging to the divisions of Gram-positive and Gram-negative ones.

LESSON 3

1. Micro- and macrocapsules of bacteria: definition of the term, composition, function, condi tions when the capsule is produced; encapsulated bacteria and methods of the detection of the capsule.
2. Bacterial flagella: organelles responsible for the motility of bacteria, character of movement of flagella, bacterial classification according to the number and localization of flagella; methods of detection of flagella.
3. Endospore: definition of the term, function, composition, conditions for sporulation, the factors ensuring thermal resistance, spore – forming bacteria and methods of detection of spores. Exospores: definition of the term, differences between exospore and endospore.
4. Morphological and ultra-structural peculiarities of actinomycetes: classification, importance for medicine, morphology, production of exospores and ultra- structural features.
5. Morphological and ultra-structural peculiarities of spirochetes: classification, morphological features, ultra-structural peculiarities, Romanovsky-Giemsa staining technique, microscopy techniques used for detection of spirochetes.
6. Morphological and ultra-structural features of rickettsiae and chlamydiae: classification, principal differences between them and other prokaryotes, shape of bacterial cell, localization in the host cell; staining techniques.
7. Morphological and ultra-structural peculiarities of mycoplasmas: classification, principal differences between mycoplasmas and other prokaryotes, techniques applied for study of their morphology and properties.
8. Ziehl-Neelsen (acid-fast) staining technique: the purposes of application and the main steps of the procedure of staining.
9. Fungi: classification and taxonomy, structure and morphology of fungal cell. Dimorphism of fungi.

LESSON 4

1. Metabolism in bacteria: features of metabolism in microorganisms, main routes of penetration of nutrient into bacterial cell, classification of bacterial enzymes.
2. Classification of bacteria by the source of carbon and by their growth factors

needs.

3. Classification of bacteria by the features of their energy metabolism and by their requirements of the oxygen in the air. Classification of bacterial enzymes.
4. Features of metabolism in rickettsiae, chlamydiae and mycoplasmas. Reproduction of bacteria: ways of reproduction of bacteria and the developmental cycle of Chlamydia.
5. Classification of media and characteristics of some media.
6. Bacterial culture requirements (nutrient needs, the temperature optimal for cultivation) and the character of bacterial growth in liquid and solid nutrient media.
7. Stages of growth of bacterial culture.

LESSON 5

1. The methods of cultivation of anaerobes. Kitt-Tarozzi's method of cultivation of anaerobic bacteria. The principal scheme of the culture method: preliminary stage.
2. The principal scheme of the culture method: the I. II and III stages.
3. Cultural features of bacteria. Study of biochemical properties of bacteria (on the example of enterobacteriae): during the I^{st}, II^{nd} and III^{rd} stages (tests revealing carbohydrolytic activity and proteolytic activity and tests revealing the activity of separate enzymes).
4. The equipment for automatic identification of bacteria and the principles of their work.
5. Bacteriophage (phage): definition of the term, discovery, nomenclature and structure of T-even bacteriophages. Classification of phages by their lytic spectrum (their effect on bacterial cell).
6. Classification of phages by the result of their effect on a bacterial cell: a virulent phage and a temperate phage. Consequences of interaction of the phage with a host bacterial cell: virulent and temperate phage.
7. Practical application of the phage in medicine: phage diagnostics, phage therapy and prophylaxis. Isolation of bacteriophages.
8. Phage indication: method of «streaming down drop». Bacteria phage typing.

LESSON 6

1. Bacterial genetics. Organization of genetic material in bacteria: DNA and extra-chromosomal factors of heredity (autonomous and non-autonomous). Plasmids: definition of the term, the plasmid DNA characteristics and physical properties, functions of plasmids, possible location, presence of tra-operon, character of control of their replication by nucleoid and compatibility of plasmids when they are located in the same cell.
2. F-plasmids: definition of the term and variants of the location of F-plasmids in the bacterial cell. R-plasmids: definition of the term, composition and the ways of transfer of the plasmids from one bacterial cell to other ones. Plasmids of bacteriocynogenity (example with Col-plasmids of *E.coli*): definition of the term, composition, main peculiarities, biological and medical importance.
3. Transposons: definition of the term, location in bacterial cell and composition. IS-elements: definition of the term, differences in comparison with transposons

and functions.

4. Variability in bacteria. Modifications in bacteria. Mutations in bacteria: definition of the term and classification according to the occurring mechanism and classification of mutations according to the direction of the mutation.
5. SR-dissociation: definition of the term, mechanism and biological importance. Mutagens: definition of the term and the conditions when a mutation occurs. DNA repair: photoreactivation and reparations, which occur in the absence of visible light.
6. Recombinant variability: definition of the term, and forms of recombinant variability.
7. Gene engineering in medical microbiology: the stages of production of the recombinant vaccine for the prophylaxis of hepatitis B.
8. Methods of genetics applied in medical diagnostics. Methods of molecular hybridization and polymerase chain reaction.

LESSON 7

1. Ecology of microorganisms. Basics of Microbiological Ecology. Definition of the term ”ecology of microorganisms”. Main terms of Ecological Microbiology: population, biotope, microbiocenosis, ecological system, biosphere and onthosphere.
2. Ecological relations of microorganisms in microbiocenoses: neutralism, symbiosis, competition and parasitism.
3. Ecological niches of microorganisms: characteristics of microbiocenosis and sanitary control of soil.
4. Ecological niches of microorganisms: characteristics of microbiocenosis and sanitary control of water.
5. Micro-flora of human organism: characteristics, composition of normal intestinal micro-flora. The role of normal micro-flora in human organism.
6. Disturbances in composition of normal micro-flora and some approaches to the normalization of misbalance.
7. Microbial decontamination: definition of the term and types of decontamination. Sterilization: definition of the term and methods of sterilization.
8. Disinfection. Antisepsis. Asepsis: definition of the term and applied methods.
9. Influence of the ecological factors on microorganisms: effect of physical factors of the natural environment (surrounding), effect of chemical factors of the natural environment.
10. Resistance of fungi to the factors of the external environment.

LESSON 8

1. The basics of the infection. Basic terms and concepts of the Infectiology: infectious process (infection) and epidemiological process, chain of the infection, links of the epidemic process and mechanisms of transmission of the infection.
2. Stages of the mechanism of transmission of the infection, factors of transmission, the ways of transmission and the portals (place of entry) of the infection. The main scheme of epidemiological process.

3. Classification of infections according to the mechanism of transmission, ways of transmission and portals of entry of the infection: faecal-oral, air born, blood born, contact and vertical mechanisms.
4. Classification of infections according to the nature of infectious agent, according to their origin and ways of spreading, according to redevelopment of disease caused by the same or different infectious agent.
5. Classification of infections according to clinical manifestations, according to the character of the spreading of the infection and covered territory.
6. Characteristic properties of the infectious disease. Pathogenicity and virulence: definition of the terms. Characteristics of pathogenicity. Detection and assessment of the virulence.
7. Factors of virulence and their characteristics. Bacterial toxins. Protein toxins: general characteristics, properties and classification. Endotoxin: definition of the term, differences in compare with protein toxins.

LESSON 9

1. Chemotherapeutic agents: definition of the term, the basic characteristics, the most important groups of chemotherapeutic agents and the mechanism of their effect (sulphanilamide preparations, organic and inorganic compounds of metals and sulphur, preparations of compounds of nitrofuranum, antifungals and antiparasitics).
2. Antibiotics: definition of the term, classification of antibiotics according to the source of their isolation and to the method of their production.
3. Classification of antibiotics according to the mechanism and to the spectrum of their antimicrobial activity and to the results of their antimicrobial influence on the microorganisms.
4. Complications of antibiotic therapy: effect on macro-organism (humans) and microorganism. Principles of rational antibiotic therapy: microbiological, pharmacological and clinical.
5. Principles of rational antibiotic therapy: epidemiological and pharmaceutical. The rules of preference and limitations in use of antibiotics in clinic.
6. Mechanisms of resistance of bacteria to antimicrobial agents: primary and secondary. Measures preventing development of resistance of microorganisms to antimicrobial agents.
7. Antimicrobial susceptibility tests: the Kirby-Bauer disk diffusion method and broth dilution techniques.

3. IMMUNOLOGY

LESSON 11

1. Characteristics of immunology as a science and growing importance of immunology for medicine. The statement of the term “immunity”.
2. The scheme of defence of human organism against antigens: constitutive and inducible host defence. Characteristics of innate immunity: non-specific resistance.
3. Defence of the internal environment of human organism: the mechanisms and levels of the defence.

4. The scheme of defence of human organism against antigens: non-immune factors of innate immunity. Immune factors of innate immunity (list the factors only).
5. Unique properties of lymphocytes. Molecular recognition.
6. Types of acquired immunity: mechanisms of immunological reactivity.
7. Antimicrobial substances of host origin: lysozyme, complement, β-lysine, defensins, fibronectin, interferons.
8. Antimicrobial substances of host origin: interleukins, peroxidase, acute phase proteins, properdin, lactoferrin and transferring. Endogenous peptides-antibiotics.
9. Interferons: inductors of synthesis, types, cellular origin and predominant effect.
10. NK-cells: characteristics, function and their effect.
11. The complement system: main characteristics, activators of classical pathway and the scheme of its activation. Anaphylotoxins. Activators. Evaluation of the activity of the complement system.
12. Stages of activation of the classical pathway.
13. Alternative pathway of the complement activation: activators and the scheme of its activation.
14. Stages of the activation of the alternative pathway.
15. Functions of the complement system.
16. Phagocytosis: definition of the term, characteristics of the first and the second phases of the process of phagocytosis.
17. Characteristics of the third and the fourth phases of the process of phagocytosis. Types of phagocytosis. Mechanisms of killing by phagocytes. The ways of escape of microorganisms from killing.
18. Functions of phagocytosis (the functions of macrophages). Evaluation of the activity of phagocytes.

LESSON 12

1. Composition of immune system: general scheme. Anatomo-physiological principle of composition of immune system. Immunocompetent organs (central and peripheral) and their functions.
2. Immunocompetent cells. Differentiation of T- and B-cells. Expression of the surface markers on T- and B-lymphocytes.
3. T- cells (lymphocytes). Main characteristics and functions. T- helpers: main characteristics of subpopulations and their functions. TCR.
4. B-cells (lymphocytes). Main characteristics and functions. BCR. 23.
5. Macrophages: tissue macrophages and macrophage like cells. Functions of macrophages.
6. Molecules of immune system: receptor-ligand and circulating m o l e c u l e s (cytokines).
7. Immunodiagnostic tests: classification. Serological reactions (tests): purposes and classification.
8. Reactions of agglutination: direct and indirect or passive.
9. Reactions of precipitation (list the main variants of precipitation reaction). Single immunodiffusion (Mancini technique).
10. Immunoelectrophoresis. Immunoblotting.
11. Complex serological reactions: visible and invisible. Serological reactions

occurring with use of labels (list of the reactions).

LESSON 13

1. Antigens: definition of the term and composition of antigens. Epitopes: definition of the term and synonyms of the term epitope. Haptens. Types of epitopes.
2. Factors, which determine the immunogenicity of antigen. Adjuvants: definition of the term. Autoantigens: definition of the term and their main characteristics.
3. Antigens of the major histocompatibility complex (MHC): main characteristics.
4. MHC I and MHC II and antigen presentation.
5. Bacterial antigens: classification according to their specificity and according to their nature (origin). Antigens – organelles of bacterial cell (cell debris) and antigens – metabolic products of microbial cells (products of their vital activity).
6. Fungi: antigenic structure.
7. Cell – mediated immunity: main stages.
8. Processing and presentation of antigen. Activation of T-lymphocytes.
9. Basic scheme of cell - mediated immune response. Mechanisms of killing by cytotoxic lymphocytes (T-killers).
10. Necrotic and apoptotic cell death.
11. Reaction of agglutination (RA): basic terms, conditions of the proceeding of the reaction of agglutination.
12. Stages of the reaction of agglutination: specific and non-specific. Visible displays of the RA. Passive haemagglutination reaction.

LESSON 14

1. Humoral immunity: the mechanisms of B-cells activation (main scheme). B-cell as an antigen-presenting cell.
2. Differences between plasma cells and B cells.
3. The general scheme of humoral immune response. The mechanisms of the effector action of antibodies (main scheme only).
4. The mechanisms of the effector function of antibodies (describe different mechanisms in details).
5. The general scheme of immune response (humoral and cell-mediated immune response developed against T-dependent and T-independent antigens).
6. The general scheme of immune response: differences in recognition of antigens by B and T cells.
7. Suppression of the immune response.
8. Co-operative mechanism of the immune response and its regulation: co-operation between different systems of the organism described by the theory of immunity proposed by Zdradovsky.
9. Immunoglobulins (antibodies): definition of the term, existing forms of immunoglobulins (circulating antibodies, receptor molecules and myeloma proteins)
10. Basic structure of immunoglobulins: domain and paratope, heavy and light chains, variable and constant regions.
11. Classification of immunoglobulins: classes and subclasses. Additional polypeptide chains and main functions of different classes of immunoglobulins (IgG, IgM, IgA and IgE).

12. Morphofunctional peculiarities of immunoglobulins (monomers and polymers), affinity and avidity of immunoglobulins. Normally occurring antibodies: definition of the term and main functions of these antibodies.
13. Monoclonal antibodies: definition of the term and main significance of the antibodies. Incomplete antibodies: definition of the term.
14. Tests revealing incomplete antibodies (Coombs test). Absyms. Dynamics of the synthesis of antibodies: characteristics of the stages.
15. Clonal selection theory (Burnett's theory): main postulates and explanation of the phenomenon of immunological tolerance according to the clonal selection theory. Molecular-genetic theory of Tonegawa.
16. Diagnostic sera: the ways of use and the approaches to production of the diagnostic sera.

LESSON 15

1. Allergy: general description and explanation of the terms allergen and allergy. Classification of allergic reactions based on the involved mechanism and time taken for the reaction.
2. Immediate – and delayed – type hypersensitivity. The algorithm of the development of allergic reaction.
3. The stages of allergic reactions. Characteristics of immunological, pathochemical and pathophysiological.
4. Anaphylaxis: the allergens, which cause anaphylaxis, the mechanism of the reaction and shock organs.
5. The scheme of development of Type I hypersensitivity reaction. Athopy.
6. The principals of the therapy of anaphylactic reactions.
7. Type II (cytotoxic) allergic reaction: the scheme of development and main characteristics. Complement dependent cytolysis and antibody – dependent (mediated) cytotoxicity. Treatment of cytotoxic type of the allergic reactions.
8. Type III allergic reaction (immune complex hypersensitivity): the mechanism of development, clinical displays and treatment.
9. Type IV allergic reaction (DTH): allergens and main scheme of development. Mechanisms of damage of tissue in DTH. Treatment of IV type allergic reactions.
10. Infectious allergy: general description and the role in the infectious process. The main cases when DTH can occur. Diagnostic importance.
11. Allergy caused by medication: drug-induced allergic reactions, immune response developed against haptens. Diagnostics of allergy: the methods of diagnostics of the Types I – IV allergic reaction.
12. Reaction of precipitation (RP): general terms, application of the RP, the procedure of setting up of the RP.
13. Immunodiffusion: single immunodiffusion and double immunodiffusion (by Ouchterlony).
14. Immunoelectrophoresis and immunoblotting.
15. Reactions of neutralisation of toxin by anti-toxic serum: in vitro and in vivo neutralisation reactions.

LESSON 16

1. Immunological tolerance: general description, tolerogens, classification of tolerance by its origin, the scheme of the development of acquired tolerance.
2. Factors that determine induction of tolerance, the mechanisms of the development of the state of tolerance and the mechanisms of its termination.
3. Autoimmunity: definition of the term, characteristic features and mechanisms of the development of autoimmune reaction.
4. Immune deficiencies: definition of the term and classification, characteristics of primary, secondary and iatrogenic immune deficiencies.
5. Mycoses and immunity: specific and non-specific immune response and allergy.
6. Immunological tests involved in diagnostics of mycoses.
7. Clinical Immunology: definition of the term, "immune status" – general statement, scheme that describes the concept of immune status.
8. The factors, which influence the immune status, methods of the immune status evaluation (to list) and oral rules for the evaluation of the immunograms.
9. Immunity in transplantation: MHC antigens in graft rejection, types of graft and humoral immunity in graft rejection.
10. Cell – mediated immunity and transplantation, different patterns of graft rejection and methods of suppression of the immune reactions of the graft rejection. The reaction «graft against host».
11. Tumour associated antigens and the general scheme of the immune response involved into anti-tumoural defence.
12. Serological tests involving complement general statement, the reaction of immune lysis (scheme and types of the reaction), immune adherence reaction (stages) and reaction of immobilization (scheme).
13. Complement fixation reaction: stages (general stage and indicative stage), the figure showing positive and negative results of complement fixation reaction.

LESSON 17

1. Immune prophylaxis: history of development and general statement.
2. Classification of vaccines.
3. Live (attenuated) vaccines: the way of production and general characteristics.
4. Killed (inactivated) vaccines: the way of production and general characteristics.
5. Chemical vaccines: the way of production and general characteristics. Molecular (anatoxins and toxoids) vaccines: the way of production and general characteristics.
6. New generation of vaccines. Vaccine prophylaxis: planned vaccination and vaccination in the case of epidemiological reasons.
7. Complications of vaccination.
8. The scheme of vaccination and repeated introduction of vaccines. Passive immunity: classification and the cases when it is practiced.
9. Immunotherapy: general description, preparations used for immunotherapy.
10. Vaccinotherapy.
11. Therapeutic sera and immunoglobulins (two main groups). Complications following the introduction of alien protein (present in vaccines and sera). Immune modulators: definition of the term and the cases when they are used.
12. Immunity and age: immunity in ageing (the scheme) and immunity of newborn (complement system, phagocytosis and immunocompetent cells).

13. Serological tests using labelled antibodies or antigens: the scheme and general characteristics of IFR (Coons' technique): direct and indirect reaction.
14. Enzyme-linked immunosorbent assay (ELISA): general characteristics and the scheme, stages of the assay for revealing of antibodies (patient serum) or the order of stages when antigen is to be identified.
15. Radioimmunoassay: general characteristics and the scheme of the assay.

4. MEDICAL BACTERIOLOGY WITH BASICS OF MYCOLOGY AND PROTOZOOLOGY

LESSON 19

1. Classification of pathogenic cocci. Staphylococci: species of staphylococci. Morphology, growth requirements, biochemical, metabolic characteristics and antigenic composition of staphylococci and their resistance to unfavourable environmental conditions.
2. Virulence (pathogenicity) factors of staphylococci: virulence enzymes, protein A, protein toxins, allergens, cross-reactive antigens and factors, which inhibit phagocytosis.
3. Staphylococcal infections: epidemiology (the source of the infections and the mechanisms of their spreading), the role of staphylococci in human pathology. Laboratory diagnostics of the infections caused by staphylococci. The role of *Staphylococcus epidermidis* and *Staphylococcus saprophyticus* in human pathology.
4. Streptococci: classification, species, morphology, growth characteristics, biochemical and metabolic characteristics, antigenic composition and resistance to unfavourable conditions of environment. Virulence factors of streptococci: pili, enzymes, protein toxins and exfoliatin.
5. Streptococcal infections: epidemiology (the source of the infections and the mechanisms of their spreading), pathogenesis, clinical forms of the infectious diseases and laboratory diagnostics.
6. Enterococci (main characteristics and the role in human pathology). Pneumococci: morphology, growth characteristics, biochemical and metabolic characteristics, antigenic composition, virulence factors and resistance to unfavourable conditions of environment.

7. Pneumacoccal infections: epidemiology (the source of the infections and the mechanisms of their spreading), the factors which make humans more susceptible to the infection, pathogenesis and laboratory diagnostics.
8. Meningococcus and gonococcus: comparative characteristics of their morphology, growth characteristics, biochemical and metabolic characteristics, antigenic composition, virulence factors and resistance to unfavourable conditions of environment.
9. Meningococcal infection: epidemiology (the source of the infections and the mechanisms of their spreading), the role in human pathology, pathogenesis and laboratory diagnostics.
10. Gonococcal infection: epidemiology (the source of the infections and the mechanisms of their spreading), pathogenesis and laboratory diagnostics.

LESSON 20

1. The family of *Enterobacteriaceae*: classification and the role in human disease.
2. The main characteristics of enterobacteriae: morphology, growth requirements, biochemical and metabolic characteristics and antigenic structure. Virulence (pathogenicity) factors of enterobacteriae: endotoxin, adhesion and aggression factors and protein toxin. Resistance of enterobacteriae to unfavourable conditions of environment.
3. The genus Escherichia: species, antigenic composition and the role in human pathology.
4. Pathogenesis of the infections caused by diarrhoeagenic strains of E.coli.
5. Infections caused by escherichiae: epidemiology (the source of the infections and the mechanisms of their spreading), immunity and laboratory diagnostics.
6. Shigellae: international classification, biochemical and metabolic characteristics and antigenic structure. The factors of pathogenicity of shigellae.
7. Bacterial dysentery: epidemiology, main characteristics of the disease, pathogenesis, immunity, laboratory diagnostics and prophylaxis (prevention).
8. Classification of the genus Salmonella. Biochemical and metabolic characteristics and antigenic structure of salmonellae. The factors of pathogenicity of salmonellae and their resistance to unfavourable conditions of environment.
9. Typhoid fever and enteric fever: epidemiology and clinical symptoms.
10. Typhoid fever and enteric fever: pathogenesis and immunity.
11. Typhoid fever and enteric fever: laboratory diagnostics, the algorithm of the approaches applied to reveal transmission in large population groups and prevention measures.
12. Salmonellosis (gastroenteritis): epidemiology, pathogenesis, immunity and laboratory diagnostics. The distinctive features of laboratory diagnostics of the hospital-acquired (nosocomial) infections caused by salmonellae.

LESSON 21

1. *Klebsiellae*: classification of the genus, morphology, biochemical and metabolic characteristics, antigenic composition and factors of

pathogenicity. Laboratory diagnostics of klebsiellosis.

2. The role of klebsiellae in human disease: *K. pneumonia var. rhinoscleromatis*,
3. *K. pneumoniae var. ozaenae, K. pneumoniae var. pneumoniae* and *K. oxytoca*. The role of klebsiellae in disease of young children.
4. *Proteus*: classification of the genus, main characteristics of the group. The role of *Proteus* in human disease. Pathogenesis of the urinary tract infections caused by Proteus. Laboratory diagnostics of the infections produced by Proteus.
5. *Yersinia*: classification of the genus and the role of yersiniae in human disease. Yersinia enterocolitica: biochemical and metabolic characteristics, antigenic composition and pathogenicity factors.
6. Intestinal yersiniosis (enterocolitis): epidemiology, main characteristics of the disease, pathogenesis, immunity and laboratory diagnostics.
7. Infections caused by opportunistic yersiniae: main characteristics of pseudotuberculosis.
8. The Pseudomonas group: classification. *Pseudomonas aeruginosa:* morphology, biochemical and metabolic characteristics. Bacteria belonging to the genus *Burkholderia*: the role in human disease.
9. *Pseudomonas aeruginosa*: antigenic composition, phage typing of the bacteria belonging to the species *aeruginosa*, factors of pathogenicity of the bacteria and resistance to unfavourable conditions of the environment.
10. Blue pus infections caused by *Pseudomonas aeruginosa*: epidemiology, the role of the bacterium in human disease, immunity, laboratory diagnostics and specific prophylaxis.
11. *Acinetobacterium:* species included in the genus, main characteristics and role in human disease.
12. *Campylobacter*: classification, morphology and cultivation.
13. *Campylobacter*: biochemical and metabolic characteristics, antigenic composition, pathogenicity factors and resistance to unfavourable conditions of the environment.
14. Campylobacteriosis: epidemiology, biotopes of human organism inhabited by these bacteria, the role in human disease, immunity and laboratory diagnostics.
15. Helicobacteria: classification. *Helicobacter pylori*: main characteristics, pathogenicity factors, the urease activity of the bacterium as the pathogenicity factor.
16. Helicobacteriosis: the role of *Helicobacter pylori* in human disease, epidemiology and laboratory diagnostics.

LESSON 22

1. Special danger infections: main characteristics, classification, significance for humans and special safety regime.
2. Vibrios: classification and the role in human disease. *Vibrio cholerae*: morphology, biochemical and metabolic characteristics and cultivation.
3. *Vibrio cholerae*: antigenic composition, the sera used for diagnostics, the algorithm of serological identification, main characteristics used for identification of serological variants.
4. Pathogenicity factors of *Vibrio cholerae*.
5. Resistance to unfavourable conditions of the environment of *Vibrio cholerae* and

approaches to revealing of non-cultivated forms of vibrios. Parahaemolytic vibrio: distribution in the natural environment, epidemiology, pathogenicity factors and the role in human disease.

6. Cholera: epidemiology, specific features of the 7th pandemics, pathogenesis of the disease, immunity and laboratory diagnostics.
7. The brucellae: classification, morphology, biochemical, metabolic characteristics and cultivation.
8. Brucellosis: epidemiology, main characteristics of the disease, pathogenesis and immunity.
9. Laboratory diagnostics of brucellosis, revealing infected humans and specific prophylaxis.
10. The pathogen causing tularaemia: classification, morphology, cultivation, biochemical and metabolic characteristics, antigenic composition, pathogenicity factors and resistance to unfavourable conditions of environment.
11. Tularaemia: epidemiology, main characteristics of the disease, pathogenesis, immunity, laboratory diagnostics and specific prophylaxis (vaccine).
12. The pathogen causing plague: classification, morphology, cultivation, biochemical and metabolic characteristics.
13. The pathogen causing plague: antigenic composition, pathogenicity factors and resistance to unfavourable conditions of environment.
14. Plague: epidemiology, main characteristics of the disease, pathogenesis, immunity and specific prophylaxis (vaccine).
15. Plague: methods of laboratory diagnostics.
16. The pathogen causing anthrax: classification, morphology, cultivation, biochemical and metabolic characteristics, antigenic composition, pathogenicity factors and resistance to unfavourable conditions of environment.
17. Anthrax: epidemiology, pathogenesis, immunity and specific prophylaxis (vaccine).
18. Anthrax: methods of laboratory diagnostics.
19. *Bacillus cereus*: the role in human disease, pathogenesis and the comparative characteristics in comparison to the pathogen causing anthrax.

LESSON 23

1. Mycobacteria: classification and main groups. Distinctive features of mycobacteria in comparison with other prokaryotes. Resistance to high acidity.
2. Pathogen causing tuberculosis: morphology, cultivation, biochemical and metabolic characteristics, antigenic composition and resistance to unfavourable conditions of environment.
3. Pathogenicity factors of tubercle bacilli.
4. Tuberculosis: epidemiology, main characteristics of the disease, pathogenesis (the first contact with host and reactivated tuberculosis) and specific prophylaxis.
5. Tubercle (granuloma): localisation, composition and variants of its development (healing or necrosis).
6. Immunity and infectious allergy in tuberculosis. Tubeculin skin test: the purposes of use. The role of DTH and cell-mediated immunity in pathogenesis of tuberculosis. Resistance of humans to tubercle bacilli.

7. Laboratory diagnostics of tuberculosis: the main scheme, used methods (microscopy, preparing of the specimens for using of the methods of cultivation and biological method, methods of concentration of the specimens).
8. Laboratory diagnostics of tuberculosis: method of cultivation, biological method and the method of rapid growing of mycobacteria (microcultures). Approaches to differentiation of *M. tuberculosis* and *M. bovis*, revealing of L-forms of tubercle bacilli.
9. Opportunistic mycobacteria and their role in human disease.
10. *Mycobacterium leprae*: main characteristics. Leprosy: main characteristics of the disease, epidemiology, pathogenesis, immunity and laboratory diagnostics.

LESSON 24

1. Actinomycetes: classification, main characteristics of pathogenic actinomycetes (morphology, composition of the "sulfur granule", growth characteristics and disease). Distribution of pathogenic actinomycetes in the natural environment. Aetiology of actinomysosis.
2. Actinomycosis: pathogenesis, main characteristics of the disease and immunity. Laboratory diagnostics of the atinomycosis.
3. Listeriae: classification, morphology, cultivation (selective media for growing listeriae).
4. Listeriae: biochemical, metabolic characteristics, antigenic composition, pathogenicity factors and resistance to unfavourable conditions of environment.
5. Listeriosis: epidemiology, main characteristics of the disease, pathogenesis and immunity.
6. Listeriosis: laboratory diagnostics, isolation of pure culture and immunological methods of identification.

LESSON 25

1. Ecological groups of anaerobic bacteria: the main reasons of anaerobic respiration, bacteria, which are highly sensitive to the presence of oxygen and aerotolerant bacteria. Classification of anaerobic bacteria.
2. Clostridia: main characteristics and classification.
3. Clostridia: natural habitats, the ability to produce spores, their resistance to unfavourable conditions of surrounding and the pathogenicity factors.
4. The clostridia producing gas gangrene: main characteristics.
5. The pathogenicity factors of *Clostridium perfringens* and of other clostridia producing gas gangrene.
6. *Clostridium* difficile: the role in human disease. The role of *C. difficile* in hospital-acquired infections. Bacteria – infectious agent producing food poisoning infections (toxic infections and intoxications).
7. Gas gangrene: pathogenesis, laboratory diagnostics, immune prophylaxis and immune therapy.
8. The pathogen causing tetanus: main characteristics of the bacterium and characteristics of the tetanus toxin.
9. Tetanus: pathogenesis, immunity, laboratory diagnostics, routine immune prophylaxis and the algorithm of urgent immunisation.
10. The pathogen causing botulism: main characteristics, pathogenesis and laboratory diagnostics.

11. Botulism: immune prophylaxis and immune therapy.
12. Botulinum toxin.
13. Asporogenous anaerobic bacteria and their role in human disease: species of
14. *Bacteroides, Porphyromonas, Fusobacterium, Prevotella, peptococci* and *peptostreptococci.*
15. Asporogenous anaerobic bacteria and their role in human disease: fusobacteria, peptococci and peptostreptococci. Main approaches to the laboratory diagnostics of the infections produced by asporogenous anaerobic bacteria.

LESSON 26

1. Main characteristics of corynebacteria. Diphtheroids: main differences in comparison with diphtheria-producing rods, classification and the role in human disease.
2. Corynebacteria causing diphtheria: morphology, cultivation, biochemical characteristics, antigenic composition and resistance to unfavourable conditions of environment.
3. Pathogenicity factors of diphtheria-producing rods: main characteristics.
4. Diphtheria: epidemiology, main characteristics of the disease, pathogenesis, immunity and immune prophylaxis.
5. Laboratory diagnostics of diphtheria.
6. *Bordetella* genus: main characteristics, the approaches to the differentiation of pathogenic species. Characteristics of the pathogenicity factors of the pathogen causing whooping cough.
7. The pathogen causing whooping cough: morphology, cultivation, biochemical characteristics, antigenic composition and sensitivity to unfavourable conditions of environment.
8. Whooping cough: epidemiology, pathogenesis, stages of the disease, immunity, laboratory diagnostics and specific prophylaxis.
9. Classification of haemophilic bacteria. Haemophilic rod: main characteristics, epidemiology of the infections caused by haemophilic rod, carriage, laboratory diagnostics and specific prophylaxis.
10. The genera *Legionella Coxiella*: classification. Morphology, cultivation, biochemical characteristics and antigenic composition of legionellae, their pathogenicity factors and resistance to unfavourable conditions of environment.
11. Legionnaires' disease: epidemiology, pathogenesis, immunity and laboratory diagnostics.
12. Q fever: the aetiology (the pathogen causing disease), pathogenesis, immunity and laboratory diagnostics.

LESSON 27

1. Spirochetes: main differences in comparison with other prokaryotes, main characteristics of the ultra-structure, the types of movement, classification of pathogenic spirochetes, tinctorial features (pertaining to staining). Diseases related to syphilis: epidemiology and laboratory diagnostics.
2. Pathogenic treponemes: species. *T. pallidum* var. *pallidum*: morphology, cultivation, biochemical characteristics, antigenic composition and factors

of pathogenicity.

3. Syphilis: pathogenesis, main characteristics and characteristics of the stages of the disease, specificity of immunity, the mechanism of the rush appearance, epidemiology and resistance of the pathogen to unfavourable conditions of environment. The conditions when congenital syphilis is developed. Laboratory diagnostics of syphilis.
4. Main groups of pathogenic borreliae, main characteristics and antigenic structure of pathogenic borreliae.
5. Epidemic relapsing fever: aetiology, pathogenesis and laboratory diagnostics. Tick-born spirochaetoses endemic regions and the causative agents.
6. Lyme disease: aetiology, epidemiology, vectors, pathogenesis, main characteristics of the disease and laboratory diagnostics.
7. Leptospiras: classification, morphology, the leading method of diagnostics, cultivation, serological groups and serological variants of pathogenic leptospiras, resistance in the environment, pathogenicity factors and distribution in the natural environment.
8. Leptospirosis: specificity of penetration of the bacteria into the human organism, pathogenesis, laboratory diagnostics and immune prophylaxis.

LESSON 28

1. *Bartonella*: the role in human disease. *Orientia*: the role in human disease. The bacteria – obligate intracellular parasites. *Erlichia*: the role in human disease.
2. Rickettsiae: main characteristics, morphological types, the main reason for exclusively intracellular multiplication, sensitivity to unfavourable conditions of environment and factors of pathogenicity. Classification of rickettsiae and rickettsioses.
3. Epidemic typhus: distribution of the infection, aetiology, pathogenesis and laboratory diagnostics. The mechanisms of later relapses of the disease and the approaches, which help to distinguish late relapse (“Brill-Zinsser disease”) from “fresh” case of the disease.
4. Endemic typhus: aetiology, specificity of penetration of the bacteria into the human organism and the approaches, which help to differentiate endemic typhus and epidemic typhus.
5. Chlamydiae: morphology of the elementary bodies, propagation, intracellular inclusion bodies, classification (species and serological variants) and the role in human disease. Trachoma: epidemiology and pathogenesis.
6. Urogenital chlamydiosis: the distinctive features of the pathology. *C. psittaci*: pathogenesis of the disease.
7. Respiratory infections caused by chlamydiae.
8. Laboratory diagnostics of the diseases caused by chlamydiae.
9. Mycoplasmas: classification, main characteristics, pathogenicity factors, the role in human disease. Laboratory diagnostics of the diseases caused by mycoplasmas.

LESSON 29

1. Classification of mycoses and main characteristics of the main groups of mycoses. Superficial mycoses. Epidermomycoses (dermatophytosis): main

pathogens and laboratory diagnostics of the infections.

2. Dermatophyte causing tinea cruris: name of main pathogen and laboratory diagnostics of the infection. Dermatophyte causing tinea pedis: name of main pathogen and laboratory diagnostics of the infection.
3. Trychophytia (ringworm): names of main pathogens and laboratory diagnostics of mycoses caused by *Trichophyton* and *Microsporum*.
4. Opportunistic mycoses: list of the pathogens and their main characteristics.
5. Candidiasis: distribution, the pathogens, the ways of penetration of the bacteria into the human organism and laboratory diagnostics.
6. Asperigillosis: distribution, the pathogens, the ways of penetration of the bacteria into the human organism, production of aflatoxins and laboratory diagnostics.
7. Infections caused by phycomycetes: distribution, the pathogens, the ways of penetration of the bacteria into the human organism, pathogenesis and laboratory diagnostics.
8. The mycoses caused by Pneumocystis: the conditions which enable the development of the disease, the pathogens, the ways of penetration of the bacteria into the human organism, pathogenesis and laboratory diagnostics. Pneumocystosis in HIV patients.
9. Laboratory diagnostics of mycoses: characteristics of the methods.
10. Pathogenic protozoa: main characteristics, classification, pathogenicity factors and antigenic structure.
11. Laboratory diagnostics of invasions – infections caused by parasites.
12. Malaria: aetiology and laboratory diagnostics.
13. Toxoplasmosis: aetiology and laboratory diagnostics.
14. Infections produced by Cryptosporidium: aetiology and laboratory diagnostics.
15. Amoebiasis: aetiology, pathogenesis, main ways of invasion of the intestinal wall by the parasite and the input of the invasion into pathogenesis; laboratory diagnostics of amoebiasis.
16. Giardiasis: aetiology, pathogenesis, the reason for development of cholecystocholangitis and laboratory diagnostics.
17. Trichomoniasis: aetiology and laboratory diagnostics. Infections produced by associations of parasites with chlamydiae, mycoplasmas and gonococci.

5. **GENERAL AND MEDICAL VIROLOGY**

LESSON 31

1. The history of discovery of the first viruses. Main peculiarities by which viruses differ from other forms of life. Main peculiarities used for classification of viruses.
2. Classifications of viruses. Other small infectious agents resembling viruses.
3. Structure of virions (fully assembled infectious viruses). Structure of the virion envelope. Existing forms of viruses. Size of virions. Shape of virions.
4. Main characteristics of viral DNA, RNA and viral proteins.
5. Strict tissue tropism of the viruses. The mechanisms involved into attachment of the viruses to the infected cell and steps of multiplication of the viruses in the

infected cell. The place of the assembling of virions (maturation). The ways of transcription of viral genome.

6. Genetic recombination, genetic reactivation, complementation and phenotypic mixing of the viruses.
7. Viral infections: pathological processes induced by viruses in the infected cell and their main characteristics. The results of the integration of viral DNA into host cell DNA. The results of activation of the persisted virus. Virus-mediated effects on the infected cells and overall infected macro-organism (human organism).
8. General scheme of pathogenesis of viral infections. Immunity in viral infections. Effects of the interaction of the viruses with phagocytes.
9. Antiviral agents: main classification. The immune preparations used in immune prophylaxis and immune therapy of viral infections.
10. Laboratory diagnostics of viral infections: the methods, general scheme of virological method and the methods of express-diagnostics.
11. The use of chick embryo, cell cultures and laboratory animals in laboratory diagnostics of viral infections.

LESSON 32

1. Orthomyxoviruses: classification, main characteristics of the family and the leading method used for their cultivation.
2. Flu viruses: morphology (structure) of the virion, antigenic structure, variation of antigenic structure and the consequences of high antigenic variability. Main characteristics of *influenza virus C*.
3. Influenza: pathogenesis of the disease, immunity, immune- and chemoprophylaxis; laboratory diagnostics.
4. Bird flu virus: main reservoir of the pathogen, characteristics of the serotype, specificity of pathogenesis in humans and an ability to cause pandemic.
5. Paramyxoviruses: classification and morphology. *Parainfluenza virus*: main characteristics. Parainfluenza: pathogenesis of the disease.
6. Mumps (epidemic parotitis): main characteristics of the virus, pathogenesis of the disease and immune prophylaxis.
7. Measles virus: main characteristics, pathogenesis of measles and immune prophylaxis.
8. *Respiratory syncytial virus* (*RSV*): main characteristics. Pathogenesis of RSV- infection.
9. Coronaviruses: classification and main characteristics (structure of the virion, antigenic groups and cultivation).
10. Infections produced by coronaviruses: pathology of diseases. SARS. 22.
11. *Rubivirus*: classification, structure of the virion and main properties of the virus.
12. Pathogenesis and specific prophylaxis of rubella.

LESSON 33

1. Retroviruses: classification and main characteristics of the family. The history of discovery of *HIV*. *HIV* proteins (the spikes, the core proteins and

enzymes).

2. Structure and function of *HIV-1* genome and the differences between the genomes of *HIV-1* and *HIV-2*.
3. *HIV*: antigenic types, classification of *HIV-1* and phenotypes of *HIV-1* (tropism of *HIV* to human cells).
4. Life cycle of *HIV* in CD4-cells (lymphocytes).
5. The ways of transmission of *HIV*, humans belonging to high risk groups, the typical model of *HIV* spreading and biological fluids contaminated by *HIV*.
6. Pathogenesis of *HIV* infection. AIDS-associated infections.
7. *HIV*-infection: laboratory diagnostics, indirect tests revealing the immune status of a patient, serological tests and procedure of testing in high risk groups.
8. The methods of isolation (cultivation) of *HIV*.

LESSON 34

1. Picornaviruses: classification of the family, main characteristics, the features which help to differentiate the genera of the family and the role in human disease.
2. Enteroviruses: classification of the genus, main characteristics and cultivation.
3. Polioviruses: main characteristics and pathogenesis of poliomyelitis.
4. Poliomyelitis: immunity, laboratory diagnostics and immune prophylaxis.
5. Human coxsackieviruses and echoviruses: main characteristics and the role in disease of humans.
6. *Aphtovirus*: main characteristics and its infectiveness for humans.
7. Rhinoviruses: classification of the genus, main characteristics and role in human disease.
8. Acute upper respiratory infection (URI): pathogenesis, immunity and laboratory diagnostics.
9. Caliciviruses: specific characteristics, the role in human disease and laboratory diagnostics.

LESSON 35

1. Ecologic groups of arbo- and roboviruses: main characteristics and composition of the group (main families).
2. *Togaviridae* (*Alphavirus*): the role in human disease and main characteristics.
3. Flaviviruses: classification of the family, antigenic groups and main characteristics of the genus *Flavivirus*.
4. Tick-borne encephalitis: the pathogen, pathogenesis, immunity and specific prophylaxis.
5. Tick-borne encephalitis: the dynamics of the antibody's appearance at different stages of the disease, laboratory diagnostics, the approaches to diagnostics of the tick-borne encephalitis used in the Republic of Belarus.
6. The infections caused by flaviviruses: dengue fever, yellow fever and Japanese encephalitis.
7. Bunyaviruses: classification, the role in human disease, main

characteristics, pathogenesis of Crimean-Congo haemorrhagic fever and haemorrhagic fever with renal syndrome.

8. Arenaviruses: general concepts (structure of virion and role in human disease).
9. Main characteristics of filoviruses. *Ebola virus*.
10. Reoviruses: classification and main characteristics of the family.
11. Gastroenteritis caused by rotaviruses: pathogenesis and laboratory diagnostics.
12. Rhabdoviruses: classification. *Rabies virus*: main characteristics, pathogenesis of rabies and fixed rabies virus.
13. Rabies: laboratory diagnostics and modern methods of prevention.

LESSON 36

1. Main peculiarities of DNA viruses. Poxviruses: main characteristics and classification. The history of development of the methods of immune prophylaxis of smallpox and worldwide smallpox eradication.
2. Herpes viruses: classification and main characteristics of the family.
3. Herpes viruses: methods applied for their cultivation and specific features of reproduction. Infections caused by herpes viruses and main characteristics of immunity.
4. Laboratory diagnostics of the infections caused by HSV.
5. Varicella-zoster virus: main similarities and differences between varicella-zoster and herpes simplex viruses. Pathogenesis of chickenpox and herpes zoster (shingles).
6. Chickenpox: immunity, laboratory diagnostics and immune prophylaxis.
7. Cytomegalovirus and its role in human disease. Epstein-Barr virus. Laboratory diagnostics of infectious mononucleosis.
8. Human herpes virus 6. The role of HHV-6, HHV-7 and HHV-8 in human disease.
9. Adenoviruses: main characteristics, cultivation and reproduction of the viruses.
10. Adenoviruses: classification, pathogenesis of the infections and the consequences of the vertical infections.
11. Adenovirus infections: immunity, laboratory diagnostics, chemo-and immune prophylaxis.
12. Papilloma- and polyomaviruses: general concepts and the role in human disease.
13. Parvoviruses: main characteristics and their role in human disease.

LESSON 37

1. Viral hepatitis: classification of the infections. HAV: morphology of the virion and main characteristics. Main differences of HAV in comparison with other picornaviruses. Hepatitis A: pathogenesis.
2. Hepatitis A: variants of the outcome of the disease, immunity, laboratory diagnostics and specific prophylaxis.
3. HBV: morphology of the virion, specific features of its replication, antigenic structure and polypeptide fragments of HBs-Ag.
4. Subtypes of HBV, the origin of HBe-Ag, carcinogenicity and epidemiology.

Hepatitis B: pathogenesis, iatrogenic character of the disease, immunity, laboratory diagnostics and immune prophylaxis.

5. Distinctive properties of HCV, main characteristics of the disease, the outcome of the disease and laboratory diagnostics.
6. Hepatitis D: main characteristics of the pathogen, main characteristics of the disease and laboratory diagnostics.
7. Hepatitis E: main characteristics of the disease and laboratory diagnostics. HFV.
8. Hepatitis G: main characteristics of the pathogen and laboratory diagnostics.
9. TTV (transfusion-transmitted virus): characteristics of the pathogen and laboratory diagnostics.
10. Virological theory of carcinogenesis. Mutation theory of carcinogenesis. Modern theory of malignant transformation: proto-oncogenes, oncogenes and future of the tumour cell.
11. The factors, which promote the transformation of proto-oncogenes into oncogenes, viral and cellular oncogenes and the mechanisms of viral carcinogenesis.
12. Main characteristics of oncogenic viruses. The examples of viruses, which possess oncogenic potential. Retrotransposons.
13. Slow infections: main characteristics of the infections; characteristics of scrapie, kuru and slow viral infections.
14. Slow infections caused by prions (prion disease): characteristics of the pathological processes and their distinctive features. Prusiner's discovery. The meaning of the term "prion".
15. Two isoforms of prions. PrPC. The mechanism of PrPC transformation into PrPSc. The principal differences between PrSc and normal isoform. Characteristics of the process of the accumulation of PrPSc.
16. The mechanisms of the development of prion diseases. The frequency of the prion disease in human population. New variant of Creutzfeldt-Jakob (C-J) disease (the end of XX century). Laboratory diagnostics of prion diseases.

THEMATIC PLANS OF THE LECTURES ON THE DECIPLINE "MICROBIOLOGY. VIROLOGY. IMMUNOLOGY"
Medical Faculty for International Students (English medium)
Specialty 1 – 79 01 01 «General Medicine»

Week/Lecture №	THEME	Lecturer
V Semester		
	MEDICAL BACTERIOLOGY WITH BASICS OF MYCOLOGY AND PROTOZOOLOGY	
1/1	PIOGENIC COCCI. ESCHERICHIAE. SHIGELLAE. SALMONELLAE. VIBRIO. BRUCELLA. FRANCISELLA. YERSINIA PESTIS. BACILLUS: MAIN CHARACTERISTICS	Assoc. prof. S.A. Astrautsova
2/2	MICROBIOLOGICAL DIAGNOSTICS OF THE INFECTIONS CAUSED BY OPPORTUNISTIC ENTEROBACTERIAE	The lecture is determined for the self-

3/3	PROTEUS, PSEUDOMONAS, CAMPYLOBACTER AND HELICOBACTER	- « -
4/4	VIBRIO. BRUCELLA. FRANCISELLA. YERSINIA PESTIS. BACILLUS	- « -
5/5	MYCOBACTERIA. ACTINOMYCETES. LISTERIA	- « -
6/6	ANAEROBIC BACTERIA. CORYNEBACTERIA. BORDETELLA. HAEMOPHILUS. LEGIONELLA. COXIELLA	- « -
7/7	TREPONEMA. BORRELIA. LEPTOSPIRA. BARTONELLA. ORIENTIA. EHRLICHIA. RICKETTSIA. CHLAMYDIA. MYCOPLASMA	- « -
8/8	PATHOGENIC FUNGI AND PROTOZOA	- « -
	GENERAL AND MEDICAL VIROLOGY. CLINICAL MICROBIOLOGY	
9/9	GENERAL VIROLOGY	Assoc. prof. S.A. Astrautsova
10/10	AVIAN FLU. ORTHOMYXOVIRUSES. PARAMYXOVIRUSES. CORONAVIRUSES. TOGAVIRUSES (RUBIVIRUS). RETROVIRUSES. PICORNAVIRUSES. CALICIVIRUSES	The lecture is determined for the self-dependent work
11/11	ECOLOGICAL GROUPS OF ARBO- AND ROBOVIRUSES. REOVIRUSES. RHABDOVIRUSES. DNA VIRUSES	- « -
12/12	HEPATITIS VIRUSES. ONCOGENIC VIRUSES. SLOW INFECTIONS. CLINICAL MICROBIOLOGY	- « -

THEMATIC PLAN OF THE PRACTICAL CLASSES

Week/lesson№	DATE	THEME	Hours
	V Semester		
MEDICAL BACTERIOLOGY WITH BASICS OF MYCOLOGY AND PROTOZOOLOGY			
1 / 20	01.09 - 3.09	Escherichia. Shigella. The main characteristics of enterobacteriae. Laboratory diagnostics of enteric infections caused by escherichiae, diagnostics of bacterial dysentery and salmonellosis (gastroenteritis)	2,5
2 / 21	06.09 – 10.09	Opportunistic enterobacteriae. The Pseudomonas group. Acinetobacterium. Campylobacter. Helicobacter. Laboratory diagnostics of klebsiellosis, yersiniosis, infections caused by bacteria belonging to the Proteus group, blue pus infections, campylobacteriosis and helicobacteriosis	2,5
3 / 22	13.09 – 17.09	Vibrio. Brucella. Francisella. Yersinia pestis. Bacillus spp. Main characteristics of special danger infections	2,5
4 / 23	20.09 – 24.09	Mycobacteria	2,5
5 / 24	27.09 – 01.10	Actinomyces. Listeria	2,5
6 / 25	04.10 – 08.10	Anaerobic bacteria	2,5
7 / 26	11.10 – 15.10	Corynebacterium. Bordetella. Haemophilus. Legionella. Coxiella	2,5
8 / 27	18.10 – 22.10	Treponema. Borrelia. Leptospira	2,5

9 / 28	25.10 – 29.10	Bartonella. Rickettsia. Orientia. Ehrlichia. Chlamydia. Mycoplasma	2,5
10 / 29	01.11 – 05.11	Pathogenic fungi and protozoa	2,5
11 / 30	**08.11 -12.11**	**Mini-exam « MEDICAL BACTERIOLOGY WITH BASICS OF MEDICAL MYCOLOGY AND MEDICAL PROTOZOOLOGY»**	2,5

GENERAL AND MEDICAL VIROLOGY. CLINICAL MICROBIOLOGY

12 / 31	15.11 – 19.11	General virology. Main features of viruses. Classification of viruses. Composition of the virion and its interactions with the host cell. Virological diagnostic tests	2,5
13 / 32	22.11 – 26.11	Orthomyxoviridae. Paramyxoviridae. Coronaviridae. Rubivirus	2,5
14 / 33	29.11 – 03.12	Retroviridae	2,5
15 / 34	06.12 – 10.12	Picornaviridae. Caliciviridae. Astroviridae	2,5
16 / 35	13.12 – 17.12	Ecologic grouping of arbo- and roboviruses. Reoviridae. Rhabdoviridae	2,5
17 / 36	20.12 -24.12	DNA viruses	2,5
18 / 37	27.12 -31.12	Hepatitis viruses. Oncogenic viruses. Slow infections. Clinical microbiology	2,5
19 / 38	**3.01 - 06.01**	**Mini-exam «GENERAL AND MEDICAL VIROLOGY»**	2,5