



MINISTRY OF SCIENCE AND HIGHER EDUCATION OF RUSSIAN FEDERATION  
Federal State Autonomous Educational Institution of Higher Education  
**Far Eastern Federal University**  
(FEFU)  
SCHOOL OF BIOMEDICINE

AGREED  
Head of OP

(Signed) (Full name)



CLAIM  
Director of the Department of Medical Biology and  
Biotechnology

(Signed) (Acting Name)  
December 30, 2021

WORK PROGRAM OF THE DISCIPLINE  
Immunology  
Direction of training 06.04.01 Biology  
(Molecular and Cell Biology)  
Form of training: full-time

Course 2 semester 3  
lectures 10 hours.  
practical exercises 26 hours.  
laboratory work - hour.  
total hours of classroom load 36 hours.  
independent work 27 hours.  
including 45 hours to prepare for the exam.  
exam 3 semester

The work program is drawn up in accordance with the requirements of the Federal State Educational Standard in the direction of training 06.04.01 Biology, approved by the order of the Ministry of Science of the Republic of Russia dated 11.08.2020. № 934.

The work program was discussed at the meeting of the Department of Medical Biology and Biotechnology Protocol dated December 30, 2021 No. 5

Director of the Department of Implementing Structural Unit Ph.D., Associate Professor Kumeiko V.V.

Compiled by: Doctor of Biological Sciences, Professor Shevtsov M. A.

Vladivostok  
2021

Reverse side of the RPD cover page

1. The work program was revised at the meeting of the Department / department / department (implementing the discipline) and approved at the meeting of the Department / department / department (issuing structural unit), the protocol from " \_\_\_\_\_ № \_\_\_\_\_

2. The work program was revised at the meeting of the Department / department / department (implementing the discipline) and approved at the meeting of the Department / department / department (issuing structural unit), the protocol from " \_\_\_\_\_ № \_\_\_\_\_

3. The work program was revised at the meeting of the Department / Department / Department (implementing the discipline) and approved at the meeting of the Department / Department / Department (issuing structural unit), the protocol from " \_\_\_\_\_ № \_\_\_\_\_

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## 1. Goals and objectives of mastering the discipline:

**Purpose:** to study the structural and functional organization of the immune system, the mechanisms of recognition, memorization and elimination of genetically alien structures, methods for studying the immune status.

### Tasks:

- 1) study of systemic, organ, tissue, cellular and molecular levels of reactions of innate and adaptive immunity, individual forms of the immune process;
- 2) familiarity with the mechanisms of recognition, memorization and elimination of genetically alien structures, methods of studying the immune status;
- 3) to teach the use of knowledge of the fundamental foundations of immunology and allergology in the pedagogical process and scientific research.

### Professional competencies of graduates and indicators of their achievement:

Task type	Code and name of professional competence (the result of mastery)	Code and name of the competency achievement indicator
research	PC-1 Is able to creatively use in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines (modules) that determine the scope of molecular and cell biology.	PC-1.1 Works with scientific and technical information and special literature, studies the achievements of domestic and foreign science in the field of molecular and cell biology using new technologies and electronic databases.
		PC-1.2 Comprehends and formulates diagnostic solutions to the problems of molecular and cellular biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity
		PC-1.3 Uses in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology

Code and name of the competency achievement indicator	Name of the assessment indicator (the result of training in the discipline)
PC-1.1 Works with scientific and technical information and special literature, studies the achievements of domestic and foreign science in the field of molecular and cell biology using new technologies and electronic databases.	Knows the features of working with scientific literature in the field of immunology and sources of information. He is able to work with scientific and technical information and special literature, to study the achievements of domestic and foreign science in the field of molecular and cell biology using new technologies and electronic databases. He has the skills to navigate in electronic databases and find the necessary information in the field of immunology.
PC-1.2 Comprehends and formulates diagnostic solutions to the problems of molecular and cellular biology by integrating fundamental biological	He knows the basic mechanisms of immunology at the molecular and cellular levels. Able to comprehend and formulate diagnostic solutions to the problems of molecular and cell biology by integrating

concepts and specialized knowledge in the field of professional activity	fundamental biological concepts and specialized knowledge in the field of professional activity. He has the skills to detect patterns and the relationship between various processes of immunology and related disciplines.
PC-1.3 Uses in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology	He knows about the features of scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology. He is able to use in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of activity of molecular and cell biology. He has the skills to apply the acquired knowledge of immunology in scientific and production-technological activities and the study of related disciplines.

### 1. Labor intensity of discipline and types of training sessions in the discipline

The total labor intensity of the discipline is 3 credited units (108 academic hours), (1 credit unit corresponds to 36 academic hours).

Types of training sessions and work of the student in the discipline are:

Designation	Types of training sessions and work of the student
Lek	Lecture
Lek electr.	
Ave	Practical exercises
Pr electr.	
WED:	Independent work of the student during the period of theoretical training
including control	Independent work of the student and contact work of the student with the teacher during the period of intermediate certification

### Structure of the discipline:

The form of training is full-time.

№	Name of the section Discipline	Se me ster	Number of hours by types of training sessions and work of the student						Intermediate attestation forms
			Lek	Lab	Av e	OK	WE D	Cont rol	
1.	Section 1 Introduction to Immunology: Structural and Functional Organization of the Immune System	3	2	-	5	-	5	9	Exam Questions
2.	Section No2 Innate immunity	3	2	-	5	-	5	9	Exam Questions

3.	Section No3 immunity      Adaptic	3	2	-	5	-	5	9	Exam Questions
4.	Section 4 Humoral Immunity. Immunological      Memory. Cellular Immunity	3	2	-	5	-	5	9	Exam Questions
5.	Section No5 Interrelation of mechanisms of innate and adaptive immunity.	3	2	-	6	-	7	9	Exam Questions
	Total:	3	10	-	26	-	27	45	Exam

## THE STRUCTURE AND CONTENT OF THE THEORETICAL PART OF THE COURSE

Lectures of 10 hours.

### **Topic 1. Introduction to Immunology: Structural and Functional Organization of the Immune System (2 hours)**

History of immunology

Organs of the immune system

The purpose of the immune system

The main works of immunity

### **Topic 2: Innate Immunity (2 hours)**

Myeloid cells as the basis of innate immunity.

Recognition of the alien in the system of innate immunity.

Cellular mechanisms of innate immunity.

The contribution of lymphoid cells to innate immunity. Natural killers.

Humoral factors of innate immunity.

### **Topic 3: Adaptive immunity (2 hours)**

Molecules that recognize antigens.

Antigens.

Lymphoid cells.

Organs of the immune system.

Activation of lymphocytes and triggering an immune response.

Immune response.

### **Topic 4. Humoral immunity. Immunological memory. Cellular immunity (2 hours)**

Immune response along the humoral pathway

Structure and varieties of antibodies

Genetic mechanisms of antibody diversity

Immunological memory.

Serological phenomena of interaction of antibodies and antigens (precipitation and agglutination)

Cellular immune response

Immune response along the cellular pathway.

Biological role and mechanism of cytotoxicity and apoptosis.

**Topic 5. The relationship between the mechanisms of innate and adaptive immunity. (2 hours)**

Immune system linking innate and adaptive immune response

Signal transmission between adaptive and innate immunity cells

The role of cytokines in the regulation of the immune response.

#### **IV. STRUCTURE AND CONTENT OF THE PRACTICAL PART OF THE COURSE AND INDEPENDENT WORK**

Practical training of 26 hours.

**Section No1 Introduction to Immunology. Structural and functional organization of the immune system (5 hours)**

Structural and functional organization of the immune system. Study of the structural organization of the immune system. Organs, tissues, cells, molecules and functional organization of the immune system. Factors of immunity

**Section No2 Innate immunity (5 hours)**

Receptor surface molecules of innate immune cells: Signaling cascades of cytotoxicity and activation of the innate immune response.

**Section No3 Adaptive immunity (5 hours)**

Receptor surface molecules of adaptive immunity: Signaling cascades of cytotoxicity and activation of the innate immune response. Antibody production

**Section No. 4 Humoral immunity. Immunological memory. Cellular immunity (5 hours)**

Assembly of antibodies in the cell. Extraction of antibodies from B lymphocytes. Selection of T and B lymphocytes.

**Section No5 Interrelation of mechanisms of innate and adaptive immunity. (6 hours)**

Analysis of the strategy of the immune response in various infectious diseases. Inflammation: Immunological surveillance of carcinogenic cells.

**Exemplary topics of independent work of students**

1. Merits of domestic scientists in the development of immunology

2. Immunological memory, its role.
3. Myeloid cells as the basis of innate immunity.
4. Cells of innate immunity.
5. Humoral factors of innate immunity.
6. Modern vaccines.
7. Immunoprophylaxis.
8. Methods of studying various parts of the immune system.
9. Phagocytosis.
10. Compliment system.
11. Cytokines.
12. Genomic organization of the main complex of histocompatibility and its antigens.
13. Mechanisms of formation of antigenic diversity of antibodies and antigen-recognizing receptors.
14. Monoclonal antibodies preparation and application.

## **V. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF INDEPENDENT WORK OF STUDENTS**

### Recommendations for independent work of students

The purpose of the independent work of the student is to work meaningfully and independently first with educational material, then with scientific information, to lay the foundations of self-organization and self-education in order to instill the ability to further continuously improve their professional qualifications.

The process of organizing the independent work of the student includes the following stages:

- preparatory (setting goals, drawing up a program, preparing methodological support, preparing equipment);
- basic (implementation of the program, the use of methods of information retrieval, assimilation, processing, application, transfer of knowledge, fixation of results, self-organization of the work process);
- final (assessment of the significance and analysis of the results, their systematization, assessment of the effectiveness of the program and methods of work, conclusions on the directions of labor optimization).

In the process of independent work, the student acquires the skills of self-organization, self-control, self-government, self-reflection and becomes an active independent subject of educational activity. Independent work of students should have an important impact on the formation of the personality of the

future specialist, it is planned by the student independently. Each student independently determines the mode of his work and the measure of work spent on mastering the educational content in each discipline. He performs extracurricular work according to a personal individual plan, depending on his preparation, time and other conditions.

#### Methodical recommendations for independent work of students

As the material on the subject of the discipline is mastered, it is planned to perform independent work of students on the collection and processing of literary material to expand the field of knowledge in the discipline under study, which allows you to deepen and consolidate specific practical knowledge gained in classroom classes. To study and fully master the program material on the discipline, educational, reference and other literature recommended by this program, as well as specialized periodicals, are used.

When independently preparing for classes, students take notes on the material, independently study the issues on the topics covered, using the educational literature from the proposed list, periodicals, scientific and methodological information, databases of information networks.

Independent work consists of such types of work as the study of material on textbooks, reference books, videos and presentations, as well as other reliable sources of information; preparation for the zechet. To consolidate the material, it is enough, flipping through the notes or reading it, mentally restore the material. If necessary, refer to the recommended educational and reference literature, write down incomprehensible moments in the questions to understand them in the upcoming lesson.

Preparation for practical exercises. This type of independent work consists of several stages:

1) Repetition of the studied material. For this purpose, lecture notes, recommended basic and additional literature are used;

2) Deepening knowledge on the proposed topics. It is necessary to differentiate the available material in lectures, textbooks in accordance with the points of the plan of the practical lesson. Separately write out unclear questions, terms. It is better to do this in the margins of the lecture notes or textbook. Clarification should be carried out with the help of reference literature (dictionaries, encyclopedic publications, etc.);

3) Drawing up a detailed plan for the speech, or conducting calculations, solving problems, exercises, etc. In preparation for practical exercises, students take notes on the material, prepare answers to the above questions on the topics of practical exercises. In addition to the practical material, students



independently study questions on the proposed topics, using educational literature from the proposed list, periodicals, scientific and methodological information, databases of information networks (Internet, etc.).

Requirements for the presentation and design of the results of independent work

There are no special requirements for the provision and design of the results of this independent work.

Control over the implementation of the plan of independent work of students is carried out by the teacher in practical classes by interviewing and by including in the final tasks specified in the lesson from the plan of independent work.

## VI. MONITORING THE ACHIEVEMENT OF COURSE OBJECTIVES

No p/n	Supervised sections / topics of the discipline	Achievement indicator code and name	Learning outcomes	Assessment tools	
				current control	Intermediate-accurate certification
1.	Section 1 Introduction to Immunology: Structural and Functional Organization of the Immune System	PC-1.1; PC-1.2; PC-1.3	Knows the features of working with scientific literature in the field of immunology and sources of information. He is able to work with scientific and technical information and special literature, to study the achievements of domestic and foreign science in the field of molecular and cell biology using new technologies and electronic databases. He has the skills to navigate in electronic databases and find the necessary information in the field of immunology.  He knows the basic mechanisms of immunology at the molecular and cellular levels. Able to comprehend and formulate diagnostic solutions to the problems of molecular and cell biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity. He has the skills to detect patterns and the relationship between various processes of immunology and related disciplines.  He knows about the peculiarities of	Oral questioning	Exam Questions
2.	Section No2 Innate immunity	PC-1.1; PC-1.2; PC-1.3		Test	Exam Questions
3.	Section No3 Adaptive immunity	PC-1.1; PC-1.2; PC-1.3		Test	Exam Questions
4.	Section 4 Humoral Immunity. Immunological Memory. Cellular Immunity	PC-1.1; PC-1.2; PC-1.3		Oral questioning	Exam Questions
5.	Section No5 Interrelation of mechanisms of	PC-1.1; PC-1.2; PC-1.3		Oral questioning	Exam Questions

	innate and adaptive immunity.	<p>scientific and production-technological activity of knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology.</p> <p>He is able to use in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of activity of molecular and cell biology.</p> <p>He has the skills to apply the acquired knowledge of immunology in scientific and production-technological activities and the study of related disciplines.</p>		
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## VII. LIST OF REFERENCES AND INFORMATION AND METHODOLOGICAL SUPPORT OF THE DISCIPLINE

### Main literature

1. Anokhina, N. V. *Obschchaya i klinicheskaya immunologiya : uchebnoe posobie* / N. V. Anokhina. — 2nd ed. — Saratov : Nauchnaya kniga, 2019. — 159 c. — ISBN 978-5-9758-1755-6. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/81032.html>
2. Churilov, L. P. *Pathophiziology of the immune system : uchebnoe posobie* / L. P. Churilov, A. G. Vasil'ev. — Sankt-Peterburg : Foliant, 2014. — 664 c. — ISBN 978-5-93929-251-1. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/60938.html>
3. Zamorina, S. A. *Immunology: myeloid suppressor cells : uchebnoe posobie* / S. A. Zamorina, M. B. Raev, P. V. Khramtsov. — Perm : Perm State National Research University, 2019. — 88 c. — ISBN 978-5-7944-3413-2. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/123058.html>
4. Novikov, D. K. *Klinicheskaya immunologiya i allergologiya : uchebnik* / D. K. Novikov, P. D. Novikov, N. D. Titova. — Minsk : Vysheisha shkola, 2019. — 496 c. — ISBN 978-985-06-3057-5. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/119986.html>
5. *Clinical immunology, allergology. Basic methods: practicum / compilers E. V. Saidakova.* — Perm : Perm State National Research University, 2020. — 40 p. — Text : elektronnyi // Fillektsi obrazovatel'nyi resurs IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/123059.html>
6. Markova, M. P. *Osnovy immunologii : uchebno-metodicheskoe posobie* / M. P. Markova. — Tula : Tula State Pedagogical University named after L.N. Tolstoy, 2021. — 47 c. — ISBN 978-5-6047371-8-7. — Text : electronic // Digital

educational resource IPR SMART : [site]. — URL:  
<https://www.iprbookshop.ru/119705.html>

7. Zemskov, A. M. Klinicheskaya immunologiya i allergologiya : uchebnik / HOURS Zemskov, V.M. Zemskov, V.A. Zemskova. — Moscow : INFRA-M, 2023. — 420 p. + Additional. materialy [Elektronnyi resurs]. – (Higher education: Specialist's degree). — DOI 10.12737/1048793. - ISBN 978-5-16-015737-5. - Text : electronic. - URL: <https://znanium.com/catalog/product/1048793>

8. Mechnikov, I. I. Immunology. Izbrannye raboty / I. I. Mechnikov. — Moscow : Izdatelstvo Yurait, 2023. — 274 p. — (Anthology of Thought). — ISBN 978-5-534-12700-3. — Text : electronic // Educational platform Yurait [site]. — URL: <https://urait.ru/bcode/514419>

#### Further reading

1. Martin, S. J., Delves, P. J., Roitt, I. M., Burton, D. R. (2017). Essential Immunology. United Kingdom: Wiley.
2. Paul, W. E. (2013). Fundamental Immunology. United Kingdom: Wolters Kluwer Health.
3. Malik, V. S. (2013). Antibody Techniques. United States of America: Elsevier Science.
4. Abbas, A. K., Pillai, S., Lichtman, A. H. (2011). Cellular and Molecular Immunology E-Book. UK: Elsevier Health Sciences.

#### List of resources of the information and telecommunication network "Internet"

1. <http://elibrary.ru/> - scientific electronic library
2. <http://molbiol.ru/> is an information resource on molecular biology
3. <http://macroevolution.narod.ru/> is an electronic resource on evolutionary biology.
4. <http://science.km.ru/> - electronic resource on different sections of biology
5. <http://elementy.ru/> is an information and cognitive resource dedicated to the natural sciences.
6. <http://www.iprbookshop.ru/> is an electronic library system IPRbooks.
7. <http://znanium.com/> - EBS "Znanium".
8. <https://nplus1.ru/> - N+1, a popular science online publication on science, engineering and technology
9. <http://antropogenez.ru/> - popular science information resource about human evolution

10. <http://web.a.ebscohost.com/ehost/search/basic?sid=851485f8-6200-4b3e-aaab-df4ba7be3576@sessionmgr4008&vid=1&tid=2003EB> is a collection of books on various sections from the EBSCOhost database.
11. <http://rosalind.info/problems/locations/>- resource for self-study of bioinformatics Rosalind.
12. <http://www.ncbi.nlm.nih.gov/>- website of the National Center for Biotechnology Information NCBI.
13. <http://www.mendeley.com/>- *Mendeley*: Free reference manager and PDF organizer; bibliothecar program.
14. <http://www.ebi.ac.uk/>- website of the European Bioinformatics Institute
15. <http://www.scopus.com> – Bibliographic database and Scopus citation index
16. <http://thomsonreuters.com/thomson-reuters-web-of-science/> bibliographic database and Web of Science citation index

#### List of information technologies and software

1. Microsoft Office Professional Plus 2013 is an office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.);
2. 7Zip 16.04 - free file archiver with a high degree of data compression;
3. Adobe Acrobat XI Pro – a software package for creating and viewing electronic publications in PDF format;
4. AutoCAD Electrical 2015 - three-dimensional computer-aided design and drafting system;
5. ESET Endpoint Security 5 is a comprehensive protection for Windows-based workstations. Virtualization support + new technologies;
6. WinDjView 2.0.2 - a software to recognize and view files with the same format DJV and DjVu; SolidWorks 2016 - CAD software package for automation of industrial enterprise operations at the stages of design and technological preparation of production
7. Compass-3D LT V12 - three-dimensional modeling system
8. Notepad++ 6.68 – text editor

#### **Lecture**

**The lecture-** is the main active form of conducting classroom classes, explaining the fundamental and most difficult theoretical sections of molecular biology and the theory of genetic engineering, which involves intensive mental activity of the student and is especially important for mastering the subject. The lecture should always be cognitive, developmental, educational and organizing in

nature. Lecture notes help to assimilate the theoretical material of the discipline. When listening to the lecture, it is necessary to take notes – main information, preferably in your own wording, which allows you to better remember the material. The abstract is useful when it is written by the student independently.

In a lecture, the teacher gives only a small fraction of the material on certain topics that are presented in the textbooks. In addition, the teacher informs students about what additional information can be obtained on the topics discussed, and from what sources. Therefore, when working with lecture notes, it is always necessary to use the main textbooks, additional literature and other recommended sources on this discipline. It is such a serious work of the student with the lecture material that allows him to achieve success in mastering new knowledge.

To present a lecture course in the discipline "Fundamentals of Medical Knowledge", the following are used as forms of active learning: lecture-conversation, lecture-visualization, which are based on the knowledge gained by students in the framework of the subjects preceding the course. To illustrate verbal information, electronic presentations, tables, video files, diagrams on the board are used. In the course of presenting the lecture material, problematic questions or questions with elements of discussion are posed.

#### **Lecture – visualization**

The lecture is accompanied by the display of tables, electronic presentations, video files - such a combination of methods of presenting information greatly simplifies its development by students. Verbal presentation of the material should be accompanied and combined with the visual form. Information presented in the form of diagrams on the board, tables, slides, allows you to form problematic issues, and contribute to the development of professional thinking of future specialists.

#### **Lecture - conversation**

Lecture-conversation, "dialogue with the audience", is the most common form of active learning and allows you to involve students in the educational process, as there is a direct contact of the teacher with the audience. Such contact is achieved during the lecture, when students are asked questions of a problematic or informational nature or when they are invited to ask the teacher questions themselves. Questions are offered to the entire audience, and any of the students can offer their answer; another can complement it. During the educational process, this allows you to identify the most active students and activate those who do not participate in the work. This form of lecture allows you to involve students in the work process, attract their attention, stimulate thinking, gain collective experience, learn how to form questions. The advantage of the lecture-conversation is that it allows you to attract the attention of students to the most important issues of the

topic, determine the content and pace of presentation of the educational material, as well as determine the topics of interest to students, with the aim of possibly adjusting the form of the material taught.

### **Colloquia**

Colloquium is a collective form of consideration and consolidation of educational material. Colloquia are one of the types of practical classes designed for in-depth study of the discipline, conducted in an interactive mode. At the classes on the topic of the colloquium, questions are analyzed, and then, together with the teacher, their discussion is held, which is aimed at consolidating the material, forming the skills to conduct polemics, developing independence and critical thinking, the ability of students to navigate in large information flows, to develop and defend their own position on problematic issues of the academic discipline.

As methods of interactive learning at colloquia, the following are used: a detailed conversation, a debate, a press conference.

**A detailed conversation** involves the preparation of students on each issue of the lesson plan with a single list of recommended mandatory and additional literature for all. Reports are prepared by students on a pre-proposed topic.

**The debate** in the group has a number of advantages. The dispute can be caused by the teacher during the lesson or is planned in advance by him.

**Press conference.** The teacher instructs several students to prepare brief (thesis) messages. After the reports, students ask questions that are answered by the speakers and other members of the expert group. Based on the questions and answers, a creative discussion unfolds together with the teacher.

**Case study** method. The case-study method is a method of active problem-situation analysis based on learning by solving specific problems - situations (solving cases). The method of specific situations (case study method) refers to non-game imitative active learning methods and is considered as a tool that allows you to apply theoretical knowledge to solving practical problems. At the end of the lesson, the teacher tells a number of situations and offers to find solutions for those problems that are voiced in them. At the same time, the problem itself does not have unambiguous solutions. Students should analyze the situation, understand the essence of the problems, offer possible solutions and choose the best of them. Thanks to the knowledge gained at the lecture, it is easy for the student to correlate the theoretical baggage of knowledge obtained with the real practical situation. Being an interactive method of teaching, it wins a positive attitude from students, who see in it an opportunity to show initiative, feel independent in mastering theoretical positions and mastering practical skills. No less important is the fact that the analysis of situations has a strong impact on the professionalization of

students, contributes to their maturation, forms interest and positive motivation for learning. The method is aimed not so much at mastering specific knowledge or skills, as at developing the general intellectual and communicative potential of the student and teacher.

It is a teaching method designed to improve skills and gain experience in the following areas:

- identification, selection and problem solving;
- work with information – comprehension of the meaning of the details described in the situation;
- analysis and synthesis of information and arguments;
- work with assumptions and conclusions;
- evaluation of alternatives;
- decision-making;
- listening and understanding other people are group work skills. The main function of the case method is to teach students to solve complex unstructured problems that cannot be solved in an analytical way. The case activates students, develops analytical and communicative skills, leaving students alone with real situations.

*The case study* is designed to improve the effectiveness of educational activities: as an illustration for solving a certain problem, explaining a particular phenomenon, studying the features of its manifestations in real life, developing competence aimed at resolving various life and production situations (the use of the case involves individual and group work of students).

Brainstorming (brainstorming) is a widely used way of producing new ideas to solve scientific and practical problems. Its purpose is to organize collective mental activity to find non-traditional ways to solve problems.

The use of the brainstorming method in the educational process allows you to solve the following problems:

- creative assimilation of educational material by students;
- the relationship of theoretical knowledge with practice;
- activation of educational and cognitive activity of trainees;
- formation of the ability to concentrate attention and mental efforts on solving an urgent problem;
- formation of experience of collective mental activity.

The problem formulated in the brainstorming session should have theoretical or practical relevance and arouse the active interest of students. A common requirement to consider when choosing a problem for brainstorming is the

possibility of many ambiguous options for solving a problem that is put forward to students as a learning task.

### **Tests and testing**

Current control of the assimilation of the material is assessed by oral answers, tests, as well as paper testing.

From the assessments of laboratory, colloquiums, tests and testing, an assessment of this discipline is mainly formed.

## **IX. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE**

Training sessions on the discipline are held in rooms equipped with appropriate equipment and software.

The list of material and technical and software of the discipline is given in the table.

### **Logistics and Software Discipline**

Name of special premises and premises for independent work	Equipment special premises and rooms for independent work	List of licensed software. Details of the supporting document
690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 605	Multimedia audience: 236*147 cm Trim Screen Line; DLP Projector, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; Specialized Equipment Mount Subsystem CORSA-2007 Tuarex; Video Switching Subsystem: DVI DXP 44 DVI Protron Matrix Switch DVI 201 Tx/Rx Extron Twisted Pair Extension Cable; Audio Switching and Sound Amplification Subsystem; SI 3CT LP Extron Ceiling Mount Speaker; DMP 44 LC Extron Digital Audio Processor; Extension for IPL T CR Control Controller 48; Wireless LANs for trainees are provided with a system based on 802.11a/b/g/n 2x2 MIMO(2SS) access points. HP All-in-One 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, Wi-Fi, WT, usb kbd/mse, Win7Pro (64-	-



	bit)+Win8.1Pro(64-bit), 1-1-1 Wty	
690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 422	Multimedia audience: Monoblock HP ProOne 400 G1 AiO 19.5" Intel Core i3-4130T 4GB DDR3-1600 SODIMM (1x4GB)500GB; Projection screen Projecta Elpro Electrol, 300x173 cm; Multimedia projector, Mitsubishi FD630U, 4000 ANSI Lumen, 1920x1080; Mortise interface with TLS TAM 201 Stan automatic cable retraction system; Avervision CP355AF Visualizer; Microphone cordless radio system UHF band Sennheiser EW 122 G3 consisting of a wireless microphone and receiver; LifeSizeExpress 220-Codeonly- Non-AES video conferencing codec; Network video camera Multipix MP-HD718; Two 47" LCD panels, Full HD, LG M4716CCBA; Subsystem of audio switching and sound amplification; centralized uninterrupted power supply	-
690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 627	Light microscope Carl Zeiss GmbH Primo Star 3144014501 (13 pcs.); Light microscope with digital camera Altami BIO8 (2 pcs).	-
Computer Class of the School of Biomedicine Aud. M723, 15 workplaces	Screen with electric drive 236 * 147 cm Trim Screen Line; Projector DLP, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; Subsystem of specialized fasteners of equipment CORSA-2007 Tuarex; Video switching subsystem: DVI DXP 44 DVI Pro Extron matrix switch; DVI twisted pair extender DVI 201 Tx/Rx Extron; Subsystem of audio switching and sound amplification; acoustic system for ceiling mounting SI 3CT LP Extron; digital audio processor DMP 44 LC Extron; extension for IPL T CR48 management controller; Wireless LANs for trainees are provided with a system based on 802.11a/b/g/n 2x2 MIMO(2SS) access points.	-

	HP All-in-One 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, Wi-Fi, WT, usb kbd/mse, Win7Pro (64-bit)+Win8.1Pro(64-bit), 1-1-1 Wty	
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## **X. VALUATION FUNDS**

The following assessment tools are used for discipline:

1. Poll
2. Testing

### **Oral questioning.**

Oral questioning allows you to assess the knowledge and logic of the student, the ability to use terminology, speech skills and other communication skills.

The training function is to identify details that for some reason were not sufficiently understood during the training sessions and in preparation for the test.

A survey is a means of control, organized as a special conversation of the teacher with the student on topics related to the discipline being studied, and designed to clarify the amount of knowledge of the student on a certain section, topic, problem, etc.

### **Examples of topics for oral inquiry**

1. The subject and tasks of immunology.
2. Stages of development of immunology. The main achievements of immunology
3. Immune system. Central IP Authorities. Structural organization and functions
4. Immune system. Peripheral IP bodies. Structural organization and functions
5. Cells of the immune system. Lymphocytes.
6. Differentiation of T-cells in the thymus. Positive and negative selection thymocytes. Populations and subpopulations of lymphocytes.
7. Stages of differentiation of B-cells in the bone marrow.
8. Cells of the immune system. A system of mononuclear phagocytes.
9. Cells of the immune system. Granulocytes, mast cells, platelets

10. Antigens. Structure and properties of antigens.
11. Classification of antigens. Thymus-dependent and thymus-independent antigens
12. Immunoglobulins. Molecular structure of immunoglobulins.
13. Characteristics of individual classes of immunoglobulins
14. Immunoglobulin genes
15. Formation of antigenic diversity of antibodies
16. Effector function of antibodies (neutralization, opsonization, activation reactions complement).
17. Immunoglobulin B-lymphocyte receptors and signal-conducting molecules.
18. Structure, genes and formation of the repertoire of antigen-recognizing T-cell receptors.
19. Proteins of the main histocompatibility complex (MHC molecule)
20. Mechanism of activation of T- and B- lymphocytes.
21. Cytokines. Classification. General characteristics
22. CD4 - cells, their role in the humoral and cellular immune response.
23. The role of cytotoxic lymphocytes in the immune response.
24. Factors of non-specific resistance
25. Complement system. The role of complement in non-specific resistance and a specific immune response.
26. Humoral nonspecific protection factors: lysozyme, interferons, acute proteins Phase.
27. Phagocytosis. Oxygen-dependent and oxygen-independent destruction mechanisms foreign antigens
28. Extracellular mechanisms of pathogen destruction. Natural killers, eosinophylls.
29. Features of antibacterial immunity in humans..
30. Features of antiviral immunity in humans.
31. Immune defense against fungi and protozoa in the human body.
32. Modern approaches to the creation and use of vaccines.
33. Immunodeficiency states.
34. Immunological mechanisms of allergy. GNT.
35. Immunological mechanisms of allergy. HRT.
36. Autoimmune conditions. The concept of autoantibodies and

autoantigens.

### **Testing.**

Testing is the most effective and objective form of assessing knowledge, skills and abilities, which allows to identify not only the level of educational achievements, but also the structure of knowledge, the degree of its deviation from the norm. Testing involves a standardized, verified procedure for collecting and processing data, as well as their interpretation, allows you to check the knowledge of students on a wide range of issues. Testing excludes the subjectivity of the teacher, both in the process of control and in the process of assessment.

### **Examples of test tasks**

The factor on which the degree of immunogenicity depends:

- a. antigenicity
- b. Foreignness
- c. specificity

The valence of the antigen depends on the number:

- a. epitopes
- b. antideterminant
- c. Haptens

Non-immune:

- a. proteins
- b. polysaccharides
- c. lipids

Substances that enhance the immunogenicity of antigens:

Determinants

- b. haptens
- c. adjuvants

Ability to specifically interact with the products of the immune response:

- a. immunogenicity
- b. antigenicity
- c. specificity

Substance capable of causing an immune response:

- a. antigen
- b. antibody
- c. hapten

The greatest ability to phagocytosis have:

- a. basophils and lymphocytes
- b. neutrophils and monocytes
- c. eosinophils and lymphocytes

Antibodies are synthesized in:

- a. neutrophils
- b. basophils and eosinophils
- c. lymphocytes

A section of antigen that does not overlap with epitopes, but interacts with MHC products:

- a. Carrier
- b. hapten
- c. agretop

Substances with immunogenicity only with a sufficiently large molecular weight:

- a. polysaccharides
- b. nucleic acids
- c. lipids

Substance specifically reacting with the antigen:

- a. agretop
- b. antibody
- c. hapten

The antigen region interacting with MHC products:

- a. determinant
- b. agretop
- c. adjuvant

Antigens of tissues and cells that differ from the recipient at the intraspecific level:

- a. autoantigens
- b. xenoantigens
- c. alloantigens

Antigens of genetically identical individuals:

- a. autoantigens
- b. xenoantigens
- c. isoantigens

Antigens of tissues and cells that differ from the recipient at the species level:

- a. autoantigens
- b. xenoantigens
- c. alloantigens

Antigens of cells, proteins that cause areactivity:

- a. allergens
- b. tolerogens
- c. haptens

Antigens of own cells:

- a. autoantigens
- b. tolerogens
- c. alloantigens

Antigens causing increased reactivity:

- a. allergens
- b. tolerogens
- c. haptens

Cell surface antigens controlled by HCGS:

- a. transplantation
- b. tolerogens
- c. isoantigens

Various cells and large particles (bacteria, protozoa, erythrocytes, etc.) belong to:

- a. soluble antigens
- b. corpuscular antigens
- c. transplant antigens

Proteins of varying degrees of complexity refer to:

- a. soluble antigens
- b. corpuscular antigens

c. transplant antigens

35. Antigens that cause immediate hypersensitivity:

a. allergens

b. tolerogens

c. haptens

Affinity is:

a. strength of the bond of the antibody to the corresponding antigen

b. strength of the bond between individual antideterminants and determinants

c. Bond strength of heavy and light chains

Immunoglobulin, which has the ability to pass through the placenta:

a. Ig G

b. Ig A

c. Ig D

Immunoglobulin, which serves as a receptor for B-lymphocytes:

a. Ig M

b. Ig E

c. Ig D

Immunoglobulin A is synthesized in:

a. bone marrow

b. spleen

c. lymphatic follicles

Immunoglobulin contained in serum in the highest concentration:

a. Ig G

b. Ig A

c. Ig M

Avidity is:

a. strength of the bond of the antibody to the corresponding antigen

b. strength of the bond between individual antideterminants and determinants

c. Bond strength of heavy and light chains

Detection of antibodies of this class in the fetus indicates an intrauterine infection:

a. Ig D

B. Ig A  
in. Ig M

This immunoglobulin was previously attributed to the group of reagents:

- a. Ig G
- b. Ig M
- c. Ig E

Immunoglobulin, contained both in the serum and in the mucous membranes:

- a. Ig G
- b. Ig A
- c. Ig D

### **Test Evaluation Criteria**

evaluation	50-60 points (unsatisfactory)	61-75 points (satisfactory)	76-85 points (good)	86-100 points (excellent)
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**Methodological recommendations that determine the procedures for assessing the results of mastering the discipline**

### **Assessment tools for intermediate attestation**

Intermediate certification of students in the discipline is carried out in accordance with local fevu regulations and is mandatory. The form of reporting on the discipline is an exam.

### **Methodical instructions for passing the exam**

The exam is taken by the leading teacher (associate professor, professor), for whom this type of educational load is assigned in an individual plan. The form of the exam is oral.

The time allowed to the student to prepare for the answer to the exam should be no more than 40 minutes. After this time, the student should be ready to respond.

The presence at the examination of unauthorized persons (except for persons carrying out the inspection) without the permission of the relevant persons (rector or vice-rector for academic affairs, director of the School, head of the OBOR or director of the department) is not allowed. Disabled persons and persons with



disabilities who do not have the opportunity to move independently are allowed to take the exam with accompanying persons.

With an intermediate assessment, students are given a grade of "excellent", "good", "satisfactory" or "unsatisfactory". If the student does not appear for the exam, an entry "did not appear" is made in the statement.

### Exam Questions

1. Immune response and its stages.
2. Endocytosis of antigens, processing of exogenous and endogenous antigens and their representation.
3. Antigen recognition by naïve T and B cells.
4. Activation of the lymphocytic clone.
5. Clonal expansion and differentiation of lymphocytes.
6. Memory cells.
7. Features of immune responses to different antigens.
8. Types and importance of regulation of immune responses.
9. The principle of negative feedback.
10. Idiotip-anti-idiotypic and ergotype-antiergotypic interactions.
11. The role of costimulating molecules.
12. Cytokine regulation. The Paradigm of Tx1/Tx2 in Modern Immunology.
  
13. New paradigms of immunoregulatory subpopulations of lymphocytes.
14. The role of the liver in the regulation of immune responses.
15. Neuro-endocrine regulation.
16. Genetic regulation of the diversity of specificity of effectors and the strength of the immune response.
17. Experimental animals (genetic knockout mice, transgenic mice).
18. Neutralization reaction.
19. Formation of immune complexes and phagocytosis.
20. Activation of complement in the classical way.
21. Significance of precipitation and agglutination reactions for diagnosis.
22. Pathological reactions involving antibodies (II, W types of hypersensitivity).
23. Determination of immune complexes by selective immunoprecipitation.
24. Formation of cytotoxic CD8 + T-lymphocytes. Apoptosis and cytotoxic reactions.
25. Formation of CD4+ T-effectors. Immune inflammation (HRT), its physiological and pathological aspects (type IV hypersensitivity).
26. Lymphocyte blast transformation reaction.

27. Allergens. Features of the atopic immune response to allergens.
28. The role of IgE, mast cells, basophils and eosinophils.
29. Early and late phases of atopic hypersensitivity.
30. Atopic diseases.
31. Allergy diagnostics in vitro (determination of IgE by radioimmune method, mast cell degranulation test).
32. Mechanisms of maintaining immunological tolerance to own antigens.
33. Mechanisms of tolerance breakdown.
34. Autoimmune disorders and their diagnosis.
35. Principle of immunofluorescence method.
36. Systematization of immunodeficiencies.
37. Molecular abnormalities underlying primary immunodeficiencies.
38. Diagnosis of primary immunodeficiencies.
39. Secondary immunodeficiencies.
40. Polymerase chain reaction.
41. Polymorphism of lengths of restriction fragments.
42. Mechanisms of antitumor immunity.
43. Escape of tumor cells from the control of the immune system.
44. Changes in the immune system of tumor carriers at different stages of tumor growth.
45. Immunodiagnostics and principles of tumor immunotherapy

### **Criteria for grading a student on the exam**

Evaluation of the test	Requirements for the formed competencies
"Excellent"	The "excellent" grade is given to the student if he has deeply and firmly mastered the program material, exhaustively, consistently, clearly and logically coherently presents it, is able to closely link the theory with practice, freely copes with tasks, questions and other types of application of knowledge, and does not find it difficult to answer when modifying tasks, uses the material of monographic literature in the answer, correctly justifies the decision made, has versatile skills and techniques implementation of practical tasks on the methodology of scientific research.
"Good"	The "good" grade is given to the student if he firmly knows the material, correctly and substantively presents it, avoiding significant inaccuracies in the answer to the question, correctly applies theoretical provisions when solving practical questions and problems, possesses the necessary skills and techniques for their implementation.
"satisfactory"	The grade "satisfactory" is given to the student if he has knowledge only of the basic material, but has not mastered its details, admits inaccuracies, insufficiently correct wording, violations of the logical sequence in the presentation of the program material, has difficulties in performing practical work.
"unsatisfactory"	The grade "unsatisfactory" is given to a student who does not know a significant part of the program material, makes significant mistakes, uncertainly, with great difficulties performs practical work. As a rule, the grade "unsatisfactory" is given to students who cannot continue their studies without additional classes in the relevant discipline.

