



MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION  
Federal state autonomous educational institution  
of higher education  
«Far Eastern Federal University»  
(FEFU)

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**SCHOOL OF BIOMEDICINE**

«AGREED»

Head of education program  
«General medicine»

  
\_\_\_\_\_  
(signature) Khotimchenko Yu.S.  
(Full name)  
«09» of July 2019

«APPROVED»

Director of the Department of Clinical  
Medicine

  
\_\_\_\_\_  
(signature) Geltser B.I.  
(Full name)  
«09» of July 2019



**WORKING PROGRAM OF ACADEMIC DISCIPLINE (WPAD)**

**« Immunology Courses»**

Educational program

Specialty 31.05.01 «General medicine»

**Form of study: full time**

year 2 semester 3  
lectures 18 hours  
practical classes 36 hours  
laboratory works not provided  
total amount of in-classroom work 54 hours  
independent self-work 54 hours  
control works ()  
credit not provided  
exam 2 year, 3 semester

The working program is drawn up in accordance with the requirements of the Federal state educational standard of higher education (level of training), approved by the order of the Ministry of education and science of the Russian Federation from 09.02.2016 № 95.

The working program of the discipline was discussed at the meeting of the Department of fundamental and clinical medicine. Protocol No. 8, 09 of July 2019

Author: PhD, MD, professor Martynova A.V.

## **Annotation**

The discipline "Immunology Courses" is intended for students enrolled in the educational program "General Medicine", is included in the basic part of the curriculum. Discipline is implemented in the 2 course, 3<sup>th</sup> semester, is a basic discipline.

In developing the work program of the discipline, the Federal State Educational Standard of Higher Education (level of training of highly qualified personnel) in the specialty 31.05.01 was used. "General Medicine" (the level of training of highly qualified personnel), the curriculum for preparing students for the General Education and Training Program "General Medicine". The total complexity of the discipline is 108 hours, 3 credits.

The course program is based on the basic medical knowledge gained by experts:

- the ability and willingness to conduct epidemiological protection, to organize the protection of public health in the focal points of especially dangerous infections, in case of degradation of the radiation situation, natural disasters and other emergency situations (PC – 3)
- the readiness for educational activities to eliminate the risk factors and promote healthy lifestyles (PC – 16)

The purpose of the course: mastering the knowledge of the general laws of development, structure and function of the body's immune system in normal conditions and in diseases caused by impaired immune mechanisms, as well as the basic principles of diagnosis, treatment of immune-mediated human diseases.

Tasks:

1. Acquisition by students of knowledge about the basic structural and functional features of the immune system.
2. Acquisition by students of knowledge about the causes of development, immunopathogenesis and clinical manifestations of the main immunodeficiency, allergic and other diseases of the immune system.

3. Training students in the most important methods of assessing the immune status using modern molecular genetic, immunological and cellular technologies; allowing to detect defects in the immune system.

4. Formation of ideas about the leading role of immunogenetic factors in the development and functioning of the immune system, the development of immunopathologies.

5. Formation of approaches to the formulation of the immune diagnosis and the development of tactics for the treatment and prevention of diseases of the immune system.

To solve these problems, a course of thematic lectures, laboratory and practical classes is planned.

As a result of studying this discipline, students form the following professional competencies.

Code and formulation of competence	Stage of competence	
the ability and willingness to conduct epidemiological protection, to organize the protection of public health in the focal points of especially dangerous infections, in case of degradation of the radiation situation, natural disasters and other emergency situations (PC – 3)	Know	capable and ready to carry out anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations
	Know how	capable and ready to carry out anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations
	Master	ability and readiness to conduct anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations
the readiness for educational activities to eliminate the risk factors and promote healthy lifestyles (PC – 16)	Know	and ready for educational activities to eliminate risk factors and develop healthy lifestyle habits;
	Know how	and ready for educational activities to eliminate risk factors and develop healthy lifestyle habits;
	Master	willingness to educate on the elimination of risk factors and the formation of skills for a healthy lifestyle;

# **I. STRUCTURE AND CONTENT OF THEORETICAL PART OF THE COURSE**

## **SECTION 1. Basics of Immunology (18 hours)**

**Topic 1.** Immunology as a science, its history and modern significance for biology and medicine. (2 hours)

The subject of immunology. Place of immunology in the system of natural sciences. Immunology methods. The main sections of modern immunology and their relationship with clinical medicine. Brief history of the development of immunology. Prospects for development and the main tasks of modern immunology.

**Topic 2.** The human immune system, its organs, immune cells and the principles of their migration. (2 hours)

Organs of the immune system, cellular and humoral components of the immune system, ontogenesis of the human immune system. The organization of the movement of immune cells.

**Topic 3.** Congenital immunity, antigen recognition principles, complement system. (2 hours)

Principles and receptors of antigen recognition by innate cells and immunity, phagocytic cells, natural killers. Humoral components of reactions of innate immunity. Complement system

**Topic 4.** Congenital immunity, phagocytic cells. (2 hours)

Various types of phagocytic cells, microphages and macrophages. The system of mononuclear phagocytes. Dendritic cells.

**Topic 5.** Adaptive immunity, recognition principles, types of lymphocytes. (2 hours)

Types of antigen-recognizing T and B lymphocyte receptors. Antigen recognition conditions by lymphocytes. Antigen-presenting cells, genetic bases of the immune response (HLA complex),

**Topic 6.** The development of the immune response with the participation of T-and B-lymphocytes (4 hours).

Formation of effector T-helper cells, cytotoxic lymphocytes, B-lymphocytes, plasma cells during various types of immune responses. Functions of effector lymphocytes. Memory cells.

**Topic 7.** The development of an immune response against bacteria. (2 hours).

Antibacterial protective immune reactions. The escape of bacteria from the immune response. Toxins and superantigens. Types of effector defense reactions from extracellular and intracellular microorganisms. Conditions for the development of immunopathological conditions. Systemic inflammatory response. Sepsis.

**Topic 8.** The development of an immune response against viruses. (2 hours).

Interferon system, antiviral reactions of innate immunity. The elimination of viruses from the immune response. Causes of the development of immunopathological conditions. Acute and latent viral infections.

**Topic 9.** Vaccinology. (2 hours). Classes are held using the method of active learning "lecture-press conference."

Types of vaccines. Composition of vaccines. Vaccination schedule. Modern vaccines (split vaccines, DNA vaccines, recombinant vaccines). The dangers and complications of vaccination.

## **II. STRUCTURE AND CONTENT OF PRACTICAL PART**

(36 hours)

Lesson 1. THE MAIN STAGES OF THE DEVELOPMENT OF IMMUNOLOGY, METHODOLOGICAL BREAKTHROUGHS THAT ENSURED THE PROGRESS IN THE FIELD OF IMMUNOLOGY (2 hours)

1. Overview of the history of immunology
2. The birth of immunology as a science
3. The development of immunology until the mid-twentieth century
4. "New Immunology" of the 1950s – 1980s
5. The present stage of development of immunology - molecular immunology

Lesson 2. STRUCTURAL AND FUNCTIONAL ORGANIZATION OF THE IMMUNE SYSTEM (2 hrs.)

1. Target molecules of immunity (images of pathogenicity, antigens) and receptors that recognize them. Types of immune cells of myeloid and lymphoid lines.
2. The concept of innate and adaptive immunity. Immunological memory
3. Types of immune response, effector mechanisms of the immune response.
4. The relationship of factors of innate and adaptive immunity.
5. Organs of the immune system.

### Lesson 3: CONGENITAL IMMUNITY, PRINCIPLES OF ORGANIZATION OF CONGENITAL IMMUNE RESPONSE (2 hrs.)

1. Non-specific resistance of barrier tissues.
2. Phagocytosis. Types of phagocytic cells and their characteristics.
3. Bactericidal mechanisms
4. Macrophages and inflammatory cytokines, mononuclear phagocyte system.
5. Types of receptors for antigens on cells of innate immunity.
6. Dendritic cells.

### Lesson 4. POSSIBILITIES OF MIGRATION (TRAFFIC) OF CELLS OF CONGENITAL IMMUNITY (2 hours)

1. Adhesive interactions of cells of the immune system, types of adhesion molecules.
2. Integrins and their role in the activation of immune cells.
3. The main groups of chemoattractants.
4. Chemokines and chemokine receptors.
5. Receptors for opsonins and their regulatory role for cells of innate immunity.
6. Transfer of cells of innate immunity to the focus of inflammation.

### Lesson 5. LYMPHOID CELLS OF CONGENITAL IMMUNITY. NATURAL KILLERS (2 hours)

1. Characteristics of natural killers
2. Development and homeostasis of the natural killer population
3. Natural Killer Receptors
4. Effector functions of natural killer
5. The Role of Natural Killers in Immune Protection
6. NKT lymphocytes
7. N-glycan receptors on natural killer cells.

### Lesson 6: HUMORAL FACTORS OF CONGENITAL IMMUNITY (2 hrs.)

1. The complement system
2. Proteins of the acute phase of inflammation. Pentraxins
3. Nutrient amines

4. Lipid mediators. Eicosanoids

5. Cytokines, major groups and families.

Lesson 7. ADAPTIVE IMMUNITY, RECEPTORS OF V-LYMPHOCYTES RECOGNITING ANTIGENS (2 hrs.)

Lesson 7. ADAPTIVE IMMUNITY, RECEPTORS OF V-LYMPHOCYTES RECOGNITING ANTIGENS (2 hrs.)

1. Immunoglobulins as antibodies. The structure of immunoglobulins.

2. Antigen binding sites of immunoglobulins

3. Isotypes and antigenic variants of immunoglobulins

4. B-cell receptor and additional polypeptide chains, B-cell receptor complex.

5. Formation of B-lymphocyte Receptor Genes

6. Events at activation of V-lymphocytes.

Lesson 8. MAIN COMPLEX OF HISTOCOMPATIBILITY AND ANTIGENES RECOGNIZED BY T-CELLS (2 hours)

1. Main histocompatibility complex

2. Processing of antigen for T-cells

3. Features of recognition of antigenic ligands by T-cell receptor complexes

4. Superantigens

Lesson 9. ANTIGENS AND THEIR IMMUNOGENICITY (2 hours)

1. Immunogenicity of antigens and its determinants

2. Interaction of antigens and antibodies, affinity, avidity

3. Major histocompatibility complex and antigens recognized by T-cells

4. Processing of antigen for T-cells

5. Recognition of antigenic ligands by T-cell receptor complexes

6. Recognition of lipid antigens

Lesson 10. ADAPTIVE IMMUNITY, ANTIGEN-RECOGNIZING T-LYMPHOCYTES RECEPTORS (2 hours)

1. The structure of the T-cell receptor.

2. Formation of T-lymphocyte Receptor Genes

3. T-cell receptor and its associated molecules. CD3 complex

4. T-cell co-receptors
5. Events during the activation of T-lymphocytes

#### Lesson 11. T-LYMPHOCYTES (2 hours)

1. Thymus - T-Lymphopoiesis Organ
2. Development of  $\alpha\beta$ T cells, formation of T-cell receptor
3. Stages and directions of selection of T-lymphocytes in the thymus
4. Differentiation of CD4 + and CD8 + Thymocytes
5. Formation of antigen-specific effector populations of lymphocytes.

#### Lesson 12. V-LYMPHOCYTES (2 hrs.)

1. Development of B-lymphocytes in CM, formation of B-cell receptor
2. Differentiation of B-lymphocytes.
3. Antigen-dependent differentiation in secondary lymphoid organs
4. Subpopulations of B-lymphocytes

#### Lesson 13. ACTIVATION OF LYMPHOCYTES AND STARTING OF THE IMMUNE RESPONSE (2 hours)

1. Presentation of antigen and types of AIC
2. Immune synapse, costimulation and adhesion interactions
3. Proliferative expansion of clones of T - and B-lymphocytes
4. Differentiation of T - and B-lymphocytes
5. Cytokines that control and mediate adaptive lymphocyte reactions
6. Types of immune response

#### Lesson 14. BASES OF IMMUNODIAGNOSTICS, immunochemistry (2 hours)

1. The formation of monoclonal antibodies
2. Methods based on immunoprecipitation
3. Agglutination reactions
4. The study of antibodies, based on the consolidation of molecules with retention on the solid phase
5. Methods for determining the affinity of the interaction of an antibody with an antigen



Lesson 15. BASES OF IMMUNODIAGNOSTICS, microscopy and flow cytometry (2 hours)

1. Microscopic visualization of cells and subcellular structures
2. Immunofluorescence microscopy methods
3. Flow cytometry
4. Magnetic cell sorting
5. Analysis of the cell cycle
6. The study of cell death
7. Animal experimental systems (models)

Lesson 16. REGULATION OF IMMUNE RESPONSE (2 hours)

1. Genetic control of the immune response
2. Intracellular mechanisms of immunosuppression. Suppressor immunoreceptors
3. Suppressor cytokines
4. Regulatory T-cells
5. Regulatory B-cells
6. Hormonal regulation of the immune response
7. Nervous regulation of the immune response

Lesson 17. ANTIINFECTIOUS IMMUNITY (2 hours)

1. Infectious agents as immunogens. Launch of anti-infective immunity
2. Factors of pathogens that modify the activity of the host immune system
3. Manifestations of immune protection against major pathogen groups
4. Types of protective immune response in infectious diseases

Lesson 18. TRANSPLANT IMMUNITY (2 hours)

1. Immunopathological events in the transplantation of allogeneic organs and tissues.
2. Immunological methods for the selection of histocompatible donor-recipient pairs.
3. Modern methods of HLA typing (serological, genotyping, cross-sampling).
4. Immune mechanisms of graft rejection.
5. Graft versus host disease.

6. The concept of chimerism.

### **III. TRAINING AND METHODOLOGICAL SUPPORT OF INDEPENDENT WORK OF STUDENTS**

The main content of the topics, evaluation tools are presented in the RSPU: terms and concepts necessary to master the discipline.

In the course of mastering the course “Immunology”, the student will have to do a large amount of independent work, which includes preparation for seminars and writing an essay.

Practical exercises help students to deeper learn the material, to acquire the skills of creative work on documents and primary sources.

Plans for practical classes, their topics, recommended literature, the purpose and objectives of its study are communicated by the teacher at the introductory classes or in the curriculum for the discipline.

Before proceeding to the study of the topic, it is necessary to familiarize yourself with the main questions of the practical training plan and list of recommended literature.

Starting the preparation for the practical lesson, it is necessary first of all to refer to the lecture notes, sections of textbooks and teaching aids in order to get a general idea of the place and importance of the topic in the course being studied. Then work with additional literature, make notes on the recommended sources.

In the process of studying the recommended material, it is necessary to understand the construction of the topic being studied, to highlight the main points, to follow their logic and thereby to get into the essence of the problem being studied.

It is necessary to keep records of the material being studied in the form of an outline, which, along with the visual, includes the motor memory and allows you to accumulate an individual fund of auxiliary materials for a quick repetition of what you read, to mobilize accumulated knowledge. The main forms of record: a plan (simple and detailed), extracts, theses.

In the process of preparation, it is important to compare the sources, think over the material being studied and build an algorithm of actions, carefully consider your oral presentation.

At a practical lesson, each participant should be ready to speak on all the questions posed in the plan, to be as active as possible in their consideration. The speech should be convincing and reasoned, and simple reading of the abstract is not allowed. It is important to show your own attitude to what is being said, express your personal opinion, understanding, substantiate it and draw the right conclusions from what has been said. You can refer to notes of notes and lectures, directly to primary sources, use the knowledge of monographs and publications, facts and observations of modern life, etc.

A student who did not have time to speak at a practical lesson can present a prepared summary to the teacher for verification and, if necessary, answer the teacher's questions on the topic of the practical lesson in order to get a credit score on this topic.

The educational and methodological support of students' independent work in the discipline "Immunology" is presented in Appendix 1 and includes:

the schedule of the independent work on the discipline, including the approximate standard time to perform for each task;

the characteristic of tasks for independent work of students and methodical recommendations on their implementation;

requirements for the presentation and presentation of the results of independent work;

criteria for assessing the performance of independent work.

#### **IV. CONTROL OF ACHIEVEMENT OF COURSE GOALS**

№	Controlled modules/ parts / subjects of discipline	Codes and stage of competence		Control meanings – name	
				Current control	Interim attestation
	Part I. Introduction in Immunology. Basics of immunology.	the ability and willingness to conduct epidemiological	Know	SC-1 Conversation	Passed-exam questions 3 Semester

Immunology as a science. Methods of immunology.	protection, to organize the protection of public health in the focal points of especially dangerous infections, in case of degradation of the radiation situation, natural disasters and other emergency situations (PC – 3)	Know how	Practice-1 Test	Practice-1 Test
		Master	SC-3 Report	SC-2 Colloquium
Part II. Organizing of immune response. Organs of immune system. Transportation of immune cells. Native immune response. Part III . Immune response against pathogens. Native immunity . Phagocytosis	the readiness for educational activities to eliminate the risk factors and promote healthy lifestyles (PC – 16)	Know	SC-1 Conversation	Passed-exam questions 3 Semester
		Know how	Practice-1 Test	Practice-1 Test
		Master	SC-3 Report	SC-2 Colloquium

Control and methodological materials, as well as criteria and indicators necessary for the assessment of knowledge and skills, and characterizing the stages of the formation of competencies in the process of mastering the educational program are presented in Appendix 2.

## V. LIST OF EDUCATIONAL LITERATURE AND INFORMATION SUPPORT OF THE DISCIPLINE

### Main literature

1. Immunology of the Skin / Springer Japan 2016  
<https://link.springer.com/book/10.1007/978-4-431-55855-2#editorsandaffiliations>
2. Encyclopedia of medical immunology / Springer, Boston, MA 2017  
<https://link.springer.com/referencework/10.1007/978-1-4614-9211-5>
3. Basic Immunology / Springer, Cham 2018  
[https://link.springer.com/chapter/10.1007/978-3-030-02026-2\\_20](https://link.springer.com/chapter/10.1007/978-3-030-02026-2_20)

### Additional literature

1. Rheumatology and Immunology / Springer, Cham 2018  
[https://link.springer.com/chapter/10.1007/978-3-319-29182-6\\_55](https://link.springer.com/chapter/10.1007/978-3-319-29182-6_55)

*The list of resources information and telecommunications network "Internet"*

Scientific electronic library: <http://elibrary.ru/defaultx.asp>.

Single window of access to educational resources:

<http://window.edu.ru/http://www.aids.ru/>

<http://medbiol.ru/>

<http://www.who.int/ru/>

<http://meduniver.com/Medical/Microbiology/6.html>

<http://www.medicum.nnov.ru/doctor/library/immunology/Lolor/index.php>

[http://humbio.ru/Humbio/01122001/canc\\_sv/00014b2c.htm](http://humbio.ru/Humbio/01122001/canc_sv/00014b2c.htm)

<http://www.immunoanaliz.ru/http://www.immunoanaliz.ru/>

<http://immunology.agava.ru/>

<http://immuno.health-ua.com/>

<http://www.raaci.ru/>

<http://www.immunologylink.com/>

<http://www.immunology.edu.ru/>

<http://www.biology.arizona.edu/immunology/immunology.html>

<http://www.immunology.org/>

[http://www.immunology.klimov.tom.ru/Demo\\_ru/Index.html](http://www.immunology.klimov.tom.ru/Demo_ru/Index.html)

<http://www.mcb.harvard.edu/BioLinks/immunology.html>

<http://pathmicro.med.sc.edu/book/immunol-sta.htm>

<http://www.keratin.com/am/>

<http://bcs.whfreeman.com/immunology5e/default.asp?s=&n=&i=&v=&o=&ns=0&t=&uid=0&rau=0>

<http://immune.uchc.edu/>

<http://www.immunology.utoronto.ca/Page223.aspx>

<http://www.biomedcentral.com/bcimmunol/>

<http://www.cehs.siu.edu/fix/medmicro/genimm.htm>  
<http://www.whfreeman.com/Catalog/static/whf/kuby/>  
<http://www.immunologyclinic.com/>  
<http://www.clinimmsoc.org/>  
<http://www.bsaci.org/>  
<http://www.allergy.org.au/>  
<http://www.eaaci.net/index.php>  
<http://www.microbiologybytes.com/iandi/ClinicalI.html>  
<http://medicine.yale.edu/intmed/allergy/index.aspx>  
<http://www.medscape.com/allergy-immunology>

## LIST OF INFORMATION TECHNOLOGIES AND SOFTWARE

<b>The location of the computer equipment on which the software is installed, the number of jobs</b>	<b>List of licensed software</b>
Multimedia auditorium Vladivostok Russian island, Ayaks 10, building 25.1, RM. M723 Area of 80.3 m2 (Room for independent work)	Windows Seven enterprice SP3x64 Operating System Microsoft Office Professional Plus 2010 office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.); 7Zip 9.20 - free file archiver with a high degree of data compression; ABBYY FineReader 11 - a program for optical character recognition; Adobe Acrobat XI Pro 11.0.00 - software package for creating and viewing electronic publications in PDF; WinDjView 2.0.2 - a program for recognizing and viewing files with the same format DJV and DjVu.

In order to provide special conditions for the education of persons  
 with disabilities all buildings are equipped with ramps, elevators, lifts,  
 specialized places equipped with toilet rooms, information and navigation  
 support signs

## **VI. METHODOLOGICAL RECOMMENDATIONS ON THE COMPLETING THE DISCIPLINE**

The main goal is the formation of students' scientific outlook, preventive thinking based on pathology knowledge, competencies in systemic fundamental knowledge, skills and abilities in matters of hygiene and human ecology, necessary for the subsequent practical activities of the doctor.

Performing by students of extracurricular individual work in extracurricular time, both under the guidance of a teacher and without his direct participation is important in order to achieve this goal.

Students are encouraged to systematically study the teaching material using textbooks, texts and methodical writings in accordance with the study plan, and to perform all task in a timely manner, which is especially important when using grade-rating system for assessing students' knowledge.

The goal of students' individual work is to master fundamental knowledge, professional skills and experiences of their specialty, experience of creative scientific research. Individual work of students promotes the development of autonomy, responsibility and organization, creative approach to solving the problems of the educational and professional level, deepen and broaden knowledge, formation of interest to cognitive activity, mastering the techniques of learning, the development of cognitive abilities.

Individual work of students for the discipline is mandatory for each student, its volume is determined by the federal educational standard and curriculum. It is necessary at the very beginning of the course to carefully plan the time allocated for individual work with the sources and literature on the subject.

Individual work includes:

- a) reading textbooks, lectures, methodical recommendations, scientific articles
- b) reading and analyzing literature passages of journalistic nature;

c) reading and analysis of literary passages of scientific nature;

g) working with resources posted on the Internet.

The purpose of this types of work is to instill an interest in reading and to teach students to overcome difficulties in reading, extract the necessary information from the text to teach them to use Russian and International sources for self-education and improve their professional skills.

## LOGISTICS DISCIPLINE

For practical work, as well as for the organization of independent work, students have access to the following laboratory equipment and specialized classrooms that meet the current sanitary and fire regulations, as well as safety requirements during training and scientific and industrial works:

<b>Name of the equipped rooms and rooms for independent work</b>	<b>List of main equipment</b>
The computer class of the School of biomedical AUD. M723, 15 work placts	Screen, electrically 236*147 cm to trim the screen; Projector DLP technology, 3000 ANSI LM, WXGA with 1280x800 resolution, 2000:1 Mitsubishi EW330U; Subsystem of specialized mounting equipment course-2007 Tuarex; Subsystem of videocommunity: matrix switch DVI and DXP 44 DVI Pro advertising; extension cable DVI over twisted pair DVI 201 TX/RX advertising; Subsystem of audiocommentary and sound; speaker system for ceiling si 3ct LP Extron on from; digital audio processor DMP 44 LC the Extron; the extension for the controller control IPL T CR48; wireless LAN for students is provided with a system based on 802.11 a/b/g/N 2x2 MIMO(2SS) access points.  Monoblock HP Loope 400 all-in-one 19.5 in (1600x900), core i3-4150t, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, and a DVD+ / -RW, GigEth, Wi-Fi and BT, the USB port of roses/MSE, Win7Pro (64-bit)+Win8.1Pro(64-bit), 1-1-1 Wty
Multimedia audience	AIO PC HP ProOne 400 G1 AiO 19.5" Intel Core i3-4130T 4GB DDR3-1600 SODIMM (1x4GB)500GB; Screen projection Projecta Elpro Electrol, 300x173 cm; Multimedia projector, Mitsubishi FD630U, 4000 ANSI Lumen 1920 x 1080; Flush interface with automatic retracting cables TLS TAM 201 Stan; Aversion CP355AF; lavalier Microphone system UHF band Sennheiser EW 122 G3 composed of a wireless microphone and receiver; Codec of videoconferencing LifeSizeExpress 220 - Codeconly - Non-AES;



	Network camera Multipix MP-HD718; Two 47 " LCD panels, Full HD, LG M4716CCBA; audio commutation and sound amplification Subsystem; centralized uninterruptible power supply
Reading rooms of the Scientific library of the University open access Fund (building a - 10)	Monoblock HP Loope 400 All-in-One 19.5 in (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW,GigEth,wifi,BT,usb kbd/mse,Win7Pro (64-bit)+Win8.1Pro(64-bit),1-1-1 Wty Speed Internet access 500 Mbps. Jobs for people with disabilities equipped with displays and Braille printers.; equipped with: portable reading devices flatbed texts, scanning and reading machines videovelocity with adjustable color spectrums; increasing electronic loops and ultrasonic marker
Accreditation-simulation center of the school of Biomedicine	

Medical Center of the Federal State Autonomous Educational Institution of Higher Professional Education "Far Eastern Federal University";



THE MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN  
FEDERATION

Federal State autonomous education institution of higher education

«**Far Eastern Federal University**»

(FEFU)

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**SCHOOL OF BIOMEDICINE**

**TRAINING AND METHODOLOGICAL SUPPORT OF INDEPENDENT  
WORK OF STUDENTS**

**Immunology courses**

**Educational Program**

**Specialty 31.05.01 «General Medicine»**

**Full-time training**

**Vladivostok**

**2018**

Independent work includes:

1. library and homework with educational literature and lecture notes,
2. preparation for practical exercises,
3. fulfillment of an individual task
4. preparation of the essay
5. preparation for testing and control interview (offset)

The procedure for the performance of independent work by students is determined by the schedule for the performance of independent work on the discipline.

### **Schedule of the independent work on the discipline**

<b>№</b>	<b>Date/terms</b>	<b>Independent work</b>	<b>Terms</b>	<b>Control</b>
1	3 semester	Preparation	6 hours	Tests, conversation
2	3 semester	Essay writing	6 hours.	Essay
3.	3 semester	Preparation to tests	9 hours	Evaluation of tasks
4.	3 semester	Preparation to presentation	6 hours	Evaluation of presentations
5.	3 semester	Preparation to control(3)	45 hours	Evaluation of results

### **Topics of reports and abstracts**

On the discipline of 54 hours of independent work, within the framework of these hours, an abstract is carried out on the proposed topics.

### **ESSAYS THEMES IN SEMESTER 4**

1. Differentiation of T -, B-lymphocytes, natural killer cells.
2. The interaction of cells in the immune system.
3. Cytotoxic cells of the immune system.
4. The main complex of histocompatibility of humans (HLA) and mouse (H-2).
5. Immunoglobulin and T-cell receptor genes.
6. Hormones and mediators of the immune system

7. HLA - associated diseases.
8. Immunogenetic basis of transplantology.
9. Regulatory cells in the immune system.
10. HLA-typing in clinical practice.
11. Modern approaches to the creation of experimental models in immunology.
12. Immunoassay: the role in modern immunodiagnostics.
13. Polymerase chain reaction: role in modern immunodiagnostics.
14. ELISPOT method: role in modern immunodiagnostics.
15. Flow cytometry: the role in modern immunodiagnostics.
16. Molecular genetic research methods in immunology.
17. Modern possibilities of diagnosis and treatment of HIV infection.
18. Genetic aspects of T and B lymphocyte differentiation.
19. Genetic impairment of T and B lymphocyte differentiation.

### **Guidelines for writing and design of the essay**

Essays - the creative activity of the student, which reproduces in its structure research activities on solving theoretical and applied problems in a certain branch of scientific knowledge.

The essay, being a model of scientific research, is an independent work in which a student solves a problem of a theoretical or practical nature, applying the scientific principles and methods of a given branch of scientific knowledge. The result of this scientific search can have not only subjective, but also objective scientific novelty, and therefore can be presented for discussion by the scientific community in the form of a scientific report or a message at a scientific-practical conference, as well as in the form of a scientific article.

Essay is carried out under the direction of the supervisor and involves the acquisition of skills to build business cooperation based on ethical standards of scientific activity. Purposefulness, initiative, disinterested cognitive interest,

responsibility for the results of their actions, conscientiousness, competence - personality traits that characterize the subject of research activities corresponding to the ideals and norms of modern science.

Essay is an independent educational and research activity of the student. The supervisor provides advisory assistance and evaluates the process and results of activities. He provides approximate topics of abstract works, clarifies with the student the problem and topic of research, helps to plan and organize research activities, assigns time and a minimum number of consultations. The supervisor accepts the text of the abstract for verification at least ten days before the defense.

Traditionally there was a certain structure of the abstract, the main elements of which in order of their location are the following:

1. Title page.
2. The task.
3. Table of Contents
4. List of symbols, symbols and terms (if necessary).
5. Introduction.
6. The main part.
7. Conclusion.
8. Bibliographic list.
9. Applications.

The title page lists: educational institution, graduating department, author, scientific adviser, research topic, place and year of the essay.

The title of the abstract should be as short as possible and fully consistent with its content.

The table of contents (content) reflects the names of the structural parts of the abstract and the pages on which they are located. The table of contents should be placed on one page at the beginning of work.

The presence of a detailed introduction - a mandatory requirement for the abstract. Despite the small volume of this structural part, its writing causes considerable difficulties. However, it is precisely the qualitatively executed introduction that is

the key to understanding the whole work, which testifies to the professionalism of the author.

Thus, the introduction is a very crucial part of the essay. The introduction should start with a justification of the relevance of the chosen topic. As applied to the abstract, the concept of "relevance" has one feature. From how the author of the essay can choose a topic and how correctly he understands and evaluates this topic from the point of view of modernity and social significance, characterizes his scientific maturity and professional readiness.

In addition, in the introduction it is necessary to isolate the methodological basis of the essay, to name the authors, whose works constituted the theoretical basis of the study. A review of the literature on the topic should show the author's thorough acquaintance with special literature, his ability to systematize sources, critically examine them, highlight the essential, determine the most important thing in the modern world.

It is indicated: educational institution, graduating department, author, supervisor, research topic, place and year of the essay.

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The introduction reflects the importance and relevance of the chosen topic, defines the object and subject, purpose and objectives, and the chronological framework of the study.

The introduction ends with a presentation of general conclusions about the scientific and practical significance of the topic, the degree of its knowledge and sources, and the hypothesis being put forward.

The main part describes the essence of the problem, reveals the topic, determines the author's position, factual material is given as an argument and for illustrations of put forward provisions. The author must demonstrate the ability to consistently present the material while analyzing it simultaneously. Preference is given to the main facts, rather than small details.

The essay ends with the final part, which is called "conclusion". Like any conclusion, this part of the abstract serves as a conclusion, due to the logic of the study, which is a form of synthesis accumulated in the main part of scientific information. This synthesis is a consistent, coherent presentation of the results obtained and their relation to a common goal and specific tasks set and formulated in the introduction. It is here that contains the so-called "output" knowledge, which is new in relation to the original knowledge. The conclusion may include suggestions of a practical nature, thereby increasing the value of theoretical materials.

So, in conclusion, the essay should be: a) presents the conclusions of the study; b) theoretical and practical significance, novelty of the abstract; c) indicated the possibility of applying the results of the study.

After the conclusion it is accepted to place the bibliographic list of the used literature. This list is one of the essential parts of the abstract and reflects the independent creative work of the author of the abstract.

The list of sources used is placed at the end of the work. It is made or in alphabetical order (by the name of the author or the name of the book), or in the order in which the references appear in the text of the written work. In all cases, the full title of the work, the names of the authors or the editor of the publication are indicated if the writing team involved a group of authors, data on the number of volumes, the name of the city and publisher in which the work was published, year of publication, number of pages.

#### **Criteria for evaluation of the essay.**

The stated understanding of the abstract as a holistic copyright text defines the criteria for its evaluation: the novelty of the text; the validity of the choice of source; the degree of disclosure of the essence of the issue; compliance with the requirements for registration.

The novelty of the text: a) the relevance of the research topic; b) novelty and independence in the formulation of the problem, the formulation of a new aspect of the well-known problem in the establishment of new connections (interdisciplinary, intra-subject, integration); c) the ability to work with research, critical literature, systematize and structure the material; d) the appearance of the author's position, independence of assessments and judgments; d) stylistic unity of the text, the unity of genre features.

The degree of disclosure of the essence of the question: a) the plan compliance with the topic of the abstract; b) compliance with the content of the topic and plan of the abstract; c) completeness and depth of knowledge on the topic; d) the validity of the methods and methods of work with the material; e) the ability to



generalize, draw conclusions, compare different points of view on one issue (problem).

The validity of the choice of sources: a) evaluation of the used literature: whether the most famous works on the topic of research are involved (including recent journal publications, recent statistics, summaries, references, etc.).

Compliance with the requirements for registration: a) how correct the references to the used literature, references are; b) assessment of literacy and presentation culture (including spelling, punctuation, stylistic culture), knowledge of terminology; c) compliance with the requirements for the volume of the abstract.

The reviewer should clearly state the remark and questions, preferably with references to the work (possible on specific pages of the work), to research and evidence that the author did not take into account.

The reviewer can also indicate: whether the resident has addressed the topic earlier (essays, written works, creative works, olympiad works, etc.) and whether there are any preliminary results; how the graduate conducted the work (plan, intermediate stages, consultation, revision and processing of the written or lack of a clear plan, rejection of the recommendations of the head).

The student submits an essay for review no later than a week before the defense. The reviewer is the supervisor. Experience shows that it is advisable to acquaint the student with the review a few days before the defense. Opponents are appointed by the teacher from among the students. For an oral presentation, a student needs about 10–20 minutes (approximately as long as he answers with tickets for the exam).

Grade 5 is set if all the requirements for writing and defending an essay are fulfilled: the problem is indicated and its relevance is justified, a brief analysis of various points of view on the problem under consideration is made and one's own position is logically presented, conclusions are formulated, the topic is fully disclosed, the volume is met, external requirements are met design, given the correct answers to additional questions.

Grade 4 - the basic requirements for the essay and its protection are met, but there are shortcomings. In particular, there are inaccuracies in the presentation of the material; there is no logical sequence in the judgments; not sustained volume of the abstract; there are omissions in the design; Additional questions for the protection given incomplete answers.

Grade 3 - there are significant deviations from the requirements for referencing. In particular: the topic is covered only partially; factual errors in the content of the abstract or when answering additional questions; during the protection there is no output.

Grade 2 - the topic of the essay has not been disclosed, there is a significant misunderstanding of the problem.

Grade 1 - students' essay is not presented.



THE MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN  
FEDERATION

Federal State autonomous education institution of higher education

«Far Eastern Federal University»

(FEFU)

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**SCHOOL OF BIOMEDICINE**

**FUND OF THE ASSESSMENT TOOLS**

**“Immunology courses”**

**Educational Program**

**Specialty 31.05.01 «General Medicine»**

**Full-time training**

**Vladivostok 2018**

## PASSPORT OF FUND OF THE ASSESSMENT TOOLS

Completed in accordance with the Regulations on the Funds of Evaluation Assets of Educational Programs of Higher Education - Bachelor programs, specialties, magistracies of FEFU, approved by order of the rector No. 12-13-850 of 12.05.2015.

Code and formulation of competence	Stage of competence	
the ability and willingness to conduct epidemiological protection, to organize the protection of public health in the focal points of especially dangerous infections, in case of degradation of the radiation situation, natural disasters and other emergency situations (PC – 3)	Know	capable and ready to carry out anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations
	Know how	capable and ready to carry out anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations
	Master	ability and readiness to conduct anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations
the readiness for educational activities to eliminate the risk factors and promote healthy lifestyles (PC – 16)	Know	and ready for educational activities to eliminate risk factors and develop healthy lifestyle habits;
	Know how	and ready for educational activities to eliminate risk factors and develop healthy lifestyle habits;
	Master	willingness to educate on the elimination of risk factors and the formation of skills for a healthy lifestyle;

## CONTROL OF ACHIEVEMENT OF COURSE GOALS

№	Controlled modules/ parts / subjects of discipline	Codes and stage of competence		Control meanings – name	
				Current control	Interim attestation
	Part I. Introduction in Immunology. Basics of immunology. Immunology as a science. Methods of immunology.	the ability and willingness to conduct epidemiological protection, to organize the protection of public health in the focal points of especially dangerous infections, in case of	Know	SC-1 Conversation	Passed-exam questions 3 Semester
			Know how	Practice-1 Test	Practice-1 Test
			Master	SC-3 Report	SC-2 Colloquium

		degradation of the radiation situation, natural disasters and other emergency situations (PC – 3)			
Part II. Organizing of immune response. Organs of immune system. Transportation of immune cells. Native immune response. Part III . Immune response against pathogens. Native immunity . Phagocytosis	the readiness for educational activities to eliminate the risk factors and promote healthy lifestyles (PC – 16)	Know	SC-1 Conversation	Passed-exam questions 3 Semester	
			Know how	Practice-1 Test	Practice-1 Test
			Master	SC-3 Report	SC-2 Colloquium

### Scale of assessment of the level of formation of competencies

Code and formulation of competence	Stage of competence formation	Criteria	Indices		Points
the readiness for educational activities to eliminate the risk factors and promote healthy lifestyles (PC – 16)	<b>Knows</b>	capable and ready to carry out anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations capable and ready	Knowledge of anti-epidemic measures, organization of protection of the population in the outbreaks of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations	Formed structured systematic knowledge of anti-epidemic measures, organization of protection of the population in the outbreaks of particularly dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations	65-71
	<b>Able to</b>	To carry out anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations	to carry out anti-epidemic measures, organization of protection of the population in the outbreaks of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations	Formed structured systematic ability to carry out anti-epidemic measures, organizing the protection of the population in the outbreaks of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations	71-84
		ability and readiness to conduct anti-	Knowledge of anti-epidemic measures,	Formed by structured systematic	

	<b>Master</b>	epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations	the population in the outbreaks of especially dangerous infections, with a deterioration of the radiation organization of the situation, natural disasters and other emergency situations	knowledge and ability of anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, knowledge of natural disasters and other emergency situations	5-100
the readiness for educational activities to eliminate the risk factors and promote healthy lifestyles (PC – 16)	<b>Knows</b>	ready for educational activities to eliminate risk factors	Knowledge of risk education and education of healthy life-style	Formed structured systematic knowledge of	65-71
	<b>Able to</b>	develop healthy lifestyle habits; and ready for educational activities to eliminate risk factors and develop healthy lifestyle habits;	Ability to develop healthy lifestyle habits; and ready for educational activities to eliminate risk factors and develop healthy lifestyle habits	Ready and able to develop healthy lifestyle habits; and ready for educational activities to eliminate risk factors and develop healthy lifestyle habits	71-84
	<b>Master</b>	willingness to educate on the elimination of risk factors and the formation of skills for a healthy lifestyle;	Skill in educational activities to eliminate risk factors and develop healthy lifestyle habits.	Systematic application of educational activities to eliminate risk factors and develop healthy lifestyle habits	85-100

### Questions for assessing previous competencies.

1. The history of the development of immunology as a science. The subject and objectives of immunology.
2. The structure and role of the central organs of the immune system.
3. Structure and role of the peripheral organs of the immune system.
4. Congenital immunity. Components of innate immunity: physical, chemical, biological barriers
5. Mechanisms of immune responses
6. Antigens. The concept of antigenicity. The origin and chemical structure of antigens. Properties of antigens.
7. The development of monocytes. The system of mononuclear phagocytes.

8. Phagocytosis cells and their markers.
9. Stages of phagocytosis. Phagocytic mechanisms.
10. General concepts of the complement system. History of discovery. Composition and main functions.
11. Classical activation of complement.
12. Alternative activation of the complement
13. Interactions of B-cells with T-helpers and the subsequent reaction of B-lymphocytes.
14. Antigen presenting function of B cells. The development and structure of the B-cell receptor (BCR).
15. Th2-variant of the immune response. The process of formation.
16. Realization of the Th2 pathway of the immune response.
17. Mutual regulation of the functioning of T-lymphocytes and B-lymphocytes in its implementation.
18. The structure of immunoglobulin molecules. Immunoglobulin genes.
19. Main histocompatibility complex, H-2 complex, HIA complex.
20. Molecules MHC I class
21. Molecules MHC class II. Other products of the MHC genes.
22. Cytokine system. Types of cytokines. The main properties of cytokines.
23. The genes of the immune response. Regulation of immunological processes.
24. The main mechanisms of T-cell cytotoxicity. Biological role.
25. IgM as a factor of humoral immunity. Features of the structure. Properties Biological role.
26. IgG as a factor of humoral immunity. Subclasses Properties Biological role.

27. IgA as a factor of humoral immunity. Features of the structure. Subclasses Properties Biological role.
28. IgE as a factor of humoral immunity. Properties Biological role.
- 29.. The main issues of immunogenetics.
30. Major Histocompatibility Complex (MHC). Notion Basic properties..
31. Features of infectious agents as immunogens.
32. Features of the immune response in infections of the immune system.
33. Protective immunity to infections
34. Immunological diagnosis of infectious diseases.
35. The concept of vaccination. The history of development. Goals and objectives of vaccination.
36. Types of vaccines and vaccine composition.
37. Vaccine safety issue.
38. Vaccine reactions and complications. Kinds. Ways of prevention.
39. The main forms of human immunopathology

**Control tests are designed for students studying the course "Immunology."**

Tests are necessary both for the control of knowledge in the process of the current intermediate certification, and for the assessment of knowledge, the result of which can be the setting of credit.

When working with tests, the student is invited to choose one answer from three to four proposed. At the same time, tests are unequal in complexity. Among the proposed there are tests that contain several options for correct answers. The student must specify all the correct answers.

Tests are designed for both individual and collective decision. They can be used in the process and classroom, and independent work. The selection of tests necessary



for the control of knowledge in the process of intermediate certification is done by each teacher individually.

The results of the test tasks are assessed by the teacher on a five-point scale for issuing attestation or according to the "test" system - "no test". The mark "excellent" is set with the correct answer to more than 90% of the tests proposed by the teacher. A rating of "good" - with the correct answer to more than 70% of tests. A rating of "satisfactory" - with the correct answer to 50% of the tests proposed by the student.

### **Examples of test items.**

*Choose the most correct answer.*

1) Cellular elements involved in presenting antigen to T-lymphocytes:

- A. NK cells
- B. plasma cells,
- C. macrophages
- D. platelets
- E. mast cells

2) The main cells involved in the formation of allergic inflammation are:

- A. T-lymphocytes
- B. B lymphocytes
- C. Basophils
- D. neutrophils,
- E. eosinophils

3) It is known:

- A. 1 type of histamine receptors,
- B. 2 types of histamine receptors,
- B. 3 types of histamine receptors,
- C. 4 types of histamine receptors,
- D. 5 types of histamine receptors

4) IgA class antibodies have the ability to:

- A. to participate in cell lysis,
- B. to acquire a secretory component,
- C. interact with the allergen,
- D. to cross the placenta from mother to fetus,
- E. fixed on mast cells

5) Food allergies are more common:

- A. in the first months and years of life,
- B. in adolescence
- C. in adolescence,
- D. in adulthood
- E. in old age

6) Class antibodies are involved in the pathogenesis of serum sickness.

- A. IgE,
- B. IgA,
- C. IgG4,
- D. IgG
- E. IgM

7) There are no therapeutic and diagnostic allergens for:

- A. sugar,
- B. orange,
- C. pork,
- D. birch pollen,
- E. House dust

8) Allergic skin diseases do not apply:

- A. atopic dermatitis,
- B. urticaria and angioedema,
- C. acute toxic and allergic reactions,
- D. Sarcoma Kaposi,
- E. contact dermatitis

**Answer the code: A - true 1,2,3; B - true 1.3; B - true 2.4; G - only 4 is true; D - right all**

9) In the treatment of primary immunodeficiencies are not used.

1. immunoglobulins for intravenous administration
2. bone marrow transplantation
3. genetic engineering therapy,
4. immunomodulators

**Answer G**

**Answer the code: A - true 1,2,3; B - true 1.3; B - true 2.4; G - only 4 is true; D - right all**

10) Ways of allowing the allergen to enter the sensitized organism are

1. hitting an allergen in a wound,
2. allergen aerosol inhalation,
3. intradermal administration of the allergen,
4. enteral route

**Answer D**

**Answer the code: A - true 1,2,3; B - true 1.3; B - true 2.4; G - only 4 is true; D - right all**

11) IgE antibodies are capable of:

1. fix complement,
2. interact with the allergen,
3. participate in cell lysis,
4. fixed on the surface of the fat cells
5. form immune complexes

12) Cellular Immunity **Answer B**

**Answer the code: A - true 1,2,3; B - true 1.3; B - true 2.4; G - only 4 is true; D - right all**

- this:

1. the number of T-, B-lymphocytes, natural killer cells,
2. induction of cytotoxic CD8 T lymphocytes,
3. phagocytic reaction,
4. alien transplant rejection

**Answer B**

**Answer the code: A - true 1,2,3, 4; B - true 1.3; B - true 2.4; G - only 4 is true; D - right all**

13. Antibody formation occurs in:

1. lymph nodes
2. Peyer's patches,
3. spleen,
4. bone marrow
5. thymus

**Answer A**

**Answer the code: A - true 1,2,3; B - true 1.3; B - true 2.4; G - only 4 is true; D - right all**

14. Secondary immunodeficiencies develop as a result of:

1. radiation injury
2. allergen exposure

3. glucocorticoid therapy of genetic disorders,
4. genetic disorders

**Answer B**

**Answer the code: A - true 1,2,3; B - true 1.3; B - true 2.4; G - only 4 is true; D - right all**

15. The starting factor for the activation of the complement system in serum sickness is:

1. inhibition of the C1 inhibitor,
2. aggregation of Ig molecules
3. properdin,
4. formation of immune complexes

**Answer G**

**Answer the code: A - true 1,2,3; B - true 1.3; B - true 2.4; G - only 4 is true; D - right all**

16. Laboratory tests of specific diagnostics in comparison with tests in vivo have the following advantages:

1. can be performed in cases where it is impossible to test in vivo,
2. can be performed with an unlimited number of allergens,
3. give a better quantitative assessment of sensitization,
4. free from the risk of allergic reactions

**Answer D**

17. By origin, there are two types of immunity: \_\_\_\_\_ and \_\_\_\_\_

**Answer: Congenital and Acquired (Adaptive)**

18. Antigen is an alien substance that, when released into the body, is capable of causing \_\_\_\_\_, aimed at its removal.

**Answer: Immune Response**

19. Antigens are peculiar to:

one.

2

3

**Answer: 1. Specificity 2. Alien 3. Immunogenicity**

20. Antibodies are \_\_\_\_\_, with specificity, i.e. affinity of their active center for specific antigenic epitopes.

**Answer: Immunoglobulins**

### **Examples of situational tasks**

Task 1:

An experimental animal (intact guinea pig) was injected intradermally with guinea pig serum with sensitized horse serum. After 6–12 hours, horse serum was administered intravenously to the guinea pig along with Evans blue. After a few minutes, an inflammatory infiltrate appeared in the area of intradermal administration, colored in blue.

Questions:

1. Explain the cause of the development of inflammation in the skin of an intact animal.
2. What is active and passive sensitization? Describe the mechanisms.
3. What type of antibodies contributes to the formation of inflammatory infiltrate in this reaction?

4. What type of hypersensitivity is the reaction that occurred in the guinea pig: Delayed type Hypersensitivity or Rapid Hypersensitivity?

5. What is the role of target cells in the formation of inflammatory infiltrate, why does it turn blue when Evans dye is injected?

Short answers:

1. The animal developed a local allergic reaction of type 1;
2. Passive sensitization of an intact animal: in RTH, in the administration of serum of a sensitized animal, in DTH, in the administration of lymphocytes;
3. Ig E;
4. Rapid type hypersensitivity;
5. Degranulation of mast cells leads to the release of biologically active substances that increase the permeability of blood vessels.

Task 2:

Patient K., 36 years old, was admitted to the surgical department with extensive injuries of the lower extremities. An injection of 0.5 ml of undiluted tetanus toxoid was performed. After a few minutes, the patient became agitated, watery, rhinorrhea, breathing increased (up to 34 min), pulse 85 beats. per minute, A / D 150/100 mm Hg The severity of the patient's condition. Spastic dry cough, expiratory dyspnea, vomiting appeared. The skin became cyanotic, the pulse is filiform, the number of heart contractions decreased to 55 beats. per minute, muffled heart sounds, A / D dropped to 65/40 mm Hg. The patient was covered with cold, sticky sweat and fainted. Involuntary defecation and urination occurred. There were convulsions in the form of fibrillar twitches of individual muscle groups.

Diagnosis: Anaphylactic shock.



Questions:

1. What type of hypersensitivity (RTH or DTH) is anaphylactic shock?
2. Name the antibodies involved in the development of anaphylaxis.
3. Name the phases of allergic reactions.
4. What are the stages in the clinical picture of anaphylactic shock?
5. Name the method of specific desensitization of anaphylaxis.

Short answers:

1. To immediate type hypersensitivity;
2. Immunoglobulins of classes Ig G4 and Ig E;
3. Immunological, pathochemical, pathophysiological;
4. Erectile and torpid;
5. Desensitization method for uncommonly. Fractional administration of the allergen.

Task 3:

Patient G., 34 years old, complained of itching and redness of the eyes, lacrimation, and discharge of a large amount of liquid mucus from the nasal cavity. From the anamnesis: similar phenomena have been noted in the spring over the past few years.

Examination revealed conjunctivitis and rhinitis. An allergy test revealed antibodies to poplar pollen.

Diagnosis: Pollinosis.

Questions:

1. What type of hypersensitivity (DTH or Immediate Type hypersensitivity) is pollinosis?
2. Name the antibodies involved in the development of pollinosis.
3. Name the distinctive property of these antibodies.
4. What biologically active substances play a role in the development of pollinosis?
5. What is the method of non-specific desensitization of pollinosis?

Short answers:

1. To immediate type hypersensitivity;
2. Immunoglobulins class Ig E;
3. Cytophilicity;
4. Histamine, bradykinin, prostaglandins, leukotrienes;
5. Antihistamines, glucocorticoids, antispasmodics.

Task 4:

During the initial contact of the skin with latex gloves, the medical worker experienced severe erythema on the hands, accompanied by the formation of blisters and vesicles. The application test with a piece of latex glove on the skin of the inner surface of the forearm was positive after 72 hours. The use of histamine receptor blockers did not reduce the severity of the reaction. The inflammation was removed by local use of glucocorticoids.

Questions:

1. What type of allergic reaction did the health worker have? Describe its mechanism.
2. Why do glucocorticoids have an anti-inflammatory effect in this type of allergy?

3. Explain why the use of histamine receptor blockers did not reduce the severity of the reaction?
4. Explain why the inflammatory infiltrate appeared only 72 hours after contact with latex.
5. Is it possible to induce a similar reaction on the skin with the help of serum or lymphocytes in a non-sensitized person?

Short answers:

1. immediate hypersensitivity ;
2. Glucocorticoids have an immunosuppressive effect;
3. The use of histamine receptor blockers has a positive effect only in the reactions of GNT;
4. This is the time required for the accumulation of chemokines and the recruitment (fixation in the tissue) of macrophages;
5. A similar reaction can be caused on the skin with the help of lymphocytes taken from a sensitized person.

Task 5:

Patient F., 55 years old, on a doctor's prescription, took tetracycline for 10 days. At the end of the course of taking the antibiotic, he developed headaches, fatigue, weakness, drowsiness. A blood test showed a decrease in the number of red blood cells and hemoglobin content. Adding tetracycline to whole blood led to hemolysis of red blood cells.

Questions:

1. As a result of what kind of immune response did the patient have anemia? Describe its mechanism.

2. What type of antibodies mediates this pathology?
3. What is the role of the complement system in the development of hemolysis?
4. What type of cell death is hemolysis? To apoptosis or necrosis?
5. Explain the pathogenesis of the development of clinical signs of the developed pathology.

Short answers:

1. Cytotoxic type of immune response;
  2. Immunoglobulins type Ig M and Ig G;
  3. Due to the activation of the complement system is formed membrane-attacking complex that causes cell death;
  4. During hemolysis, cell necrosis occurs, since at first apoptosis DNA is fragmented and mitochondria are destroyed, and then the membrane is damaged;
1. In the pathogenesis of this pathology, the leading role belongs to type 2 allergy (cytotoxic).

Task 6.

Patient K., 35 years old, revealed the following changes in the immunogram.

**INDICATOR IN NORM OF THE SURVEYED**

CD3 + lymphocytes in% 60-80 73

CD4 + lymphocytes in% 33-50 40

CD8 + lymphocytes in% 16-39 29

CD16 + lymphocytes in% 3-10 7

CD20 + lymphocytes in% 6-23 21

CD4 + / CD8 + 1,5-2,0 1,5 index

Phagocytic activity% 50-90 68

Phagocytic number 2-9 5

Phagocytic reserve% 65

IgG, g / l 0.9-4.5 6.0

IgA, g / l 8-20 2

IgM, g / l 0.6-2.5 1.8

Questions:

1. What part of the immunity is violated by the results of the presented immunogram?
2. What is the immunological diagnosis you put the patient on changes in the immunogram?
3. What immunomodulators can be assigned to a patient for the correction of identified changes?
4. When is it necessary to conduct a repeat immunological examination after immunocorrection?
5. What are the most common complaints presented by the patient with a diagnosis of immunological failure?

Answers:

1. Humoral immunity.
2. Hypoimmunoglobulinemia (reduction of IgA).
3. Ribomunil, Bronhomunal, IRS-19, Likopid.

4. Not earlier than 2 weeks after the end of therapy.
5. Frequent colds, a long course of infectious diseases, the presence of diseases caused by conditionally pathogenic flora, frequent exacerbations of any chronic diseases.

#### Task 7.

A 20-year-old patient complained of episodes of sneezing (10 to 30 times in a row), for abundant secretion of watery secretion, leading to hyperemia - irritation of the skin of the wings of the nose and upper lip, violation of nasal breathing, itching of the nose, palate, eye, tearing. These symptoms appear in the summer and are most pronounced in the morning. Also, the patient notes slight fatigue, lack of appetite, irritability.

#### Questions:

1. What is your presumptive diagnosis?
2. What is the amount of the allergy examination you will prescribe to the patient?
3. What groups of drugs are shown in this clinical case?
4. In which case would you appoint a local hormone therapy as a spray?
5. Is it possible to conduct specific immunotherapy in this patient?

#### Answers:

1. Allergic rhinitis.
2. General blood test, immunological examination, determination of total IgE, IgE-specific, skin tests.
3. Antihistamine, mast cell membrane stabilizers, use of hormonal nasal sprays, SIT.
4. In case of pronounced exacerbation of allergic rhinitis.

5. Yes.

Task 8.

Patient M, 53 years old, underwent surgery for gangrenous-perforative appendicitis, diffuse peritonitis. The postoperative period was complicated by lower lobe left-sided pneumonia. The immunogram shows leukocytosis, lymphopenia, a decrease in CD3 + cells, CD4 + cells, CD8 + cells, a decrease in IRI.

Questions:

1. What is the immunological conclusion?
2. What immunotherapy in combination with antibiotic therapy is indicated in this case?
3. By what scheme of administration is "Imunofan" assigned in this clinical case?
4. How quickly should a repeated immunological examination be carried out after the end of therapy?
5. What contraindications do you know when prescribing T-immunostimulants?

Answers:

1. Secondary immunological insufficiency by T-cell link.
2. Purpose of T-immunostimulants, the choice is "Imunofan".
3. "Imunofan" 0,005% - 1 ml, №10, intramuscularly. №5 - every other day, the next №5 - once every three days.
4. Repeated immunological examination is carried out not earlier than in 2 weeks.
5. Contraindications for immunostimulants: pregnancy, autoimmune pathology, allergopathology.

Performed using basic knowledge of the discipline

**Criteria for evaluation:**

**Read** - the student solved the situational problem without errors

**Not credited** - the student could not solve the situational problem

**Individual task**

Formed an individual task with a student on the topic of employment

**Criteria for evaluation:**

**Credited** - the student completed an individual task

**Not credited** - the student was unable to complete an individual task

**Examples of topics of test questions:**

1. The history of the development of immunology (E. Jenner, L. Pasteur, I. Mechnikov, P. Ehrlich, F. M. Burnet, R. Zinkernagel, C. Januay).
2. The general concept of immunity. Definition, function, species (congenital, adaptive).
3. The main differences between the innate and adaptive immune response (conditions of formation, the object of recognition (images of pathogenicity, stress molecules) than recognizes (pathogen recognition receptors), effector cells, the type of response, the threat of auto-aggression, the presence of memory).
4. "Pattern recognition receptors" (PRR). Classification, a brief description.
5. Humoral (secretory) and membrane PI. Characteristics of the main representatives.
6. Signal transfer membrane PI. Toll-like receptors (species, structure, biological function).



7. Cytokines. Definition, main groups, functions, general properties, variants of manifestation of biological action.
8. Anatomical and physiological mechanisms of innate immunity (protective function of the skin, mucous membranes, barrier function of organs and tissues, excretory function, temperature reaction).
9. Normal microbiota, concept, function. Normal intestinal microbiota features of the intestinal epithelium, microbial composition, function. The normal microbiota of the vagina - the value in the formation of the microbiota of the newborn.
10. The main cells of the congenital receptor (neutrophils, basophils, eosinophils, mast cells, macrophage monocytes, dendritic cells, natural killer cells) - a general scheme of education, features of blood circulation.
11. Neutrophils. Morphology, development (mitotic and postmitotic phases). Parietal and free neutrophils. General characteristics, changes in the ratio during exercise.
12. Features of the mobilization of neutrophils from the bloodstream (rolling, adhesion, diapedez), chemotaxis, methods of destroying someone else's (absorption, secretion of granules into the environment, neutrophil extracellular traps, cytolysis).
13. Mononuclear phagocytic system (monocytes, tissue macrophages, dendritic cells), basic functions.
14. Monocyte macrophages, development. Fixed tissue macrophages. Associations with authorities, main functions. Inflammatory macrophages, regulation of inflammatory reactions (pro- and anti-inflammatory activation).
15. Phagocytosis, definition, stages. Completed and incomplete phagocytosis. Study of the activity, intensity and completeness of phagocytosis.
16. Eosinophils, mast cells (mast cells) and basophils. General characteristics, characteristics of ripening, migration, variety.

17. Dendritic cells. Origin, species (myeloid and lymphoid dendritic cells). Features of antigen presentation by myeloid dendritic cells (endosomal and proteosomal pathways). Follicular dendritic cells.
18. Natural killers. Origin, target recognition mechanism, destruction (contact cytolysis and FasL interaction).
19. The complement system. General characteristics, structure, producers of components of the complement system. Functions.
20. Cytolytic function of the complement system. Ways of activation (classic, lectin, alternative).
21. Opsonic function of the complement system. The value of C3b and iC3b in the process of opsonization. Components of the complement system (C5a, C3a) and chemotaxis. Anaphylotoxic function of C4a, C3a, C5a of complement components.
22. Interferons of type I ( $\alpha$ ,  $\beta$ ). The main producer cells, inductors, biological effects, use in medicine.
23. Biological effects of type II interferons. The main producer cells, inductors, biological effects.
24. Lysozyme and beta lysines. General characteristics, mechanism of action, content in biological fluids. Methods of study.
25. General characteristics of adaptive immunity. Definition, conditions of formation, object of recognition, effector cells, the presence of immunological memory.
26. Types of adaptive immunity (natural, artificial, passive, active). Brief description, examples.
27. The immune system, the principle of action, anatomical and physiological features of the organization. Organs of the immune system (central, peripheral). General characteristics, functional differences.

28. Red bone marrow. Localization, function, red bone marrow cells.
29. Thymus. Features of morphogenesis (age-related involution). The location, structure, functional value of the thymus zones, "positive" and "negative" selection.
30. Lymph nodes and spleen. Structure, features of blood circulation, functional significance of the zones (T-, B-zones).
31. Lymphoid tissue associated with mucous membranes (MALT - Mucosal – Associated Lymphoid Tissue). Morphological and functional features.
32. The general concept of an antigen, structure (epitope, agritope), types of epitopes and their significance in the formation of the immune response. Properties of antigens (foreignness, specificity, immunogenicity).
33. Classification of antigens by origin, by nature, by molecular structure, by degree of immunogenicity, by degree of foreignness, by direction of activation, and by the provision of immune response.
34. General characteristics of the immune response to T-dependent and T-independent antigens.
35. Antigens of microorganisms (somatic, capsular, flagellated), general characteristics. General characteristics of superantigen, cross-reactive, protective antigens.
36. Histocompatibility antigens (MHC I, MHC II, MHC III), general characteristics, structure, functions.
37. General characteristics of cells of the immune system, localization in the organs of the immune system. Comparative characteristics of T and B lymphocytes.
38. B-lymphocytes. Varieties, receptor apparatus, features of recognition of hypertension. Plasma cells, morphological features, species, receptor apparatus, localization in tissues and organs, functions.

39. The structure of the monomer of immunoglobulins. Structural and functional features of immunoglobulins of various classes. The concepts of valence, affinity, avidity antibodies. General characteristics of the functions of antibodies.
40. T-lymphocytes, species, receptor apparatus, features of recognition of antibodies, functions.
41. Methods for counting the number of lymphocytes (fluorescent microscopy, flow cytometry), the basis of the method, the type, diagnostic value.
42. Brief description of adaptive immunity. Theories of immunogenesis. Phases of the immune response.
43. The main objectives of the humoral immune response. General characteristics of the cells participating in the humoral immune response (T, B-lymphocytes, plasma cells, antigen-presenting cells). Subpopulations, membrane receptors, objects of recognition. The interaction of cells in the formation of the humoral adaptive response.
44. The overall structure of the monomer of immunoglobulin, the concept of valence, affinity, avidity varieties of antibodies (IgM, IgG, IgA, IgE, IgD), function.
45. Comparative characteristics of the primary and secondary humoral immune response. Dynamics of antibody synthesis.
46. Serological method of research, the general concept, the objects of detection, the principle of interaction of hypertension and antibodies, the main groups of reactions.
47. Agglutination reactions, principle, varieties (approximate, unfolded, passive (RPHA)).
48. Precipitation reactions, principle, varieties (ring-precipitation, precipitation in semi-liquid agar, radial immunodiffusion reaction).
49. Complement fixation reaction, principle, main phases. Wasserman reaction.

50. Neutralization reactions, principle, features.
51. Reactions using labeled antibodies or antigens. Immunofluorescence reaction. Radioimmunological analysis of the principle, features of the method.
52. Immunoassay (direct, indirect), labels, modifications. Immunoblotting, principle, features of the method.
53. Features of the cellular adaptive immune response. Variants of the cellular adaptive immune response, depending on the location of the pathogen.
54. Brief description of the cytotoxic variant of the cellular adaptive immune response (main cells, object for recognition, methods of destruction). Cell cooperation in the formation of cellular adaptive immune response
55. Brief description of the inflammatory variant of the cellular adaptive immune response. The cooperation of cells in the formation of the inflammatory type of cellular adaptive immune response.
56. Characterization of the mechanisms of activation of macrophages for the purpose of effective cytolysis in phagosomes within the framework of the inflammatory type of cellular adaptive immune response.
57. Granuloma. The structure, the value of the granulomatous process in the pathogenesis of diseases caused by microorganisms that retain viability within macrophages.
58. Interferon  $\gamma$ . General properties, cell producers, value in activation of macrophages.
59. Factors of immune resistance of the tumor. Antigenic differences of tumor cells. Classification, a brief description of tumor antigens (tumor-specific, tumor-associated).
60. Heteroorganic tumor antigens and paraneoplastic syndrome.

61. Classification of tumors depending on the sensitivity to the immune mechanisms of the body. Immunological surveillance of tumor growth, concept, basic theory.
62. Congenital immunity and tumors (NK, macrophages, neutrophil traps).
63. Cellular adaptive immunity and tumors (CTL, Th1).
64. Humoral adaptive immunity and tumors (B-lymphocytes, the value of antibodies and circulating immune complexes).
65. T-reg (markers, species) - the value in the development of the tumor process.
66. Immunodiagnosis of malignant oncological processes. Biotherapy, definition, classification methods. Dendritic vaccines, mechanism of action.
67. Definition of transplantation. Types of transplants depending on the genetic foreignness of the antigen. Immunological characteristics of the graft.
68. The main mechanisms of transplantation immunity. Cellular adaptive immunity and transplantation. Humoral adaptive immune response and normal antibodies in graft rejection.
69. Immunological basis of super-acute, acute and delayed transplant rejection.
70. Bone marrow transplantation. Graft versus host reaction.
71. Immunological tolerance, definition, classifications, mechanisms of formation.
72. Interferons and interferon inducers: drugs, mechanisms of action and areas of clinical application.
73. Monoclonal antibodies, history of creation, characterization of chimeric, humanized, genetically engineered forms. Drugs, basic principles of action, clinical application.
75. The concept of active and passive immunization. Vaccination: definition, classification of vaccines (examples).

76. Classification of inactivated vaccines. Types and functions of adjuvants.

77. Immune sera: determination, classification, method of administration.