



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  
Neuroscience  
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 - hour.  
laboratory work 26 hours.  
total hours of classroom load 36 hours.  
independent work 72 hours.  
Credit 3 semester  
exam is not provided

The work program is drawn up in accordance with the requirements of the Federal State Educational Standard in the direction of training 19.03.01 Biotechnology, approved by the order of the Ministry of Education and Science of Russia dated 10.08.2021. №736.

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 of the Cand. Biol. Ph.D., Associate Professor V.V. Kumeiko

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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 " \_\_\_\_\_ № \_\_\_\_\_

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

Purpose: formation of ideas about the functional organization of the nervous system, the neural mechanisms of the organization of reflex behavior and the principles of the systemic organization of brain functions; about the basics of the physiology of the nervous tissue and the central nervous system of a person; the principles of the systemic organization of brain functions; physiological mechanisms for receiving and processing information by a living organism; about the physiology of human sensory systems that ensure adequate interaction of the organism as a whole with Environment.

### Tasks:

1) to present as fully as possible the most significant achievements of world and domestic neurobiology as a science that studies the structure, functioning, development, genetics, biochemistry, physiology and pathology of the nervous system;

2) to develop in students the skills and abilities of analytical and critical development of the works of outstanding researchers of the nervous system;

3) show that the structure and functions of the human brain include different levels of study: from molecular to cellular (individual neurons), from relatively small associations of neurons, to large systems, such as the cerebral cortex or cerebellum, and the highest level - the nervous system as a whole;

4) to contribute to the expansion of scientific horizons and the improvement of the culture of psychological thinking of students.

### 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-5 Is able to conduct a systematic analysis of the relationship between cells, tissues and functional systems of organisms.	PC-5.1 Studies the relationship between cells, tissues and functional systems of organisms.
		PC-5.2 Investigates the relationship between cells, tissues and functional systems of organisms.
		PC-5.3 Conducts a systematic analysis of the relationship between cells, tissues and functional systems of organisms.

Code and name of the competency achievement indicator	Name of the assessment indicator (the result of training in the discipline)
PC-5.1 Studies the relationship between cells, tissues and functional systems of organisms.	Knows – the relationship of cells, tissues and functional systems of organisms



1.	Topic 1-2	3	1	5	-	-	10	-	Questions for credit
2.	Topic 3-4	3	1	3	-	-	12	-	Questions for credit
3.	Topic 5-6	3	2	5	-	-	12	-	Questions for credit
4.	Topic 7-8	3	2	5	-	-	14	-	Questions for credit
5.	Topic 9-10	3	2	3	-	-	12	-	Questions for credit
6.	Topic 11-12	3	2	5	-	-	12	-	Questions for credit
	Total:	3	10	26	-	-	72	-	Credit

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

Lectures of 10 hours.

Topic 1. Introduction to neurobiology. Concepts, terms. Basic theories and principles (0.5 h).

Topic 2. Neuroanatomy: evolution of the central nervous system and the mammalian brain (0.5 h).

Topic 3. Anatomy of the human central nervous system: an overview of the cranial nerves and blood supply to the central nervous system (1 h).

Topic 4. Neuroanatomy: Internal anatomy of the human central nervous system (1 h)

Topic 5. Neural signaling: Electrical excitability and signal propagation (1 h).

Topic 6. Neural signaling: synaptic transmission and synaptic plasticity (1 h).

Topic 7. Sensory systems: General principles of the somatic nervous system (1 h).

Topic 8. Sensor systems: Visual system (1 h).

Topic 9. Sensory systems: Hearing, vestibular sensation and chemical sensory organs (1 h).

Topic 10. Motor systems: motor neurons (1 h).

Topic 11. Motion and motor control: visceral motor skills (1 h)

Topic 12. Brain function: Sleep, emotions and addictions (1 h).

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

Laboratory work 26 hours.

Topic 1. General methodological principles of studying the structure of the nervous system (3 h)

Topic 2. IMMIn neurological methods of identification of neurons and glial cells of the central nervous system (3 h)

Topic 3. 3D visualization of the brain and the entire organ (4 h)

Topic 4. Methods of chemical enlightenment of nervous tissue and its immunodetection (4 h)

Topic 5. Confocal microscopy and general CNS samples (4 h)

Topic 6. MRI (4 h)

Topic 7. Genetic methods of visualization of nervous tissue (4 h)

Independent work (72 hours)

Sample abstract topics:

1. The subject of neurobiology. Basic levels of study of the nervous system. The place of neurobiology among the natural sciences and humanities. Practical significance of neurobiology.

2. Behavior as a result of the activity of the nervous system. Purposeful behavior. The basic elementary components of behavior.

3. The history of the formation of ideas about the mechanisms of the brain. Understanding of the psyche by philosophers of antiquity. The birth of modern ideas about the psyche and the functioning of the nervous system.

4. The most important trends and developments of modern ideas about the mechanisms of the psyche and behavior in the late XIX - early XX centuries: Thorndike, Watson, Köller, Sechenov, Pavlov.

5. Methods of studying brain activity: morphological, biochemical, physiological. Methods of studying behavior: ethological, conditioned-reflex, cognitive. Microelectrode studies, encephalography, tomography, oculography.

6. Development of the nervous system in ontogeny. The formation of the neural tube, brain bubbles, the formation of the main parts of the nervous system. General plan of the structure of the central and peripheral nervous system.

## **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.	Topic No. 1-4	PC-5.1 Studies the relationship between cells, tissues and functional systems of organisms	<p>Knows</p> <ul style="list-style-type: none"> <li>– the relationship of cells, tissues and functional systems of organisms</li> </ul> <p>Can</p> <ul style="list-style-type: none"> <li>– independently work with scientific and reference literature</li> </ul> <p>Owns</p> <ul style="list-style-type: none"> <li>– basic concepts and terminology on the topic of the relationship between cells, tissues and functional systems of organisms</li> </ul>	poll	Questions for credit
2.	Topic No . 5-8	PC-5.2 Investigates the relationship between cells, tissues and functional systems of organisms	<p>Knows</p> <ul style="list-style-type: none"> <li>– molecular, immunological and physiological aspects of the study of cells of multicellular and unicellular organisms</li> </ul> <p>Can</p> <ul style="list-style-type: none"> <li>– to conduct and investigate the adaptation of tissue elements to the action of various biological, physical, chemical and other factors</li> </ul> <p>Owns</p> <ul style="list-style-type: none"> <li>– skills with the analysis of the relationship between cells, tissues and functional systems of organisms –</li> </ul>	colloquium	Questions for credit

			representatives of all kingdoms		
3.	Topic No . 9-12	PC-5.3 Conducts a systematic analysis of the relationship between cells, tissues and functional systems of organisms	Knows – the theoretical part of the analysis of the relationship between cells, tissues and functional systems of organisms Can – to conduct a systematic analysis of the relationship between cells, tissues and functional systems of organisms Owns – a method of conducting an analysis of the relationship between cells, tissues and functional systems of organisms	poll	Questions for credit

## VII. LIST OF REFERENCES AND INFORMATION AND METHODOLOGICAL SUPPORT OF THE DISCIPLINE

### Main literature

1. Krivoshchekov, S. G. Psikhofisiologiya : uchebnoe posobie / S.G. Krivoshchekov, R.I. Aizman. — Moscow : INFRA-M, 2022. — 249 p. — (Higher education). — DOI 10.12737/10884. - ISBN 978-5-16-009649-0. - Text : electronic. - URL: <https://znanium.com/catalog/product/1859825>
2. Maryutina, T. M. Psychophysiology: general, age, differential, clinical : textbook / T. M. Maryutina. - 4th ed., revision. and add. — Moscow : INFRA-M, 2022. — 436 p. — (Higher education: Bachelor's degree). - ISBN 978-5-16-010818-6. - Text : electronic. - URL: <https://znanium.com/catalog/product/1843165>

3. Aizman, R. I. Age physiology and psychophysiology : uchebnoe posobie / R.I. Aizman, N.F. Lysova. — Moscow : INFRA-M, 2021. — 352 p. — (Secondary vocational education). - ISBN 978-5-16-013904-3. - Text : electronic. - URL: <https://znanium.com/catalog/product/1206690>

4. Physiology of excitable tissues, central nervous system, higher nervous activity and analyzers : laboratory practicum / comp. P. N. Smirnov, N. V. Efanova, L. M. Osina, S. V. Batalova ; Novosib. state agrarian. un-t. Biological-technologist, fak. - Novosibirsk : IC NGA «Zolotoy kolos», 2018. - 119 p. - Text : electronic. - URL: <https://znanium.com/catalog/product/1461109>

5. Samko, Y. N. Morphology and physiology of sensory systems and higher nervous activity : uchebnoe posobie / Yu.N. Samko. — Moscow : INFRA-M, 2023. — 158 p. — (Higher education). — DOI 10.12737/940. - ISBN 978-5-16-009052-8. - Text : electronic. - URL: <https://znanium.com/catalog/product/1863044>

6. Dyakonova, V. E. Postreflex neurobiology of behavior / V. E. Dyakonova, D. A. Sakharov. — Moscow : Izdatel'skii Dom YASK, 2019. — 592 c. — ISBN 978-5-907117-52-5. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/92408.html>

7. Biophysical and biochemical methods of experimental neurobiology. Modern views. Ch. 1 : uchebnoe posobie / E. I. Pchitskaya, A. I. Erofeev, P. A. Egorova [i dr.] ; edited by I. B. Besprozvanny, O. L. Vlasova. — St. Petersburg : Peter the Great St. Petersburg Polytechnic University, 2017. — 71 p. — ISBN 978-5-7422-5899-5 (Part 1), 978-5-7422-5898-8. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/83293.html>

8. Babenko, V. V. Central nervous system: anatomy and physiology: Textbook / Babenko V.V. - Rostov-on-Don : Southern Federal University, 2016. - 214 p.: ISBN 978-5-9275-2031-2. - Text : electronic. - URL: <https://znanium.com/catalog/product/991882>

9. Kostromina, S. N. Vvedenie v neurodidaktiki: uchebnoe posobie / S. N. Kostromina. — St. Petersburg : St. Petersburg University Press, 2019. — 182 p.- ISBN 978-5-288-05911-7. [### DO NOT CHANGE !!! ###]. - Text : electronic. - URL: <https://znanium.com/catalog/product/1054132>

10. Aizman, R. I. Physiologiya cheloveka : uchebnoe posobie / R. I. Aizman, N. P. Abaskalova, N. S. Shulenina. — 2-e ed., pererab. i dop. — Moscow : INFRA-M, 2022. — 432 p. — (Higher education: Bachelor's degree). - ISBN 978-5-16-009279-9. - Text : electronic. - URL: <https://znanium.com/catalog/product/1844262>

### Further reading

1. Psychophysiology: [textbook] / O. M. Razumnikova. Novosibirsk : Izd-vo Novosibirskogo tekhnicheskogo universiteta, 2016. 306 s.  
<http://lib.dvfu.ru:8080/lib/item?id=chamo:843116&theme=FEFU>
2. Physiology of higher nervous activity : textbook for universities / V. V. Shulgovskiy. Moscow: Akademiya, 2014. 384 s.  
<http://lib.dvfu.ru:8080/lib/item?id=chamo:813667&theme=FEFU>
3. Physiologiya chelya [Elektronnyi resurs]: uchebnik / Pod red. V.M. Pokrovskogo, G.F. Korotko - 3-e izd. - M.:Meditsina, 2011.  
<http://www.studmedlib.ru/ru/book/ISBN9785225100087.html>
4. Normal physiology [Elektronnyi resurs] : uchebnik / Pod red. K.V. Sudakova - M.: GEOTAR-Media, 2012.  
<http://www.studmedlib.ru/book/ISBN9785970419656.html>

### 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](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

### VIII.METHODICAL INSTRUCTIONS FOR MASTERING THE DISCIPLINE

#### 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 "Neurobiology", 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 the presentation of 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.

### **Labs**

They are used for conducting experiments, experiments, observations of phenomena, processes mainly in the conditions of special laboratories, offices and with the use of technical means. This method stimulates the activity of actions both at the stage of preparation for research and in the process of its implementation.

Laboratory work improves the quality of learning, contributes to the development of cognitive activity in students, their logical thinking and creative independence. In the process of performing laboratory work, theoretical knowledge is deepened and concretized, the ability to apply them in practice is developed. Skills in working with microscopes, tables and atlases are acquired. The student learns to analyze the data obtained, identify the norm and deviation from it, acquires the skills of working with a living object and physiological measuring devices, performing operations, conducting a comparative analysis, summarizing the material obtained and drawing conclusions. All this allows us to better understand the mechanisms of functioning of a living organism and the principles of its interaction with the environment. Research skills and professional competencies are formed.

Traditionally, laboratory classes are the main type of training sessions aimed at experimental confirmation of theoretical positions. In the process of laboratory classes, students perform one or more laboratory work (tasks) under the guidance of a teacher in accordance with the studied content of the educational material. Students perform laboratory work is aimed at:

- generalization, systematization, deepening of theoretical knowledge on specific topics of the academic discipline;
- formation of skills to accept the acquired knowledge in practical activities;
- development of analytical, design, constructive skills;
- development of independence, responsibility and creative initiative.

Necessary structural elements of the laboratory lesson:

- instruction conducted by the teacher;
- independent activity of students;
- discussion of the results of the laboratory work (task).

Before performing a laboratory task (work), students' knowledge is tested - their theoretical readiness to perform the task.

**Laboratory task (work) can be reproductive, partially search and search in nature.**

Works of a **reproductive** nature are distinguished by the fact that when conducting them, students use detailed instructions, which indicate: the purpose of the work, explanations (theory, main characteristics), equipment, equipment, materials and their characteristics, the order of work, tables, conclusions (without wording), control questions, educational and special literature.

The works, which are **of a partial-exploratory** nature, differ in that when conducting students do not use detailed instructions, they are not given the order of performing the necessary actions, students are required to independently select equipment, choose ways to perform work, instructional and reference literature.

Works of a **exploratory** nature are distinguished by the fact that students must solve a new problem for them, relying on their theoretical knowledge.

The forms of organization of students for conducting a laboratory lesson - frontal, group and individual - is determined by the teacher, based on the topic, purpose, order of work. With the frontal form of organization of classes, all students perform the same work. In the group form of organizing classes, the same work is performed in teams of 2-5 people. With an individual form of organization of classes, each student performs an individual task.

The results of the laboratory task (work) are drawn up by students in the form of a report, grades for the implementation of the laboratory task (work) are indicators of the current performance of students in the academic discipline.

Research skills and professional competencies are formed.

### **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.

## 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: 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	-

	<p>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.</p> <p>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</p>	
<p>690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 422</p>	<p>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</p>	-
<p>690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 627</p>	<p>Light microscope Carl Zeiss GmbH Primo Star 3144014501 (13 pcs.); Light microscope with digital camera Altami BIO8 (2 pcs).</p>	-

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  
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HP All-in-One 400 All-in-  
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i3-4150T, 4GB DDR3-1600  
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SATA, DVD+/-RW, GigEth,  
Wi- Fi, WT, usb kbd/mse,  
Win7Pro (64-  
bit)+Win8.1Pro(64-bit), 1-1-  
1 Wty

## X. VALUATION FUNDS

Code and name of the competency achievement indicator	Name of the assessment indicator (the result of training in the discipline)
PC-5.1 Studies the relationship between cells, tissues and functional systems of organisms.	<p>Knows</p> <ul style="list-style-type: none"> <li>– the relationship of cells, tissues and functional systems of organisms</li> </ul> <p>Can</p> <ul style="list-style-type: none"> <li>– independently work with scientific and reference literature</li> </ul> <p>Owns</p> <ul style="list-style-type: none"> <li>– basic concepts and terminology on the topic of the relationship between cells, tissues and functional systems of organisms</li> </ul>
PC-5.2 Investigates the relationship between cells, tissues and functional systems of organisms.	<p>Knows</p> <ul style="list-style-type: none"> <li>– molecular, immunological and physiological aspects of the study of cells of multicellular and unicellular organisms</li> </ul> <p>Can</p> <ul style="list-style-type: none"> <li>– to conduct and investigate the adaptation of tissue elements to the action of various biological, physical, chemical and other factors</li> </ul> <p>Owns</p> <ul style="list-style-type: none"> <li>– skills with the analysis of the relationship between cells, tissues and functional systems of organisms – representatives of all kingdoms</li> </ul>
PC-5.3 Conducts a systematic analysis of the relationship between cells, tissues and functional systems of organisms.	<p>Knows</p> <ul style="list-style-type: none"> <li>– the theoretical part of the analysis of the relationship between cells, tissues and functional systems of organisms</li> </ul> <p>Can</p> <ul style="list-style-type: none"> <li>– to conduct a systematic analysis of the relationship between cells, tissues and functional systems of organisms</li> </ul> <p>Owns</p> <ul style="list-style-type: none"> <li>– a method of conducting an analysis of the relationship between cells, tissues and functional systems of organisms</li> </ul>

No p/n	Supervised sections / topics of the discipline	Achievement indicator code and name	Learning outcomes	Assessment tools	
				current control	Intermediate-accurate certification
1.	Topic No. 1-4	PC-5.1 Studies the relationship between cells, tissues and functional systems of organisms	<p>Knows</p> <ul style="list-style-type: none"> <li>– the relationship of cells, tissues and functional systems of organisms</li> </ul> <p>Can</p> <ul style="list-style-type: none"> <li>– independently work with scientific and reference literature</li> </ul> <p>Owns</p> <ul style="list-style-type: none"> <li>– basic concepts and terminology on the topic of the relationship between cells,</li> </ul>	poll	Questions for credit

			tissues and functional systems of organisms		
2.	Topic No . 5-8	PC-5.2 Investigates the relationship between cells, tissues and functional systems of organisms	Knows – molecular, immunological and physiological aspects of the study of cells of multicellular and unicellular organisms Can – to conduct and investigate the adaptation of tissue elements to the action of various biological, physical, chemical and other factors Owns – skills with the analysis of the relationship between cells, tissues and functional systems of organisms – representatives of all kingdoms	colloquium	Questions for credit
3.	Topic No . 9-12	PC-5.3 Conducts a systematic analysis of the relationship between cells, tissues and functional systems of organisms	Knows – the theoretical part of the analysis of the relationship between cells, tissues and functional systems of organisms Can – to conduct a systematic analysis of the relationship between cells, tissues and functional systems of organisms Owns	poll	Questions for credit

			– a method of conducting an analysis of the relationship between cells, tissues and functional systems of organisms		
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The following assessment tools are used for discipline:

1. Poll
2. Colloquium

### **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.

List of topics for oral questioning

1. The main methods of research of the physiology of the nervous system.
2. Principles of organization of sensor systems.
3. Types of receptors, their structure and functions.
4. Methods for converting external and internal signals by receptors.
5. The structure of the visual system.
6. The structure of the retina, the distribution of photoreceptors.
7. Conversion of an external stimulus in receptors. Early and late receptor potentials. Photoisomerization reaction.
8. Functions of individual retinal cells in the conversion of an external signal.
9. Receptive fields of retinal cells.
10. External geniculate body, its structure.
11. Receptive fields of neurons of the external geniculate body and their functions in the transmission of information about the parameters of the visual signal.
12. Classification of receptive fields of the visual cortex.
13. Columns of the visual cortex and their function in the analysis of visual information.
14. Detector properties of neurons of the visual cortex, their genesis.

15. The role of eye movements in the organization of visual perception.
16. Mechanisms of binocular vision, their role in perception.
17. The "where" system and its role in visual perception.
18. The "what" system and its role in visual perception.
19. Mechanisms of perception of the human face.
20. Functions of the outer, middle and inner ear in the transmission of sound vibrations.
21. Corti organ, encoding of sounds by cochlea hair cells, their receptor potentials.
22. Functions of nuclei that transmit sound information to the auditory cortex, frequency-threshold curves.
23. Processing of sensory information in the auditory cortex. Binoural hearing.
24. Basics of speech and music perception.
25. Vestibular apparatus, its receptors and adequate stimuli.
26. Participation of vestibular nuclei in the regulation of posture.
27. Functions of vestibular nuclei in controlling eye movements.
28. Functions of the thalamus and postcentral cortex in orientation in space and determination of body schema.
29. Tendon receptors, muscle spindles and tendon organs of Golgi in the transmission of sensory information about the state of the motor system.
30. Tactile receptors, transmission of excitation to the spinal cord.
31. Temperature receptors and transmission of excitation to the spinal cord.
32. Pain receptors and transmission of excitation to the spinal cord.
33. The role of the cortex in the analysis of skin sensitivity.
34. Emotional coloring of skin sensitivity and conscious regulation.
35. Structure of taste buds. The mechanism of taste reception.
36. Conductive pathways and central parts of the taste sensory system.
37. Genetic basis of taste sensitivity.
38. Olfactory epithelium and the mechanism of perception of odors.
39. Central Department of the Olfactory System.
40. Physiological effect of odors, their perception.
41. Vomeronasal organ of a person, its participation in the organization of behavior in ontogenesis.
42. Properties of the dominant and its relationship with learning.
43. Functional plasticity of nervous tissue. Hebb's plastic synapse.
44. The role of the genome in plastic changes in nervous tissue.
45. Neurogenesis in the adult brain and its effect on learning.
46. Gene expression and learning.
47. Structure of the behavioral act - functional system



48. Neurophysiological mechanisms of movement control.
49. Central motor programs.
50. Conceptual reflex arc.
51. Speech functions of the cerebral hemispheres.
52. General types of higher nervous activity and specially human: artists and thinkers (according to I.P. Pavlov).
53. Biochemical and electroencephalographic variables of individual differences.
54. Genotype and phenotype in the manifestations of higher nervous activity of a person.
55. Connection of the properties of the nervous system with anxiety, introversion, neuroticism, extraversion.
56. Memory and neurogenesis in the adult brain
57. Associative learning and its neurophysiological mechanisms.
58. Conditioned reflex as a form of procedural memory.
59. Molecular mechanisms of memory.
60. The role of genes in the plastic restructuring of the nervous system.
61. Cognitive functions of slow-wave and FAST sleep.
62. Brain mechanisms of regulation of functional states.
63. Functions and mechanisms of reinforcement in the formation of temporary connections.
64. Mechanisms of voluntary movements. Cerebellar function.
65. Brain mechanisms of speech perception and generation.
66. Molecular mechanisms of taste.
67. Genetic mechanisms of collective behavior of living organisms.
68. Stress and the brain.
69. Neural networks.
70. Functional systems of P.K. Anokhin. Acceptor of action.

### **Colloquium.**

Colloquium is a form of final testing of students' knowledge on certain topics. It can serve as a form not only of testing, but also of increasing students' knowledge. At colloquia, individual parts, sections, topics, questions of the course under study are discussed, usually not included in the subject of seminar and other practical training sessions, as well as abstracts, projects and other works of students.

### **Colloquium on "Structures and Systems of the Nervous System"**

Purpose: assimilation of educational material on the discipline.

Tasks: to check the self-preparation of students in the development of lecture material, work with literature.

Questions for preparation:

1. The general scheme and functions of the main parts of the nervous system.
2. Autonomic nervous system, its main departments, functions.
3. Somatic nervous system, reflex principle of operation.
4. Structure and functions of the spinal cord.
5. The main functions of the structures of the brain stem.
6. Cerebellum, its importance in the vital activity of the body.
7. The importance of the structures of the diencephalon in the vital activity of the body.
8. The concept and functions of the reticular formation of the brain stem.
9. The concept and functions of the limbic system of the brain.
10. Basal nuclei of the forebrain, their main functions.
11. Architectonics of the cerebral cortex. Functions of KBP shares.
12. Pyramidal and extrapyramidal systems of the brain.

Brief guidelines:

The material can be mastered by lectures and textbooks offered for preparation.

Rating scale

Evaluation	Points	Description
5	9-10	The student demonstrates a comprehensive, systematic and deep knowledge of the educational material, has mastered the main literature and is familiar with additional literature, the recommended program, is able to freely navigate the topic of the lesson, freely operates with the acquired knowledge, skills, forms his ideas and concepts.
4	6-8	The student demonstrates the formation of disciplinary competencies: basic knowledge, skills are mastered, but minor errors, inaccuracies, difficulties in analytical operations are made, new ideas are not formed.
3	3-5	The student experiences significant difficulties in operating with knowledge.
2	1-2	There is a complete or almost complete lack of knowledge.

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

Intermediate certification of students in the discipline is carried out in accordance with local fefu regulations and is mandatory. The form of reporting on the discipline is zaeven. Zaeven for the discipline includes answers to 2 questions.

## **Methodical instructions for the delivery of zachyota**

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

During the study, students can use the work program of the discipline, as well as with the permission of the teacher conducting the test, reference literature and other manuals.

The time allowed to the student to prepare for the answer to the z couple should be no more than 40 minutes.

The presence 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 attestation, students are given a grade of "zaread" or "not credited". If the student does not appear for credit, an entry "did not appear" is made in the statement.

### **Questions for credit**

- 1) The subject and tasks of neurophysiology.
- 2) Methods of neurophysiological research.
- 3) Morphology of nervous tissue.
- 4) Modern ideas about the structure of the membrane
- 5) Modes of transport across the membrane
- 6) Building a peace potential.
- 7) The potential of action and its formation.
- 8) Trace potentials.
- 9) Excitability of the membrane during the action potential.
- 10) Local response. Accommodation.
- 11) Mechanism of propagation of the action potential along the nerve fibers.
- 12) Classification of nerve fibers by the rate of excitation.
- 13) Methods of information transmission in the nervous system.
- 14) Electrical synapses.
- 15) The structure of the chemical synapse.
- 16) Synaptic transmission in the central nervous system.
- 17) Types of inhibition in the central nervous system.
- 18) Neurophysiology of movements.

- 19) Motor function of the spinal cord. Motor reflexes.
- 20) Programmed motor acts carried out by the spinal cord.
- 21) Spinal locomotor center.
- 22) Motor functions of the brain stem (medulla oblongata, bridge, midbrain).
- 23) Motor centers of the brain stem. Red nucleus, lateral vestibular nucleus, Daiters nucleus, reticular formation.
- 24) Static and statokinetic reflexes.
- 25) The role of the cerebellum in the organization of motor function.
- 26) Programming of movements. Motor symptoms of cerebellar insufficiency.
- 27) Diencephalon. Hypothalamic locomotor region.
- 28) Cerebral hemispheres. Striopallidar system.
- 29) Motor function of the basal ganglia.
- 30) Motor functions of the cerebral cortex.
- 31) Downward control of motor activity.
- 32) Formation of conditioned motor reflexes.
- 33) Violations of the functions of the motor cortex.
- 34) Higher functions of the nervous system.
- 35) Science of GNI. Basic concepts and principles.
- 36) Theories underlying GNI.
- 37) Methods of research of IRR.
- 38) Unconditioned reflexes.
- 39) Conditioned reflexes.
- 40) Neurophysiology of sleep.
- 41) Neurophysiology of memory.
- 42) Neurophysiology of emotions.
- 43) Neurophysiology of thinking.

### **Criteria for assigning a grade to a student on the test**

<b>Evaluation of the test</b>	<b>Requirements for the formed competencies</b>
"credited"	"credited" is exhibited 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 in the answer the material of monographic literature, correctly justifies the decision made, has versatile skills and techniques for performing practical tasks in the methodology of scientific research.
"credited"	The grade "credited" 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 tasks, possesses the necessary skills and techniques for their implementation.
"credited"	The grade "credited" is given to the student if he has knowledge only of the basic material, but has not mastered its details, allows inaccuracies, insufficiently correct wording, violations of the logical sequence in the presentation of the program material, has difficulties in performing practical work.
"not credited"	The grade "not credited" 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, it is not credited to students who cannot continue their studies without additional classes in the relevant discipline.